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# CENTRAL BANK OF NIGERIA

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# An Aggregate Import Demand Function for Nigeria: An Auto-Regressive Distributed Lag (ARDL) Approach

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A. Englama, N. C. Oputa, G. K. Sanni, M. U. Yakub, O. Adesanya, and, Z. Sani\*

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## Abstract

The paper sought to examine the dynamics underlying the high import bills in Nigeria and proffered appropriate policy recommendations. In achieving this, the Autoregressive Distributed Lag (ARDL) technique was utilised to estimate the aggregate import demand function for Nigeria using the quarterly data covering the period 1970 to 2011. The paper found that the coefficients of external reserves, domestic consumer prices, level of income and exchange rate were all statistically significant, suggesting that these variables were important factors determining the level of imports in Nigeria. The short-run elasticity result revealed that Nigeria's aggregate demand for imports was both price and income elastic; implying that import demand would increase as the level of economic activity and domestic prices increased. Furthermore, the coefficient of the speed of adjustment revealed that it would take about 0.05 years for imports to respond to changes in any of the explanatory variables. The paper, therefore recommended appropriate fiscal policy measures to address the high level of consumer goods imports since it accounted for about 45.0 per cent of total imports between 2006 and 2011.

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## I. Introduction

The positive impact of trade on investment, employment generation and economic growth has been well acknowledged in the literature. Emerging economies, such as China and India, have liberalised trade to reap the gains of globalisation; this is not the case with most sub-Saharan African countries. For developing economies, growth in capital and raw material imports could boost industrial output. However, excessive importation without corresponding growth in exports could precipitate balance of payments problems. It is against this backdrop that concerns have been expressed on the rising import bills in Nigeria and the need to determine the appropriate import demand function for the economy.

Generally, import is vital to economic growth and development as it affects production, which in turn constitutes the source of expansion in any economy. Empirical studies on trade-related issues have focused more on the degree of

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imports or exports elasticity. The conventional international trade theory links the long-run quantity demanded for imports (exports) to domestic (foreign) income growth, price trend at home and abroad, and the changing value of local currency. Generally, a good is said to have an elastic demand when a price increase results in a large decrease in the quantity consumed. More specifically, it refers to the situation where a one per cent increase in price causes a decrease in the quantity demanded by more than one per cent. On the other hand, a good has an inelastic demand when a rise in price results in a less than proportionate reduction in the quantity demanded or when a one per cent increase in price causes a reduction in the quantity demanded by less than one per cent. Thus, reliable estimates of elasticity parameters are generally important for informed economic policy formulation.

A major feature of the Nigerian economy is the overwhelming influence of the external sector due to the huge foreign exchange receipts from crude oil exports. These inflows consistently drive the level of imports. The combined effect of rising imports and exports in the last two decades was manifested in higher index of trade openness, which fluctuated between 23 - 56 per cent during 1960 - 2010. Considering that the index of openness has been consistently above the 15 - 20 per cent, the Nigerian economy can be said to be relatively open in time with the international standard. An excessive importation could cause shortages of foreign exchange, disequilibrium in the balance of payments account as well as macroeconomic instability.

The objective of the paper is to empirically determine the import demand function for Nigeria amidst the rising trend. The paper is divided into six sections. Following this introduction is the conceptual issues and review of literature in section two. Section three reviews the trend in imports to Nigeria. Section four presents the econometric investigation, while section five presents the analytical results. Section six highlights the policy implications while section seven contains the summary and conclusion of the paper.

## **II. Literature Review**

### **II.1 Theoretical Literature**

As discussed by Alam and Ahmed (2010) the traditional import demand theory is based on the consumer theory of demand, which states that the aim of the consumer is to maximise satisfaction. This argument is extended to the demand for imports such that the demand for imports by a consumer is influenced by income and import prices as well as the prices of other commodities. The sum of individual demand for imports constitutes the aggregate imports demand for the economy

(Harrod and Hague, 1963).

The motivation for a country to import goods and services varies from one country to another. The motives include: to provide goods and services required for the wellbeing of the citizenry; to bridge production gap for goods that can be produced locally but not in large quantity; and raw materials for industrial usage. Most importantly, in conformity with the comparative advantage, countries tend to import goods that cannot be produced efficiently, while others are for fiscal reasons to boost government revenue for developmental purposes. However, excessive importation of goods and services has serious implications for macroeconomic stability through imported inflation. It can also engender balance of payments disequilibrium and impinge on the credit rating of a country. Excessive importation can also lead to a drain on foreign exchange reserves and further worsen balance of payments position. In most cases, however, import is expected to propel growth if it is investment-induced.

Imports are major components of trade in any economy. Contemporary trade theories dwell on different models of international trade, which includes; the neoclassical comparative advantage theory (Heckscher-Ohlin), Keynesian trade multiplier, and the new trade theory (imperfect competition theory).

The neoclassical comparative advantage theory characterised by Heckscher Ohlin (H-O) framework was built on the works of Ricardo, (1817). The theory is based on the assumption that countries differ by the factors of production, therefore, they tend to import goods that they have least factor endowment. Consequently, international trade is affected by changes in relative prices of these endowed factors.

The Keynesian trade multiplier theory views import demand as a function of output and price, while assuming employment to be a variable and international capital movements are assumed to adjust as required by the trade balance. The Keynesian framework focuses on the short-run relationship between income and import demand at the aggregate level, and predicts that the marginal income propensity to import should be one.

The new trade theory (imperfect competition) focuses on intra-industry trade,



which is not well explained by the theory of comparative advantage by incorporating market imperfections. The new trade theory explains the effects of economies of scale, product differentiation, and imperfect competition on international trade (Hong, 1999).

## II.2 Empirical Review

Empirically, Emran and Shilpi (2007) estimated the import demand function for India and Sri Lanka using annual time series data for the period 1952-99 (India) and 1960-95 (Sri Lanka). They employed structural econometric approaches, which included fully modified Augmented Autoregressive Distributed Lag (ARDL), Full Maximum Augmented Autoregressive Distributed Lag (FM-AADL) and Dynamic Ordinary Least Squares (DOLS). They found that the estimated coefficients were highly statistically significant for income and relative prices and satisfied the theoretical sign restrictions for both India and Sri Lanka regardless of the estimation technique considered. For the income coefficient, the magnitude of DOLS estimate was lower than the estimates from ARDL and FM-AADL in both countries. For instance, for Sri Lanka, the estimates of income coefficient varied from 0.76 (DOLS) to 0.90 (FM-AADL). The estimates of income coefficient were relatively larger in India [1.17(ARDL, FM-AADL) and 1.02 (DOLS)]. Furthermore, they found that both sets of estimates for India and Sri Lanka were reasonably close to long-run unitary income elasticity.

Egwaikhide (1999) examined the determinants of aggregate imports and its major components in Nigeria covering the period 1953 and 1989, using cointegration analysis and the error correction model (ECM). He found out that the price elasticity of demand for import was large but less than unity ( $-0.895$ ). His finding supported the conclusion of Harberger (1957) that the price elasticity of demand for import was generally within the range of  $-0.5$  to  $-1.0$  or above this limit, which indicated that a devaluation of the local currency might significantly reduce import demand. In addition, he found that short-run changes in the relative prices and foreign exchange receipt played remarkable role in determining import behaviour between 1953 and 1989 in Nigeria.

Song (2006) estimated the import demand elasticities for agricultural products in Korea. Two estimation methods were employed- the ordinary least squares with first-order autoregressive correction (AR (1)) and two-stage least squares (2SLS)

with first order autoregressive correction. The paper found that among the aggregated level of sectors in agriculture, import-demand for livestock products and vegetables was responsive to changes in import prices but those of other sectors were not affected by changes in import prices.

Sinha (1996) investigated the behaviour of aggregate imports in India and argued that there was no empirical evidence in favour of the existence of any cointegrated relationship among the variables used in the aggregate import demand function. As import was an apparently crucial economic variable, it would be useful to explore the underlying causes of the import growth by examining the applicability of two major models of import demand functions - (i) aggregate and (ii) disaggregate. The first model was to aggregate the final expenditure demand in which the dependent variable was real imports, and the independent variables were both real output and relative import price, (Carone, 1996; Goldstein and Khan, 1985; Houthakker and Magee, 1969; Leamer and Stem, 1970; and Murray and Ginman, 1976). The implicit assumption was that higher level of output or income would create higher demand for imports, such as raw materials, semi-manufactures, capital goods and consumable goods. Import price growth relative to the general price level would reduce the demand for imports.

Using annual data over sample period 1965 to 1998 to examine the determinants of aggregate import demand behaviour in Bangladesh, Tang (2002) showed a long-run relationship existed among quantity of import demand and private consumption expenditure, government consumption expenditure, exports, gross domestic investment and relative price using the error correction model for analysis. He also found out that the estimated short-run and long-run elasticities of various import components exhibited different effects on the aggregate import demand. For instance, the estimated long-run elasticity of relative price was extremely low at -0.25, which suggested that exchange rate policy was found to be unfavorable in improving Bangladesh's trade balance in the long-run.

Huseyin (2006) investigated aggregate import demand function behaviour of Turkey during the period 1994:1-2003:12 using cointegration and error correction approaches. From the empirical results indicated that there existed a unique long-run equilibrium relationship among imports, relative import price and real GNP. In

the estimated ECM, relative prices and real GNP (lagged six month) emerged as important determinants of the import demand function for Turkey. The estimated coefficient of the error correction term (i.e. the speed of adjustment to equilibrium) was -0.28. The econometric estimates of the aggregate merchandise import demand function for Turkey implied that imports were sensitive to relative import prices changes of -1.07. Additionally, price elasticities of demand for imports were found to be greater than income elasticities.

Narayan and Narayan (2010) applied two cointegration techniques to re-estimate the import demand elasticities for Mauritius and South Africa. The two techniques included ARDL and the Bivariate Dale Model (BDM) to test for the existence of long-run relationships. The ARDL technique was used to estimate the long-run elasticities, using annual time series data, covering the period 1963 to 1995 for Mauritius and 1960 to 1996 for South Africa. Both techniques revealed consistent results and showed a significant relationship between import volumes, relative prices and domestic income in the long-run, with domestic income having the most impact on import volumes. The results showed that a shock to the import demand model took import volumes three years (Mauritius) and eight years (South Africa) away from their equilibrium levels.

Wijeweera et al., (2008) examined the likely impacts of trade liberalisation policies on the disaggregated import function in Bangladesh for the period 1973 to 2004. The objective was to establish whether or not bilateral import elasticities were significantly different between five major trading partners - India, Japan, Malaysia, Singapore and the USA. The empirical findings revealed that the import price elasticity was significantly negative for both India and the United States, suggesting that as Bangladesh domestic currency depreciates, its demand for products from these countries would reduce. For instance, if the real exchange rate depreciates by 1.0 per cent, demand for Indian imports would go down by about 2.0 per cent. Similarly, the demand for goods and services from the United States would fall by an approximately 1.5 per cent. The price elasticities related to Japan, Malaysia and Singapore were all positive. From the five trading partner, only the income elasticity for Malaysian imports was positive and statistically significant, suggesting that a 10 per cent increase in Bangladeshi real gross domestic product (GDP) would increase imports from Malaysia by about 7 per cent. Estimated income elasticity was negative for India, Japan and the United

States, and positive but insignificant for Singapore.

Khalid and Nourah (2002) studied aggregate import demand function for Saudi Arabia using cointegration analysis and error correction model. It was established that in both models, domestic and import prices as well as income were all important in determining the aggregate import demand. The result showed that aggregate import demand tended to be elastic with respect to income and domestic prices, but inelastic with respect to import prices. The result also revealed that Engle-Granger approach outperformed the other model in terms of having the smallest ex-post forecast errors.

Empirical investigation for Nigeria revealed remarkable results. For instance, Chimobi and Ogbonna (2008) investigated the behaviour of Nigeria's aggregate imports for the period 1980 to 2005, using cointegration and error correction model approaches. They found that real GDP largely explained the import demand function in Nigeria.

Babatunde and Egwaikhide (2010) studied aggregate import demand behaviour for Nigeria for the period 1980 to 2006 using bounds testing approach. It was shown that imports, income and relative prices were cointegrated and the estimated long-run elasticities of import demand with respect to income and relative prices were 2.48 and -0.133, respectively. The results suggested that the Marshall-Lerner conditions were not satisfied for Nigeria since the price elasticity of demand for imports is less than unity.

Omoke (2010) studied the import demand function for Nigeria using error correction method and cointegration techniques. The results showed that the estimates were statistically significant even though the variables were not cointegrated, suggesting that there was no long-run relationship among the variables. The results further established that real GDP and relative price were components of import demand function and they positively affected the volume of import in Nigeria in the short run.

Awomuse and Fatokasi (2011) assessed the determinants of demand functions for import in Nigeria using data from the period 1970 to 2008. Error correction model approach was employed for the analysis and the results revealed that real GDP

was the major determinant of import demand in Nigeria in the short-run. The result also showed the existence of a long-run relationship among the variables as the error correction model was significant.

### III. Stylised Facts on Import Trend in Nigeria

Nigeria's aggregate import had grown considerably since the country's independence. Total imports rose from an average of ₦4.23 billion or 16.9 per cent of GDP from 1970 to 1980, to ₦16.86 billion or 16.0 per cent of GDP, during 1981 to 1990; and further to ₦540.95 billion or 26.7 per cent of GDP from 1991 to 2000. The substantial rise in import bills was attributed to the country's quest to develop its infrastructural facilities. Further analysis, revealed that imports, as a percentage of total trade, rose from 38.5 per cent during the period 1970 to 1980 to 42.9 per cent, from 1981 to 1990, but fell slightly to 41.4 per cent during 1991 to 2000 (Table 1.1).

The persistent growth in the value of total imports continued in 2001 and stood at ₦1,358.18 billion or 28.7 per cent of GDP, it peaked at ₦2,080.24 billion and contributed 24.5 per cent to GDP in 2003, but thereafter fell steadily to ₦1,987.05 billion or 17.4 per cent of GDP in 2004. The share of imports in total trade during the same period stood at 42.1, 40.3 and 30.2 per cent, respectively.

The upward trend in the value of total imports remained sustained since 2005 to

**Table 1.1: Selected Imports Ratios**

Year	Imports (c & f) (₦ Billion)	Imports (% of GDP)	Imports (% of total trade)
1970-1980*	4.23	16.98	38.5
1981-1990*	16.86	16.05	42.9
1991-2000*	540.95	26.73	41.4
2001	1,358.18	28.7	42.1
2002	1,512.70	21.8	46.4
2003	2,080.24	24.5	40.3
2004	1,987.05	17.4	30.2
2005	2,800.86	19.2	27.9
2006	3,108.52	16.7	29.8
2007	3,911.95	18.9	32.0
2008	5,189.80	21.4	33.8
2009	5,102.53	20.6	37.9
2010	7,614.66	22.4	39.9
2011	10,235.17	27.4	41.8

Source: CBN, Annual Reports

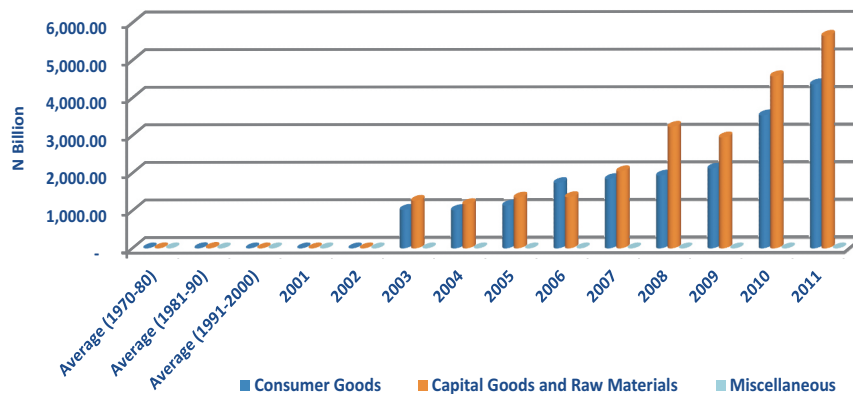
Note: \* - Average Figure, c & f – cost and freight

2011. Import bills rose from ₦2,800.86 billion or 19.2 per cent of GDP in 2005 to ₦3,108.52, ₦3,911.95 and ₦5,189.80 billion or 16.7, 18.9 and 21.4 per cent of GDP in 2006, 2007 and 2008, respectively. The value of imports continued to rise and in 2011 it stood at ₦10,235.17 billion or 27.4 per cent of GDP. Also, the share of imports in total trade rose steadily from 27.9 per cent in 2005 to 41.8 per cent in 2011.

The persistent growth in import bills had been largely attributed to several factors, which included: the appreciation of the ₦/US\$ exchange rate; the acceleration in economic productivity - particularly the downstream oil sector deregulation; and the infrastructure rehabilitation by the government to boost the domestic capacity of the real sector.

Figure 1 showed the Nigeria's total imports disaggregated into categories of consumer and capital/raw materials goods. The breakdown of import by category revealed that the relative share of consumer goods and capital/raw materials in total imports remained unchanged (Table 1.2). The categories of import were, however, determined by prevailing domestic policies and exchange rate movements. With the implementation of the import liberalisation programme in the early 1980s, there was a shift to the importation of consumer goods. However, the importation of capital and raw material goods remained dominant over the entire period.

**Figure 1: Categories of Nigeria's Imports**



The share of capital and raw materials goods in total merchandise import rose from 68.2 per cent in 1970 to 1980 to 69.6 per cent during the period 1981-1990 and thereafter fell to 62.3 per cent between 1991 and 2000. The share of capital and raw materials goods continued with its steady decline to 43.73 per cent in 2006 and thereafter rebounded to 62.2 per cent in 2008. But its relative share could not be sustained as it decline modestly to 56.1 per cent in 2011.

On the other hand, the share of consumer goods rose from 30.2 to 37.4 per cent from the period 1981 - 1990 to 1991 - 2000. The share of consumer goods further grew to 46.2 per cent in 2004 and continued to trend upward to 55.7 per cent in

**Table 1.2: Disaggregated Imports**

<b>Year</b>	<b>Consumer Goods</b>	<b>Capital and Raw Materials</b>	<b>Miscellaneous</b>
1970-1980*	31.51	68.22	0.26
1981-1990*	30.19	69.63	0.18
1991-2000*	37.43	62.33	0.24
2001	45.35	54.35	0.30
2002	45.49	54.21	0.30
2003	44.61	55.03	0.37
2004	46.20	53.50	0.30
2005	45.50	54.00	0.50
2006	55.74	43.73	0.53
2007	46.98	52.34	0.68
2008	37.22	62.15	0.63
2009	41.55	57.69	0.77
2010	43.36	56.14	0.50
2011	43.30	56.11	0.58

Source: CBN, Annual Reports

\*: Average Figure

2006. This acceleration reflected the stance of monetary policy and its influence on the exchange rate. Overall, the share of consumer goods averaged 45.0 per cent from the period 2006 to 2011.

#### **IV. Methodology and Model Specification**

##### **IV.1 Methodology**

The econometric technique adopted was the Auto-Regressive Distributed Lag (ARDL) method, which estimated cointegrating relationship. Pesaran and Shin (1997) noted that econometric analysis of long-run relations had been the focus of most theoretical and empirical research in economics. In the case where the variables in the long-run relation of interest are trend stationary, the general practice had been to de-trend the series and to model the de-trended series as stationary distributed lag or ARDL models. The ARDL approach was adopted because it produced consistent estimates of the long-run coefficients that were asymptotically normal, irrespective of whether the underlying regressors were integrated of order one  $I(1)$  or integrated of order zero  $I(0)$  (Pesaran and Shin, 1997). This means that it avoided the pre-testing problems associated with standard cointegration, which required that variables are classified as  $I(1)$  or  $I(0)$ .

##### **IV.2 Data Sources**

We utilised quarterly data on imports, real gross domestic product, exchange rate,

consumer price index, and external reserves. The data were obtained from the Central Bank of Nigeria Statistical Bulletin and covered the period 1970:Q1-2011:Q4.

### IV.3 Import Demand Model

Following the studies by Khalid and Nourah (2002), and Narayan and Narayan (2010), the import demand model specified was in the linear form and expressed as:

$$LIMP_t = \alpha_0 + \alpha_1 LRGDP_t + \alpha_2 LEXR_t + \alpha_3 LCPI_t + \alpha_4 LEXRES_t + \varepsilon_t \quad 4.1$$

Where, at period  $t$ ,

$LIMP$  = log of import of goods;

$LRGDP$  = log of real gross domestic product;

$LCPI$  = log of consumer price index;

$LEXR$  = log of nominal exchange rate; and

$LEXRES$  = log of external reserves.

$\alpha_0$  is a constant;  $\varepsilon$ , is the error term; and  $\alpha_1$ ,  $\alpha_2$ ,  $\alpha_3$  and  $\alpha_4$  are the income, exchange rate, price and external reserves elasticities, respectively. In line with theory,  $\alpha_1$ ,  $\alpha_3$  and  $\alpha_4$  are expected to be positive, while  $\alpha_2$  is expected to be negative. Using the variables in equation 4.1, the import demand model for the long-run in ARDL form could be specified as:

$$\begin{aligned} \Delta LIMP_t = & \alpha_0 + \sum_{i=1}^n \alpha_{1i} \Delta LIMP_{t-i} + \sum_{i=0}^n \alpha_{2i} \Delta LIMP_{t-i} + \sum_{i=0}^n \alpha_{2i} \Delta LEXR_{t-i} \\ & + \sum_{i=0}^n \alpha_{4i} \Delta LCPI_{t-i} + \sum_{i=0}^n \alpha_{5i} \Delta LEXRES_{t-i} + \beta_1 LIMP_{t-i} \\ & + \beta_2 LRGDP_{t-i} + \beta_3 LEXR_{t-i} + \beta_4 LCPI_{t-i} + \beta_5 LEXRES_{t-i} + e_t \end{aligned} \quad 4.2$$

Where  $\Delta$  denotes the first difference operator;  $\beta_1 - \beta_5$  are the long-run relationship while  $\alpha_1 - \alpha_5$  with their summations are the short-run dynamics.

## V. Empirical Results

Here, we presented the unit root tests to ascertain the data generating process using the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) unit root tests, the Granger causality tests results, the bounds cointegration test results and the outcome of the error correction model.



### V.1 Unit Root Test

Table 1.3 presented the results of the time series properties of the variables using the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) unit root tests. The results showed that imports, exchange rate, external reserves, real gross domestic product and consumer price index were non-stationary at levels. However, these series became stationary after taking the first differences.

**Table 1.3: Unit Root Test**

Variables	Augmented Dickey-Fuller		Phillips-Perron		Order of Integration
	Levels	First Differences	Levels	First Differences	
<i>LIMP</i>	-1.57	-6.35***	-2.01	-6.27***	1 (1)
<i>LEXR</i>	-0.20	-14.09***	-0.16	-14.06***	1 (1)
<i>LEXRES</i>	-2.11	-19.07***	-2.33	-18.61***	1 (1)
<i>LRGDP</i>	-1.99	-5.35***	-2.05	-5.30***	1 (1)
<i>LCPI</i>	-0.32	-4.38***	-0.55	-5.72***	1 (1)

Note: \*\*\*, \*\* and \* denotes level of significance at 1%, 5 % and 10 %, respectively

### V.2 Granger Causality Test

The result of the Granger causality was presented in Table 1.4. The result indicated a bi-directional causality between imports and external reserves as well as exchange rate and real GDP, while unidirectional causality existed between exchange rate and imports as well as exchange rate and external reserves.

**Table 1.4: Granger Causality Test**

Null Hypothesis	F-Statistics	Probability	Remark
<i>LRGDP</i> does not Granger Cause <i>LIMP</i>	1.43	0.24	Accept
<i>LIMP</i> does not Granger Cause <i>LRGDP</i>	0.96	0.38	Accept
<i>LEXRES</i> does not Granger Cause <i>LIMP</i>	7.47	0.00	Reject
<i>LIMP</i> does not Granger Cause <i>LEXRES</i>	4.94	0.00	Reject
<i>LCPI</i> does not Granger Cause <i>LIMP</i>	1.44	0.23	Accept
<i>LIMP</i> does not Granger Cause <i>LCPI</i>	0.84	0.43	Accept
<i>LEXR</i> does not Granger Cause <i>LIMP</i>	9.21	0.00	Reject
<i>LIMP</i> does not Granger Cause <i>LEXR</i>	1.91	0.15	Accept
<i>LEXRES</i> does not Granger Cause <i>LRGDP</i>	1.61	0.20	Accept
<i>LRGDP</i> does not Granger Cause <i>LEXRES</i>	0.25	0.77	Accept
<i>LCPI</i> does not Granger Cause <i>LRGDP</i>	1.25	0.28	Accept
<i>LRGDP</i> does not Granger Cause <i>LCPI</i>	1.00	0.36	Accept
<i>LEXR</i> does not Granger Cause <i>LRGDP</i>	10.53	0.00	Reject
<i>LRGDP</i> does not Granger Cause <i>LEXR</i>	3.98	0.02	Reject
<i>LCPI</i> does not Granger Cause <i>LEXRES</i>	4.64	0.01	Reject
<i>LEXRES</i> does not Granger Cause <i>LCPI</i>	1.06	0.34	Accept
<i>LEXR</i> does not Granger Cause <i>LEXRES</i>	4.18	0.01	Reject
<i>LEXRES</i> does not Granger Cause <i>LEXR</i>	0.39	0.67	Accept
<i>LEXR</i> does not Granger Cause <i>LCPI</i>	0.85	0.42	Accept
<i>LCPI</i> does not Granger Cause <i>LEXR</i>	2.07	0.12	Accept

Based upon the F-test results in Table 1.4, it showed strong evidence of long-run bi-directional Granger causality between imports and external reserves, thus implying that excessive financing of import through external reserves without a corresponding growth in export receipts could precipitate balance of payments crisis. Furthermore, there was evidence of unidirectional causality between exchange rate and imports, implying that imports responds to adjustments in the exchange rate, however, there was no Granger causality arising from imports to exchange rate, thus inferring the absence of two-way feedbacks between exchange rate and imports.

Overall, the establishment of causality implied the existence of relationship among the variables, suggesting that in designing policies for managing any of the variables its impact on the others must be established in order to ensure policy efficacy.

### V.3 Cointegration Test

Cointegration tests were conducted to determine whether a long-run relationship existed among the variables. To examine the existence of long-run relationships among the variables, the bounds testing procedure using the F-test was employed for *LIMP*, *LRGDP*, *LEXR*, *LCPI* and *LEXRES*. The null hypothesis of the F-test stated that no cointegration existed amongst the variables while the alternative hypothesis stated the contrary. To ascertain the presence of cointegration among the variables, the estimated F-test would be compared to the upper and lower bounds test critical values as compiled by Pesaran et al., (2001). In the bounds test procedure, when the estimated F-statistics exceeds the upper bound critical value then there is exists a long-run relationship among the variables of interest, while an estimated F-statistics below the lower bound critical value connotes no cointegration among the variables. However, when the estimated F-statistics lies in between the lower and upper bounds critical value, then an indeterminate conclusion is reached.

The cointegration results as reported in Table 1.5 revealed that the estimated F-statistic specified as;  $F(LIMP/LRGDP, LEXRES, LEXR, LCPI = 2.819)$  fell between the 95 per cent lower and upper bounds critical value (2.649 - 3.805), thus suggesting an inconclusive outcome. Since the estimated F-statistics was more than the lower bound critical value (2.649) and less than the upper critical bound value (3.805), it suggested that we cannot reject the null hypothesis of no cointegration neither could we reject the alternative hypothesis.

Further examination revealed the existence of a long-run relationship between *LEXR* and *LIMP*, *LRGDP*, *LEXRES*, *LCPI*. Hence, we proceeded to estimate the error

correction model, since the cointegration result showed an inconclusive outcome.

**Table 1.5: F-statistics for Testing the Existence of a Long-run Relationship**

Equation	F- statistics
F (LIMP / LRGDP, LEXRES, LEXR, LCPI)	2.81
F (LRGDP / LIMP, LEXRES, LEXR, LCPI)	1.82
F (LEXRES / LIMP, LRGDP, LEXR, LCPI)	3.29
F (LEXR / LIMP, LRGDP, LEXRES, LCPI)	3.18**
F (LCPI / LIMP, LRGDP, LEXR, LEXRES)	1.51

**Note:** The bounds critical values were obtained from Pesaran and Pesaran (1997) and the critical values of the F-statistics for the 5 variables (LIMP, LRGDP, LEXRES, LEXR and LCPI) with intercept and no trend are 2.26 - 3.36 at a 10% significance level, 2.64 - 3.80 at a 5% significance level and 3.51 - 4.78 at 1% significance level, respectively. \*\*\*, \*\* and \* denotes 1%, 5% and 10% significance level, respectively.

#### V.4 Error Correction Model

The result of the ECM in Table 1.6 indicated that the coefficient of LRGDP met *a priori* expectation and was statistically significant. The result also indicated that the short-run income elasticity was 0.9 per cent. In other words, a 1.0 per cent rise in income would increase imports by 86.6 per cent in the short-run.

**Table 1.6: Log-linear Error Correction Representation for ARDL (2, 2, 0, 0, 0) based on the Schwarz Bayesian Criterion**

Regressor	Coefficient	Standard Error	T-Ratio [Prob]
$\Delta$ LIMP(-1)	0.583	0.062***	9.322 [0.000]
$\Delta$ LRGDP	0.866	0.085***	10.122 [0.000]
$\Delta$ LEXRES	0.025	0.007***	3.363 [0.001]
$\Delta$ LEXR	-0.044	0.021**	-2.060 [0.041]
$\Delta$ LCPI	0.042	0.021*	1.927 [0.056]
ECM(-1)	-0.055	0.019***	-2.841 [0.005]
Adjusted R-Squared	0.735	DW-statistic	1.94
AIC	370.14	SBC	356.19
F-Stat.	65.86 [0.000]		

**Note:** \*\*\*, \*\*, \*denotes levels of significance at 1%, 5% and 10%, respectively.

The short-run elasticities in Table 1.6 revealed that all the regressors in the error correction model for the ARDL (2, 2, 0, 0, 0) were highly statistically significant at 1, 5 and 10 per cent, respectively, suggesting that they all contributed to changes in the aggregate import demand. Also, the coefficients of *LRGDP*, *LEXRES*, *LCPI* and *LEXR* confirmed with the *a priori* signs, since increased economic growth, external reserves and consumer price index were expected to positively stimulate import, while exchange rate depreciation was expected to reduce import demand.

In terms of magnitude,  $\Delta LRGDP$  definitely exerted the largest impact on import and 1.0 per cent rise in economic growth is expected to increase imports demand by 0.87 per cent. Thus, the short-run income elasticity is an indispensable factor accounting for the increase in import demand in Nigeria. Also, a striking outcome is the short-run price elasticity ( $\Delta LCPI$ ), which was expected to induce an increase of 0.04 per cent in import demand. A 1.0 per cent accretion in external reserves would increase import by 0.03 per cent.

The adjusted R-squared was 0.73, which implied that the change in dependent variable was explained by 73.0 per cent change in the independent variable. The joint significance of the model as captured by the F-statistics was statistically significant, indicating that the explanatory variables determined the import demand for Nigeria. In essence, the explanatory variables were jointly significant in explaining the import demand function for Nigeria. The Durbin-Watson statistic (1.9) reported in the model indicated the absence of serial correlation in the residuals of the estimated equation.

The error correction mechanism [*ECM (-1)*], which captured the long-run effect, met all its conditions as shown in Table 3.6. The estimated coefficient of *ECM (-1)* at -0.05 was highly statistically significant at 99.0 per cent confidence level and negatively signed. The *ECM* term reflected the speed of adjustment to equilibrium when there was a shock and thus, suggested that that it would take about 0.05 years for imports to respond to changes in any of the explanatory variables. Alternatively, it suggested that deviations from equilibrium were restored by about 5.0 per cent over the next quarter. Furthermore, the outcome of the error correction term indicated that a long-run relationship existed between import demand and its explanatory variables.

## **VI. Policy Implications**

The policy implications of the findings implied that in trying to design import policy for Nigeria, there was need to consider the level of income, exchange rate, stock of external reserves and consumer prices. Increase in the level of income would

result in a shift in demand for imports; this was consistent with the theory that stated that a growing economy would require higher imports, especially import of capital goods.

There was a short-run relationship between national income and imports as indicated by the ARDL results. This implied that in designing an effective policy, the income elasticity must be taken into cognisance. Our findings were consistent with the studies of Narayan and Narayan (2010) for Mauritius and South Africa, Khalid and Nourah (2002) for Saudi Arabia and Huseyin (2006) for Turkey. There existed a short and long-run relationship between imports and all the explanatory variables. Hence, the study further confirmed the findings of Egwaikhide (1999) that explanatory variables, especially price and income were important in determining import demand in Nigeria.

#### **VII. Summary and Conclusion**

The paper examined empirically the import demand function for Nigeria. Cointegration and ARDL techniques were used to measure the impact of economic activity, domestic prices, nominal exchange rate and external reserves on import demand. The result showed that changes in imports demand were responsive to changes in all the explanatory variables, with highest rate of responsiveness stimulated by changes in the level of income. This revealed that aggregate demand for imports in Nigeria was highly income elastic. To curtail massive importation of goods in Nigeria, appropriate fiscal and monetary policies are required, especially consumer goods import, which accounted for an average of 45.0 per cent of total import over the past five years.

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# Determinants of Bilateral Trade Performance of the Member Countries of the West African Monetary Zone (WAMZ)

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Osuji, E.

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## Abstract

*This study sought to identify the drivers of import demand in the region, as a basis for proposing achievable alternative strategies for enhancing the level of intra-regional trade in the Zone. The study estimated a global import trade model for the Zone to establish the key determinants of its import demand. Using the pooled regression technique, the study analysed quarterly data spanning the period 1985 to 2012, for the five original member countries of the WAMZ. The following is a highlight of the outcome of the analyses: given its positive sign and significance, trade liberalisation has the potential of boosting intra-regional trade and improving the welfare of the citizens; nominal exchange rate is a significant factor in the demand for imports in the Zone; its significance and negative sign show that exchange rate movements have negative impact on bilateral intra-WAMZ trade, with implications for incurring avoidable foreign exchange transaction costs; positive signs of both domestic and foreign economic growth proxy variable (GDP) indicated that economic growth in the Zone, as well as its foreign trading partners, is generally accompanied by increase in the demand for import by members. Based on these findings, the study recommended, among others, that policy-makers in the Zone should de-emphasise individual exchange controls in favour of adopting a common exchange rate mechanism as a way of reducing transaction costs associated with trading with each other through a third party currency.*

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**Key Words:** *International Trade, Regional Economic Integration, Panel Data, Pooled, Regression WAMZ.*

## I. Introduction

The traditional global approach to the promotion of trade between the developed and developing nations has been to foster trade agreements, which aim to create trading opportunities for developing nations through trade policies that discriminate in their favour. This strategy gave rise to such agreements as the Lome Convention, which was signed in 1975 between seventy-one members of the Africa, Caribbean and Pacific countries (ACP) on the one hand and the European Community (EU) on the other. This convention sought to give preference to the ACP countries in their trade relations with the EU.

Much as there was some success under this strategy, emphasis is now shifting away from such agreements or treaties. The current trend is to promote trade by

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encouraging states, especially contiguous ones, to come together in the form of economic blocks or enter into Regional Trade Agreements (RTAs). Recent partnership agreements between Europe and the ACP, as well as those between the latter and the United States of America, have shifted focus away from discriminatory and preferential trade arrangements to encourage regional economic integration.

The main objective of this strategy is to consciously encourage trade diversion from the rest of the world to the integrating block. This objective, among others, forms the rationale for formation of economic blocks in most regions of the world. The West African Monetary Zone (WAMZ), which is the brain child of the Economic Community of West African States (ECOWAS), is a fast track initiative to regional economic integration. The WAMZ, comprising The Gambia, Ghana, Guinea, Nigeria, Sierra Leone and the new addition, Liberia seeks to expedite the evolution of a second monetary zone in West Africa. The rising global trend in RTAs stems from the fact that regional economic integration galvanises economic activity and ultimately increases the level of trade among the participating countries (Rose, 2000; Mason and Pattillo, 2004).

Considerable time and resources have been expended over time to improve the level of trade among the member countries of the WAMZ. Indeed, serious effort to achieve higher levels of intra-regional trade in the West African sub-region has been on-going since the signing of the ECOWAS Treaty in 1975, and the establishment of the Economic Community of West African States (ECOWAS). Over this period, a number of protocols have been signed aimed at facilitating and liberalising trade in the sub-region. However, despite the time and effort spent in this regard, the level of intra-WAMZ trade has remained low. According to Bamidele (2003), the level of intra-regional trade in the ECOWAS region has hovered around 10.9 and 11.4 per cent respectively, thereby trailing other regions. Thus, although the member countries of the WAMZ may be witnessing increases in their global trade, they are certainly doing very little with one another. This poor performance has been attributed to a number of factors including, lack of commitment to the ideals of the group, non-implementation of trade liberalisation protocols, lack of awareness, non-tariff barriers and other political and technical factors (Ogunkola and Jerome, 2005).

The West African Monetary Zone (WAMZ) was established in the year 2000, under the Bamako Treaty. Its primary mandate is to create the enabling environment that would galvanise the ECOWAS sub-region to achieve a monetary union. The original participating countries were the Gambia, Ghana, Guinea, Nigeria and

Sierra Leone, until February 2010 when Liberia was admitted. The WAMZ was, however, still a monetary zone under construction, the ultimate objective of which is to create a common central bank and a common currency for what would become the second monetary zone in West Africa.

The Zone has faced a number of challenges that have hindered trade among members. Principal among these challenges is the fact that members do not have a common convertible currency. They therefore continue to trade through third currencies. It is also a fact that differences in languages is also impacting negatively on trade and this is reinforced by traditional colonial alliances that seem to favour trade with colonial masters at the expense of members. As a result, there is a large and rising amount of informal trade going on in the sub-region and threatening formal trade. Other constraints to the growth of intra-regional trade in the Zone include ineffective trade liberalisation policy. The trade liberalisation scheme that was introduced in 1990 has not been effectively implemented (Ogunkola and Jerome, 2005).

Import dependence, which is one of the major hindrances to economic growth in the Zone, has its origin in the immediate post-independence Import-Substitution Industrialization (ISI) strategy, widely adopted by the founding fathers of the Zone (Ahmed, 1983). The legacy of this development strategy, which is still with us, is highlighted by industrial sectors that are not only shallow, but also highly reliant on imported input. Thus, we have a situation where import-substitution activity ends up fuelling more importation. According to Okongwu (1984), import substitution will always result in increased importation. This view is in tandem with one earlier expressed by Ahmed (1983) who observed that it was mounting imports, in the face of unstable export performance, that partly explained the overall adverse external sector performance of these countries in the 1980s, especially Nigeria. Consequently, a large proportion of their foreign exchange earnings is spent on the importation of a wide range of goods and services, including raw materials, plant and machinery and consumables, such as drinks, soaps, tooth paste and fruit juices. This awkward situation, according to Vogel and Wagner (2008), is the natural consequence of a flawed industrial development with heavy dependence on imported input.

There has also been considerable study of import demand using the trade gravity model, which tries to capture the influence of economic power in trade relations. The trade gravity model is typically specified with the product of the real GDP of the two countries both in levels and also in per capita terms. Also included in the arguments are: the distance between them, their land masses; and a number of

dummy variables, which seek to capture some common characteristics of the two countries. These dummies may include: common language and currency; common borders or adjacency; and common colonising authority (Frankel and Rose, 1998). It has often been argued that Nigeria ought to dominate the sub-regional trade activity given its resource endowment and economic size.

Typically and following Rose (2000) a trade gravity model takes the following form:

$$\ln(X_{ij}) = B_0 + B_1 \ln(y_i y_j) + B_2 \ln\left(\frac{y'_i}{Pop_i} \frac{y'_j}{Pop_j}\right) + B_3 \ln(Area_i Area_j) + \sum_{k=1}^n B_{3+k} D_k \dots\dots\dots 4.6$$

where  $X_{ij}$  is the total bilateral (import and export) trade between the two countries.

- $y_i y_j$  = Real output of partner countries in U.S dollars
- $y'_i y'_j$  = Nominal output of partner countries in U.S dollars
- $Pop_i Pop_j$  = Population of partner countries
- $Area_i Area_j$  = Land mass of partner countries
- $D$  = Dummies; such as: common borders or adjacency, common colonial past and common language (Osuji, 2010).

The broad objective of this study is to determine the key factors that determine intra-regional trade in the Zone. More specifically, the objectives of the study are to examine the extent to which an effective trade liberalisation policy can impact trade among the member countries of the Zone. Furthermore, the study proposes to investigate the extent to which intra-regional trade in the Zone is affected by exchange rate movements, given the absence of a common currency for the Zone. This is with a view to proposing workable strategies to boost trade among the members. The study will also examine the impact of economic growth in major trading partners of the region on her internal trade performance. It therefore focuses on the need to reverse the low level of trade observed among member countries of the WAMZ. It is expected that such solutions would help to galvanise the cooperative endeavours of member countries of the WAMZ and enable them to maximise the benefits of their current economic integration efforts and improve the socio-economic well-being of their citizens.

Accordingly, the paper is organised into five parts. Section I is the introduction, which sets the tone of the study and highlights the challenges at hand. Section II

takes a look at relevant literature to provide background and theoretical foundations for the study. Section III develops the theoretical framework and establishes the methodology of the work. We presented the result of the analysis in Section IV, while Section V contains the conclusions and policy recommendations.

## **II. Review of Relevant Literature**

The econometric estimation of import demand parameters has been the focus of considerable literature in both developing and developed countries. Such studies include Houthakker and Magee (1969), in which the authors established the superiority of the double logarithmic equation over the simultaneous equation model in the area of international trade. They concluded that even if all countries inflated at the same rate, the trade balance of some would still be subject to secular improvement or deterioration due to disparities in their income elasticities of demand for imports. Frimpong and Oteng-Abayie (2006), established that Ghana's imports in the long-run depended on investments and exports. Similarly, in their study of alternative measures of relative prices in import demand, Goldstein, Khan and Officer (1977), showed that import demand elasticities based on value-added index of tradable goods yields superior price elasticities than those based on unit value indices. In another study of import demand in developing countries, Khan and Schwartz (1974), provided estimates of import and export demand functions for 15 countries that could be characterised as developing. Olopoenia (1991) carried out a study, which related demand for imports to real expenditure and real exchange rate.

Import demand elasticity parameters are very important for planning purposes. They are, especially useful in such areas as the calculation of optimal taxes, tariff reduction and their implications on trade, as well as in exchange rate policy analysis (Hong, 1999). An understanding of the import demand parameters of the WAMZ region will highlight key areas of policy action that would positively impact bilateral trade and hence, improve the level of trade among member countries of the WAMZ.

### **II.2 Gains from Trade**

One of the basic questions that are posed about international trade is why do nations trade with one another or what do they benefit by doing so? This question has long been answered as far back as 1851 in the Ricardian theory of Comparative Advantage, which was developed from the background of Mercantilism. The doctrine of mercantilism was highly nationalistic. It favoured anything that increased the own county's stock of precious metals. It therefore favoured the regulation and planning of economic activity and viewed foreign

trade with suspicion, as it may lead to the dissipation of the nation's stock of gold. As a result, trade had to be controlled and regulated. It was from this environment that Adam Smith and David Ricardo emerged to condemn and confront the status quo with their new perspectives and theories of trade.

The orthodox interpretation of trade as expounded by classical and neoclassical economists is that foreign trade can become a propelling force driving resource allocation and utilisation in the development process. In that regard, trade could become a mechanism for efficient resource allocation and hence act as an engine of growth. That was why Adam Smith's model of foreign trade postulated the existence of idle resources when a country is in the state of autarky. Smith (1776) had stated that a nation would gain from trading by producing more than it needs of the goods in which it has absolute advantage and exchanging the difference for what it does not produce. Thus, resources which otherwise would have been idle are used to produce goods, which international trade "vents" to the outside world thereby creating new jobs and incomes and ultimately improving societal welfare (Mieir, 1984). According to Romer (1986), as the citizens have access to more goods and services, which before trade, were not available to them, welfare gains occur. This is the Absolute Advantage theory of Adam Smith.

On his own part, Ricardo (1817) posited that trade should still go on even if one country has absolute advantage over its counterpart on the production of all goods. According to him, what is important is comparative advantage and not absolute advantage. Thus, countries should specialise in the production of goods in which they have comparative absolute advantage. Country A is said to have comparative advantage over B in the production of a commodity if it has a lower opportunity cost of producing the commodity than country B. It follows therefore that trade occurs because of productivity differentials among countries. This model in which trade takes place solely because of international differences in the productivity of labour is known as the Ricardian trade model. It presupposes that nations should specialise in the production of goods in which they have comparative advantage.

The foregoing classical theory ascribed the occurrence of trade to differences in the productivity of labour among nations and provided an intelligent explanation of the reason why nations trade. However, this view has been challenged by some other group of writers known as the Neoclassical economists, who believe that trade is brought about, not by productivity differentials, but by factor endowments. According to the neoclassical economists, trade results from the fact that different countries are endowed with different levels of natural resources

or technology. They therefore postulate that a country produces goods based on its factor endowment. Some countries have abundance of labour, while others have capital surplus. Countries with technological or capital endowments, according to the theory, will produce capital-intensive goods, while those with the abundance of labour will produce labour-intensive goods. Each country will then import from others what it does not produce. Thus, what determines trade is factor endowment. This is the thesis of the Heckscher-Ohlin trade model.

Both the classical and neoclassical theories of trade suggested that certain gains accrue to trading nations. Such gains include both static gains arising from resource reallocation and dynamic gains, which arise from the outward shift of the production possibility frontiers of trading countries (Cruz, 2008). The export growth that arises from this shift serves as a continuing source of growth, especially where production is subject to increasing returns to scale. Trade also stimulates competition and enhances efficiency.

The more traditional theories of the static gains from trade involve the role of allocative efficiency, which can be achieved more easily with an open trade regime, even when factors of production are assumed to be immobile. It is a basic postulate of the theory of Comparative Advantage that higher levels of output will follow when countries specialise according to their relative comparative advantage. This is clearly complementary to the position of Thirlwall (2003), which is to the effect that the causes which determine the economic progress of nations belong to the study of international trade and specialisation.

### II.3 Functional form of Import Demand Equation

Behind the import demand equation is the theory of individual consumption decisions which play an important role in economic activity. Individual preferences are fundamental to consumption decisions. An understanding of how preferences affect demand, and how demand and prices interact, is vital for the analysis of import demand. In a two commodity consumption choice problem involving two goods A and B, there are a number of combinations of goods the individual can consume. To determine the combination preferred by the consumer, we must rank the combinations. Thus, the ranking of various combinations of the goods  $(X_1, X_2)$ , which might be expressed as index number assignment rule may be written as  $U(X_1, X_2)$ . This ranking of the various combinations is the individual's utility function. Therefore for any two combinations  $(X_1^0, X_2^0)$  and  $(X_1^*, X_2^*)$ , where  $U(X_1^0, X_2^0) > U(X_1^*, X_2^*)$ , it means that combination  $(X_1^0, X_2^0)$  is preferred to combination  $(X_1^*, X_2^*)$ . This is the basis of the choice which the individual makes between two baskets of consumption goods. Thus, the maximisation of individual

utility and societal preferences is at the root of the theory of demand, which in its simplest form, assumes that individuals are rational and would allocate their limited resources to maximise their satisfaction.

Although Leamer and Stern (1970) had noted that there are no well-defined criteria for choosing a particular functional specification of the import demand model, this study will draw from the works of Houthakker and Magee (1969), Khan (1974), Egwaikhide (1999), Frimpong and Oteng-Abayie (2006) and, Emran and Shilpi (2001), among others. These authors estimated demand elasticities for both imports and exports for a number of countries, cutting across both the developed and developing world, including the WAMZ.

In studies of import demand, several empirical formulations of the import demand function have been adopted to analyse the relationship between imports and its determinants. According to studies by Frimpong and Oteng-Abayie (2006), Bahman-Oskooee (1984), Goldstein, Mohsin and Officer (1977) and Houthakker and Magee (1969), the simplest formulation of an aggregate import demand function relates the quantity of imports demanded to relative prices (the ratio of import prices to the prices of domestic substitutes), and real income at a given period of time,  $t$ . In this formulation, the basic explanatory variables are the price of imports relative to the price of substitutes, and real income. The choice of these variables is rooted in the theory of behaviour and demand with regard to changes in income and the price of goods. From economic theory, the sign of the partial derivative of import with respect to income,  $\partial M^d / \partial Y$ , is generally expected to be positive, while the partial derivative of imports with respect to relative prices, is expected to be negative. This formulation assumes some level of substitutability (though imperfect) between imports and domestic goods, hence it is referred to as the Imperfect Substitutes Model.

It is noteworthy, however, as Magee (1975) explained, that some ambiguity may arise, with regard to the direction of the partial derivative of imports with respect to income. According to him, depending on whether or not imports are viewed as the difference between domestic consumption and domestic production of importables less export, the outcome of the partial derivative may differ. If income rises and domestic consumption rises faster than domestic output, then import demand will rise, yielding a positive sign for the partial derivative of the income variable. The reverse will be the case if consumption rises more slowly than domestic production as income increases.

Economic theory does not provide *a priori* criteria for choosing the functional form

of the import demand function, according to Leamer and Stern (1970). This choice has been left to the discretion of the researcher. However, from available literature, the most preferred form of the equation has been the log linear form, which was applied by Kreinin (1976), Khan (1974), Magee (1975), Egwaikhide (1999), and Narayan and Narayan (2005), in their various studies. Other empirical works that have utilised the log-linear formulation of the simple import demand model include Boylan, Cuddy, and O'Murrcheartaigh (1979), Ho (2004), and Frimpong and Oteng Abayie (2006).

#### **II.4 Other Empirical Studies**

Most of the traditional studies focus on the practical and theoretical importance of price elasticities, which without doubt, is valuable beyond question. However, it has been argued by Chang and Nair (2002) that income elasticities are also at least equally important, especially in developing countries.

Johansen (1988) highlighted the importance of the income elasticity of demand for imports when he noted that under certain conditions, the direction which a country's trade balance follows over time depends, to a large extent, on its income elasticity of demand for imports relative to the world's income elasticity of demand for the country's exports. Johnson further showed that if trade was initially in a balance in a two-country model, with prices held constant and incomes growing at the same rate, the trade balance of the two countries could still change over time, if their income elasticities for each other's exports vary.

According to him, the country with greater income elasticity of demand for its imports, than the foreign income elasticity for her exports, will face more rapid growth in imports and consequently, a deterioration of its balance of trade. This will eventually put pressure on her foreign exchange resources and exchange rate. Thus, a country might experience reasonable income growth while still persisting in balance of trade disequilibrium because the relative income elasticities are sufficiently adverse. The foregoing makes it evident that income and price elasticities have practical and theoretical value in international trade, as well as in economic planning.

Egwaikhide (1999) studied the determinants of import demand in Nigeria. This study examined the determinants of aggregate imports and its major components in Nigeria, covering the period 1953 to 1989. The model specification draws on both the traditional and the Hemphill import demand functions, while the estimation procedures took into consideration the recent developments in time series modeling. The results obtained were very informative. Quantitative evidence



indicated that short-run changes in the availability of foreign exchange earnings, relative prices and real output significantly explained the growth of total imports during the period under investigation. Particularly striking was the short-run impact of foreign exchange availability, which was tied to the long-run effect through a feedback mechanism. Thus, even though these variables all play an important role in sharpening import behaviour, the effect of foreign exchange availability was particularly remarkable.

It follows therefore that to increase total imports, it is essential to implement the set of macroeconomic and sector-specific policies that can considerably relax the binding constraint on the availability of foreign exchange. Moreover, the near unity of the price elasticity of import demand suggested the high sensitivity of demand to the price of imports. In this sense, assuming neutrality of other economic policies, devaluation can reduce the demand for aggregate imports.

The foregoing literature review showed that the essential cause of trade among nations is their individual differences, evident either in terms of labour productivity, resource endowment or economic size. Bilateral trade analysis using the Trade Gravity model has gained considerable prominence in recent literature. The factor of international differences remains a powerful explanation of trade as the literature revealed. It is also clear from the review that exchange rate and national income are central to bilateral trade performance.

### **III. Theoretical Framework and Methodology**

Following from the studies reviewed in the previous section, particularly the works of Houthakker and Magee (1969), Frimpong and Oteng-Abayie (2006), Khan (1974) and Egwaikhide (1999), which not only focused on areas with similar features as the WAMZ, but also utilised simple and easily adaptable frameworks and models, the theoretical framework for this study is developed. Accordingly, the study adopted the log linear single equation model with appropriate modifications for its analysis. This will enable us to maximally profit from its flexibility and read off relevant elasticities straight from the equations.

#### **III.1 Methodology of the Research**

To successfully implement the theoretical framework, the study will estimate a global equation for the intra-regional trade of members. The intra-WAMZ trade model to be estimated in this study focuses on the global import trade of the five original member countries of the Gambia, Ghana, Guinea, Nigeria and Sierra-Leone. These countries have gained considerable experience trying to make the monetary zone a reality. Their trade relations and activities are likely to reflect some

outcome of their many years of economic cooperation than those of non-members. Liberia was a non-member until very recently, hence we believe her structures and systems of trade policy and management are yet to internalise the conduct of an integrating members, hence her exclusion in the present study.

The study estimated an aggregate pooled import demand equation for the combined bilateral imports of the Zone as a whole (Zone-wide Global Intra-WAMZ Import Demand) in which it tries to identify the drivers of bilateral trade among members, using a 5x2 panel.

The construction of the panel will entail a total of ten (10) cross-sectional identifiers, namely Gambia–Ghana (Gam–Gha), Gambia–Guinea (Gam–Gui), Gambia–Nigeria (Gam–Nig) Gambia–Sierra Leone (Gam–Sie), Ghana–Guinea (Gha–Gui), Ghana–Nigeria (Gha–Nig), Ghana–Sierra Leone (Gha–Sie), Guinea–Nigeria (Gui–Nig), Guinea–Sierra Leone (Gui–Sie), and Nigeria–Sierra Leone (Nig–Sie).

### **III.2 Inclusion of Foreign Trading Partner GDP in the Model**

The study hypothesises that imports not only depend on Domestic National Income (GDPD), but also on the level of economic activity, reflected by the GDP, in the foreign representative trading partner country from which the WAMZ imports (GDPF) – the United States of America (the United States).

The major import of the United States from the Zone is oil. Economic growth in the United States would naturally be accompanied by an increase in the demand for oil, which is the main fuel that powers the industrial machinery of the United States. This rise in income will in turn bring about an increase in demand for imports both from the United States and other sources. This will happen for a number of reasons, including the rules of reciprocity in trade that require countries to reciprocate trade. Thus, the theoretical expectation of the partial derivative of imports with respect to changes in foreign partner's GDP is therefore positive.

The United States having been chosen for the role of representative foreign partner for this study, her GDP shall be included as an explanatory variable in all WAMZ countries' import demand functions. Her long-standing prominent position as a dominant trading partner of the WAMZ members, prior to the recent rise of China, informed the choice of the United States for this role.

### **III.3 Two Price Terms**

While the earlier researchers generally used a single-price term for the relative price variable, this study shall use two-price terms. The price terms will be the unit

value indices for imports ( $tPMD$ ) and exports ( $tPMF$ ). According to Dash (2005) and Shiells (1999), these indices provide a better representation of prices than other variables, such as the ratio of import prices to wholesale prices and the ratio of import prices to GDP (Goldstein, et al., 1977). While providing further justification for the use of unit value indices of import and export as price terms in the import demand equation, Arize and Walker (1992), noted that the approach is better in capturing the reaction of import to its own price as well as the prices of domestically produced competing alternatives.

Two different sets of unit value indices of import and export are available for oil exporting and non-oil exporting countries. The unit values, which apply to non-oil exporting countries, are the same for all such countries. Similarly, the unit values, which apply to oil exporting countries, are the same for all of them. For our purposes, Nigeria is the only country in the oil-exporting category. Thus, when two countries ( $i$  and  $j$ ) whose bilateral trade is estimated are in the same category (say non-oil exporting countries), the same unit value index of imports ( $PMD$ ) will be used because here  $PMD_i = PMD_j$ . However, two import prices ( $PMD_i$  and  $PMD_j$ ) would be used when the combination of partner countries is such that they are not in the same group (one is oil-exporting and the other is non-oil exporting), because here  $PMD_i \neq PMD_j$ . This is the International Monetary Fund's classification of countries to oil exporting and non-oil exporting for purposes of the unit value indices.

#### III.4 Cross Rates in Bilateral Trade

The exchange rate used in the bilateral intra-WAMZ equation was computed as a ratio i.e.,  $EXR_i/EXR_j$ , which expressed the exchange rates of both countries in terms of their third currency. This cross exchange rate is the ratio of the exchange rate of the currency of country  $i$  to the US dollar to the exchange rate of the currency of country  $j$  also to the US dollar.

#### III.5 Sources of Data Used in Study

The data analysed in this study are secondary time series and cross-sectional data obtained from published statistics of the various countries. The main data sources are the national monetary and statistical authorities of the member countries and WAMZ institutions. These include the National Bureau of Statistics (NBS) of Nigeria and the West African Monetary Institute (WAMI) in Ghana. Other sources include the publications of the ECOWAS Secretariat, the International Financial Statistics and the Direction of Trade Data of the WAMZ Members published by the International Monetary Fund. These foreign statistics were used primarily to augment data from local sources published by the individual countries.

Furthermore, references were made, in the case of Nigeria, to data published in the Nigerian Trade Summary, Annual Abstracts of Statistics, Economic Indicators, Digest of Statistics and, Economic and Financial Review, all published by the NBS. Data from the publications of the West African Monetary Institute and the ECOWAS website were also used to fill appropriate gaps in the statistics of some of the countries, not otherwise available. Some data were also provided by the officials of WAMI, with whom the researcher interacted during the visit to the Institute in Ghana in furtherance of the data collection aspect of the research.

**III.6 Data Adjustment: Quarterisation of Annual GDP**

The national income figures in the equations are the real gross domestic product (GDP) of the relevant countries. These data came as annual figures and had to be converted to quarterly data. According to Bloem, Dippelsman, and Maehle (2001), several techniques of quarterisation and benchmarking are in use. These techniques include the Pro Rata Distribution Technique, the Basic Extrapolation with an Indicator technique and the Proportional Denton Method. The study utilised the Proportional Denton Method of interpolation of annual flow time series, which is recommended by the World Bank and the International Monetary Fund.

The Basic Version of the Proportional Denton Method keeps the benchmarked series as proportional to the indicator as possible by minimising (in a least-squares sense) the difference in relative adjustment to neighbouring quarters subject to the constraints provided by the annual benchmarks. This method, which is preferred and described by the IMF in its publications as “relatively simple, robust, and well-suited for large-scale application”, uses an associated “indicator series”, imposing the constraint that the interpolated series obeys the annual totals (Bloem, Dippelsman, and Maehle, 2001). Thus, the sum of the interpolated quarterly figures must equal the annual figure, which served as a benchmark for each year. This technique was applied to the GDP figures of all the five WAMZ countries.

The basic version of the Proportional Denton Method may be expressed as follows:

$$\left( X_t \dots X_{4,\beta}^{\min} \dots X_T \right) \sum_{t=2}^T \left[ \frac{X_t}{I_t} - \frac{X_{t-1}}{I_{t-1}} \right]^2 \dots\dots\dots 3.6.1$$

$$t \in \{1 \dots (4\beta) \dots T\}$$

under the restriction that, for flow series,

$$\sum_{t=2}^T X_t = A_y, y \in \{1 \dots \beta\} \dots\dots\dots 3.6.2$$

That is, the sum of the quarters should be equal to the annual data for each benchmark year.

where

- $t$  is time (e.g.,  $t = 4y - 3$  is the first quarter of year  $y$ , and  $t = 4y$  is the fourth quarter of year  $y$ );  $X_t$
- is the derived QNA estimate for quarter  $t$ ;
- $I_t$  is the level of the indicator for quarter  $t$ ;
- $A_y$  is the annual data for year  $y$ ;
- $\beta$  is the last year for which an annual benchmark is available; and
- $T$  is the last quarter for which quarterly source data are available.

The proportional Denton technique implicitly constructed from the annual observed BI ratios a time series of quarterly benchmarked QNA estimates-to indicator (quarterly BI) ratios that are as smooth as possible and, in the case of flow series:

- For the back series,  $(y_{-1} \dots \beta)$  averages to the annual BI ratios for each year  $y$ .
- For the forward series,  $(y_{\beta+1} \dots T)$  are kept constant and equal to the ratio for the last quarter of the last benchmark year.

### III.7 Model Specification for the Global Intra-WAMZ Trade Model

The following implicit model will be specified:

$$TM = f \left( \begin{array}{l} GDPD_i, GDPD_j, GDFP, PMD_i, PMD_j, PMF_i, PMF_j, FR_i, FR_j, \\ EXR_i / EXR_j, OPEN_i, OPEN_j \end{array} \right) + \dots \mu \dots 3.7.1$$

and log-linearised as:

where:

Log (TM)	=	Total bilateral import in U.S dollars
Log (GDPD) <sub>i</sub>	=	Gross domestic product of country in U.S dollars
Log (GDPD) <sub>j</sub>	=	Gross domestic product in U.S dollars of country $j$
Log (GDFP)	=	Gross domestic product of foreign trading partner
Log (PMD) <sub>i</sub>	=	Unit value index of imports for country $i$
Log (PMD) <sub>j</sub>	=	Unit value index of imports for country $j$
Log (PMF) <sub>i</sub>	=	Unit value index of exports for country $i$

$\text{Log } (PFM)_j$	=	Unit value Index of exports for country $j$
$\text{Log } (FR)_i$	=	Foreign reserve of country $I$
$\text{Log } (FR)_j$	=	Foreign reserve of country $j$
$\text{Log } (EXR)_i$	=	Exchange rate of country $I$
$\text{Log } (EXR)_j$	=	Exchange rate of country $j$
$EXR_i / EXR_j$	=	Cross rate of exchange to the USD of both countries
$\text{Log } (OPEN)_{ij}$	=	$\frac{TTMX_i}{GDP_j}, \frac{TTMX_j}{GDP_j}$ Index of economic openness or import penetration ratios of countries $i$ and $j$ .

$b_1, b_2, b_3, b_4, b_5, b_6, \dots, b_{12}$  are the elasticity of the relevant variables.

All variables are expressed in log form and all GDP and foreign reserve figures are in U.S dollars.

#### IV. Estimation Results

Table1: Zone-Wide Bilateral Intra-WAMZ Model					
Dependent Variable: Total Import [Log (TM)]					
Estimation Method: Pooled Equation Generalized Least Square (Cross Section Weights)					
Sample: 1985Q1 - 2012Q4					
Included Observations: 92					
Cross - Sections Included: 10					
Total Pooled (Balanced) Observations: 920					
Linear Estimation after one-step weighting matrix					
Variable		Coefficient		Statistics	
Name	Symbol	Name	Value	t-stat	Probability
Constant	C	a	-3.05	-8.18	0.00
Domestic GDP for country <i>i</i>	Log(GDPD <i>i</i> )	b1	0.40	4.72	0.00
Domestic GDP for country <i>j</i>	Log(GDPD <i>j</i> )	b2	0.07	2.65	0.01
Domestic GDP for foreign partner	Log (GDPF)	b3	-0.24	-2.10	0.04
Import Prices	Log (PMD <i>i</i> )	b4	0.83	9.48	0.00
Export Prices	Log (PMFi )	b5	-0.25	-3.07	0.00
Foreign Reserve for Country <i>i</i>	Log (FR <i>i</i> )	b6	-0.02	-2.76	0.01
Foreign Reserve for Country <i>j</i>	Log (FR <i>j</i> )	b7	0.01	0.62	0.53
Openness Index for Country <i>i</i>	Log (OPEN <i>i</i> )	b8	0.01	8.01	0.00
Openness Index for Country <i>j</i>	Log (OPEN <i>j</i> )	b9	0.00	4.63	0.00
Cross Exchange rate	Log (EXR <i>i</i> /EXR <i>j</i> )	b10	-0.02	-3.19	0.00
<b>Fixed Effects</b>					
-GAMGHA- - C			-0.63		
-GAMGUI- - C			-0.65		
-GAMNIG- - C			-0.67		
-GAMSIE- - C			-0.73		
-GHAGUI- - C			-0.55		
-GHANIG- - C			3.73		
-GHASIE- - C			-0.63		
-GUINIG- - C			0.41		
-GUISIE- - C			-0.41		
-NIGSIE- - C			0.12		
<b>Weighted Statistics</b>					
R-Squared	0.83		Mean Dependent Var	0.64	
Adjusted R-Squared	0.82		S.D Dependent Var	0.71	
S.E of Regression	0.35		Sum Squared Residual	111.88	
F-Statistics	231.42		Durbin Watson Stat	1.99	
Prob (F-Statistics)	0.00				

Table 1 summarises the pooled regression results of the global bilateral intra-WAMZ import demand model. The result showed that all the explanatory variables, except foreign reserves, were significant. The model returned an adjusted R-Squared of 0.83, which indicated a very good fit. The regression output showed

that, on the average, aggregate bilateral import trade of member countries was positively impacted by their individual domestic output or GDP growth. This variable was significant for each pair of trading countries. The positive sign of Domestic GDP indicated that bilateral import demand was boosted as their individual economies grow. This result was theoretically consistent with *a priori* expectations. Growth implied the expansion of production and the demand for necessary input to grow output.

The growth of the national output of their foreign trading partner, represented here by the United States of America returned a negative sign. This implied that output growth in the foreign trading partner had the effect of depressing bilateral trade in the Zone. This result is quite plausible. If we consider that growth in output in the foreign trading partner could lead to cheaper import for WAMZ members, then it would not be difficult to understand the negative sign of that variable. This would therefore mean increased trade with the foreign partner and a diversion of trade from member countries. So, as members increase their trade with their foreign trading partner and the rest of the world, they would naturally trade less with one another. Thus, economic growth in the foreign partner has the effect of reducing intra-regional trade – a kind of trade diversion away from the WAMZ to the outside world.

This situation could also arise from the increased demand for raw materials from the WAMZ occasioned by rising output in the foreign trading partner's economy. This may in turn lead to higher revenues in the WAMZ that may be spent importing from their foreign partners. This situation is likely behind the negative sign for the coefficient of Foreign GDP as we find in this study. It is easy to see how economic prosperity, evidenced by increased output (GDP) in the foreign trading partner, diverts trade away from the sub-region. It implied an increase in demand for raw materials; more money to producers of such raw materials (the WAMZ members) and of course more imports by such members from the foreign partner where the foreign exchange earnings, from the increased supply of raw materials are normally held in reserves.

A key objective of economic groupings like the WAMZ is trade creation - to increase trading among members of the sub-region so as to ignite growth and developmental benefits that follow trade. It is therefore very important that strategies are put in place to harness the benefits of increased supply of input to the foreign partners as their economies grow without diverting trade from members of the zone. Other factors that could enhance this trade diversion effect are the need for reciprocity. If the foreign partner patronises a member by



importing raw materials from her, such a member may be obliged to reciprocate the gesture by importing finished goods from the trading partner. Reciprocity is an acknowledged principle of international relations and is often brought to bear on trade.

Of particular relevance in this result was Trade Liberalisation or economic openness. This variable not only returned a positively signed coefficient, it was also very significant. This implied that members actually traded more with one another as trade is liberalised among them. This is a positive sign, given that only about 10.0 per cent of the trade of the Zone is taking place among members (Bamidele, 2003). This low trade, which has been blamed on both tariff and non-tariff barriers, is therefore likely to improve as the members of the Zone focus on the elimination of trade barriers among them.

The cross exchange rate variable returned a negative sign. This is a significant outcome and needs elaboration. The negative sign implied that a worsening of the exchange rate, reflecting devaluation of the local currencies of the Zone would negatively impact on bilateral trade among members. This result is not only theoretically consistent; it is understandable and also serves as a wakeup call on those handling the implementation of the common currency project of the WAMZ. The WAMZ countries are trading with one another through third currencies, mostly the United States dollar, with consequent increase in transaction costs that arise from exchange rate movements.

Foreign reserves expectedly returned an inverse relationship with import demand, while relative exchange rate also had the expected negative sign and was significant. This is also plausible. With regard to exchange rate, WAMZ members traded via a third currency, the US dollar. Exchange rate movement against their individual currencies is bound to retard trade among them. Thus, while devaluation may boost inter-WAMZ exports, it depresses intra-WAMZ imports. As regards trade liberalisation, the zone-wide bilateral intra-WAMZ trade model returned positively signed and significant coefficients. Thus, trade liberalisation, had a bolstering effect on bilateral intra-WAMZ trade.

## **V. Summary, Conclusions and Recommendations**

The results of the study reflect the present character of trade among member countries of the Zone. There is a high degree of trade diversion from members to the outside world. The importance of trade liberalisation in the growth of regional trade was highlighted by the results, which showed its potential to expand intra-regional trade. The continued presence of trade barriers is contrary to the terms of

the various protocols established by the sub-region. Bilateral trade among members of the Zone would profit from a concerted effort on the part of members to further liberalise trade and focus more on factors that create rather than divert trade among members.

The negative effects of trading with a third currency rather than a zonal single currency of their own reflected in the results. Member's pursuit of their individual monetary and exchange rate policies has negative effect on their bilateral trade. The need for the Eco to become operational therefore continues to be urgent. The influence of former colonial masters who often times are the major trading partners of members of the WAMZ continue to impact trade in the sub-region. There appears therefore to be a substantial trade diversion to these partners and away from the integrating members. It would be profitable for members to make concerted effort to divert trade to themselves within the limits of their internal economic interests.

Based on these findings on the impact of exchange rate on intra-regional trade, the study recommends, that concerted effort should be made to implement the single currency policy without further delay. There is need to re-examine the macroeconomic convergence approach. The time has come to seek ways to achieve the single currency objective without hinging it on the ever elusive macroeconomic convergence. This will not only eliminate unnecessary transaction costs incurred by members in trading with one another, but also facilitate economic interaction among them.

This research shed more light on the understanding of the role of exchange rate in the import demand in the Zone by providing evidence that devaluation of the local currencies of the sub-region will not reduce their demand for imports from the rest of the world. It has therefore widened our perspectives and added to the body of knowledge in this field.

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# Does Gender Inequality Retard Productivity in Nigeria? A Search for Evidence

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## **Abstract**

The paper adopted the bounds test and autoregressive distributed lag approach to evaluate the impact of gender inequality in education on real productivity in Nigeria using quarterly data from 1985 to 2011. Empirical evidence to establish the rejection of the null hypothesis of no cointegration among the variables was provided. The empirical results suggest that gender inequality in education depresses real productivity, with an output elasticity of -0.1 per cent per quarter. Further empirical evidence indicates that higher school enrolment of males enhances real productivity in Nigeria, while the influence of female school enrolment was not affirmative owing to some socio-cultural factors that tend to inhibit female participation in economic activities. The paper, thus, recommends the implementation of deliberate policies to improve female participation in economic activities besides strengthening the policy on affirmative action for women in Nigeria.

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**Key words:** Gender Inequality, Real Productivity, Bounds Test

**JEL Classifications:** J16, C32

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## **I. Introduction**

Promotion of gender equality, being one of the key Millennium Development Goals (MDGs), has gained increased prominence in public policy discourse, particularly with respect to developing countries. This is against the backdrop of the perceived adverse effect of discrimination against women on real productivity in several developing countries. Zahid *et al.*, (2012) noted that women in Pakistan do not only have less access to education, health and employment opportunities but enjoy very limited ownership rights, thereby inhibiting their contributions to economic and development activities. Gender equality is, thus, not seen as an end in itself but as an essential catalyst for economic transformation. It is in realisation of this that governments and non-governmental organisations are intensifying efforts towards empowering women through the advancement of women's rights in addition to facilitating their access to resources and education.

Gender equality enhances women participation in the national workforce, thereby expanding labour supply with enormous potentials to enhance productivity in the affected countries. Moreover, women empowerment enables

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progress by ensuring a balanced population and alleviating poverty through enhancement in income levels to supporting improvements in living standards and providing for the proximate future. Gender equality, on the other hand, enables women to have equal voice and better influence in family and national decisions towards enhancing the well-being of disadvantaged groups and enabling them to contribute more to economic development.

Gender disparities in Nigeria range from literacy to labour participation and wage/income gaps. These disparities are widespread in Nigeria cutting across levels of government and sectors of the economy. Despite the enormity of the implications of such disparities, empirical study on the impact of gender inequality on real productivity in Nigeria is still relatively scanty. Against this backdrop, this study investigates the impact of gender inequality in education on Nigeria's real productivity with a view to proffering appropriate policy recommendations to address the problem.

The study employed the bounds test and autoregressive distributed lag (ARDL) models to investigate the impact of gender inequality on real productivity in Nigeria using quarterly data spanning 1985:q1 to 2011:q4. The choice of the ARDL was in view of its flexibility in analysing the dynamic behaviours of non-stationary multivariate time series. Thus, real gross domestic product (rGDP) was regressed on a constructed index of gender inequality, and some control variables (investment rate, population growth rate and openness) with a view to determining the interactions between gender inequality and real productivity in Nigeria. In addition, the study sought to determine whether male or female school enrolments influenced the level of real output.

The paper was structured as follows: Section I provided background information on the study, while Section II reviewed theoretical framework and empirical literature. Section III provided the methodology, including data sources and techniques. The empirical results were analysed in Section IV, while the conclusion and policy suggestions formed Section V.

## **II. Theoretical Framework and Empirical Review**

### **II.1 Theoretical Framework**

There are three main channels identified in the literature through which gender inequality affects the level of output namely; the selection distortion factor, the environment effect and the demographic transition effect (Klasen, 1999).

Under the selection distortion factor, the argument is as follows: If both genders

have identical inherent abilities, then it presupposes that gender inequality in education occurs when less brilliant boys are able to acquire formal education. Hence, the proficiency of those who eventually receive education would be lower than when everyone (male and female) is given equal educational opportunity. This distortion in the selection of who should be educated would adversely impact on the productivity of the workforce; reduce profit and investment rates and leads to eventual decline in output. From the environment effect perspective, the diffusion of female education tends to be higher since it is anticipated that when a female is educated her offspring's may likely receive qualitative education, thus the gap between the educated males and females would be reduced overtime, thereby improving the intellectual environment. In the converse case, the gender gap would continue to widen and gender inequality in education would negatively affect national productivity. Several studies have been conducted to examine the causal link between female education and fertility. The demographic transition effect assumes that there is a negative correlation between years of schooling and the number of children born. It further proposes that educated women tend to get married late and space their pregnancies leading to substantial drop in fertility rates and dependency ratios. With the declining fertility rates, there would be increased saving, higher investment rates and enhanced productivity.

## **II.2 Empirical Review**

Attempts had been made to examine the relationship between gender inequality and economic growth in both developed and developing countries with mixed results (Barro and Lee, 1994; Galor and Weil, 1996; Schultz, 1997; Dollar and Gatti, 1999; Knowles, Lorgelly and Owen, 2002; Klasen, 1999; 2002; Lagerlöf, 2003; Klasen and Lamanna, 2009 and Esteve-Volart, 2009). However, the consensus reached in most of the studies is the existence of a negative relationship between gender inequality and growth. In reality, these studies established that contracting the gender inequality gap spurs economic growth due to varied savings-consumption behaviours between the gender classes which arises from differences in access to social safety nets and the need to smoothen income (Seguino, 2006). Some studies have claimed that increased women participation in the labour force enhances national productivity, since women have a higher propensity to save than their male counterpart (Löfström, 2009).

Klasen (1999; 2002) employed cross-country/panel regressions and found that gender inequality in education and unemployment significantly influenced the level of economic productivity and that the responsiveness is sensitive to model



specifications and the extent of endogeneity bias. He further established that gender inequality in education directly affected the level of economic activity through its effect of reducing the quality of human resources and indirectly through its effect on investment and population growth. Moreover, the analysis revealed that per capita income would have grown by 0.5 to 0.9 per cent annually between 1960 and 1992 in South Asia and Sub-Saharan Africa supposing they had achieved gender equality in education; the regions would have grown rapidly as the East Asian economies. For Africa, this would imply an almost doubling of per capita income growth.

Dollar and Gatti (1999) assessed the linkages between gender inequality in education and growth on 127 countries from 1975-79 to 1990 using the ordinary least squares (OLS) and Two-Stage Least Square (2SLS) techniques. They found that gender inequality in education is inimical to economic growth. They also revealed that more female secondary education exerts higher growth rates, although the contrary effect holds for more male secondary education, implying that lower growth rates would be witnessed in economies with less investment in female education. They equally found a strong positive association between GDP per capita and gender equality. Furthermore, they established a convex relationship between income and female attainment, inferring an infinitesimal improvement in the transition of economies from extremely poor to lower-middle income, and further transition to more developed economies.

Knowles et al., (2002) examined the effects of educational gender gaps on development as well as the impact of female education on labour productivity in both developed and developing countries. They regressed both female and male education as independent explanatory variables on output per worker using cross-sectional data. The OLS, 2SLS and Generalised Method of Moments (GMM) techniques were employed using data spanning 1960 to 1990. The variables employed were similar to those utilised by Barro and Lee (1996) that included the average age of schooling of the population aged 15 and over (disaggregated by gender), life expectancy, income per worker, share of physical capital investment in national income, growth rate of labour force and a proxy for technical efficiency. The point estimates revealed that in most countries female education contributes more to labour productivity than male education.

Lagerlöf (2003) discussed the link between gender equality, economic growth and employment in the European Union (EU) member states by utilising an overlapping-generations framework in which males and females with identical

abilities may possibly turn out with different levels of human capital. He used three different indexes to capture gender equality which includes; the United Nations Gender-related Development Index (UN-GDI), the World Economic Forum Global Gender Gap Index (WEF-GGG) and the European Union Gender Equity Index (EU-GEI). Overall, the study found a strong positive association between GDP per capita and gender equality and thus, established that the sharing of power between the genders was a precondition for the execution of sustainable gender equality policies.

In a cross-sectional study by Klasen and Lamanna (2009), they focused on determining the magnitude of change in economic growth as a result of gender gaps in education and employment, especially in economies with significantly high gender gaps, such as the Middle East and North Africa (MENA), sub-Saharan Africa and South Asia during 1960–2000 by using panel regression. The regressors utilised in their study included real GDP per capita; average investment rates; population growth rates; life expectancy; number of years of schooling (total population, growth in male and female years of schooling, female–male ratio), labour force participation measured by female share of the total labour force as well as economic activity rates (total population, male and female economic activity rate, female–male ratio). Their findings revealed that gender inequality in education had significantly larger impact on growth than gender inequality in employment. This difference in growth arising from gender inequality in education accounted for a growth gap ranging between 0.2 and 1.4 percentage points in South Asia. Conversely, the impact of gender inequality in employment on growth was higher than that of education in the MENA region; this is attributable to the social, cultural, and ideological barriers (Klasen and Lamanna, 2009). Moreover, Esteve-Volart (2009) alluded to psychological, sociological and religious reasons for gender discrimination against women. It has been noted that these social-cultural barriers tend to limit the active participation of women in the workforce and their appeal to potential employers (Boserup, 1986). Generally, their findings support the negative impact of gender inequality in employment on economic growth.

In assessing the implication of gender discrimination on growth in India between 1961 and 1991, particularly entry to the labour market and decision-making positions, Esteve-Volart (2009) employed panel regressions and instrumental variables techniques to control for endogeneity. The empirical specification controlled for female-to-male managers, female-to-male workers, female/male literacy rates, population growth rate, ratio of urban to total population, ratio of

capital to labour, scheduled tribes and the percentage of scheduled population, total work force, election dummy, election turnout, political competition, state effects and year effects, all of which determined per capita GDP. From the empirical analysis, the study found significant negative influence of gender discrimination in employment and managerial positions on economic growth, which ensued in lower GDP per capita and misallocation of talent. The findings revealed that an anticipated 10.0 per cent increase in the female-to-male managers result in 2.0 per cent growth in GDP, whereas 10.0 per cent rise in the female-to-male workers would induce 8.0 per cent growth in GDP.

There are empirical evidences to confirm that gender inequality positively influenced economic growth, although these evidences were few. The positive hypothesis had been proven by Seguino (2000) and Mitra-Kahn and Mitra-Kahn (2008). Seguino (2000) empirically investigated gender inequality and economic growth using cross-country analysis for semi-industrialised export-oriented economies between 1975 and 1995 and established a positive connection between growth and gender wage inequality, thus inferring that gender inequality induced expansion in economic output. Hence, the lower the earnings of the female workforce in export-oriented economies, the higher the rate of economic growth, particularly growth induced by higher investments and surplus in external trade. The author concluded that discrimination against women in the initial phases of economic development was growth-enhancing. Mitra-Kahn and Mitra-Kahn (2008) further confirmed the inferences obtained by Seguino (2000).

### **III. Data and Methodology**

#### **III.1 Data**

The paper uses quarterly data for the period 1985q1 to 2011q4. The choice of the period was motivated by the availability of the relevant data required for the work. The period was also considered adequate to capture both the short- and long-run dynamics in the model. The data were obtained from various editions of the Central Bank of Nigeria (CBN) Statistical Bulletin, CBN Annual Report and Statements of Account, the National Bureau of Statistics (NBS) database, the World Development Indicators and Global Development Finance of the World Bank. The variables included real productivity (GDP), Investment Rate (IVR), Degree of Openness (DOP), Female School Enrollment Index (FEW), Male School Enrollment Index (MEW) and Population Growth Rate (PGR).

An index of gender inequality (GINw) was constructed by averaging the female-to-male primary and secondary school enrolment ratios and attaching weights in

the ratio 40:60 for primary and secondary school enrolments, respectively in line with our expectation of higher productivity from more educated school leavers. To ensure the robustness of the results, two separate measures of gender inequality were adopted – the weighted average of female primary and secondary school enrolment and the weighted average of male primary and secondary school enrolment. The DOP is measured as the ratio of total trade to GDP while IVR is the rate of change in the level of investment. PGR is the rate of change in total population.

### III.2 Methodology

The paper employs bounds test for cointegration and autoregressive distributed lag (ARDL) models to establish the short- and long-run relationships among the variables of interest. According to Pesaran and Shin (1998), the bounds testing approach enables us to draw robust inference regardless of whether the underlying variables are entirely  $I(0)$  or  $I(1)$  or a mix of  $I(0)$  and  $I(1)$ . The time-series properties of the variables was investigated using the Augmented Dickey-Fuller (ADF) and the Phillips Perron (PP) tests of unit root.

After specifying the models, the order of integration of the variables was verified before testing for cointegration in alternate specifications using the bounds test. Then, the ARDL models was estimated with error correction mechanisms to correct for disequilibrium and to distinguish between the long- and short-run interactions of the variables.

### III.3 Model Specification

The functional forms of the econometric models are expressed as follows:

$$\text{Model 1: } \text{GDP}_t = f(\text{GIN}_{w_t}, \text{IVR}_t, \text{PGR}_t, \text{DOP}_t) \quad (3.1)$$

(-)    (+)    (+/-)    (+)

$$\text{Model 2: } \text{GDP}_t = f(\text{FEW}_t, \text{IVR}_t, \text{PGR}_t, \text{DOP}_t) \quad (3.2)$$

(+)    (+)    (+/-)    (+)

$$\text{Model 3: } \text{GDP}_t = f(\text{MEW}_t, \text{IVR}_t, \text{PGR}_t, \text{DOP}_t) \quad (3.3)$$

(+)    (+)    (+/-)    (+)

$$\text{Model 3: } \text{GDP}_t = f(\text{FEW}_t, \text{MEW}_t, \text{IVR}_t, \text{PGR}_t, \text{DOP}_t) \quad (3.4)$$

(+)    (+)    (+)    (+/-)    (+)

Where: the variables are as earlier defined; the subscript  $t$  denotes time period and

the signs in parenthesis signify the *a priori* expectations.

The ARDL representations of (3.1 - 3.4) gives rise to equations 3.5 - 3.8 as expressed below:

$$\begin{aligned}
 \text{Model 1 } DLGDP_t = & \alpha_0 + \sum_{i=1}^n \alpha_{1i} DLGDP_{t-i} + \sum_{i=0}^n \alpha_{2i} DGINw_{t-i} + \sum_{i=0}^n \alpha_{3i} DIVR_{t-i} \\
 & + \sum_{i=0}^n a_{4i} DPGR_{t-i} + \sum_{i=0}^n \alpha_{5i} DDOP_{t-i} + \beta_1 LGDP_{t-i} \\
 & + \beta_2 GIN_{t-i} + \beta_3 IVR_{t-i} + \beta_4 PGR_{t-i} + \beta_5 DOP_{t-i} + e
 \end{aligned} \quad (3.5)$$

$$\begin{aligned}
 \text{Model 2 } DLGDP_t = & \alpha_0 + \sum_{i=1}^n \alpha_{1i} DLGDP_{t-i} + \sum_{i=0}^n \alpha_{2i} DFEW_{t-i} + \sum_{i=0}^n \alpha_{3i} DIVR_{t-i} \\
 & + \sum_{i=0}^n a_{4i} DPGR_{t-i} + \sum_{i=0}^n \alpha_{5i} DDOP_{t-i} + \beta_1 LGDP_{t-i} \\
 & + \beta_2 FEW_{t-i} + \beta_3 IVR_{t-i} + \beta_4 PGR_{t-i} + \beta_5 DOP_{t-1} + e_t
 \end{aligned} \quad (3.6)$$

$$\begin{aligned}
 \text{Model 3 } DLGDP_t = & \alpha_0 + \sum_{i=1}^n \alpha_{1i} DLGDP_{t-i} + \sum_{i=0}^n \alpha_{2i} DMEW_{t-i} + \sum_{i=0}^n \alpha_{3i} DIVR_{t-i} \\
 & + \sum_{i=0}^n a_{4i} DPGR_{t-i} + \sum_{i=0}^n \alpha_{5i} DDOP_{t-i} + \beta_1 LGDP_{t-i} \\
 & + \beta_2 MEW_{t-i} + \beta_3 IVR_{t-i} + \beta_4 PGR_{t-i} + \beta_5 DOP_{t-1} + e_t
 \end{aligned} \quad (3.7)$$

#### Model 4

$$\begin{aligned}
 DLGDP_t = & \alpha_0 + \sum_{i=1}^n \alpha_{1i} DLGDP_{t-i} + \sum_{i=0}^n \alpha_{2i} DFEW_{t-i} + \sum_{i=0}^n \alpha_{3i} DMEW_{t-i} + \sum_{i=0}^n \alpha_{4i} DIVR_{t-i} \\
 & + \sum_{i=0}^n a_{5i} DPGR_{t-i} + \sum_{i=0}^n \alpha_{6i} DDOP_{t-i} + \beta_1 LGDP_{t-i} + \beta_2 FEW_{t-i} \\
 & + \beta_3 MEW_{t-i} + \beta_4 IVR_{t-i} + \beta_5 PGR_{t-i} + \beta_6 DOP_{t-1} + e_t
 \end{aligned} \quad (3.8)$$

Where: in the alternate specifications, D is the first difference operator, the prefix L shows log-transformation,  $\alpha_0$  is the drift component, and  $e_t$  the error term. The  $\beta_i$ s represents the long-run coefficients while  $\alpha_1$  to  $\alpha_6$  represent the short-run coefficients

## IV. Empirical Analysis and Results

### IV.1 Unit Root Test

The unit root tests using the ADF and PP procedures are reported in Table 1.1. The ADF results showed that the log of real GDP, gender inequality index, female school enrolment index, male school enrolment index and population growth rate are non-stationary at levels,  $I(1)$  while the investment rate and degree of openness are stationary at levels,  $I(0)$ .

However, the PP results showed that the log of real GDP, gender inequality index and female school enrolment index are non-stationary at levels,  $I(1)$ , while the male school enrolment index, investment rate, population growth rate and degree of openness are stationary at levels,  $I(0)$ . Overall, the non-stationary series were all stationary after taking their first differences.

**Table 1.1: Results of Unit Root Test**

Variables	Augmented Dickey-Fuller		Order of Integration	Phillips-Perron		Order of Integration
	Test Statistic	Critical Value		Test Statistic	Critical Value	
LGDP	-3.140	-2.889**	$I(1)$	-7.908	-3.493***	$I(1)$
GINw	-9.398	-3.495***	$I(1)$	-9.398	-3.495***	$I(1)$
FEw	-3.812	-3.495***	$I(1)$	-6.558	-3.493***	$I(1)$
MEw	-3.922	-3.495***	$I(1)$	-2.856	-2.888**	$I(0)$
IVR	-10.543	-3.492***	$I(0)$	-10.629	-3.492***	$I(0)$
PGR	-3.587	-3.499**	$I(1)$	-8.892	-3.492***	$I(0)$
DOP	-3.012	-2.888**	$I(0)$	-2.983	-2.888**	$I(0)$

Note: The notations: \*\*\*, \*\* and \* denotes level of significance at 1.0, 5.0 and 10.0 per cent, respectively

### IV.2 Bounds Test Analysis

The bounds testing approach for cointegration is based on Pesaran *et al.* (2001). In the bounds test, the calculated F-statistic is compared to the lower and upper bounds asymptotical critical values. There is cointegration when the calculated F-statistics exceeds the upper bound critical value and when it is below the lower bound critical value there is absence of cointegration among the variables. The result becomes inconclusive when the calculated F-statistics falls between the two set of critical values. Assuming an unrestricted intercept, the test for cointegration using the bounds testing approach is performed, under the joint null of  $H_0: \beta_1 = \dots = \beta_q = 0$ . The null hypothesis states that there is no cointegration among the variables.

The tests for the existence of a long-run relationship among the variables of interest in the four ARDL models specified are reported in Table 1.2. In model 1, the null hypothesis was rejected since the calculated F-Statistic (5.425) exceeds the upper bound critical values (4.781) at 1.0 per cent level of significance. It was therefore, concluded that the linear combination of real GDP, gender inequality, investment rate, population growth rate and degree of openness are cointegrated in the long-run. Similarly, we rejected the null hypothesis in models 2 and 4 were rejected and concluded that the variables are cointegrated in the long-run. However, it was impossible to establish cointegration among the variables in model 3, as the calculated F-statistics fell within the inconclusive region, at all relevant levels of significance, respectively.

**Table 1.2: Bounds Testing for Cointegration**

Equation	Lag order	Calculated F- statistics
F (LGDP/GINw, IVR, PGR, DOP)	2	5.425***
F (LGDP/FEw, IVR, PGR, DOP)	2	3.498*
F (LGDP/MEw, IVR, PGR, DOP)	2	2.968
F (LGDP/FEw, MEw, IVR, PGR, DOP)	2	5.577***

**Note:** The bounds critical values were obtained from Pesaran and Pesaran (1997) and the critical values of the F-statistics for the 5 variables (LGDP, GINw, IVR, PGR and DOP) with unrestricted intercept and no trend (Case III) are 2.262 - 3.367 at a 10.0 per cent significance level, 2.649 - 3.805 at a 5.0 per cent significance level and 3.516 - 4.781 at 1.0 per cent significance level, respectively. The critical values of the F-statistics for the 6 variables (LGDP, FEw, MEw, IVR, PGR and DOP) with intercept and no trend are 2.141 - 3.250 at a 10.0 per cent significance level, 2.476 - 3.646 at a 5.0 per cent significance level and 3.267 - 4.540 at 1.0 per cent significance level, respectively. The notations \*\*\*, \*\* and \* denotes 1.0, 5.0 and 10.0 per cent significance level, respectively.

### IV.3 ARDL Model Analysis

From the results presented in table 1.3, the estimated coefficients of the lagged error correction terms, ECM1(-1) to ECM4(-1), were found to be statistically significant and correctly signed. Thus, the shocks generated by the explanatory variables can be corrected to restore equilibrium and the adjustment process demonstrates the dynamics existing between real productivity and the included regressors.

The coefficients of the lagged error correction terms (-0.012, -0.013, -0.012 and -0.014) corresponding to models 1 to 4 further validate the claim about the existence of long-run equilibrium relationships among the variables. The

coefficients, however, are quite small suggesting a slow adjustment process towards the restoration of equilibrium as approximately 1.2, 1.3, 1.2 and 1.4 per cent, respectively of the long-run disequilibrium would be corrected each quarter from the error shocks generated. For instance, in model 1, 1.2 per cent of the disequilibrium of the previous quarter's shock adjusts back to equilibrium in the current quarter.

From Model 1, we can infer that there is a significant negative relationship between the contemporaneous real productivity and gender inequality, thus fulfilling the *a priori* expectation. This implies that gender inequality in education hinders real productivity in Nigeria. The output elasticity of -0.110 signifies that a unit expansion in gender inequality depresses real output by 0.1 per cent per quarter. Therefore, gender disparity in school enrolment at both the primary and secondary levels plays an important role in the determination of real productivity in Nigeria.

Further analysis reveals a contemporaneous negative impact of female school enrolment on the level of real output (model 2) with an output elasticity of -0.086 which does not conform to *a priori* expectation. This suggests that female school enrolment does not stimulate real productivity in Nigeria, although this outcome is not surprising given that many educated females are often restricted from participating in economic activities owing to some socio-cultural barriers.

On the contrary, model 3 revealed that male school enrolment enhances the level of real productivity in line with the *a priori* expectation. The result indicates that a unit increase in male school enrolment would stimulate real productivity by 0.06 per cent per quarter.

Model 4 further confirms the results of models 2 and 3 that male school enrolment enhances productivity while female school enrolment retards it. The results agree with the conclusions by Boopen (2006) and Baliaoune-Lutz and McGillivray (2007) that reducing gender inequality yields productivity gains, but differs from their findings that female education has greater influence on the level of output.

Non-gender factors like population growth rate and own lag of trade openness were also found to negatively affect the level of Nigeria's real productivity. However, the own lag of real productivity, investment rate and the openness index all showed positive relationships with the dependent variable in line with the *a priori* expectations.



Table 1.3: ARDL Model

Regressors	(A) Model 1	(B) Model 2	(C) Model 3	(D) Model 4
<i>DLGDP(-1)</i>	0.772*** (0.069)	0.728*** (0.075)	0.726*** (0.075)	0.800*** (0.067)
<i>DIVR</i>	0.0003 0.00006	0.0003 0.00007	0.0004*** 0.00007	0.0003*** (0.00006)
<i>DPGR</i>	-0.013 (0.008)	0.016* (0.009)	-0.015* (0.009)	-0.013 (0.008)
<i>DPGR(-1)</i>	0.018** (0.008)	0.022** (0.009)	0.020** (0.009)	0.019** (0.008)
<i>DDOP</i>	0.001 (0.003)	0.001 (0.003)	0.002 (0.002)	(0.0006) (0.003)
<i>DMEw</i>			0.064** (0.029)	0.156*** (0.036)
<i>DMEw(-1)</i>			-0.064** (0.028)	-0.151*** (0.035)
<i>DDOP(-1)</i>	-0.007** (0.003)	0.007** (0.003)		-0.007** (0.003)
<i>DFEw</i>		-0.086** (0.035)		-0.199*** (0.043)
<i>DFEw(-1)</i>		0.077** (0.035)		0.187*** (0.045)
<i>DGINw</i>	-0.110*** (0.026)			
<i>DGINw(-1)</i>	0.096*** (0.025)			
<i>ECM1(-1)</i>	-0.012* (0.005)			
<i>ECM2(-1)</i>		-0.013** (0.006)		
<i>ECM3(-1)</i>			-0.012* (0.006)	
<i>ECM4(-1)</i>				-0.014** (0.006)
<i>Adjusted R-Squared</i>	0.729	0.663	0.665	0.756
<i>AIC</i>	450.11	438.67	438.12	454.20
<i>SBC</i>	431.60	420.16	422.26	431.72
<i>F-Stat.</i>	32.350 [0.000]	23.98 [0.000]	25.71 [0.000]	30.47 [0.000]
<i>DW-statistic</i>	2.259	2.252	2.220	2.296

Note: numbers in parenthesis are standard errors while the notations \*\*\*, \*\*, \*denotes levels of significance at 1.0, 5.0 and 10.0 per cent, respectively.

## V. Conclusion and Policy Recommendations

The paper explored the impact of gender inequality in education on real productivity in Nigeria from 1985q1 to 2011q4, using the bounds testing approach

to cointegration and the ARDL approach. It also investigated the independent impacts of female- and male- school enrolment ratios on real productivity. It further highlighted the relationships between real output and gender inequality in conjunction with some control variables that capture the dynamics in the level of real output during the period.

The empirical results provided vital insights into the real income determination process in Nigeria. The bounds tests rejected the null hypothesis of non-existence of long-run equilibrium relationships among the variables, implying that gender inequality and the included regressors had positive effects on real productivity in Nigeria.

It is instructive to note from the results that gender disparities in education have serious implications for the level of productivity in Nigeria and that increasing primary and secondary school enrolment for male would help in stimulating economic activities. However, female school enrolment was not found to stimulate real productivity in Nigeria owing to some socio-cultural barriers affecting the active participation of educated females in economic activities.

There is, therefore, need for equal opportunities for female and male participation in economic activities. It is also appropriate to further strengthen policy actions geared towards the full implementation of the affirmative action for women to minimise the impact of gender disparity on the level of productivity in Nigeria.

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# Government Size and Economic Growth in Nigeria: A Test of Wagner's Hypothesis

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## Abstract

*This paper attempted an empirical validation of Wagner's law in Nigeria using quarterly data for the period 1982 to 2012. The hypothesis that real income does not Granger-cause government expenditure was rejected. Adopting the Fully Modified Ordinary Least Square (FMOLS) regression techniques, the study found support for the Wagner's hypothesis in Nigeria. The analysis provided empirical evidence to support the existence of a long-run equilibrium relationship between economic activity and government expenditure in Nigeria. Overall, the results corroborated the Goffman's version of the Wagner's law in Nigeria. Thus, government needs to create fiscal space to enable deployment of more resources in growth-enhancing activities, while at the same time putting in place policies aimed at raising revenues concomitantly.*

**Keywords:** Wagner's law, Government expenditure, Granger causality, Cointegration, long run, Economic growth, FMOLS, ECM, Nigeria

## I. Introduction

Public finance is one of the most extensively debated facets in economics. Government expenditure, in particular, has been so well studied theoretically and empirically that further attempts to revisit it often seems to be a rehearsal of same old arguments. Nevertheless, many of the issues have remained inconclusive both at the level of theory and empiricism. What drives public expenditures, or the relationship between income and public spending, is one of such contentious issues. The Wagner Law (WL) is iconic among the early attempts to explain this relationship<sup>1</sup>. Wagner (1890) had posited that government activities or expenditure tended to increase with economic expansion, particularly, as a nation tries to industrialise. That is, the share of public expenditure in aggregate economic activity increases with the size of the economy. Though

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<sup>1</sup>Other explanations of the tendency of government expenditure to expand rather rapidly include: social disturbances Peacock and Wiseman, (1961); fiscal decentralization and Urbanization, Pryor (1968); Samuelson (1969); Kee (1977); and Ubogu (1982); public choice (Buchanan 1963, 1975; Tullock 1976, Mueller 1976, 1987); level of bureaucracy and international budgeting Wildavsky (1974), Meltzer and Richard (1981) and Niskanen (1971); fiscal illusion, economic and socio-political forces as well as government borrowing (Buchanan and Wagner (1977), Gupta 1967, Kwanashie (1981) and Ndekwo (1984); increasing government revenue shares, Hinrichs (1965), Marlour and Neela (1987), Anderson et al. (1986) and International demonstration effects and openness of the economy, Cameroun (1978)

old, this subject has remained pertinent in public finance debates. The markets have not been able to effectively displace or confine governments to providing only an enabling environment as is often envisioned by free market advocates. Recent events like the fiscal crisis in Greece and the protracted budget concern in the U.S. attest to the prime place of government expenditure in the economy.

In many oil-exporting developing economies, including Nigeria<sup>2</sup>, Morgan (1979) observed that, Government expenditure has remained the major lubricant driving economic activities such that whenever there is a decline in oil revenues, economic growth suffers. The implication for these economies is that, even when alternatives to oil revenues are found, the discourse about the relationship between government expenditure and economic activity still continues to subsist.

The Wagner's law offers a good theoretical premise for analysing the relationship between Federal Government expenditures and national income growth not just in Nigeria but in other economies. The empirical evidence of Wagner's law on developing countries is growing albeit with conflicting results. Whereas, some studies including Dada and Oguntegbe, (2013); and Ogbonna (2012) reported evidence of the Wagner's Law in Nigeria, others reported non-existence of the law based on equally robust analysis (Babatunde, 2011 and Olayemi, 2009). Consequently, further investigations are required in this direction.

The rationale behind the use of quarterly data is that more data points would be employed in the econometric estimations and this should add to the robustness of results relative to the lower frequency data used by most studies. Generally, quarterly data reveals short-term dynamics and other details that may be otherwise hidden.

The objectives of the study, therefore, are to:

- contribute to the literature on the empirical verification of Wagner's Law using quarterly data on Nigeria, as compared with annual data used in previous studies.
- describe the trends in federal government expenditure and national income growth in Nigeria in order to determine which version of Wagner's law holds true for Nigeria,
- establish the direction of causality between the federal government and national income growth in Nigeria and,

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<sup>2</sup>Where fiscal policy, especially the monetisation of oil receipts, has become a major determinant of liquidity and growth in recent times.

- determine whether Wagner's Law holds in Nigeria, and what policy implications that would elicit.

Following the introduction, Section II reviewed the literature and the gap to be filled by the study. Section III presented a descriptive analysis while Section IV specified the model. Section V presented and discussed the results. Section VI concluded the study with some policy recommendations.

## **I. Literature Review**

### **II.1 Theoretical Literature**

Of the numerous attempts to explain the growth in government expenditure, Wagner (1890), was perhaps the first systematic theoretical construct to put forward an explanation for the increasing scale of state or government activity in countries. Though Wagner's theory had been interpreted in diverse ways, Rocktenwald (1978:103), however, stated that "...from the political economy standpoint, this law means absolute and even relative growth" and that "...an ever increasing and increasingly important proportion of aggregate demand of an advancing civilised people is met by the state instead of by others...".

According to Wagner, for government to discharge its various duties to the society, it had to incur expenditure for different purposes. He went on to argue that as the scale of government increased, the amount of expenditure it incurred for various developmental projects also increased. Thus, the expansion of the public sector or economic growth and public expenditure moved in the same direction. In other words, as the economy developed, government tended to spend more in the quest for industrialisation and social development as asserted by Bhatia (1985), Rocktenwald (1978) and Ghandi (1971). This was indeed, the nexus of the Wagner's law. Thus, expenditure was posited to be positively correlated to the level of economic growth and development.

As observed earlier, the Wagner's law remained unchallenged until 1961, when Peacock and Wiseman (1961) came with an alternative hypothesis that government expenditure grew because of the presence of social disturbances. They found from the results that in the UK, government expenditure moved in a rather spasmodic and step-like manner, as the growth in government expenditure was discovered to have been concentrated within the disturbance period and occurred with displacement effect. The displacement effect was produced because people appeared to accept the higher level of taxes associated with every disturbance and that even after the disturbance, government expenditures did not return to original levels.



Since the works by Wagner in 1890 and those of Peacock and Wiseman (1961), several other studies had been carried out to determine the nature of changes in government expenditure across countries. These results varied from the school of thought that government expenditure actually grew with the level of economic activity (Beck, 1976 and 1979; and Pluta, 1981 and 1979). The decline in government expenditure was found to have occurred in both developed and developing countries, but that it was more apparent in developing countries.

## II.2 Empirical Literature

It is germane to note that while most of the theories were posited based on results of data analysed for the developed countries, few had utilised data from developing countries without considering the peculiarities of these economies<sup>3</sup>. The empirical literature presented two fundamental strands of the Wagner's law. In the first perspective, growth in public sector spending was attributed to the increasing power of interest groups, while the second perspective attributed expansion in government spending to high income elasticity of demand for public goods<sup>4</sup>.

The interest group perspective was developed by Mancur Olson's Logic of Collective Action (1971) which posited that there existed a strong relationship between the growth of public sector expenditure and the political power of interest groups. The second version of the Law stated that a high income elasticity of demand for public goods explained the rise in government expenditure. A plethora of empirical studies both in advanced and developing economies had found evidence in support of the Wagner's law. For example, Szarowska (2012)<sup>5</sup> investigated the Wagner's law in 8 European countries (The Czech Republic, Bulgaria, Latvia, Slovenia, Hungary, Romania, Slovakia, and Estonia) from 1995 to 2009. The results showed that the Law was valid in all the countries, both in the short and long-run. Similarly, Kumar et al., (2012)<sup>6</sup> used New Zealand data to test for the validity of the Wagner's law for the period 1960 to 2007 using both GNP and GDP as proxies for economic activity. Their results supported the Wagner's law. In another study, Mahdavi (2011) examined the validity of the Wagner's law in the United States using data on states and local government expenditures from 1957 to 2006. The study adopted both the Pesaran Bounds Johansen cointegration test and the Toda-Yamamoto causality approaches. The results confirmed validity of the

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<sup>3</sup>This was partly so because majority of those developing countries, including Nigeria, were under colonial rule making some authors to equate the interest of these countries to those of their colonial governments.

<sup>4</sup>Both have formed the premise for a number of empirical works including Friedman and Kuznets (1954)

<sup>5</sup>The author used the Johansen cointegration test and the error correction model.

<sup>6</sup>They carried out the following tests: Autoregressive distributed lag bounds test, Engle and Granger, Phillip Hansen's Fully Modified Ordinary Least Squares and Johansen's time series techniques

Wagner's law for the US states and local governments during the sample period.

Using a sample of 115 countries between 1950 and 1980, Rati (1987) employed the Granger causality to establish the link between government expenditure and national income. He found that 60.0 per cent of the countries in the sample had income elasticity of demand for public goods greater than 1, thus supporting the Wagner's law. He also found that the pattern of causality was different across countries, due to vast differences in each country's socio-economic and political features.

Sidelis (2008) used cointegration and Granger causality techniques to determine whether or not long-run changes in income accounted for growth in government expenditure in Greece during the period 1833 to 1938. The study found that the growth in government expenditure was as a result of the income elastic demand for public goods. In another study, Rati (1986) and Lamartina and Zaghini (2011) reported an inverse relationship between economic growth and public sector expenditure in a sample of 23 OECD countries. The study further noted the existence of a strong correlation between income growth and government expenditure in countries with low levels of initial levels of GDP per capita. Neck and Getzner (2007) tested for the Wagner's law by investigating increase in the level of public sector spending in Austria from the period 1870 to 2002. The authors were of the view that most of the increases in government expenditure were attributed to upward changes in the price levels.

Other studies reported mixed results and outright rejection of the Wagner's law. Karagianni et al., (2002)<sup>7</sup> found results that invalidated the Wagner's law. According to the cointegration results, the Law was valid for 3 (Finland, Netherlands and Italy) out of the 15 EU member countries. In addition, the causality test revealed that the Law was valid for Finland and Italy while partially valid for all other countries except Greece. The Johansen test, however, showed that the Law was invalid for France. The authors opined that the validity of the Wagner's law was sensitive to the methodology adopted.

Other studies with mixed results included Loizides and Vamvoukas (2005)<sup>8</sup>. They found that the Wagner's law was valid for Greece and the UK but not Ireland, while Chang et al (2004)<sup>9</sup> established validity of the Law for South Korea, Taiwan, Japan,

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<sup>7</sup>They employed a series of econometric tests such as Engel and Granger cointegration test, Johansen and Juselius test and Granger causality test for 1949 to 1998.

<sup>8</sup>The authors use cointegration analysis, ECM strategy and Granger causality tests for 1948 to 1995

<sup>9</sup>They employed the Johansen and Juselius cointegration test as well as the Granger causality tests for various periods ranging from 1951 to 1996.

the UK and the USA but not for Australia, Canada, New Zealand, South Africa, and Thailand. Loizides and Vamvoukas (2005) asserted that the validity of the Wagner's law could be strengthened with the inclusion of inflation variable in the model. Studies that did not find validity for the Wagner's law included Ekimova and Balatsky (2012)<sup>10</sup> for the US, Great Britain, Sweden and Russia; Durevall and Henrekson (2011)<sup>11</sup> for the UK and Sweden; Zheng et al (2010)<sup>12</sup> for China; Neck and Getzner (2007)<sup>13</sup> for Austria; Huang (2006)<sup>14</sup> for China and Taiwan; and Afxentiou and Serletis (1996) for 17 European Union countries.

An interesting finding on the Wagner's law was reported by Kuckuck (2012)<sup>15</sup> who indicated that the Law had strong validity at the early stages of economic development but tended to weaken as the country developed. This could imply that the Wagner's law may be stronger in developing than developed countries.

Studies on developing countries also reported mixed results on the validity of the Wagner's law. Bojanic (2013) applied disaggregated data on Bolivia using error correction models and cointegration analysis to test the assumption of a long-run relationship between various kinds of government expenditure and national income. The results showed that there was bi-directional causality between income and government expenditure, thus, establishing validity for the Wagner's law in Bolivia. Sahni and Singh (1984) found no bi-directional relationship between public expenditure and national income in Canada, India and the US. Enweze (1973) in a study of 15 developing countries found that the mean elasticities of public expenditures on administration, defense and education were relatively higher than other expenditure items, suggesting factors other than income, were responsible for the changes in government spending.

Afxentiou and Serletis (1991) employed Granger and Sims causality test on annual data from the European Union and their results rejected the validity of the Wagner's law. At the sub-national level, Narayan et al., (2012) found that 9 out of the 15 Indian States covered in their study indicated strong evidence of the Wagner's law but with the relationship driven more by consumer rather than

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<sup>10</sup>They tested with OLS regression for the period 1930 to 2010.

<sup>11</sup>It used Engle-Granger cointegration and Gregory Hansen tests for structural break for the period 1800 to 2006.

<sup>12</sup>They tested using linear regression, Granger causality test for 1952 to 2007.

<sup>13</sup>Their methodology included descriptive analysis, Johansen-Juselius Procedure and OLS regression for the period of 1954 to 2002.

<sup>14</sup>Author made use of Bounds Test with respect to the Unrestricted Error Correction Model (UECM) estimation and Toda-Yamamoto Granger non-causality approach for the period 1979 to 2002.

<sup>15</sup>They tested the Wagner's law in UK, Sweden, Finland, Italy and Denmark from 1850 to 2010 using the Johansen cointegration technique and vector error correction analysis.

capital expenditure. Again, this is another area that would require further empirical investigation for Nigeria.

In a study that tested for the validity of the Wagner's law in the Fiji Islands during the period 1970 to 2002, Narayan et al., (2008) applied the Johansen cointegration technique and found a long-run relationship between economic growth and government expenditures. On the nature of causality, the authors reported a unidirectional causality running from national output to government expenditure. The authors, however, cautioned that "while the results were a validation of the Wagner's law in the Fiji Islands, the high 69.0 per cent debt to GDP ratio could mean that, in future, the bulk of government expenditures would be expended on debt servicing rather than growing national income. For South Africa, Ogbonna (2009) established support for the Wagner's law in the South African economy during the period 1950 to 2008. Similarly, Ziramba (2009) also found validity for Wagner's law in South Africa for the period 1960 to 2006.

In Nigeria, the outcome of studies on the validity of the Wagner's law were also mixed, with some supporting the Law and others disputing it, but with most of the differences coming mainly from the direction of causality. Danmola, Olateju and, Abba (2013) investigated the linkages between the different components of government expenditure and real gross domestic product for Nigeria. Using Granger causality, error correction model and cointegration techniques, the results were rather mixed. While total capital expenditure and real gross domestic product support the Wagner's law through the Granger causality test showing a unidirectional causality, total recurrent expenditure and real gross domestic product exhibited bi-directional causality. Also Matthew and Adewale (2013) used VECM and confirmed the unidirectional causality running from expenditure to revenue.

Oyinlola et al., (2013) also used Nigerian data for the period 1970 to 2006, to investigate the long-run relationship between government expenditure and economic activity using the VECM. Their findings indicated that increases in federal government expenditures were positively related to economic growth in Nigeria. Usenobong (2011) examined the validity of the Wagner's Law for Nigeria for the period 1970 to 2008 using the (ARDL) bounds testing approach, vector error-correction method (VECM) and the standard Granger causality test. The study found strong support for the Wagner's long-run postulate of causal relationship from national income to public expenditure. However, a short-run causal relationship running from public expenditure to national income in Nigeria was also observed.

Other studies on Nigeria included Aregbeyen (2006) who applied the Johansen cointegration technique and found, amongst others, the presence of a bi-directional causality between non-transfer federal government expenditures and national income. Based on the analysis of the variance decomposition, a stronger causality was established running from national income to non-transfer expenditure when compared with the reverse causality. Also, Akpan (2005) found that government expenditure was positively related with economic growth in Nigeria. Olomola (2004) used the VECM to test data for the period 1970 to 2001 and indicated evidence of the Wagner's law in both the short and long-run. The causality results suggested that economic growth Granger caused government expenditures in Nigeria, which meant that the direction of causality ran from national output to government expenditure.

However, Babatunde (2011) used data for the period 1970 to 2009 and found no evidence of the Wagner's Law in Nigeria. Similarly, Clement and Dickson (2010) used disaggregated data of federal government functional expenditures for the period 1961 to 2007 to test the Wagner's law. They could not establish any evidence of the Wagner's law even when other fiscal policy variables were included in the model. Also, Omoke (2009) could not establish any evidence of long-run relationship between government expenditure and national income in Nigeria during the period 1970 to 2005. Clement et al., (2010), using disaggregated data from 1961 to 2007 to validate the Wagner's hypothesis, observed that the Law did not hold in all the estimations, instead the Keynesian hypothesis was validated.

Applying a cointegration and Granger causality to establish the existence of long run relationship between various items of agricultural capital expenditure and their contribution to GDP, Otu and Nsikan (2013) established empirical evidence for Nigeria on Musgrave's (1969) version of Wagner's law<sup>16</sup>. Equally, Akinlo (2013) investigated the connection between government spending and national income in Nigeria over the period 1961 to 2009. He incorporated population size as one of the variables and the results showed that there was a long run relationship between government spending GDP and population size.

In summary, it could be concluded that the Wagner's law had a strong validity at early stages of development, implying a weakening of the Law as the country developed. This meant that the Wagner's law had more policy relevance to developing than advanced economies; GDP might not always be the best proxy for economic activity. The inclusion of inflation and population size improved the functional specification of the relationship between government expenditure and

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<sup>16</sup>which expresses government size as a function of per capita economic activity

economic activity and the quality of the results was influenced by the econometric technique employed in the analysis. Also, most of the studies concentrated on testing the Wagner's law at the national or federal level, with very few attempts on sub-national governments in America and India. None of the studies tested the Wagner's law at the state or local government levels. This is an important area for further research. More importantly, all the studies used annual time series or cross section data in validating the Wagner's law, with none using quarterly data. The contribution of this study was the use of quarterly data from 1982 to 2012 to investigate the validity of the Wagner's law in Nigeria and its implications for policy within the context of declining oil revenues and the challenge for national development.

### III. Federal Government Expenditure and Economic Activity

In this section, a preliminary descriptive examination of the two variables of interest, federal government spending and economic activity, was presented.

**Figure 1: Government Expenditure and Nominal GDP, 1982-2012**

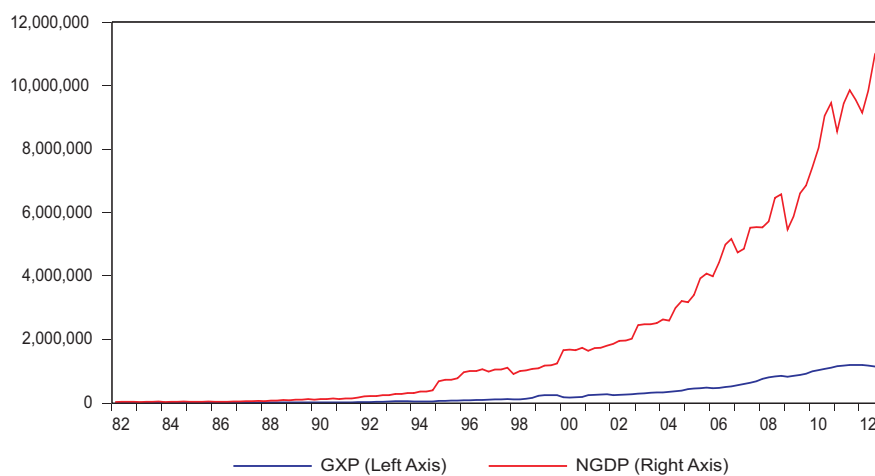
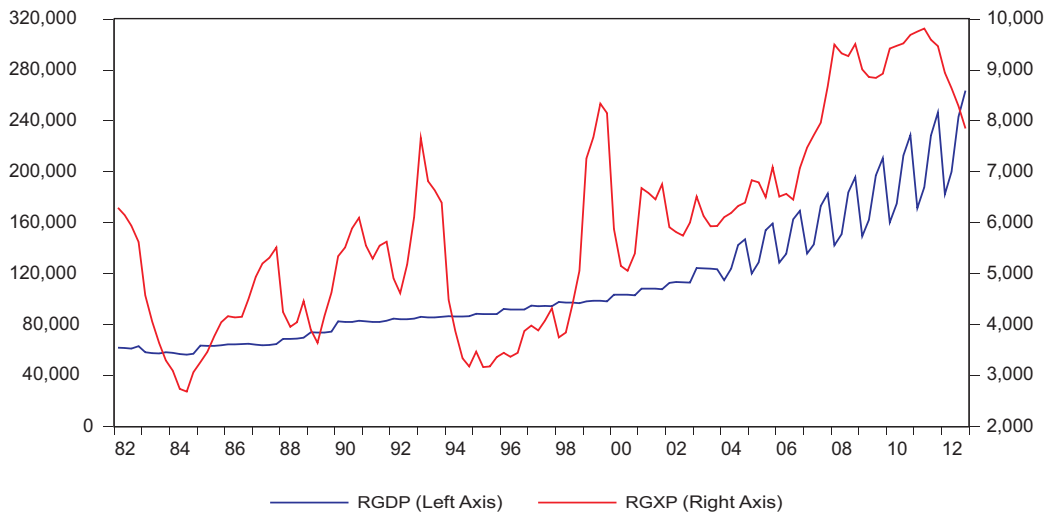


Figure 1 shows both government expenditure and nominal gross domestic product trending upwards between 1982 and 2012, suggesting some relationship. The same pattern appeared evident from the graph of real government expenditure and real GDP in figure 2. Both charts offer some indication of some kind of Wagner relationship, particularly of the absolute type.

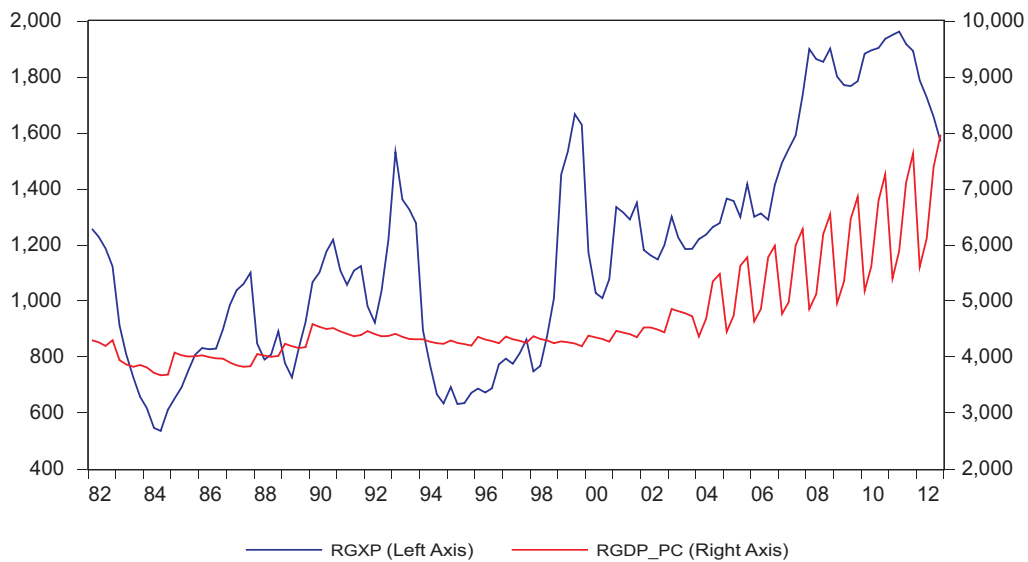
The pattern in figures 1 and 2 are also visible in the per capita variants of the government spending and income in figures 3 and 4. Again, this reinforces the suspicion that a Wagner-type mechanism could be at work with government

spending being driven by expansion in economic activity. There is also the possibility of a feedback from government to income.

**Figure 2: Real Government Expenditure and Real GDP, 1982-2012**

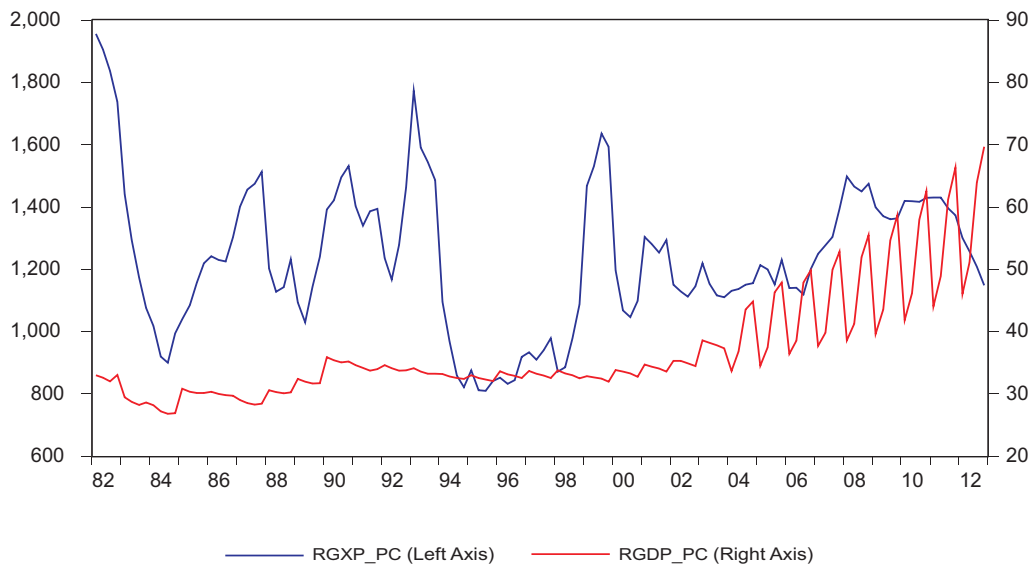


**Figure 3: Real Government Expenditure and per capita Real GDP, 1982-2012**



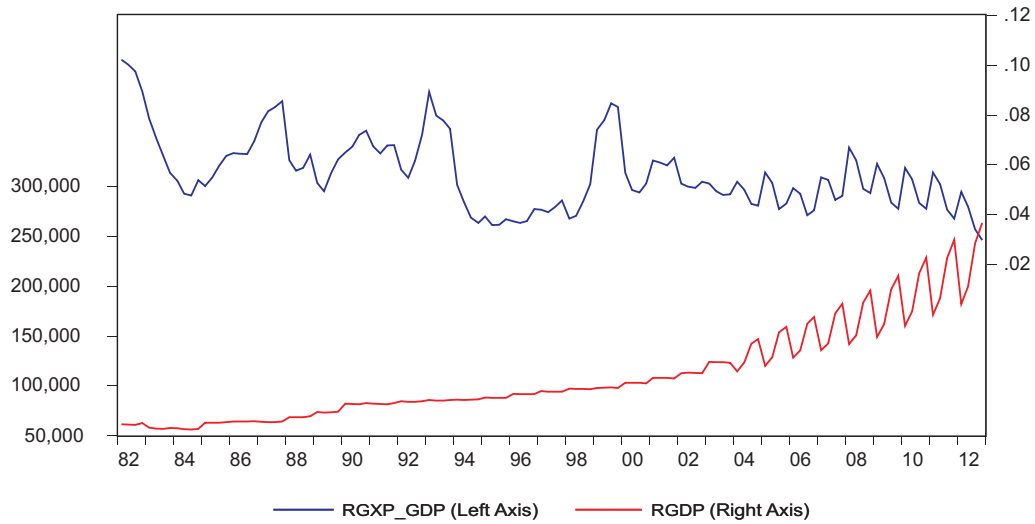
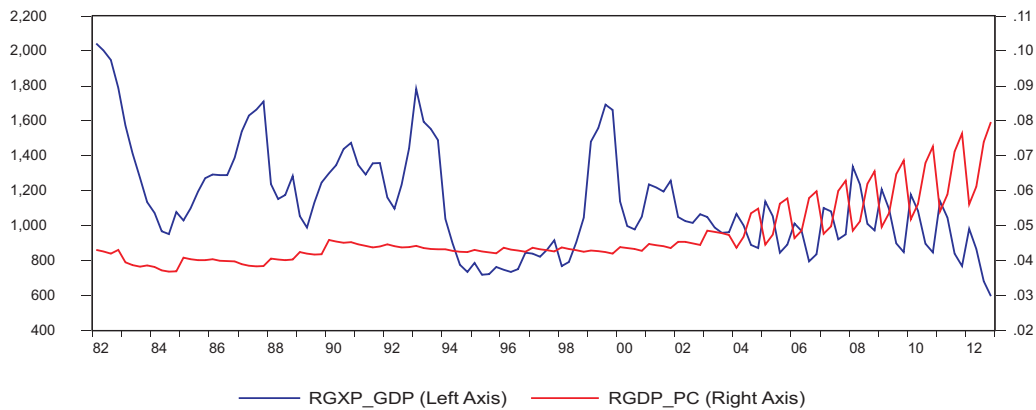
However, when relative expenditure was considered, the picture changed. Federal government expenditure as a ratio of GDP is presented alongside real GDP in figure 5. The series appear to diverge in their trends, which cast some doubts on the presence of the relative interpretation of Wagner's hypothesis by Musgrave (1969) and Mann (1980). Figure 6 reinforces this suspicion as government expenditure as a share of GDP and real GDP per capita appear to be moving in opposite directions during much of the period 1982 to 2012. However, when relative expenditure was considered, the picture changed. Federal government

**Figure 4: Real Government Expenditure and Real GDP per capita, 1982-2012**



expenditure as a ratio of GDP is presented alongside real GDP in figure 5. The series appear to diverge in their trends, which cast some doubts on the presence of the relative interpretation of Wagner's hypothesis by Musgrave (1969) and Mann (1980). Figure 6 reinforces this suspicion as government expenditure as a share of GDP and real GDP per capita appear to be moving in opposite directions during much of the period 1982 to 2012.



**Figure 5: Real Government Expenditure/GDP Ratio and Real GDP, 1982-2012****Figure 6: Real Government Expenditure/GDP Ratio and Per capita Real GDP, 1982-2012**

The foregoing preliminary indications would inform the choice of which interpretations of the Wagner's hypothesis are focused in the rest of the analysis. Specifically, the relative versions, Peacock and Wiseman (1967), Goffman (1968) and Gupta (1967), are the candidate ones given the pattern gleaned from figure 1-6.

#### IV. Methodology

##### IV.1 Data Type and Sources

This paper employed Nigeria's quarterly data from 1982 to 2012 on two main time series, real aggregate expenditure of the Federal government of Nigeria to proxy government size<sup>17</sup> and real gross national income of the country to proxy economic development. Other data employed were either subsets of the former, for example, non-oil income or relative measures of government spending per head and per capita GDP. All the data were obtained from publications of the National Bureau of Statistics (NBS) and Central Bank of Nigeria (CBN). All the series were transformed to log to enable us obtain elasticities directly upon estimation.

##### IV.2 Model Specification

In this paper, three approaches relating to three different versions of the Wagner's law were employed to investigate the Wagner's law in Nigeria. These included: Peacock - Wiseman (1961); Goffman (1968) and Gupta (1967). In the literature, the three are referred to as the absolute interpretations of the Law. Real gross domestic product (RGDP) and real gross domestic product per capita (RGDP\_PC) were used as proxy for economic activity/growth. Non-oil real gross domestic product (NON\_OIL RGDP) and non-oil real GDP per capita (NON\_OIL RGDP\_PC) were alternative measures of economic development. The study used real government expenditure (RGXP) and real government expenditure per capita (RGXP\_PC) to proxy government size.

The Peacock-Wiseman version stated that public expenditure growth was a function of revenue collection, and over time, economic development would lead to substantial increase in public sector size. In regression form, it is expressed as:

$$LRGXP_t = \alpha_0 + \alpha_1 LRGDP_t + \varepsilon_t \quad (1)$$

Where,

RGXP<sub>t</sub> = Real government expenditure at time t;

α<sub>0</sub> = Constant term; and

α<sub>1</sub> = is the elasticity of government expenditure with respect to economic development<sup>18</sup>

RGDP<sub>t</sub> = Real gross domestic product at time t and;

ε<sub>t</sub> = Stochastic Error term

<sup>17</sup>Government size envisaged by the Wagner's law is total, i.e., includes central government, states or provincial, local government and even public corporations. The study is however constrained by the dearth of reliable data on fiscal activities of government at the lower levels as well as of public corporations. The nearest reliable aggregate is Federal government spending, which is what has been used.

<sup>18</sup>The value of this elasticity is interpreted in the literature in the context of 'loose' and 'strict' Wagner's relationship, if less than one and if greater than one respectively. (Lamartina and Zaghini (2011)

The Goffman (1968) version expresses government size as a function of per capital economic activity.

$$\text{LRGXP}_t = \beta_0 + \beta_1 \text{LRGDP\_PC}_t + \varepsilon_t \quad (2)$$

Where,

$\text{RGXP}_t$	=	Real government size at time t;
$\beta_0$	=	Constant term;
$\text{RGDP\_PC}_t$	=	Real gross domestic product per capita at time t and;
$\varepsilon_t$	=	Stochastic error term

All the variables were transformed to their logarithmic form, which expressed the slope coefficients in the models as elasticities. The Wagner's law would be valid in Nigeria if the coefficients  $\alpha_1$  and  $\beta_1$  are greater than zero. The paper applied some standard analytical tools in examining the relationship between government expenditure and economic activity. The tests conducted included unit root, causality, cointegration and estimation of cointegrating equations using the Fully Modified Ordinary Least squares (FMOLS).

## V. Data Analysis

### V.1 Unit Root Tests<sup>19</sup>

The result showed that all the variables were stationary at first difference at 5.0 per cent level of significance as shown in Table 1 below.

**Table 1: Results of Stationarity Tests**

Variable	ADF (Prop. Value)		Order of Integration
	Level	1 <sup>st</sup> Diff.	
LRGXP	0.1856	0.0000	I(1)
LRGXP_PC	0.4559	0.000	I(1)
LRGDP	0.9998	0.0000	I(1)
LRGDP_PC	0.9994	0.0000	I(1)
*LNON_OIL_RGDP	0.9804	0.000	I(1)
*LNON_OIL_RGDP_PC	0.9844	0.000	I(1)

\*Non-oil real GDP

<sup>19</sup>The use of time series economic data in a regression requires a good analysis of the properties of such data to avoid spurious results. The efficacy of times series econometric methodology in establishing relationships among variables hinges on the assumption that the data is stationary (Sevitenyi, 2012). The unit root test is used to examine the status of time series data in terms of stationarity. The Augmented Dickey Fuller (ADF) test was conducted for the presence or otherwise of unit roots in the data. In its general form, it can be written as follows:

$$\Delta Y_t = \alpha + \beta_t + \gamma Y_{t-1} + \delta_1 \Delta Y_{t-1} + \dots + \delta_{p-1} \Delta Y_{t-p+1} + \varepsilon_t \dots \dots \dots (3)$$

Where,  $Y_t$  is the series,  $\alpha$  is the intercept,  $\beta$  is the coefficient on a trend,  $p$  is the order of lag of the autoregression process and  $\varepsilon_t$  is the error term. The ADF test is used to determine the level of integration as well as the possibility of cointegration among variables (Dickey and Fuller, 1981; Ogbonna, 2012). using the past values of both  $X_t$  and  $Y_t$  than it can using the past values of  $Y_t$  alone (Awe, 2012).

**V.2 Causality Tests<sup>20</sup>**

Granger causality was used to gain preliminary insights about the nature of the relationship between measures of government size and economic activity. The results are presented in Tables 2, 3 and 4.

**Table 2: LRGDP and LRGXP (Peacock – Wiseman version, 1961)**

Pairwise Granger Causality Tests			
Null Hypothesis:	Obs	F-Statistic	Prob.
LRGDP does not Granger Cause LRGXP	119	2.43138	0.0395
LRGXP does not Granger Cause LRGDP		0.73291	0.6003

The result showed that LRGDP Granger-caused LRGXP while LRGXP does not Granger-cause LRGDP. Therefore, a unidirectional causality ran from LRGDP to LRGXP. Similarly, a bi-directional causality was established between LRGDP\_PC and LRGXP.

**Table 3: LRGDP\_PC and LRGXP (Goffman, 1968)**

Pairwise Granger Causality Tests		
Null Hypothesis:	F-Statistic	Prob.
LRGDP_PC does not Granger Cause LRGXP	4.64087	0.0115
LRGXP does not Granger Cause LRGDP_PC	6.58970	0.0019

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<sup>20</sup>The essence of this study is to find out if there exists a long run tendency for federal government expenditures in Nigeria to grow along with the growth in economic activity. This implies that causality must run from economic activity to government expenditure. The Granger Causality test is employed to establish the direction of causality among variables. In mathematical form it is expressed as follows:  

$$Y_t = \alpha_0 + \alpha_1 Y_{t-1} + \alpha_2 Y_{t-2} + \dots + \alpha_j Y_{t-j} + \epsilon_t \dots \dots \dots (1)$$
 In equation 1,  $Y_t$  is expressed as a function of its past values;  

$$Y_t = \alpha_0 + \alpha_1 Y_{t-1} + \alpha_2 Y_{t-2} + \dots + \alpha_j Y_{t-j} + \beta_1 X_{t-1} + \dots + \beta_m X_{t-m} + \epsilon_t \dots \dots \dots (2)$$
 However, in equation 2,  $Y_t$  is written as a function of its past values as well as the past values of another times series variable  $X_t$ . The basic idea is that  $X_t$  can be said to Granger cause  $Y_t$  if it can better predict  $Y_t$

**Table 4: LRGDP\_PC and LRGXP\_PC (Gupta, 1967)**

<b>Pairwise Granger Causality Tests</b>		
<b>Null Hypothesis:</b>	<b>F-Statistic</b>	<b>Prob.</b>
LRGDP_PC does not Granger Cause LRGXP_PC	0.55652	0.6947
LRGXP_PC does not Granger Cause LRGDP_PC	3.00879	0.0212

A similar result was found when Goffman Approach was employed.

The causality results from the first two approaches provided useful insight into the application of the Wagner's law to Nigeria. Further investigations and evidence were presented in Section V.3.

### **V.3 Cointegration Analysis<sup>21</sup>**

Two methods, Engle and Granger (1987) and Phillips Ouliaris (1990), were used to explore cointegration. The results are presented in Table 5 and Table 6.

**Table 5: Cointegration Results based on Engle & Granger (1987)**

<b>Dependent</b>	<b>tau-statistic</b>	<b>Prob.*</b>	<b>z-statistic</b>	<b>Prob.*</b>
LRGXP	-3.746653	0.0200	-58.26262	0.0000
LRGDP	-2.47165	0.2978	-19.76325	0.0480

**Table 6: Cointegration Results based on Phillips-Ouliaris (1990)**

<b>Dependent</b>	<b>tau-statistic</b>	<b>Prob.*</b>	<b>z-statistic</b>	<b>Prob.*</b>
LRGXP	-3.65934	0.0250	-23.88	0.0188
LRGDP	-2.89052	0.1462	-16.22	0.1047

<sup>21</sup>Cointegration exists between two series if both series are integrated of order one (for instance) and the residuals or errors of the cointegrating equation are integrated at a lower order i.e. I(0). The variables may have long run relationship. The Engle and Granger (1987) test and Phillips Ouliaris (1990) procedures are used to determine if a long-run equilibrium relationship exists between government spending and economic development in this study. For Wagner's law to hold, cointegration is a necessary condition but not sufficient as the direction of causality also matters.

The cointegration results in Tables 5 and 6 showed that government size proxied by government expenditure (LRGXP) and economic activity represented in the model by log of real gross domestic product (LRGDP) are cointegrated. The tau-statistics obtained from tests (Engle and Granger and Phillips-Ouliaris) indicate clearly that this is only valid unilateral causality running from LRGDP to LRGXP. In other words, cointegration was not supported in a reverse relationship in which economic activity was explained by public size instead. This finding from Nigerian data supports the Wagner's hypothesis of increasing state activity.

Cointegration was similarly established between LRGXP and LRGDP\_PC (Goffman's model) and between LRGXP\_PC and LRGDP\_PC (Gupta's model) over the same sample period, 1982 to 2012 (Appendix)

**Wiseman-Peacock Model**

In estimating equation 1 which was the adapted Wiseman Peacock model, the study employed the fully modified ordinary least squares (FMOLS) having established cointegration between real government expenditure (LRGXP) and real gross domestic product (LRGDP).

The results obtained showed that government size tends to grow with economic expansion but by less than unity in the long-run with an estimated coefficient of 0.71 (Table 7).

The result supported the loose interpretation of the Wagner's hypothesis. A strict

**Table 7: Cointegrating Regression Result**

Dependent Variable: LRGXP				
Method: Fully Modified Least Squares (FMOLS)				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
LRGDP	0.715097	0.092602	7.722236	0.0000
C	0.382253	1.068130	0.357871	0.7211
R-squared	0.596913	Mean dependent var		8.617114
Adjusted R squared	0.593582	S.D. dependent var		0.345595

Wagner's relationship might only be inferred if the elasticity of government spending was significantly different from unity.

### Goffman's Model

In order to strengthen the evidence, the paper used another version of the Law, following Goffman (1968). Rather than aggregate GDP, Goffman used per capita income, which was viewed as a more appropriate indicator of economic development. This study similarly used real per capita income (LRGDP\_PC) to proxy state activity rather than real income (LRGDP) and log of real government expenditure to proxy for government size<sup>22</sup>. Having established the order of integration of both variables to be one, a non-stationary regression using the fully modified OLS (FMOLS) proposed by Phillips and Hansen (1990)<sup>23</sup> was conducted. The results are presented in Table 8.

**Table 8: Cointegrating Regression (FMOLS)**

Dependent Variable: LRGXP				
Method: Fully Modified Least Squares (FMOLS)				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
LRGDP_PC	1.739636	0.221143	7.866555	0.
C	-3.25944	1.510724	-2.157534	0.0329
R-squared	0.532248	Mean dependent var		8.6171
Adjusted R-squared	0.528382	S.D. dependent var		1
				0.3456

The results on Table 8 show that real government expenditure was positively related to economic activity, measured as per capita income (LRGDP\_PC) with a coefficient of 1.73. This supported the 'strict' version of the Wagner's law given that the elasticity of government spending was greater than unity<sup>24</sup>. In line with standard procedure, the residuals from the equation reported in table 8 were examined for the presence of unit roots. The absence of unit roots as suggested by

<sup>22</sup> Log transformation enables us to obtain elasticities directly

<sup>23</sup> Note that cointegration was first established between the variables (Appendix 2)

<sup>24</sup> Elasticity value of less than one is referred to in the literature as supporting loose Wagner hypothesis

the results in Table 9 implied a robust evidence of cointegration, which meant that the two series might diverge in the short-run, but converge around a long-run equilibrium.

**Table 9: Residual Unit Root Test Result**

Null Hypothesis: RESIDUAL GOFFMAN has a unit root			
		t-Statistic	Prob.*
<b>Augmented Dickey-Fuller test statistic</b>		-3.681751	0.0056
<b>Test critical values:</b>	1% level	-3.488585	
	5% level	-2.886959	
	10% level	-2.580402	

\*MacKinnon (1996) one-sided p-values

### Gupta's Model

The paper also investigated the Wagner's hypothesis following Gupta (1967) which used government spending per head as a measure of the relative size of government. Since both variables are integrated of order one, cointegration was explored and found to exist between the two (Appendix). The non-stationary regression results in Table 10 showed that per capita government expenditure (LRGXP\_PC) was positively related to economic activity. This result supported the 'strict' version of the Wagner's law given that the elasticity of government spending was greater than unity<sup>25</sup>.

**Table 10: Cointegrating Regression (FMOLS)**

Dependent Variable: LRGXP_PC				
Method: Fully Modified Least Squares (FMOLS)				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
LRGDP_PC	1.096699	0.375112	2.923658	0.0041
C	-3.346591	2.472664	-1.353435	0.1785
Trend	-0.003605	0.001773	-2.033556	0.0442
R-squared	0.065095	Mean dependent var		3.918555
Adjusted R-squared	0.049513	S.D. dependent var		0.227629

<sup>25</sup>Elasticity value of less than one is referred to in the literature as supporting loose Wagner hypothesis



The residual series from the equation, RESIDUAL GUPTA, was tested for unit roots and found to be stationary (Table 11).

**Table 11: Residual Unit Root Test Result**

<b>Null Hypothesis: RESIDUAL GUPTA has a unit root</b>			
		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.802397	0.0199
Test critical values:	1% level	-4.040532	
	5% level	-3.449716	
	<b>10% level</b>	<b>-3.150127</b>	

\*MacKinnon (1996) one-sided p-values

Overall, the analysis of data spanning 1982 to 2012 provided some evidence in support of the Wagner's Law in Nigeria. All the tests, Granger Causality, single equation cointegration tests (Engle-Granger and Phillips-Ouliaris) and FMOLS estimates suggested the relevance of the Wagner's hypothesis in explaining government expenditure in Nigeria between 1982 and 2012. It was also interesting to note that, the results did not remarkably differ from other studies using aggregate series. Table 12 presented a summary of elasticities of government expenditure with respect to economic activity.

**Table 12: Estimates of Cointegrating Equations using Real Non-Oil GDP**

Model	Dependent Variable	Independent Variable*	Elasticity	t-statistics
<b>Wiseman/Peacock</b>	LRGXP	LNON_OIL_RGDP	0.84	2.95
<b>Goffman</b>	LRGXP	LNON_OIL_RGDP_PC	1.3	7.86
<b>Gupta</b>	LRGXP_PC	LNON_OIL_RGDP_PC	0.85	2.99

\* LNON\_OIL\_RGDP is log of real non-oil gross domestic product while LNON\_OIL\_RGDP\_PC is log of real non-oil gross domestic product, per capita

The results in Table 12 simply validated the earlier ones. While the elasticity of government spending increased in the Wiseman-Peacock model, those obtained from both the Goffman and Gupta models declined when non-oil GDP was used as proxy for economic development.

## **V. Conclusion**

Recent developments in the field of econometrics had generally ensured that more rigorous and empirical evaluations of the Wagner's law could be carried out using long-run simulation on time-series data. Nevertheless, empirical works on both developed and developing countries had reported different results. The major findings of this paper was that Federal government expenditures in Nigeria is not 'completely exogenous' as implied by Keynes in the *General Theory*. The results also did not rule out the possibility of reverse causality. For Nigeria, judging by the results of this and many other studies, it was safe to say that Federal government expenditures were, in part, driven by economic development, as measured by aggregate output or per capita income. Overall, the data on Nigeria provided a strong evidence of the Goffman's version of the Wagner's law.

Given that government fiscal position was positively influenced by economic activity, a symbiotic relationship might be exploited by policy makers to accelerate growth. For planning, the results are very crucial. This is because, as economy expands, public sector financial commitment increases, which may be sustainable if the revenue side is concomitantly strengthened. It is, therefore, possible to plan and implement improvement in taxation as the economy grows to avoid fiscal indiscipline.

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### Appendix: E-Views Outputs of Cointegration Results

Dependent	tau- statistic	Prob.*	z-statistic	Prob.*
LRGXP	-3.720369	0.0215	-293.3343	0.0000
LRGDP_PC	-1.825713	0.6187	-21.11690	0.0351

\*MacKinnon (1996) p-values.

Dependent	tau- statistic	Prob.*	z-statistic	Prob.*
LRGDP_PC	-4.425279	0.0025	-39.27814	0.0004
LRGXP	-4.098319	0.0072	-31.38778	0.0029

Dependent	tau- statistic	Prob.*	z-statistic	Prob.*
LRGXP	-3.720369	0.0215	-293.3343	0.0000
LRGDP_PC	-1.825713	0.6187	-21.11690	0.0351

\*MacKinnon (1996) p-values.

Dependent	tau- statistic	Prob.*	z-statistic	Prob.*
LRGXP	-4.150720	0.0061	-31.75488	0.0027
LNON_OIL_RG DP_PC	-4.329004	0.0035	-37.28503	0.0006

\*MacKinnon (1996) p-values.

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Dependent	tau- statistic	Prob.*	z-statistic	Prob.*
LRGXP	-3.720369	0.0215	-293.3343	0.0000
LRGDP_PC	-1.825713	0.6187	-21.11690	0.0351

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\*MacKinnon (1996) p-values.

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Dependent	tau- statistic	Prob.*	z-statistic	Prob.*
LRGXP_PC	-4.233217	0.0047	-32.20790	0.0024
LRGDP_PC	0.570510	0.9973	1.226266	0.9974

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\*MacKinnon (1996) p-values.

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Dependent	tau- statistic	Prob.*	z-statistic	Prob.*
LRGXP_PC	-4.212844	0.0050	-31.96471	0.0025
LNON_OIL_RG				
DP_PC	0.783832	0.9985	1.798596	0.9988

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\*MacKinnon (1996) p-values.

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Dependent	tau- statistic	Prob.*	z-statistic	Prob.*
LRGXP	-3.720369	0.0215	-293.3343	0.0000
LRGDP_PC	-1.825713	0.6187	-21.11690	0.0351

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\*MacKinnon (1996) p-values

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