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# PRICE AND INCOME ELASTICITIES OF IMPORT DEMAND IN NIGERIA: EVIDENCE FROM THE BOUND TESTING PROCEDURE

**Uche C. Nwogwugwu[1], Anne C. Maduka[2] & Chekwube V. Madichie[3]**

[1]Department of Economics, Nnamdi Azikiwe University, Awka, Nigeria
[2]Department of Economics, Chukwuemeka Odumegwu Ojukwu University, Igbariam, Nigeria
[3]Department of Economics, Nnamdi Azikiwe University, Awka, Nigeria

**ABSTRACT:** *Trade elasticities are very crucial for both economic forecasting and international policy analysis. However, the value of trade elasticities has remained the subject of diverse opinion in most international economic policy debates. This is because results from most empirical studies in this area are still mixed. Therefore, this paper uses import substitution model framework to estimate the price and income elasticities of import demand in Nigeria for the period 1970 – 2013. We use Autoregressive Distributed Lag (ARDL) bound testing proposed by Pesaran et al. (2001) to study the long run relationship between variables of interest. The results of the unit root test based on ADF and PP provide justification for the use of ARDL bound test as the variables were either I(0) or I(1) and none is I(2). The cointegration results show that there is a long run relationship between import demand and the chosen explanatory variables, thus all the variables move together in the long run. The estimated long run coefficients show that the price and income elasticities of import demand in Nigeria were about 0.03 and 0.55 respectively during the period covered. This implies that the long run import demand in Nigeria has been price-and income-inelastic since the sizes of the coefficients of real GDP and relative prices were less than unity and among the explanatory variables studied, real GDP was the main determinant of import demand in Nigeria. Furthermore, the long run coefficient of domestic prices which is also regarded as the cross-price elasticity of import demand with respect to home made goods was about 0.0062 and statistically insignificant, thus there is evidence of imperfect substitution between foreign made goods and domestically produced goods. The results from the short run dynamics of the model suggest that about 67 percent of the disequilibrium between the long term and short term import demand is corrected each year. We therefore conclude that the use of currency devaluation as an import substitution tool is not validated by our results, whereas the use of higher taxes and interest rates as a tool of expenditure switching policies should be expected to have limited impact on Nigeria's trade balance.*

**KEYWORDS:** Price elasticity of import, Income elasticity of import, Import demand.

## INTRODUCTION

Foreign trade is one of the important components of aggregate economic activities and also one of the major drivers of economic growth in every economy. It is also known that foreign trade provides impetus for industrial development by making inputs available for domestic production particularly in developing economies (e.g Nigeria) where production activities depends heavily on imported inputs. While foreign trade enlarges market frontiers for domestic industrial output and brings about foreign exchange to the country through exports, it also expands the production possibility frontiers and increases the utility of consumers by broadening the consumption basket of the people in the participating countries through imports, thus improving their welfare (Adewuyi and Adeoye, 2008). Also, foreign trade provides avenue for government to source revenue through taxes on exports and imports. However, the extent to which a country benefits from foreign trade is a function of a number of factors, prominent among which is the trade policy regime prevalent in the economy which could be protective or liberalized. It is instructive to point out here that Nigeria as a country has experimented with a mix of the two trade policy regimes.

Over the past decades, most developing countries, Nigeria in particular, have been faced with severe problems of external imbalance stemming from a persistently growing current account deficit. This deficit is widely believed to be linked with the huge deficits in merchandize trade. As a matter of fact, the high penchant for foreign made goods coupled with the lacklustre exports performance are continuously stressed as some key issues facing the Nigerian economy and some other developing economies especially in the recent times. This catalogue of problems associated with external imbalance had, for long forced most governments of developing countries (Nigeria in particular) to implement various restrictive trade policies aimed at maintaining a favourable balance of trade.

Nigeria has, over the years favoured protective trade polices using various measures which ranges from import substitution industrialization (ISI) to haphazard application of tariff via annual budget. Thus, obtaining the estimates of the income and price elasticities of imports using historical data can be of great use in gauging the impact of changes in the economy as well as of fiscal and monetary policy measures on trade balance and consequently, on the current account. These elasticities can then be used in macroeconomic forecasting as they help describe the interrelationship between variables of interest and thus, determine the intensity of the effect of fiscal and monetary policy measures. Also, the potency of any trade policy adopted by any economy depends largely on the trade elasticities of that economy (price and income elasticities of export and import).

Trade elasticities are very crucial for both economic forecasting and international policy analysis. However, the value of trade elasticities has remained the subject of diverse opinion in most international economic policy debates. This is because results from most empirical studies are still mixed. Despite the fact that a good number of studies have attempted the estimates of income and price elasticities of imports and other related issues across countries of the world, there appears to be dearth of empirical studies in this area based on Nigerian data.

This study, therefore intends to make a modest contribution to the literatures by using the most recent method of ARDL Bound Test proposed by Pesaran et al. (2001), in obtaining the estimates of the income and price elasticities of imports using Nigerian data. Other variables other than income and price will be adequately incorporated and analysed. Most interesting of these variables is the naira/dollar exchange rate given its much discussed influence on trade and competitiveness of Nigerian goods.

The rest of the paper is structured as follows: section two (2) has the literature review; while section three (3) outlines the methodology. Section four (4) covers the empirical result, and discussion findings; while section five (5) has the conclusion.

## LITERATURE REVIEW

Income and price elasticities of imports refer to the degree of responsiveness of imports to any slight change in the income and prices of imports. Here, the price of imports is usually the relative prices, while the income is the real gross domestic product. The income and price elasticities of imports are very crucial for both economic forecasting and trade policy analysis. Thus, a number of studies have attempted the estimates of income and price elasticities of imports and other related issues across countries of the world. However, the values of the income and price elasticities of imports remained a subject of diverse opinion in most international economic policy debates. This is due to the fact that most of these empirical studies continue to show conflicting results. Also, there appears to be dearth of empirical studies that have undertaken a systematic estimation of income and price elasticities of imports using Nigerian data. In this section, some recent empirical studies are extensively reviewed.

Vojnovic and Unevska (2007), estimated the price and income elasticities of export and import and economic growth for the Republic of Macedonia during 1998 – 2006. The study follows the ARDL modelling framework. The results confirmed the existence of long term relationship between export and import demand and relative prices and income. Also, the study found evidence for high import elasticity on domestic income changes and relatively significant export elasticity to changes in the world income. The study concluded that the higher income elasticity of import over that of export accounts for the trade balance deterioration.

Chimobi and Ogbonna (2008), estimated the aggregated import demand function following cointegration and error correction modelling approaches over the period 1980 – 2005. The results suggested that real GDP largely explains the import demand.

Bobic (2009), estimated income and price elasticities of Croatian trade using panel data approach. The using of panel data method was to disaggregate data which allowed for sectoral differences in the data as well as dynamic adjustment of the data through time. The results show that the income and price elasticity coefficients both in import and in the export model have the expected signs – increase in income positively affects exports and imports while increases in prices lower them. Judging by the size of the coefficients, the study concluded that income effects appear to be more substantial than price effects.

Serge and Yue (2010), estimated a disaggregated import demand function for Cote d' Ivoire using time series data for the period 1970 – 2007. The study used ARDL modelling approach to capture the effect of final consumption expenditure, the investment expenditure, the export expenditure, and relative prices on import demand. The study found evidence of long run relationship between the variables and showed inelastic import demand for all expenditure components and relative prices.

Hye and Mashkoor (2010), estimated the aggregate import demand function for Bangladesh using data from 1980 to 2008. The study used ARDL bound test for cointegration and rolling window regression method to estimate the coefficient of each of the observation in the sample by fixing the window size. The estimation showed evidence of a long run relationship between imports, relative price and economic activity and long run economic growth elasticity is (0.93) positive and relative price elasticity is (-0.29) negative whereas the results of rolling window method show that the long run elaticities of national income variable vary in the range of 0.81 to 0.96 and the relative price elasticities are negative except few years.

Uz, (2010), in his study investigated the long-run bilateral trade elasticities of Turkey and its major trading countries. He found that, in the long run, Turkish bilateral trade was inelastic (with varying sign). Thus, the Turkish trade had an elastic income in the long run but inelastic income in the short run.

Tennakoon (2010), uses disaggregated approach to investigate the Sri Lanka's import demand functions and their price and income elasticities for the post-liberalization period of 1977 – 2007. The paper employs standard characterization of import demand functions. The econometric estimates reveal that relative price is inelastic for all categories of consumer goods, intermediate goods, and investment goods, implying that consumers may be less price sensitive.

Babatunde and Egwaikhide (2010), empirically analysed the aggregated import demand behaviour for Nigeria using annual data between 1980 and 2006. The bound test analysis was used to estimate the long run relationship between import demand and its determinants. The study found that import, income, and relative prices are cointegrated. Also, the estimated long run elasticties of import demand with respect to income and relative prices were 2.48 and -0.133.

Abu-Lila (2014), estimated the price and income elasticities of international trade for Jordan between 1980 and 2012. The study employed ADF unit root, Johansen cointegration and error correction mechanism. The study showed that the sum of price elasticities of import and export demand exceeds one for Jordan.

## METHODOLOGY

### Theoretical Framework

There are three major frameworks in the modern theory of international trade, namely, the theory of comparative advantage, the Keynesian trade multiplier, and the so called new trade theory (or, the imperfect competition theory of trade). The roles of income and prices in the determination of trade are explained differently in these theoretical frameworks. In the neoclassical trade theory of comparative advantage, as characterized by the Heckscher-Ohlin framework extended from the classical Ricardian theory, the focus is on how international trade, its volume and direction, is affected by changes in relative prices, which in turn are explained by the differences in factor endowments between countries. The effects of changes in income on trade is not the concern—the level of employment is assumed to be fixed and output is assumed to be always on a given production frontier.

Goldstein and Khan (1985) presented two trade models: the imperfect substitution model and the perfect substitution model. While the latter is mainly for the trade of homogeneous commodities, the former is the one mostly used in studying imports of manufactured goods and aggregate imports. The basic assumption of the imperfect substitution model is that neither imports nor exports serve as perfect substitutes for domestic goods. This assumption has for the most part been confirmed empirically, both in the short and in the long run. If domestic and foreign goods were perfect substitutes, then countries would specialize, either only importing or only exporting each particular good. In practice, however, both domestic and imported goods can be found coexisting on markets, indicating that countries do not in fact specialize to such a high degree.

## Model Specification

As has been established in the theoretical framework, this study is based on imperfect substitution model provided by Goldstein and Khan (1985) and has been used by Bobic (2009). The basic model contains eight equations for the quantities and prices of trade between a country and the rest of world. Among them, the import demand function is defined as:

$$IM = f(Y, PI, PD) \qquad (1)$$

Where I = imports; Y = real gross domestic product; PI = relative prices of imports; and price of domestically produced goods. Equation (1) is the framework most commonly used in empirical studies of import behavior. Based on equation (1), we specify our model as:

$$IMP = \Omega_0 + \Omega_1 RGDP + \Omega_2 RLP + \Omega_3 OPN + \Omega_4 EXR + \Omega_5 CPI + \mu \qquad (2)$$

Where IMP = imports; RGDP = real gross domestic product; RLP = relative prices; OPN = trade openness (measured as export plus import divided by GDP); EXR = exchange rate; CPI = consumer price index (domestic prices); $\mu$ = random error term; $\Omega_0$ = intercept term; and $\Omega_1$ - $\Omega_5$ = parameters to be estimated.

Adopting a log-linear specification, our model becomes:

$$LIMP = \Omega_0 + \Omega_1 LRGDP + \Omega_2 LRLP + \Omega_3 LOPN + \Omega_4 LEXR + \Omega_5 LCPI + \mu \qquad (3)$$

Where L = natural logarithm. Note that the presence of log on both sides of the equation (3) implies that the parameters, $\Omega_1$ - $\Omega_5$ are to be interpreted as elasticities.

**A priori Specification:** $\Omega_1 > 0, \Omega_2 < 0, \Omega_3 > 0, \Omega_4 < 0, \Omega_5 > 0.$

## Estimation Technique

For a robust estimation of price, and income elasticities of import in Nigeria, our study is based on ARDL framework provided by Pesaran et al. (2001) for cointegration analysis. The data used are annualized secondary time series obtained from the CBN statistical bulletin over the period 1970 – 2013.

Cointegration test is carried out using the Autoregressive Distributed Lag (ARDL) bound testing approach to as proposed by Pesaran et al (2001). This procedure is adopted because it has better small sample properties than alternative methods (ie Engel-Granger (1987), Johansen and Julius (1990), and Philip and Hansen (1990)). Another advantage of ARDL bounds testing is that unrestricted ECM seems to take satisfactory lags that captures the data generating process in a general-to-specific framework of specification (Laurenceson and Chai, 2003). This method avoids the classification of variables as I(1) and I(0) by developing bands of critical values which identifies the variables as being stationary or non-stationary processes. Unlike other cointegration techniques (e.g., Johansen's procedure which require certain pre-testing for unit roots and that the underlying variables to be integrated of the same order), the ARDL model provides an alternative test for examining a long-run relationship regardless of whether the underlying variables are purely I(0) or I(1), even fractionally integrated. Therefore, the previous unit root testing of the variables is unnecessary. Moreover, traditional cointegration method may also suffer from the problems of endogeneity while the ARDL method can distinguish between dependent and explanatory variables. Thus, estimates obtained from the ARDL method of cointegration analysis are unbiased and efficient, since they avoid the problems that may arise in the presence of serial correlation and endogeneity. Note also that the ARDL procedure allows for uneven lag orders, while the Johansen's VECM does not. However, Pesaran and Shin (1999) argued that, ―appropriate modification of the orders of ARDL model is sufficient to simultaneously correct for residual serial correlation and problem of endogenous variables. In summary, it can be seen that ARDL bound test can be used with a mixture of I(0) and I(1) data; it involves just a single-equation set-up, making it simple to implement and interpret; and different variables can be assigned different lag-length as they enter the model.

The ARDL bounds testing procedure consists of estimating an unrestricted error correction model with the following generic form:

$$\Delta LIMP_t = \alpha + \Sigma\beta_i\Delta LIMP_{t-i} + \Sigma\delta_j\Delta LRGDP_{t-j} + \Sigma\lambda_k\Delta LRLP_{t-k} + \Sigma\phi_l\Delta LOPN_{t-l} + \Sigma\gamma_m\Delta LEXR_{t-m} + \Sigma\theta_n\Delta LCPI_{t-n} + \eta_1 LIMP_{t-1} + \eta_2 LRGDP_{t-1} + \eta_3 LRLP_{t-1} + \eta_4 LOPN_{t-1} + \eta_5 LEXR_{t-1} + \eta_6 LCPI_{t-1} + \mu_t \quad (4)$$

The above equation shows the unrestricted ECM version of ARDL specification. The bounds test is mainly based on the joint F-statistic whose asymptotic distribution is nonstandard under the null hypothesis of no cointegration. The first step in the ARDL bounds test approach is to estimate equation (4) by OLS, which tests for the existence of a long-run relationship among the variables by conducting an F-test for the joint significance of the coefficient of the lagged level of the variables. Thus, the null hypothesis of no cointegration for equation (4) is stated as follows:

$H_0 : \eta_1 = \eta_2 = \eta_3 = \eta_4 = \eta_5 = \eta_6 = 0$, against $H_1 : \eta_1 \neq \eta_2 \neq \eta_3 \neq \eta_4 \neq \eta_5 \neq \eta_6 \neq 0$

Our F-statistic which normalizes on *LIMP* is denoted with $F_{LIMP}$ *(LIMP/ LRGDP, LRLP, LOPN, LEXR, LCPI).* The F-test has a nonstandard distribution which depends upon: (i) whether variables included in the ARDL model are I(0) or I(1); (ii) the number of regressors; and (iii) whether the ARDL model contains an intercept and/or a trend. Two sets of critical values are reported in Pesaran et al. (2001): one set is calculated assuming that all variables included in the ARDL model are I (0) and the other is estimated considering that the variables are I(1). We reject the null hypothesis of no cointegration when the F-statistic exceeds the upper critical bounds value. We do not reject the null hypothesis if the F-statistic is lower than the lower bounds. Finally, the decision about cointegration is inconclusive, if the calculated F-statistic falls between the lower and upper-bound critical values.

If a stable long run relationship is confirmed from the ARDL bound test, then we shall estimate the short run dynamic coefficients through the following error correction model:

$$\Delta LIMP_t = \alpha + \Sigma\beta_i\Delta LIMP_{t-i} + \Sigma\delta_j\Delta LRGDP_{t-j} + \Sigma\lambda_k\Delta LRLP_{t-k} + \Sigma\phi_l\Delta LOPN_{t-l} + \Sigma\gamma_m\Delta LEXR_{t-m} + \Sigma\theta_n\Delta LCPI_{t-n} + \Psi ECM(-1) + \mu_t \quad (5)$$

Where $ECM_{t-1}$ is the error correction term resulting from the verified long-run equilibrium relationship and Ψ is a parameter indicating the speed of adjustment to the equilibrium level after any particular shock. The sign of the $ECM_{t-1}$ must be negative and significant to ensure convergence of the dynamics to the long-run equilibrium. The value of the coefficient, Ψ, which signifies the speed of convergence to the equilibrium process, usually ranges from -1 to 0. The value of -1 signifies perfect and instantaneous convergence while 0 means no convergence after a shock in the process.

Further, Pesaran and Pesaran (1997) argued that it is imperative to ascertain the constancy of the long-run multipliers by testing the above error-correction model for the stability of its parameters. The commonly used tests for stability are the cumulative sum (CUSUM) and the cumulative sum of squares (CUSUMQ), both of which have been introduced by Brown et al. (1975).

## EMPIRICAL RESULTS AND DISCUSSION OF FINDINGS

### Unit Root Testing

As stated earlier, cointegration analysis based on ARDL bound testing implies that unit root testing is not necessary. However, it is important that we carry out this test to ensure that none of the chosen variables are order two, I(2). This is because, ARDL approach becomes meaningless in the face of I(2) variables. To determine the order of integration of the chosen variables, the Augmented Dickey-Fuller (ADF) and Philip-Perron (PP) unit root tests have been carried out on levels and differences of the included variables. The tests were performed assuming intercept and no trend in both ADF and PP unit root specifications. The results for both ADF and PP unit root tests are reported in Table 1 below.

**Table 1: ADF and PP Unit Root Results**

| Variable | ADF Statistic | Order of Integration | PP Statistic | Order of Integration |
|---|---|---|---|---|
| LIMP | -5.012116** | I(1) | -5.012116** | I(1) |
| LRGDP | -6.047241** | I(1) | -6.047241** | I(1) |
| LRLP | -5.273556** | I(1) | -5.273556** | I(1) |
| LOPN | -6.438393** | I(1) | -6.438393** | I(1) |
| LEXR | -6.049710** | I(1) | -6.049710** | I(1) |
| LCPI | -3.118846* | I(0) | -11.84020** | I(0) |

NB: **(*) implies significant at 1%(5%) level of significance.

***Source: Authors' Computation.***

The results in Table 1 show that within the framework of both ADF and PP unit root testing, all variables (LIMP, LRGDP, LRLP, LOPN, and LEXR) are I(1) except LCPI which is I(0). This implies that the use of ARDL bound test for cointegration is justified as the variables are either I(0) or I(1) and none is I(2).

### Cointegration Test

Having confirmed that all our chosen variables are either I(0) or I(1) and that none is I(2), the long run relationship among these variables is determined using one of the most recently developed ARDL bound testing procedure. This procedure consists of estimating an unconstrained ECM given by equation (4). The first step to ARDL bound was to determine the optimal lag length for the first differences of the chosen variables. The lag selection test was carried out for the first differences of the series, and the results show that the optimal lag length is 5 according to AIC and 1 as per SIC. Although it is known that SIC is preferred to AIC when dealing with small sample, but the diversity between AIC and SIC is settled with the Final

Prediction Error (FPE) which is at lag 4. The ARDL bound test results and the critical values obtained from Pesaran et al (2001, p. 300) are reported in Table 2 below.

**Table 2: ARDL Bound Testing Results (with Intercept and Trend)**

| F-Statistic | 5% Critical Value | | 1% Critical Value | |
|---|---|---|---|---|
| | Lower bound I(0) | Upper bound I(1) | Lower bound I(0) | Upper bound I(1) |
| 19.44939** | 3.12 | 4.25 | 3.93 | 5.23 |

NB: ** implies significant at both 1% and 5% levels of significance.

*Source: Authors' Computation.*

The results in Table 2 show the ARDL bound testing for cointegration. The ARDL bound tests results indicate evidence of cointegration among the variables of interest. This is confirmed by value of the F-statistic for the joint significance of the lagged level variables in equation (4) which is greater than the upper bound critical values at both 1% and 5% levels of significance. Therefore, following the ARDL bound testing approach to cointegration, we conclude that a long run relationship exist between LIMP and the chosen explanatory variables.

Furthermore, Table 3 presents the Johansen cointegration tests as a compliment to the ARDL bound test. This test was performed allowing a lag length of 4 based on the FPE. The null hypothesis underlying this test is that $r = 0$, against the general alternatives that $r > 0, 1, 2, 3, 4,$ and 5. The null hypothesis of no cointegration among the variables of interest is rejected at 5% level of significance since the values of both trace statistic and max-eigen statistic do not lead to the rejection of the null hypothesis of $r \leq 4$. Thus, there is evidence of a long run relationship among the chosen variables, and this result supports the ARDL bound test.

**Table 3: Johansen Cointegration Results**

| $H_0$ | $H_1$ | Trace Statistic | 5% Critical Value | Max-eigen Statistic | 5% Critical Value |
|---|---|---|---|---|---|
| $r = 0$ | $r > 0$ | 269.0427* | 95.75366 | 93.59226* | 40.07757 |
| $r \leq 1$ | $r > 1$ | 175.4504* | 69.81889 | 67.52357* | 33.87687 |
| $r \leq 2$ | $r > 2$ | 107.9269* | 47.85613 | 50.73509* | 27.58434 |
| $r \leq 3$ | $r > 3$ | 57.19179* | 29.79707 | 42.38832* | 21.13162 |
| $r \leq 4$ | $r > 4$ | 14.80348 | 15.49471 | 13.42349 | 14.26460 |
| $r \leq 5$ | $r > 5$ | 1.379983 | 3.841466 | 1.379983 | 3.841466 |

NB: * implies rejection of the null hypothesis ($H_0$) of at 5% level of significance. Both the trace test and max-eigen value test indicate 4 cointegrating equations at 5% level.

*Source: Authors' Computation*

**Estimated Long run Coefficients**

We present in Table 4 the estimates of equation (3) including the estimated first-order autoregressive coefficient of the error term using OLS. Although all the variables conform to a priori expectation, only the variables LRGDP and LOPN are statistically significant at 1%, others such as LRLP, LEXR, and LCPI are statistically insignificant at a 10% level of significance. The estimated long run coefficients show that a one percent increase in real gross domestic product (LRGDP) will bring about a rise in imports by about 0.55 percent in the long run while a one percent increase in relative prices (LRLP) will lead to about 0.03 percent decline in imports in the long run. These results imply that the Nigerian import demand is price- and income-inelastic since the long run price and income elasticities of imports are 0.03 and 0.55 respectively which are less than one. Also, a unit increase in the degree of openness (LOPN) will lead to about 0.32 unit rise in imports and a unit increase in the naira/dollar exchange rate (LEXR) will bring about 0.00023 decreases in imports.

Furthermore, a one percent increase in the price of domestically produced goods (LCPI) will lead to 0.0062 percent increase in imports. This implies that the domestically produced goods are not perfect substitutes for foreign made goods since the coefficient of LCPI which is also the cross elasticity of import demand with respect to home made goods is far less than unit (1). In passing, it should be noted that among the variables studied, income which is proxied by real gross domestic product (LRGDP) is the main determinant of import demand in Nigeria during the periods covered by the study.

The coefficient of determination (R-Squared) is about 0.96 which implies that about 96 percent of total variations in import demand were accounted for by variations in the explanatory variables of the model. The F-statistic value of 152.3405 with its p-value of 0.000000 shows that the overall model is statistically significant at 1% since the p-value is less than 1%. This implies that though not all the explanatory variables are individually statistically significant, they jointly explain variations in the dependent variable (LIMP). Furthermore, the value of DW and that of Breusch-Godfrey Serial Correlation LM Test show that our model is not plagued by autocorrelation of any order.

**Table 4: Estimated Long run Coefficients Results**

| Dependent variable: LIMP | | | | |
|---|---|---|---|---|
| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
| C | 15.67103** | 3.012022 | 5.202826 | 0.0000 |
| LRGDP | 0.554895** | 0.155025 | 3.579379 | 0.0010 |
| LRLP | -0.030040 | 0.143673 | -0.209085 | 0.8356 |
| LOPN | 0.324200** | 0.114837 | 2.823128 | 0.0077 |
| LEXR | -0.000233 | 0.038890 | -0.005979 | 0.9953 |
| LCPI | 0.006294 | 0.008387 | 0.750435 | 0.4579 |
| AR(1) | 0.952598** | 0.073990 | 12.87473 | 0.0000 |
| R-Squared = 0.962107; Adjusted R-Squared = 0.955791; F-statistic = 152.3405; prob.(F-statistic) = 0.000000; DW = 1.605363<br>Breusch-Godfrey Serial Correlation LM Test: F-statistic = 1.025114; Prob. F(2, 34) = 0.3696; Obs* R-Squared = 2.445471; Prob. Chi-Square(2) = 0.2944 | | | | |

NB: **(*) implies significant at 1%(5%) level.

*Source: Authors' Computation.*

**Estimated Short run Dynamics**

We present in Table 5 the short run dynamics of the import demand function given by equation (5) as a parsimonious ECM version of ARDL model. The parsimonious model was arrived at from an over-parameterized model through general to specific method. Specifically from the

ECM expressed in equation (5), the coefficients $\beta_i$, $\delta_j$, $\lambda_k$, $\phi_l$ $\gamma_m$, and $\theta_n$ capture any immediate short term or contemporaneous effect that the explanatory variables have on LIMP. The coefficient $\Omega_i$ in equation (3) reflects the long run equilibrium effect of LRGDP, LRLP, LOPN, LEXR, and LCPI on LIMP while the absolute value of $\psi$ explains how quickly the equilibrium is restored in the event of shock. Table 5 provides us the proportion of disequilibrium error that is accumulated in the previous period, which is corrected in the current period. The p-value of the error correction term coefficient in Table 5 shows that it is statistically significant at 1% level with the expected negative sign, thus suggesting that imports (LIMP) adjust to the explanatory variables. The coefficient of ECM(-1) is -0.672045 in the short run model, implying that the deviation from the long term equilibrium is corrected by about 67 percent each year. The lag length in the short run model is selected on the basis of AIC and SIC.

Furthermore, a stability test was conducted using cumulative sum and the cumulative sum of squares. The results (see Figure 1) show that the parsimonious model is dynamically stable since the fitted CUSUM and CUSUMQ shown by the tick line falls within the two dotted critical values lines at 5% level. Also, the Breusch-Godfrey Serial Correlation LM Test shows the absence of autocorrelation in the model.

**Table 5: Parsimonious Error Correction Model**

Dependent Variable: D(LIMP)

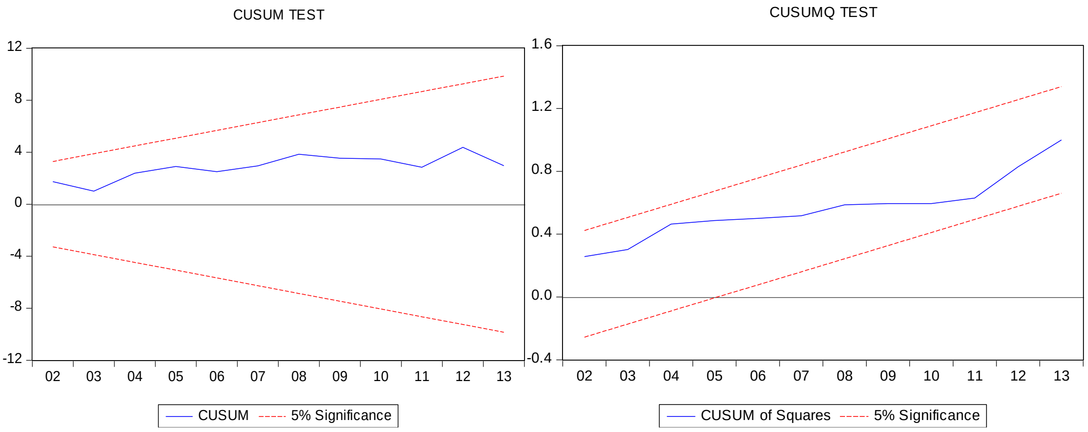
| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| C | 0.706135 | 0.086421 | 8.170904 | 0.0000 |
| D(LIMP(-1)) | 1.574909 | 0.181324 | 8.685585 | 0.0000 |
| D(LIMP(-2)) | 1.651962 | 0.175334 | 9.421784 | 0.0000 |
| D(LRLP(-1)) | -0.170713 | 0.110319 | -1.547441 | 0.1477 |
| D(LRLP(-2)) | -0.718331 | 0.137150 | -5.237564 | 0.0002 |
| D(LRGDP(-1)) | 1.615133 | 0.163816 | 9.859405 | 0.0000 |
| D(LRGDP(-2)) | 1.523142 | 0.181016 | 8.414389 | 0.0000 |
| D(LRGDP(-3)) | 1.232457 | 0.147402 | 8.361204 | 0.0000 |
| D(LOPN(-1)) | 1.211666 | 0.135353 | 8.951875 | 0.0000 |
| D(LOPN(-2)) | 1.056525 | 0.149807 | 7.052581 | 0.0000 |
| D(LEXR(-1)) | -0.077636 | 0.019581 | -3.964864 | 0.0019 |
| D(LEXR(-2)) | -0.143785 | 0.037324 | -3.852363 | 0.0023 |
| D(LCPI(-1)) | 0.077772 | 0.019495 | 3.989364 | 0.0018 |
| D(LCPI(-2)) | 0.061757 | 0.016682 | 3.701986 | 0.0030 |
| ECM(-1) | -0.672045 | 0.198817 | -5.651869 | 0.0000 |
| R-squared | 0.952913 | Mean dependent var | | 0.078188 |
| Adjusted R-squared | 0.854814 | S.D. dependent var | | 0.247964 |
| S.E. of regression | 0.094483 | Akaike info criterion | | -1.665061 |
| Sum squared resid | 0.107124 | Schwarz criterion | | -0.544607 |
| Log likelihood | 57.63616 | Hannan-Quinn criter. | | -1.266412 |
| F-statistic | 9.713790 | Durbin-Watson stat | | 2.043468 |
| Prob(F-statistic) | 0.000103 | | | |

Breusch-Godfrey Serial Correlation LM Test:

| | | | |
|---|---|---|---|
| F-statistic | 5.911828 | Prob. F(2,10) | 0.1202 |
| Obs*R-squared | 20.58770 | Prob. Chi-Square(2) | 0.1841 |

*Source: Authors' Computation*

**Figure 1: Stability Test Based on Cumulative Sum and Cumulative Sum of Squares**




***Source: Authors' Computation***

## CONCLUSION

This paper estimated the price and income elasticities of import in Nigeria for the period 1970 – 2013. We use Autoregressive Distributed Lag (ARDL) bound testing proposed by Pesaran et al. (2001) which was complimented with Johansen cointegration to study the long run relationship between variables of interest.

The results of the unit root test based on ADF and PP indicate that the variables under study follow I(1) process except the domestic prices (LCPI) which is I(0). This shows that the variables under study were either I(1) or I(0), implying that the use of ARDL bound test is justified for cointegration analysis.

The cointegration results show that there is a long run relationship between import demand (LIMP) and the chosen explanatory variables which imply that all the variables move together in the long run. The estimated long run coefficients show that the price and income elasticities of import demand in Nigeria were about 0.03 and 0.55 respectively during the period covered. This implies that the import demand in Nigeria has been price-and income-inelastic since both price and income elasticities of imports were less than unity and among the explanatory variables studied, real gross domestic product (LRGDP) was the main determinant of import demand in Nigeria. This conclusion is consistent with other studies like Serge and Yue (2010), Chimobi and Ogbonna (2008) and Hye and Mashkoor (2010).

Furthermore, the long run coefficient of domestic prices which is regarded as the cross-price elasticity of import demand with respect to home made goods was about 0.0062, thus there is evidence of imperfect substitution between foreign goods and domestic goods. Next we estimated the short run dynamics of the model and the results suggest that about 67 percent of disequilibrium between the long term and short term import demand is corrected each year.

We therefore conclude that the use of currency devaluation as an import substitution tool is not validated and also, the use of higher taxes and interest rates as a tool of expenditure switching policies should be expected to have limited impact on Nigeria's trade balance.

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