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AN AGGREGATE IMPORT DEMAND FUNCTION FOR NIGERIA

ABSTRACT

Being a small open economy, Nigeria requires imports, such as capital and intermediate goods to grow and develop. This paper uses a time series econometric technique, precisely the error-correction mechanism, to identify the factors responsible for import demand. The results show that imports, income and relative prices are all cointegrated. The econometric estimates of the import-demand function for Nigeria suggests that import demand is largely determined by real income (GDP) and less sensitive to relative prices. In addition, the structural policy shift to liberalization since 1986 is found to have little but significant impact on import demand. Development of local industries with low import content is suggested given that exchange rate policy and devaluation generally are likely to be ineffective in influencing import demand of Nigeria.

Key Words: *Import demand, relative prices, real income, cointegration, Nigeria, policy structural shift.*

INTRODUCTION

In the economic literature, international trade has been largely linked to the growth process of developing economies. As a Less Developed Country (LDC), Nigeria's import of capital goods is crucial for investment in order to generate the desired level of economic growth. In addition, a rising level of import of raw materials and spare parts is needed to sustain import competitive domestic industries. In view of the strategic role of imports in the growth of the domestic economy, there have been frequent changes in import control measures in Nigeria. Such changes, nevertheless, tend to reflect the conflicting objectives which government desired to achieve from time to time. Import control measures by design are artificial barriers to the free trade doctrine of international trade.

A number of existing studies have empirically explained the aggregate import demand behaviour in Nigeria. Among them are Olayide (1968), Ajayi (1975), Fajana (1975), Mouka (1982), Obadan (1986) and Egwaikhide (2000). These studies adopted the traditional formulation of import demand equation, the volume of imported demanded to real income and relative price variables. The assumption of this approach is that the import content of

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each macro component of final expenditure (real GDP or GNP) is the same, so also are the import coefficients of all components of aggregate expenditure assumed to be equal. The implications as enunciated by Orubu, (1989) for Nigeria, Giovannetti (1989) for Italy, and Mohammed and Tang (2000) for Malaysia; Abbot and Seddighi (1996) for U.K., are that such assumptions could intuitively lead to aggregation bias. While such an assumption could be taken for granted especially given the unavailability of adequate and consistent data in the case of Nigeria, the previous studies which used Nigerian data applied the standard ordinary least squares (OLS) regression models and in some cases, partial adjustment approaches to estimate the import demand function (for instance, Olayide, 1968; Ajayi, 1975; Fajana, 1975; Mouka, 1982; Obadan, 1986; Orubu, 1989 among others). These studies did not examine the time series properties of the data set and as such, they stood the risk of doing a "nonsense" regression.

This study on Nigeria seeks to extend the analysis of demand for imports in Nigeria by employing the cointegration technique as developed by Johansen and Juselius (1992, 1994) as well as the error-correction mechanism to determine whether there exists a long-run relationship between Nigeria's aggregate imports and its determinants using annual data covering 1970-2006. Cointegration technique as the literature has it, increases the reliability of statistical modelling by taking explicit account of non-stationary data (Hickling, 2006 and Johansen, 1988). The paper also seeks to determine the effects of the various trade reforms particularly the liberalization policy since the mid 1980s on the import demand behaviour of Nigeria. It is important for the policy makers to know whether short-run disequilibrium in the import sector are eliminated in the long-run through reforms in the sector. Unless policy makers understand the determinants of import demand in Nigeria and their response to economic reforms in the long-run, they would be unable to make consistent policy prescription on imports that would ensure necessary investment and output expansion.

The rest of the paper is organized into 4 sections. Section 2 presents a brief review of trade policy and import growth in Nigeria. Following the lead by Dutta and Ahmed (2001), section 3 presents the theoretical model. In section 4 the results of the empirical analysis are discussed, while section 5 concludes the paper and summarizes the policy implications of the findings.

2. EXTERNAL TRADE POLICIES AND IMPORT GROWTH IN NIGERIA

The trend in trade policies in Nigeria has been unstable over time reflecting the desires of government to achieve different targets at different times. The main objectives which government sought to achieve through changes in trade policies and import controls may be summed up as: control of inflation, rapid expansion of the domestic economy, revenue generation, protection of domestic import substitution industries, external balance and export promotion. Prior to the 1986 economic reforms, import controls were geared toward revenue generation during the first half of 1960s. Thereafter import controls were used to check inflationary pressures, which arose from supply bottlenecks occasioned by the 1966-1970 civil war. Tariff rates were reduced on imported items such as construction equipments, raw materials electronics and raw materials. Until 1986, the import policies consisted of quantitative import controls, administered through a comprehensive import licensing which were reviewed from time to time. In addition, quantitative restrictions on imports by way of quotas and the outright ban on selected items in line with overall development policies.

The introduction of a World Bank and International Monetary Fund (IMF) inspired Structural Adjustment Programme in 1986 marked a major shift in trade policies in Nigeria. The main thrust of trade reforms was directed at altering the production structures and

consumption patterns so as to minimise dependence on imports and stimulate exports (Inang, 1995). In 1991 trade policies were reviewed in Nigeria with a view to open up the economy through the elimination of arbitrary restrictions and the extensive liberalisation of external trade. However, the shift in policy thrust can be said to have taken-off in 1986.

Aggregate imports have grown steadily in Nigeria since independence in 1960, except in the 1982-1986 periods when the value of imports declined from ten billion naira to 5 billion naira (CBN, 1998). After the discovery of crude oil in the 1950s, import recorded an average growth rate of 2.5% in the 1960s, a higher rate of 33 percent growth per annum was recorded for the 1960s and 1970s (Egwaikhide, 2000). Up to 1965, consumer goods imports dominated the import data, accounting for 41% of total imports. Capital goods imports which was second to consumer goods fluctuated between 24% and 40% during the 1960s. The pattern however changed as from 1980 when capital goods imports were followed by raw materials and consumer goods in that order (Egwaikhide, 2000).

The phenomenal growth in imports reflects the dynamics of the changing structure of the Nigerian economy. First, the import substitution industry strategy of the 1960s created a production structure that is dependent on imported raw materials and spare parts. This helps to account for reversal in the trend of raw materials and consumer goods imports. Second, the quadrupling of crude oil price in 1973-1980 period and again since 2005 and particularly, 2008 increased foreign exchange earning which facilitated a significant rise in imports particularly capital goods and raw materials. Import levels in Nigeria may have thus responded not only to income and price variables but also to the frequent change in trade policies and import controls. Figures 1 and 2 depict the trend movements of oil prices, imports and gross domestic product of Nigeria over time. An observed deduction that can be made from Figures 1 and 2 particularly after 2002 is the pronounced increase in GDP. This sharp rise can de deduced to the observed oil price changes that occurred over that same period. Equally fundamental is the volume of imports which also correspondingly rose in reaction to increased oil price levels. As depicted in Figure 1, Table 1 also shows the nominal trend movement of domestic crude oil prices in $/bbl (1946-2006).

The rise in volume of imports particularly finished and processed goods other than capital goods and spare parts in Nigeria has also been traced to the un-competitiveness of the Nigerian economy in the face of international trade due to poor infrastructural facility. For instance, the 2002 Regional Program for Enterprise Development (RPED) survey(published by the World Bank in collaboration with African Development Bank: *The African Competitiveness Report, 2007*) of Nigerian manufacturing firms concluded that firms consider power failure to their worst constraints. Nine in ten firms surveyed indicated frequent power failure as the most pressing issue in their operations; while South Africa and Algeria did not indicate it as a worrisome issue. Cost of privately provided electricity in Nigeria is about 242 percent of that provided by the Nation's Electricity Company (Power Holding Company of Nigeria, PHCN). Damage to equipment and machinery accounts for 3.3 percent of total value of the equipment as the country equally loses about N66bn yearly through power failure (http://nm.onlinenigeria.com/template/?a=293&z=2). As a result of the power shortage, some firms have modified their production process by using less electricity-intensive inputs, which may be more costly; while some others resulted to reduction in output. Output gaps resulting from underutilisation of installed capacity as increased demand outstrips growth in supply have thus been accommodated through large imports. Consequently, it may be concluded temporarily that the increased import

Figure 1

Oil Prices ($) 1946-2006

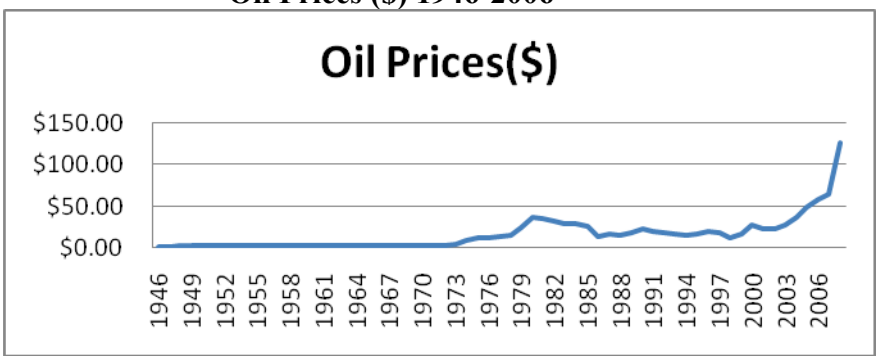

Figure 2

Gross Domestic Product and Import Volume (1970-2005)

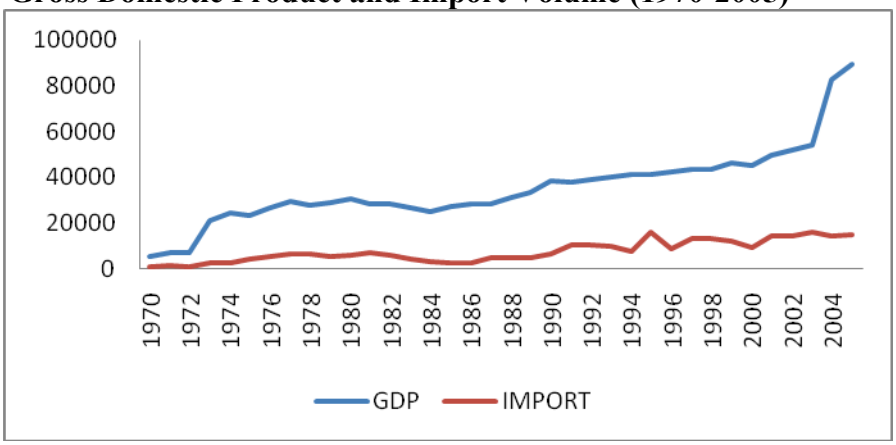

Table 1

Annual Average Domestic Crude Oil Price (1946 – 2006) U.S. Average (in $/bbl.)

Year	Nominal	Year	Nominal	Year	Nominal
1946	$1.63	1966	$3.10	1987	$17.75
1947	$2.16	1967	$3.12	1988	$14.87
1948	$2.77	1968	$3.18	1989	$18.33
1949	$2.77	1969	$3.32	1990	$23.19
1950	$2.77	1970	$3.39	1991	$20.20
1951	$2.77	1971	$3.60	1992	$19.25
1952	$2.77	1973	$4.75	1993	$16.75
1953	$2.92	1974	$9.35	1994	$15.66
1954	$2.99	1975	$12.21	1995	$16.75
1955	$2.93	1976	$13.10	1996	$20.46
1956	$2.94	1977	$14.40	1997	$18.64
1957	$3.14	1978	$14.95	1998	$11.91
1958	$3.00	1979	$25.10	1999	$16.56
1959	$3.00	1980	$37.42	2000	$27.39
1960	$2.91	1981	$35.75	2001	$23.00
1961	$2.85	1982	$31.83	2002	$22.81
1962	$2.85	1983	$29.08	2003	$27.69
1963	$2.91	1984	$28.75	2004	$37.66
1964	$3.00	1985	$26.92	2005	$50.04
1965	$3.01	1986	$14.44	2006	$58.30

Source: http://www.inflationdata.com/inflation/inflation_Rate/Historical_Oil_Prices_Table.asp

demand in Nigeria is due to improved oil prices, rise in demand, weak domestic supply as a result of poor infrastructure, etc.

3. MODELLING THE AGGREGATE IMPORT DEMAND FUNCTION FOR NIGERIA.

Goldstein and Khan (1985) have provided a theoretical framework in the literature on modelling aggregate import demand function using an imperfect substitution model. The model which has some relationship with Dixit (1984) framework for trade under an imperfect market structure, assumes that neither imports nor exports are perfect substitutes for domestic goods Dutta and Ahmed (2001). Given that Nigeria's annual total demand for import in relation to world demand is insignificant, it may not be out of necessity to further assume that the world's imports supply to Nigeria is perfectly elastic. By this token of infinite import supply elasticity, the model of analysis reduces the import demand function to a single equation model (Dutta and Ahmed, 2001).

It is well-documented in the economic literature that the import demand behaviour can be fully explained by income and relative price of import variables (Houthakker and Magee, 1969; Leamer and Stern, 1970, Goldstein and Khan, 1985, Senhadji, 1998 among others). Reinhart (1995-297) emphatically noted that a scale variable (income) and relative prices are both necessary and sufficient to define the long run behaviour of imports. This strongly argues against the inclusion of other variable to the import demand function. Dutta and Ahmed (2001) using the framework of studies by Khan and Ross (1977) and Salas (1982) suggest that a log-linear specification of the import demand function is preferable to a linear formulation. Consequent upon the above, the aggregate import demand function as will be estimated for by this paper uses the traditional import function as specified in equation (1).

$$M_t = F\,(Y, P_m/P_d)\; f_1 > 0, f_2 < 0 \qquad (1)$$

In equation (1), the variables are defined as; the desired quantity of imports demanded (M_t), the scale variable or real income (Y, expressed as real GDP), the price of imports (P_m is an import unit value index), and domestic prices (P_d is the GDP deflator or the consumer price index). Where f_1 and f_2 are the expected partial derivatives of real income and relative prices. We expect $f_1>0$, that is, an increase in real income will stimulate imports; while an increase in the import price relative to the domestic price level will inhibit import volume, thus $f_2<0$. To fit Equation (1) econometrically, the log-linear specification is preferable as earlier noted. Accordingly, the aggregate demand import demand function is log-linearly expressed in the form of:

$$lnM_t = \alpha_0 + \alpha_1 lnY_t + \alpha_2 ln(P_{mt}/P_{dt}) + \mu_1 \qquad (2)$$

In Equation (2), ln is the natural logarithm, other variables as previously defined, and μ is an error term that is assumed to be randomly and normally distributed with constant variance; $\mu \sim N(0, \sigma_\mu^2)$. The coefficients, particularly α_1 and α_2 are the estimated income and price elasticities of demand for imports respectively. It is *a priori* expected that $\alpha_1 > 0$ and $\alpha_2 < 0$. It was observed in section 2 that in 1986, there was the adoption of a Structural Adjustment Programme (SAP) which marked a major shift in the trade policies of Nigeria. To determine the impact of this policy shift on the import demand function, a dummy is incorporated into Equation (2) as;

$$lnM_t = \beta_0 + \alpha\beta_1 lnY_t + \alpha\beta_2 ln\left(\frac{P_{mt}}{P_{dt}}\right) + \beta_3 DUM + \mu_1 \qquad (3)$$

where, *DUM* is a dummy variable which takes the value of 0 for 1970-1986 and 1 thereafter. The expected sign of the coefficient of the dummy variable does not have any theoretical support. However, if the coefficient is significant statistically, then the trade reform exercise of liberalization since 1986 has a significant effect on the demand for imports depending on the sign. The random term $\mu_1$obeys the classical assumptions of IID(0,σ^2), while other variables in the equation are as previously defined.

This study uses time series data of the variables in the specified models. The time series properties of the variables will be empirically tested in order to avoid the problem of misspecification and misleading statistical inference. In view of this, should unit roots of variables exist when tested for, the first difference of the variable will be equally examined in order to obtain stationarity of the series. Thus Equations (2 and 3) may be respectively recast as Equations (4) and (5) should the presumption of no-stationarity of the series or variables holds.

$$\Delta lnM_t = \alpha_o + \alpha_1 \Delta lnYt + \alpha_2 \Delta ln(P_m/P_d)_t + \mu_i \quad (4)$$

$$\Delta lnM_t = \beta_0 + \beta_1 \Delta lnY_t + \beta_2 \Delta ln(P_m/P_d)_t + \beta_3 DUM_t + \mu_i \quad (5)$$

where, $\mu_i \sim N(0, \sigma_\mu^2)\ for\ i = 1,2.$

Δ is the first difference operator. All other variables as previously defined. An important implication of Equations (4) and (5) if estimated is that the differencing ignores inference on the long-run relationship particularly for decision making. To overcome the problem of variable loss "long-run information, an error-correction term lagged by one period (EC_{t-1}) is imposed on Equations (4) and (5). The EC_{t-1} is presumed to integrate the short-run dynamics in the long-run import demand function via cointegration. In the Johansen cointegration approach, a vector error correction mechanism (VECM) of the framework to be analysed (Equation 2) can be set up as:

$$\Delta z_t = \prod z_{t-1} + A_1 \Delta z_{t-1} + \cdots + e_t \quad (6)$$

where z_t= (m_t, $p_{md,t}$) is the error correction system of Equation (2), the major equation of interest. Equation (6) can be stated simply as Equation (7); while Equation (8) is its augmented form with the inclusion of a dummy (liberalization) variable.

Equations (7) and (8) are thus the general error correction model (ECM) derived from Equations (4) and (5) respectively as:

$$\Delta lnM_t = \varphi_o + \sum_{i=1}^{n} \varphi_{1i} \Delta lnM_{t-1} + \sum_{i=1}^{n} \varphi_{2i} \Delta lnY_{t-1} + \sum_{i=1}^{n} \varphi_{3i} \Delta ln(P_m/P_d)_{t-1} + \varphi_{4i} EC_{t-1} + \varepsilon_1 \quad (7)$$

$$\Delta lnM_t = \varphi_o + \sum_{i=1}^{n} \varphi_{1i} \Delta lnM_{t-1} + \sum_{i=1}^{n} \varphi_{2i} \Delta lnY_{t-1} + \sum_{i=1}^{n} \varphi_{3i} \Delta ln(P_m/P_d)_{t-1} + \varphi_{4i} EC_{t-1} + \rho DUM + \varepsilon_2 \quad (8)$$

where EC_{t-1} is the one period lagged error-correction, ε_1 and ε_2 are white noise and normally distributed residuals. While other variables as previously defined. Based on economic theory, the signs of the coefficients are expected to be statistically significant as follows: φ_1 and $\varphi_2 > 0$; while φ_3 and $\varphi_4 < 0$.

This analysis shall thus sequentially follow the steps highlighted below:

(a) test for unit roots of individual time series (variables) except the dummy by employing the Augmented Dickey-Fuller (ADF) and the Phillip-Perron (PP) tests;

(b) if the variables are integrated of the same order, apply the Johansen-Juselius (1990) maximum likelihood test of cointegration which allows us to test for the cointegration rank and estimate the cointegration vectors or long-run relationships;

(c) since the estimated model is a single-equation error-correction mechanism (ECM), a vector error-correction mechanisms (VECM) instead shall be estimated. The reason is because there can be more than one cointegration *vector*. If so, imposing one cointegrating vector will be inefficient and could lead to loss of information. Even if only one cointegrating vector exists, the VECM also allows for the estimation of short-term and long-term inter-sector adjustments.

(d) undertake battery of tests for normality, serial correlation and stability.

Description of Data

The sample period for the study empirical analyses in Section 4 is from 1970-2005. The data collected from the period is annual.. The data on import volume and income (gross domestic product, GDP) were obtained from the publications of the Central Bank of Nigeria: *Statistical Bulletin* 2007 and other previous issues. The quantity of import demanded is nominal imports of goods and services deflated by import price index. As noted by Dutta and Ahmed (2004), the theory on import demand suggests that the quantity rather than value is a better appropriate dependent variable in the estimation of import demand. The scale variable (real income) is proxied by real GDP is nominal GDP deflated by the GDP deflator. The relative price variable is the ratio of import price to domestic price (GDP deflator). The import price is the import unit value index obtained from price indexes and based in 2000 prices.

4. EMPIRICAL RESULTS

4.1 UNIT ROOTS

It is necessary in the chosen approach of analysis in this form of study to first determine the order of integration of each variable before applying the cointegration technique. The variables to be used for the analysis must be non-stationary and integrated of the same order. First, the stationarity of the data is tested for by applying unit root test (see Table 2). The Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests to determine the order of integration. The lag lengths of the tests were selected using the Akaike information criterion (AIC) and the Schwarz Information Criterion (SIC). The use of these criteria is to ensure that the residuals were white noise. An optimal lag length of 1 is chosen as the two criteria reported.

The resulting t-statistics from the unit root test as summarized in Table 2 were compared with the Mackinon (1996) critical values. The object is to determine whether to accept or reject H_o:$\zeta = 0$ (if $\zeta = 0$, and $\zeta = \rho - 1$, $Y_t = pY_{t-1} + \Sigma_t$; Y_t has a unit root). If $H_o : \zeta = 0$ is rejected, the first difference stationary is confirmed implying that the variable is integrated of order one; I (1). All the variables used in this study are first difference stationary, that is, they are integrated of order one. The second step is to test for cointegration of the variables since the unit roots have been confirmed.

4.2 COINTEGRATION TESTS

The cointegration results reported in Table 3 indicate the existence of a stable long-run relationship among the variables used in the study. Both the trace test and maximum Eigenvalue statistics reject the null hypothesis of no cointegration implying that there exist a unique cointegration vector among $\Delta \ln M_t$ $\Delta \ln Y_t$ and $\Delta \ln(P_m/P_d)_{t-1}$. Thus, we can conclude that there is a stable import demand function for Nigeria.

Table 2

Stationarity Tests of the Variables

Variables	Lag	ADF Level		ADF First Difference		PP Level		PP First Difference	
		$\zeta\mu$	$\zeta\varphi$	$\zeta\mu$	$\zeta\varphi$	$\zeta\mu$	$\zeta\varphi$	$\zeta\mu$	$\zeta\varphi$
$\ln M_t$	1	-2.392	-2.923	-7.414*	-7.481*	-2.413	-2.923	-7.367*	-7.433*
$\ln Y_t$	1	-2.789	-3.03	-5.241*	-5.258*	-2.815	-3.03	-5.223*	-5.248*
$\ln(P_m/P_d)_t$	1	1.259	-3.07	-4.013**	-4.510*	0.733	-3.054	-4.014**	-5.104*

Source: Author's calculations. *. 01; ** .05

$\zeta\mu$ = Intercept; $\zeta\varphi$ = intercept and trend; $\ln M_t$ = import value; $\ln Y_t$ = real income, $\ln(P_m/P_d)_t$ = relative price.

Table 3

Johansen-Juselius Maximum Likelihood Cointegration Test $\Delta \ln M_t$ $\Delta \ln Y_t$ and $\Delta \ln(P_m/P_d)_t$

Trace				Maximum Eigenvalue Test			
Null	Alternative	Statistic	95% Critical Value	Null	Alternative	Statistic	95% critical value
r = 0	r ≥ 1	51.725	42.915	r = 0	r =1	26.402	25.823
r ≤ 1	r = 2	25.323	25.872	r ≤ 1	r = 2	17.489	19.387

Note: *(a) r stands for the number of cointegrating vectors. The lag structure of VAR is determined by the highest value of the Akaike Information Criterion and the Schwartz Bayesian Criterion.*

(b) Trace and Max-eigenvalue tests indicate 1 cointegrating equation at 0.05 level.

Source: Author's calculations

4.4 CHARACTERISTICS OF THE VECTOR AUTOREGRESSIVE (VAR) MODEL

The literature on time series analysis recognizes that testing for cointegration analysis as developed by Johansen (1988) and Johansen and Juselius (1990) requires testing for the existence of a long-run relationship that demands a P^{th}- order structural and dynamic VAR model of the variables of interest. Consequent upon this, we continued by first setting an appropriate lag-length using some criteria; Final Prediction Error (FPE); Akaike Information Criterion (AIC) and the sequential modified LR test statistic. On the basis of

these information criteria, a best lag length of one year is selected. The VAR lag order selection criteria are reported in Table 4.

Table 4

VAR Lag Order Selection Criteria

Lag	LR	FPE	AIC
0	NA	0.00185	2.2228
1	168.678*	9.56e-05*	-3.04818*
2	6.5254	1.30e-05	-2.753705
3	11.5345	1.42e-05	-1.42e-05

Source: Authors' calculations

*Indicates lag order selected by the criterion

LR = Sequential modified LR test statistic; FPE = Final Prediction Error

AIC = Akaike Information Criterion

The VAR is estimated with 1 lag and we tested the residuals for normality and autocorrection. The normality test is analyzed using the Jarque-Bera. The results of the residual serial correlation LM and Jarque-Bera tests are reported in Table 5 (a & b).

Table 5a

Residuals Multivariete Normal Test

Components	Jarque-Bera	df	Prob.
1	1.6754	2	0.4327
2	1.9378	2	0.3795
3	1.5680	2	0.4983
Joint	5.1812	6	0.3105

Source: Authors' calculations

Table 5b

Residual Serial Correlation LM Tests

Lags	LM-Stat	Prob.
1	4.316259	0.8894
2	10.11363	0.3414
3	8.017591	0.5324
4	5.359868	0.8019

Source: Authors' calculations

The VAR residual normality test show that the VAR is normal while the LM test revealed absence of autocorrelation. Consequently we proceed to estimate the vector error correction model in order to determine the dynamic behaviour of import demand.

4.3 COINTEGRATING VECTOR

The normalized long-run relation cointegrating vector of the import demand function is given by

$$\ln M = -3.752 + 0.962^{*} \ln Y - 0.329^{*} \ln(P_m/P_d) \quad (9)$$
$$(0.132) \qquad (0.057)$$

$$\ln M = -4.781 + 1.043^{*} \ln Y - 0.260^{*} \ln(P_m/P_d) \quad (10)$$
$$(0.142) \qquad (0.956)$$

In Equation (9), the relative price variable is found to be inelastic in Nigeria as the estimated elasticity is less than unitary (with the correct sign, i.e. negative) and statistically significant given that the standard error values are those in parentheses. The scale variable (real income) is positively signed and statistically significant. The real income coefficient is approximately unit elastic. Equation (10) reports the long run cointegration vector of Equation (3), although it does not report a coefficient for the dummy(liberalization) variable (DUM). The reason is that the DUM variable entered the VEC model as an exogenous variable.[2]

Since it has been initially reported in sub-section 4.2 that the variables of interest are cointegrated, we shall proceed to estimate the error correction vector after a brief discussion on the characteristics of the vector autoregression (VAR).

4.5 ESTIMATION OF THE VECTOR ERROR CORRECTION MODEL

The analyzed vector error correction models are transformed into an interpretable form as presented in Equations (11) and (12). For space limitation, we report only the ΔInM_t results of the VECs.

Results of Equations (7) and (8) as reported Table 6, in line with our *a priori* expectations are similar in form and in numerical parameter values to several previous studies (Goldstein and Khan, 1985; Dutta and Ahmed, Chang, Ho and Huang, 2005; and Aziz and Horsewood, 2008). The value of the income elasticity of demand for imports is greater than unity (1.043 and 1.048) for the two estimated equations respectively. This implies that the demand for import increases more than proportionately to increase in real income. The aggregate import functions were found to be price-elastic, the coefficients being -0.08 and -0.233 for equations 8 and 9 in that order. The estimated coefficients from the t-values in parentheses are statistically significant at 0.05 level. The income elasticities are in consonance with Goldstein-Khan range of [1.0 and 2.0]. As for the coefficient estimate of the dummy variable in Equation 8, it is low (0.236) but statistically significant. The implication is that the trade reform or liberalization exercise since 1986 has a significant effect on import demand behaviour of Nigerians.

Table 6

Error Correction Results (Dependent Variable = ΔInM_t)

Explanatory Variables	***Equation (7)***	***Equation (8)***
Intercept	0.078	-0.026
ΔlnM_{t-1}	-0.082 (*-0.52*)	-0.222 (*-1.695*)
ΔlnY_{t-1}	1.043 (*2.537*)	1.048 (*3.313*)
$\Delta ln(P_m/P_d)_{t-1}$	-0.08 (*-1.748*)	-0.233 (*-2.295*)
EC_{t-1}	-0.682 (*-4.455*)	-0.686 (*-5.756*)
DUM		0.236 (*4.895*)

Diagnostic Test Results

Test	*Equation (7)*	*Equation (8)*
R^{-2}	0.409	0.551
F-test	6.708((2.69))	9.109((2.53))
AR(1) test	6.306[0.709]	6.621[0.677]
AR(2) test	5.467[0.792]	12.126[0.157]
Hetero test (F)	0.605[0.765]	0.508[0.855]
Normality test (χ^2)	41.633[0.729]	55.548[0.416]

Source: author's calculations

Note: R^{-2} = 0.41 and 0.55 imply that the models are of fairly good fit. F-test results indicate the overall significance of the models. The AR test of the two models is the Long range Multiplier test for detecting autocorrelation where the null hypothesis is 'no autocorrelation'. This test examines up to second order serial correlation and cannot reject the null hypothesis of 'no autocorrelation'. The 'normality test' assumes that the residuals contain all the properties of classical linear reform model and the test cannot reject the null hypothesis at 5% level of significance. 'Hetero test' assumes 'no heteroscedasticity' in the regression and the test statistic cannot reject the hypothesis. Figures in parentheses ( ) are t-values, brackets [ ] are p-values and those in double parentheses (( )) areF critical values.

The error correction term $(EC)_{t-1}$ for Equations (7) and (8) are statistically significant at 1 percent level and with the appropriate (negative) sign. This confirms the validity of a long-run equilibrium relationship among the variables analyzed. The estimated coefficients

(-0.682 and -0.686) respectively suggest that the system corrects previous period's disequilibrium by over 68 per cent annually. The diagnostic tests are similar to those reported for the residuals of the VAR in subsection 4.4. They (diagnostic statistics) show no evidence of misspecification of the functional form, no serial correlation nor presence of heteroscadasticity. The residuals are approximately normally distributed.

5. SUMMARY AND CONCLUSION

This paper has examined among others issues, the effect of trade policy shift (import liberalization)[2] on Nigeria's import demand at an aggregated level. With a relatively simple model specifying vector valued autoregressive process, the hypothesis of the existence of cointegration is formulated. Applying Nigerian data, import demand is found to be cointegrated with real income (GDP) and relative import prices. The three variables were found to be integrated of order one. That is they are *I(1)*. In the estimated error-correction model (ECM), real GDP, real import prices and a dummy variable introduced to measure the effect of the structural policy shift (SAP 1986) all emerged as important determinants of import demand function for Nigeria. The estimated error correction term (-0.682 and -0.686) indicate a rapid speed of adjusted to equilibrium, while their statistical significance is an indication and a feature necessary for model stability.

From policy perspective, the results presented in this paper are important. The main domestic activity variable (real income) is unit elastic while the relative import price is inelastic. Thus, the demand for imports is less sensitive to import price changes. One policy implication of this is that exchange rate policy is likely to be ineffective in influencing import

demand in Nigeria. As such, devaluation or depreciation will not have significant favourable effects on Nigeria's trade balance. The low coefficient of the dummy variable though statistically significant reveals that the structural shift in policy and liberalization of trade policy has little but significant effect on aggregate imports. The above result suggests encouraging the development of more local industries with low import content via appropriate and enabling environment.

Endnote

1. In the unit root time series processes, a variable is said to be integrated of order d, denoted I(d), if it needs to be differenced d, times to achieve stationarity. The order of differencing depends on the number of unit roots. In the same wise, regressing two I(d,) variables, where d >0, equally leads to the problem of a spurious regression. However, if two (or more) series are linked to form an equilibrium relationship into the long-run, even if the series are non-stationary, they could nevertheless move closely together and their linear combination will be stable or stationary. If this thus happen, then the series are said to be cointegrated.

2. The EViews (ver.6) software used for the analyses does not report long run cointegration coefficient for exogenous variables,

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FUNKCIJA AGREGATNE POTRAŽNJE ZA UVOZOM ZA NIGERIJU

SAŽETAK

Kako Nigerija ima malo otvoreno gospodarstvo, potreban joj je uvoz kapitala i poluproizvoda kako bi rasla i razvijala se. Ovaj rad koristi ekonometrijsku tehniku vremenskih serija, točnije mehanizme korekcije greške, kako bi se utvrdili čimbenici odgovorni za potražnju za uvozom. Rezultati pokazuju da su uvoz, prihod i odnosne cijene međusobno kointegrirane. Ekonometrijske procjene funkcije potražnje za uvozom za Nigeriju sugeriraju da je potražnja za uvozom uglavnom određena realnim prihodom (BDP) i manje osjetljiva na relativne cijene. Osim toga, izgleda da promjena u strukturalnoj politici prema liberalizaciji od 1986. ima mali ali značajan utjecaj na potražnju za uvozom. Sugerira se razvoj lokalne industrije s malim udjelom uvoza s obzirom da je vjerojatno kako će tečajna politika i devaluacija biti neuspješne u utjecanju na potražnju za uvozom u Nigeriji.

Ključne riječi: potražnja za uvozom, relativne cijene, realni prihod, kointegracija, Nigerija, izmjena strukturalne politike