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

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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

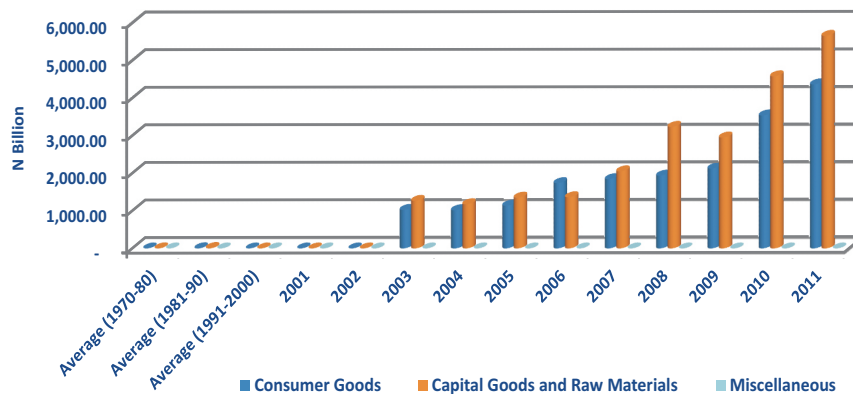
Note: \* - Average Figure, c & f – cost and freight

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;  $\varepsilon_t$  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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