THE EXTENDED BALANCE OF PAYMENT CONSTRAINED GROWTH MODEL AND NIGERIA’S LONG-RUN GROWTH PERFORMANCE

Onakoya, Adegbemi Babatunde
Department of Economics, Banking and Finance
Babcock Business School, Babcock University Ilishan-Remo, Nigeria
adegbemionakoya@yahoo.com

Abstract

Utilizing both the McCombie (1989) and McGregor and Swale (1985) test. The study investigated the applicability of the extended BPC growth model using Nigeria as a case study of a developing economy. The empirical analyses using the ARDL cointegration framework reveal that both the demand for import and export supply is income inelastic, whilst the supply of export is a direct and elastic function of world income. A percentage increase in world income will lead to 6.63 percent in exports. The results show that growth in exports, the growth in real exchange rate and terms of trade are crucial to the economic growth process in Nigeria in the short run. However, little evidence of long-run relationship between the variables exist.

JEL Codes: F32, F40, F43
Keywords: Balance of payment constraint growth model (MPC), Capital flows, Cointegration analysis, ARDL model

1. Introduction

The theories of economic growth is important in the literature is well rested. Economic factors alone do not determine economic development. Several factors influence growth including non-economic ones (geography, history, sociology, anthropology, culture etc. in the long run (McCloskey, 2010). That literature is replete with thought on economic growth is no exaggeration. The classical, neoclassical and the endogenous schools of thought are either silent or have assigned equal weights to all the economy sectors in explaining the macroeconomic productivity.

The structuralist hypothesis posits that structural change is critical to the growth of the economy. The process of economic development is characterized by fundamental transformation of the structure of production and employment. The structural modification is driven by changes in domestic and international demand (Pasinetti, 1993; Setterfield (2010), and Thirlwall, 2013).
Openness and the composition of foreign trade have however been identified by Amable (2000) as the vehicles for promoting growth. Such countries tend to adopt the Ricardian postulate of specializing in the production of commodities for which they have a comparative advantage coupled with the importation of goods which are relatively expensive to produce. However, specialization alone is not enough for generating higher growth rates as exemplified by the experiences of developing countries which have depended on exports of primary products. In formulating models of export-led growth, Kaldor (1966) and Thirlwall (1979) relied on the Verdoorn's (1949) law which posited that low prices for traded goods coupled with high competition in the export sector may lead to the reallocation of resources to a productive export sector from the less efficient non-trade sector. The resultant changes in the pattern and of level demand affect the sectoral employment. The consequential effect of this is the increase in specialization and labour skills which in turn leads to further structural changes within industries, manufacturing for export and output growth. The increase in the net export, in the notion of Kaldor (1966), is required to be faster when the level of development advances to higher stages in order to finance the soaring need of imported capital goods. The position canvassed by Thirlwall (1979) which is reemphasised by Thirlwall in 2011 is that the rates of growth of several countries do not surpass the ratio of the rate of exports growth to income elasticity of imports demand. The 1979 model asserted that unless the resulting deficits can be financed, no country surpass the balance of payments equilibrium rate consistent with current account rate. In general no country can do this. The implication of is that growth may be restrained by the equilibrium in the balance of payments.

The summary of Thirlwall’s (1979 and 2011) main proposition is that, the long-term growth of the economy is explained by the constraints on balance of payment especially its impact on the manufacturing sector demands. The reallocation of resources from the less efficient non-trade sector to the more productive export sector especially in the industrial sector portends enhanced productivity as the economy is structurally geared for expanded exports and to output growth. In order to achieve a sustainable economic growth without the attendant balance of payments constraints, Thirlwall's Law posits that the demand import income elasticity must be less than the supply import income elasticity. A developing economy like Nigeria needs to in addition to having a large and diversified export basket, should ensure that its export basket in the long run, is made up of highly diversified income elasticity of demand.
The BOP-constrained growth model (Thirlwall’s Law) by Thirlwall (1979, 2011) proposes postulates that the growth in export as a proportion of the income elasticity of demand for imports determines the BOP equilibrium in the long-run. The model is based on the assumption that relative Purchasing Power Parity (PPP) holds in the long-run, so that relative prices (measured in a common currency) do not change and BOP equilibrium is achieved via adjustments in the level of economic activity. This supposition of the BOP-constrained growth has been largely subjected to empirical scrutiny. Existing evidences are far from being uniform.

While previous studies on Nigeria are based on the traditional BPC growth, this research seeks to investigate the applicability of the extended model. As recommended by Thirlwall (2011), our model incorporates three additional variables: capital flows on the capital account balance, interest payments on debt and terms of trade movements in predicting log-run growth performance. For a better understanding of the growth experience of developing countries, the capital flow elements are required for the impact of the financing major development initiatives. Also, the interest payment on debt cannot be ignored in the wake of heavy debt burden of most developing countries during the study period. The unfavourable (slanted) terms of trade also begs for attention in view of the impact of past colonialism and continuing neo-colonialism as explained by the dependency theory (Ferraro, 2008).

The scope of this research covering 1980 to 2010 various economic cycles since the political independence of Nigeria. The period provides opportunity for a comprehensive evaluation of the impact of the external sector on the economy. The rest of this paper is structured as follows: in section two, the theoretical framework of the study and review of relevant literature is presented. The methodology incorporating the model specification, and data description are discussed in the third section. In section four, the data analysis and discussion of the results are presented. Section five concludes and offers some recommendations. In the next section, the review of relevant literature and the theoretical underpinning are presented.

2. Literature Review and Theoretical Underpinning

2.1 Literature Review

The literature on the impact and contributions of the net export to national output has met with varying results. Specifically, the channels through which the external sector balance of payments has facilitated or constrained the pace of economic growth have also been empirically reported. In the
opinion of the neoclassical school of economic thought, macroeconomic productivity are equally critical in explaining the contributions of the other components and sectors of the economy. In applying a different Kaldor (1975) approach to the dynamics of structural economic formulations. The demand regime formulated by Araujo and Trigg (2013) by deployed the Keynesian multiplier in a disaggregated version and Kaldor-Verdoor productivity regime for an open economy. The outcome is the Pasinetti's (1981) model.

The endogenization of technological progress in the Pasinetti’s framework was deployed by Araujo and Teixeira (2011). The same approach by D’Agata (2010) in adopting evolutionary theory to endogenize consumption dynamics and technological progress with bounded rational firms and consumers in the Pasinetti’s framework yielded similar results that dynamic capability is a fundamental driving force of technological changes and therefore economic growth. This is consistent with the research by Naiya and Manap (2013) which applied the ARDL bound testing technique to test the relationship among growth, inequality and poverty in Nigeria. The study reveals that the structural transformation of the economy led to the shifting of production structure from the primary to the industrial high productivity. Abu-Ismail (2003) in his study, covers actual and equilibrium growth between 1960 and 1999 and suggest that the theory of export-led growth is not generally applicable one. He submits that based on stylized facts, the manner of a country's economic performance is not affected by the export trade in both commodity and service. The level of openness and with diversity of specialization patterns, he contends is not consistently reflective of economic performance outside the cluster of outlier Gulf countries which are oil-dependent and Asian, export-intensive economies.

An experiment on the Turkish economy by Aricioglu et al. (2013) shows that neither weak form nor strong form of the Thirlwall’s law is valid. Also, Mirza & Mazhar (2012) on Pakistan utilizing both the Johansen’s test for cointegration as well as the bound test (ARDL) approaches and reports inconclusive results. In attempt to determine the long-run rate of growth in Brazil, Britto (2008) estimate the balance-of-payments constrained model using VAR technique and finds that the Thirlwall’s Law is linked with long run equilibrium rate of growth. However, the preeminent work by McCombie and Thirlwall (1994) deployed the original Thirlwall’s model for Brazil over the period 1955-1988. The study used a time series data and the cointegration procedure and the vector error correction mechanism techniques for determining the long run and short run adjustments between the variables. The Brazilian
economic growth was found to be balance of payments constrained in the long run. Similar work Jayme (2003) which extended by another ten years (1955 – 1998) also provided evidence in support of the Thirlwall’s law. Atesoglu (1993) employed a two stage least squares method to test the validity of Thirlwall’s law on the USA economy. Using two separate groups of time series data for the period 1955-1970, the study provides evidence in support of the law in the long run. Similar study of the Canadian economy in 1994 by the same author reveal growth in exports as a significant and important source of Canadian economic growth, but evidence for capital inflows is found to be otherwise.


A generalized version of the Thirlwall’s law by Soukiazis et al (2012) which incorporates private sector and public sector influences on internal demand shocks shows that generalized version is better predictor of actual growth of output in Portugal than the original model. Using the autoregressive distributed lag (ARDL) and vector error correction model (VECM) to estimate the income elasticity of imports demand, the findings by Yongbok (2006) and Ozturk and Acaravci (2009) showed that China’s and South African’s economic growth dynamics respectively reflect prediction of Thirlwall’s law. A study of 43 economies between 1960 and 1967 by Oyejide (1975) found reported a positive association between export and GDP growth rate. The verdict reached by Adewuyi and Adeoye (2008) in a study quantifying the impact of constrained balance of payments on the Nigeria’s potential growth rates was that the Nigerian output gap remains unbridged and the economy has fallen short of its
potential growth rates. Similar work by Anoka (2013) covering 1970-2010, applied the Johansen cointegration and vector error correction techniques. The findings show that exchange rate, gross domestic product, and world gross domestic product have significant and positive effects on Nigeria’s sectoral compositions of export and import.

That there is an increasing number of empirical studies on Thirlwall’s law, is indeed a commonplace knowledge, but the uniqueness of this study however, lies in its being the first to investigate the applicability of the extended Thirlwall’s law for predicting growth performance in Nigeria. This is crucial because of the need to take cognizance of capital flows involved in the funding of development projects by developing countries. This notion is pursued in greater details in the next section.

2.2 Theoretical Framework

The Neoclassical school of thought has preference for the use of the total factor productivity (TFP) as the more suitable gauge of economic development rather than labour productivity. The advantage of TFP being that it better captures technical progress by taking full cognizance of the contributions of both physical capital and labour. The labour on the other hand is bereft of both physical capital and technical progress productivity. The TFP however only estimates technical progress as residual. The endogenous growth school contends that both technological spillovers and innovations are the core engine for explaining productivity growth. As mentioned in the previous section, the neoclassical schools of economic thought have assigned equal weights to all the economy sectors in explaining the macroeconomic productivity. The suppositions of structuralist (Verdoorn, 1949; Kaldor, 1966 and Thirlwall, 1979) run contrary to these assumptions.

Following the Says law, which suggests that own demand is created by its supply, the mainstream versions of economic growth generally neglect not only the demand side of the economy, but also external sector constraints of the BOP. Although the orthodox supply constrained growth theories are closed economy models, the Thirlwall’s balance of payments constrained growth (BPCG) model links trade to growth because exports pull demand. Thirlwall (1979) also developed the balanced trade version of the BPCG model infused with the standard multiplicative imports and exports functions. The balance of payment equilibrium stated in domestic currency is presented in equation 1:
\[ P_{dt} X_t = P_{ft} M_t E_t \]  
(1)

where:

\[ X_t = \text{unit of exports at time } t; \]
\[ M_t = \text{units of imports at time } t; \]
\[ P_{dt} = \text{domestic price of exports at time } t; \]
\[ P_{ft} = \text{foreign price of imports at time } t, \text{ and} \]
\[ E_t = \text{the price foreign currency at time } t \text{ or exchange rate} \]

Expressing the demand for imports as in the demand theory, in the multiplicative forms and taking their logarithm of equation and differentiation in terms of time:

\[ pd + x = pf + m + \varepsilon \]  
(2)

\[ m = \psi(p_{dt} - pf - \varepsilon) + \pi y \]  
(3)

\[ x = \eta (p_{dt} - pf - \varepsilon) + \varepsilon z \]  
(4)

Where:

\[ y = \text{growth in domestic income} \]
\[ z = \text{growth in world income} \]
\[ x = \text{growth in unit of exports} \]
\[ m = \text{growth in units of imports} \]
\[ pd = \text{growth in domestic price of exports} \]
\[ pf = \text{growth in foreign price of imports} \]
\[ \psi = \text{the growth in price elasticity of demand for imports } (\psi > 0) \]
\[ \eta = \text{the price elasticity of demand for exports } (\eta < 0) \]
\[ \pi = \text{the income elasticity of demand for imports } (\pi > 0) \text{ and} \]
\[ \varepsilon = \text{the income elasticity of demand for exports } (\varepsilon > 0) \]

Equation (3) and (4) are the import and export equation while equation (1) represents the current account balance. Thus, solving for \( y \) gives the growth rate of output consistent with balance of payments equilibrium \( (y_{BOP}) \) in equation (5) (Thirlwall, 1979):

\[ y_b = \frac{(1 + \eta + \psi)(p_{dt} - p_{ft} - \varepsilon_i) + \sigma z}{\pi} \]  
(5)

Applying the law of ‘one price’ or the Marshall-Lerner condition, equation (5) can either be expressed in equation (6) in the context of the law of one-price:

\[ p_{dt} = p_{ft} + e_i \]  
(6)
Or in the Marshall-Lerner condition which states that currency devaluation will only lead to an improvement in the balance of payments if the sum of demand elasticity for imports and exports is greater than one:

\[ 1 + \eta + \psi = 0 \] (7)

in which case equation (7) becomes,

\[ y_b = \frac{\sigma z}{\pi} \] (8)

where: \( y_b \) = growth rate of output.

The implication of equation (8) is that a country’s growth rate depends on the growth rate of its trading partner(s). The pace of a country’s growth rate relative to others however depends on the income elasticity of demand for exports, \( \varepsilon \) which Thirlwall (2009) and Mirza & Mazhar and (2012) identifies, as a function of the structure of production and exports which is responsible for the differentials in the growth rates of nations. The equilibrium in the BOP growth rate can therefore be related directly to the growth in world income and the income elasticity of exports, while it is inversely related to the income elasticity of imports.

This traditional model of Thirlwall (1979) suggests that the external sector constraint on long-run growth of output can be relaxed or increased by increasing the income elasticity of exports, reducing the income of elasticity imports. This according to Setterfield (2002) is the supply-side Keynesianism and global Keynesianism. Equation (8) also known as the Thirlwall’s law states that unless an ever-growing deficit can be financed, an economy cannot outpace its BOP in the long run (Thirlwall, 2011:43).

Different versions of the BPC growth model have been subjected to empirical verification using various data sets and econometric techniques. By including the income elasticity of import demand and export in equations 8, and applying the standard multiplicative demand function for import, yields equation (9):

\[ M = \alpha \left( \frac{P_f E}{P_d} \right) ^\psi NY^\pi \] (9)

Where \( M = \) imports volume, \( \alpha = \) a constant, \( P_d = \) Price (domestic), \( P_f = \) Price (foreign), \( E = \) nominal exchange rate, \( \psi = \) the price elasticity of import, \( Y = \) Nigerian income, and \( \pi \) is the income elasticity of imports. Taking logs of equation (10) yields:
\[
\ln M = \ln \alpha + \psi \left( \ln P_f + \ln E - \ln P_d \right) = \pi \ln YN \tag{10}
\]

The above import demand function suggests that price competitiveness and domestic income, determine imports level. The performance of export of an economy is also determined by world demand for its product and price competitiveness. Expressed in the standard multiplicative export demand format:

\[
x = \beta \left( \frac{P_E}{P_d} \right)^\eta W Y^\sigma \tag{11}
\]

Where \( \beta = \) a constant; \( WY = \) World Income level, \( X = \) volume of export, \( \eta = \) price elasticities, and \( \sigma = \) income elasticities. The logs of equation (11) above yields:

\[
\ln X = \ln \beta + \eta \left( \ln P_f + \ln E - \ln P_d \right) + \sigma \ln WY \tag{12}
\]

Essentially, the traditional Thirwall (1979) Law represented in equation (8) is predicated on two main premise: absence of capital flows and constant relative prices. This however, limits the suitability of the model in explaining growth behaviour of developing economies. In such economies, the financing of development projects depends on the flow of capital. To this end, the basic BPC growth model might not be adequately sufficient to predict the long run growth performance of developing economies. However, in order to accommodate the growth experiences of the developing countries like Nigeria, Thirlwall (2013) relaxes the two by extending the basic model to account for additional variables such as capital flows on the capital account balance, interest payments on debt and terms of trade movements. These are the crux of the model, presented in the next section.

3. Methodology and Data Description

3.1 The Model

The starting point for the extended model is the BOP accounting identity:

\[
P_{dt}X_t + K_t = P_{\beta t}M_tE_t \tag{13}
\]

Where \( K_t = \) the nominal capital flows value.

However, the differentiation of the variables in equation (13) gives the rate of change:

\[
\lambda (p_{dt} + x_t) + \Phi K_t = p_{\beta t} + m_t + e_t \tag{14}
\]
Here the natural logarithm of change rate is depicted in the lower case. $\Phi$ is the capital flow as a percentage of total import. $\lambda$ is proportion of export earning.

The real domestic income in the extended BPC growth model can be obtained by incorporating the first difference of equations (10) and (12) into equation (14) such that,

$$y_{bop} = \left( \lambda \eta + \psi \right) \left( p_{di} - p_{fi} - e_i \right) + \left( p_{di} - p_{fi} - e_i \right) + \lambda \left( \sigma z_t \right) + \Phi \left( k_t - p_{di} \right)$$

By applying the law of ‘one-price’ as in equation (6), equation (15) will be reduced to:

$$y_{bop} = \frac{\lambda \left( \sigma z_t \right) + \Phi \left( k_t - p_{di} \right)}{\pi}$$

This is the addition of export growth ascribed to the growth in the world income and the real capital flows growth. The sum is divided by the elasticity of demand income with respect to import. This is the strong version of the unbalanced trade approach to the BPCG rate.

In the absence of information on exports demand elasticities, Perraton (2003) recommends that the actual growth rate of exports can be assumed to approximate to the rate determined by the exports demand function (i.e. $x = \sigma z_t$). This is the rate adopted by this study in view of paucity of data on the elasticities of export. The import of this is that equation (16) is converted to become the weak version of the unbalanced trade approach to the BPCG as follows:

$$y_{bop} = \frac{\lambda \left( x_t \right) + \Phi \left( k_t - p_{di} \right)}{\pi}$$

The main argument of this study, in line with Thirlwall (2013) is that the BPC growth model is useful for providing explanations for the economic growth of a developing country like Nigeria.

The extended model incorporates three factors (capital flows, interest payment and the rate of growth of real exchange rate which determines the terms of movements trade) that may vary the growth pattern from the intended path.
For the purpose of empirical analysis in addition to the above argument, error terms and a stochastic intercept are added to equation (17):

\[ y_{bop} = \beta_0 + \beta_1 x_i + \beta_2 (k - p_i) + \beta_3 rer_i + \epsilon_i \]  

(18)

Where:

\[ \beta_i = \frac{\lambda_i}{\pi}, \beta_2 = \frac{\Phi}{\pi} \text{ and } \beta_3 = -\frac{(1+\psi)}{\pi}. \]

Equation (18) is extended to include terms of trade variable (tot), in order to determine the relationship between growth in income and terms of trade. The final equation to be tested is represented as follows:

\[ y_{bop} = \beta_0 + \beta_1 x_i + \beta_2 (k - p_i) + \beta_3 rer_i + \beta_4 tot_i + \epsilon_i \]  

(19)

### 3.2 Estimation Techniques and Procedure

In the literature, two main test techniques have been deployed (Pacheco-Lopez, 2005; Pacheco-Lopez & Thirlwall, 2006, 2007; Thirlwall & Hussain, 1982 and Perraton, 2003). The income elasticity of import demand is compared in the McCombie test procedure with the equating elasticity of the potential and actual BPC model growth rates. The second approach by McGregor and Swales (1985) regresses the actual growth rate (y) on the model’s predicted growth rate (\( y_{bop} \)).

All the aforementioned test procedures are based on the estimation of the income elasticity of demand for imports. To this end, we applied an Autoregressive Distribution Lag (ARDL) modeling approach to cointegration testing of the import, export and the growth equations. The test for co-integration is meant to verify whether Nigeria’s GDP growth could be considered to be BOP-constrained during the period under consideration (1980 to 2012) or not.

The ARDL cointegration approach is considered superior to the conventional Johansen cointegration testing method since it includes an admixture of level and first order integration (I(0) and I(1)). In addition, the ARDL cointegration approach involves more than single-equation configuration, which lends it ease of calculation and interpretation (Pesaran &
Pesaran, 1997). Pesaran and Shin (1999) recommend the formulation of the ARDL cointegration \((p, q_1, q_2, ..., q_k)\) as follows:

\[
\alpha(L, p)y_i = \alpha_0 + \sum_{i=1}^{k} \beta_i (L, q_i) x_{ij} + \epsilon_i \tag{20}
\]

Where \(y_i\) is the dependent variable, \(x_{ij}\) is the vector of regressors (where \(i = 1, 2, ..., k\)), \(\alpha_0\) is a constant, \(L\) is the lag operator, and \(\epsilon_i\) is the error term. In the long-run, we have \(y_t = y_{t-1} = ... = y_{t-q}\) and \(x_u = x_{u,t-1} = ... = x_{u,t-q}\). Here, \(x_{u,t-q}\) denotes \(q^{th}\) lag of the \(i^{th}\) variable.

The long run equation can be written as follows:

\[
y_i = \alpha + \sum_{i=1}^{k} \beta_i x_i + \mu_i \tag{21}
\]

The error correction (EC) representation of the ARDL model can be written as follows:

\[
\Delta y_i = \Delta \alpha_0 - \sum_{j=1}^{q} \alpha_j \Delta y_{t-j} + \sum_{i=1}^{k} \beta_0 \Delta x_{it} - \sum_{i=1}^{k} \sum_{j=1}^{q} \beta_{i,j} \Delta x_{i,t-j} - \alpha(1, p) ECM_{t-1} + \epsilon_t \tag{22}
\]

Where \(\beta_{i,j-1}\) are the coefficients estimated from equation; \(\Delta\) is the first difference operator, \(\alpha_{j,t-1}\) (20), and \(\alpha(1, p)\) measures the speed of adjustment.

The long run and short –run relationships are thereafter estimated using the following ARDL equation:

\[
\Delta y_i = \alpha_0 + \sum_{i=1}^{q} \beta_i \Delta y_{t-i} + \sum_{i=0}^{q} \sigma_i \Delta x_{t-i} + \delta_{y,t-1} + \delta_{x,t} + \epsilon_i \tag{23}
\]

The ARDL lags order is selected using the Schwartz or the Akaike criteria before estimation. The F-test is used for testing the existence of long-run relationship in equation (23). Furthermore, we check the specification of the ARDL model from which the long run coefficients and the ECM models are derived by conducting the following diagnostic tests: serial correlation, functional form, normality, and heteroscedasticity. Having described the
estimation procedure the next discussion is on the types, sources and description of the data to be used which is presented next.

3.3 Data Source and Descriptions

Annual data covering the period 1980 to 2012 are sourced from World Development Indicators (WDI) database. Real imports (RIMP) is measured as imports of goods and services (constant 2005 US$), while real exports (REXP) on the under is measured as exports of goods and services (constant 2005 US$). Domestic income (NY) is represented as Nigeria’s gross domestic product (constant 2005 US$), while the World Income (WY) is measured as World GDP less Nigeria’s GDP (constant 2005 US$). Capital Flow (CFL) is measured as real imports less real exports. Terms of Trade (TOT) is measured as relative price of exports to imports while real exchange rate (RER) is defined as:

\[ \frac{ER \times P_f}{P_d} \]

where \( ER \) denotes nominal exchange rate (i.e. quantity of Naira per one US Dollar), \( P_f \) represents the price index of the United States while \( P_d \) represent Nigeria’s price index. The next presentation is on the findings and discussions thereon.

4. Empirical Findings and Discussions

4.1 Preliminary Analyses

The preminiray characteristics and nature of the variables are presented in Table 1. Evidence of significant trends deviations of all the variables are manifested in the large difference between the maximum and minimum values of the series. With respect to the statistical distributions of the variables, all the series with exception of \( RER \) are positively skewed. However, \( RIMP, REXP \) and \( NY \) are leptokurtic in nature while \( WY, RER, CFL \) and \( TOT \) are platykurtic in nature. The Jarque-Bera (JB) statistic which takes into consideration information from skewness and kurtosis to test for normality suggests non-normality of all the variables.
Table 1: Descriptive Statistic (1980-2012)

<table>
<thead>
<tr>
<th>Statistics</th>
<th>RIMP</th>
<th>REXP</th>
<th>NY</th>
<th>WY</th>
<th>RER</th>
<th>CFL</th>
<th>TOT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>1756.63</td>
<td>1890.05</td>
<td>85576.86</td>
<td>36168813</td>
<td>152.83</td>
<td>-0.15</td>
<td>66.08</td>
</tr>
<tr>
<td>Maximum</td>
<td>12695.61</td>
<td>17470.6</td>
<td>177678</td>
<td>53462144</td>
<td>266.87</td>
<td>0.31</td>
<td>105.28</td>
</tr>
<tr>
<td>Minimum</td>
<td>192.446</td>
<td>188.39</td>
<td>44556</td>
<td>22240375</td>
<td>46.73</td>
<td>-0.56</td>
<td>27.55</td>
</tr>
<tr>
<td>Std. Dev.</td>
<td>3117.11</td>
<td>3506.31</td>
<td>37136.09</td>
<td>9804528</td>
<td>72.58</td>
<td>0.23</td>
<td>20.77</td>
</tr>
<tr>
<td>Skewness</td>
<td>2.60</td>
<td>3.308</td>
<td>1.02</td>
<td>0.246258</td>
<td>-0.03</td>
<td>0.09</td>
<td>0.16</td>
</tr>
<tr>
<td>Kurtosis</td>
<td>8.66</td>
<td>13.99</td>
<td>3.00</td>
<td>1.803</td>
<td>1.70</td>
<td>2.24</td>
<td>2.15</td>
</tr>
<tr>
<td>Jarque-Bera</td>
<td>81.30</td>
<td>226.35</td>
<td>5.67</td>
<td>2.30</td>
<td>2.31</td>
<td>0.84</td>
<td>1.14</td>
</tr>
<tr>
<td>Observation</td>
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<td>33</td>
<td>33</td>
<td>33</td>
<td>33</td>
<td>33</td>
<td>33</td>
</tr>
</tbody>
</table>

Source: Author’s computation (2015)

Note: Real import (RIMP), real export (REXP), domestic income (NY) and world income (WY) are all measure in million USD, while real exchange rate (RER), capital flow (CFL) and terms of trade (TOT) are in rate form.

Unit roots pre-testing is not necessary before the deployment of Bound test. It might be necessary to ascertain that none of the variables is integrated above the first integration order. The Phillips-Perron (PP) and Augmented Dickey-Fuller (ADF) tests have been adopted in this study.

The obtained results are reported in Table 2. At the first difference, the trending instability condition appears to vanish for the variables which are hitherto non-stationary at level.
Table II: Unit Root and Stationarity Tests

<table>
<thead>
<tr>
<th></th>
<th>Augment Dicky-Fuller (ADF)</th>
<th>Ng-Perron (NP)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>First Level</td>
<td>Difference</td>
</tr>
<tr>
<td>LRIMP</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>LREXP</td>
<td>-3.381**a</td>
<td>-</td>
</tr>
<tr>
<td>LNY</td>
<td>-1.489b</td>
<td>-5.184a</td>
</tr>
<tr>
<td>LWY</td>
<td>-2.860b</td>
<td>-4.379a</td>
</tr>
<tr>
<td>LRER</td>
<td>-2.159a</td>
<td>-4.707a</td>
</tr>
<tr>
<td>TOT</td>
<td>-3.445**a</td>
<td>-</td>
</tr>
<tr>
<td>LCFL</td>
<td>-5.245*b</td>
<td>-</td>
</tr>
</tbody>
</table>

Source: Author’s computation (2015)

Note: * Indicates a model with constant but without deterministic trend; b is the model with constant and deterministic trend as exogenous lags are selected based on Schwarz info criteria.

*, **, *** imply that the series is stationary at 1%, 5% and 10% respectively.

ADF and NP represent Augmented Dickey-Fuller and Ng-Perron Unit Root and Stationarity tests respectively. The null hypothesis for ADF and NP is that an observable time series is not stationary (i.e. has unit root).

Since the stationarity property of variables under consideration are mixture of I(1) and I(0), hence the ARDL technique is found appropriate for estimation.

4.2. Discussion of Results

4.2.1. Imports Equation

The calculated F-statistic under the assumption of unrestricted intercept and trend of (14.72) is greater than (5.07) which is the upper bound critical value of at the 5% significance level (Asymptotic critical value bounds are obtained from Table CI(v) Case V: Unrestricted intercept and unrestricted trend for k = 3 (Pesaran et al, 2001). Therefore the Null hypothesis of the absence of long-run relationship among the variables in the import equation is rejected.

The results of the ARDL approach to estimate equation (23) is presented in Table 3.
### Table III: Estimation Results of Import Using ARDL (1,0,0,)

<table>
<thead>
<tr>
<th>Regressor</th>
<th>Long-run</th>
<th>ECM</th>
<th>Diagnostic Tests</th>
</tr>
</thead>
<tbody>
<tr>
<td>LNY</td>
<td>6.946*</td>
<td>2.965*</td>
<td>Serial Correlation: 2.6782 (0.102)</td>
</tr>
<tr>
<td></td>
<td>(5.335)</td>
<td>(2.856)</td>
<td>Functional Form: 4.5083 (0.534)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Normality: 1.3495 (0.509)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Heteroscedasticity: 0.0977 (0.755)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Calculated F-statistic under the</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>assumption of unrestricted intercept</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>and trend = 14.72</td>
</tr>
<tr>
<td>LREER</td>
<td>0.263</td>
<td>0.112</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(1.220)</td>
<td>(1.247)</td>
<td></td>
</tr>
<tr>
<td>Constant</td>
<td>-66.48*</td>
<td>-28.38*</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(-4.71)</td>
<td>(-2.823)</td>
<td></td>
</tr>
<tr>
<td>Trend</td>
<td>-0.397*</td>
<td>-0.169*</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(-6.98)</td>
<td>(-2.815)</td>
<td></td>
</tr>
<tr>
<td>ECM,-1</td>
<td>-0.426*</td>
<td>-3.035</td>
<td></td>
</tr>
<tr>
<td>R²</td>
<td>0.967</td>
<td>0.384</td>
<td></td>
</tr>
<tr>
<td>DW</td>
<td>1.484</td>
<td>1.484</td>
<td></td>
</tr>
</tbody>
</table>

Source: Author’s computation (2015)

Note: t-statistics are shown in parentheses.

*, **, *** denotes significance of the coefficient at 1, 5, 10 percent respectively.

Variables in the long run equations are measured in log levels.

The diagnostic tests show probabilities and they correspond to the ARDL models from which the ECM models and the long run coefficients are derived.

The long run coefficients and the results of the Error Correction model estimation are reported in Table (4). The long run estimation indicates that the expected signs of imports income demand elasticities of are present which therefore signify that it is significant in shaping the Nigerian import growth behaviour. It also confirms the theoretical postulation that the commodity demand both positive and direct in relations to income. The large income elasticity of import demand suggests that import is a necessity which accounts for a significant percentage of the nation’s GDP. This by implication is an indication that, the demand for import will significantly change given the change in GDP.

However, the apriori expectation of a negative relatedness of exchange rate to the import growth did not manifest. The positive sign of the coefficient of exchange rate implies that the the higher the demand for imports, the greater the price of import vis a vis the domestic export price. The explanation for this relatedness is that the country is import-dependent with consequential inelastic import demand. Also, it does appear that exchange rate do not have impact on the growth of import in Nigeria as reveal by the insignificance of their relationship.
The expected sign of the ECM result and the fact that almost 43 percent of the difference between the equilibrium value of imports and the actual suggests that it is corrected within a year. Given that from the diagnostic tests, the ARDL technique is an appropriate tool for estimating the model.

4.2.2 Export Equation

The results of the Bounds co-integration test of the export growth equation reveals that that the computed F-statistic of (6.75) is greater than the upper critical bound value of (5.07). This establishes the existence of a steady-state long-run relationship among the variables. Reported in table 4 are the short and the long run coefficients derived from the ARDL (1, 0, 0).

Table IV: Estimation Results of Export Equation Using ARDL (1,0,0.)

<table>
<thead>
<tr>
<th>Regressor</th>
<th>Long-run</th>
<th>ECM</th>
<th>Diagnostic Tests</th>
</tr>
</thead>
<tbody>
<tr>
<td>LWY</td>
<td>57.120(1.137)</td>
<td>6.615**(2.276)</td>
<td>Serial Correlation: 0.10715 (0.743)</td>
</tr>
<tr>
<td>LRER</td>
<td>0.178 (0.201)</td>
<td>0.021 (0.202)</td>
<td>Functional Form: 0.56944 (0.450)</td>
</tr>
<tr>
<td>Constant</td>
<td>-957.99 (-1.128)</td>
<td>-110.95** (-2.26)</td>
<td>Normality: 0.26100 (0.878)</td>
</tr>
<tr>
<td>Trend</td>
<td>-1.6213 (-1.196)</td>
<td>-0.188** (-2.345)</td>
<td>Heteroscedasticity: 0.0037471</td>
</tr>
<tr>
<td>ECM_{t-1}</td>
<td>-</td>
<td>-0.116** (-1.487)</td>
<td>Calculated F-statistic under the assumption of unrestricted intercept and trend = 6.75</td>
</tr>
</tbody>
</table>

| R²        | 0.958    | 0.416 | Calculated F-statistic under the assumption of unrestricted intercept and trend = 6.75 |
| DW        | 2.101    | 2.101 | Calculated F-statistic under the assumption of unrestricted intercept and trend = 6.75 |

Source: Author’s computation (2015)

Note: t-statistics are shown in parentheses.

*, **, *** denotes significance of the coefficient at 1, 5, 10 percent respectively.

Variables in the long run equations are measured in log levels.

The diagnostic tests show probabilities and they correspond to the ARDL models from which the ECM models and the long run coefficients are derived.

An increase in the Nigerian export growth predicted by real depreciation of Nigerian currency and increase in world income appears insignificant in the long-run. However, the of the world income’s coefficient value means that its 1% rise will result in 6.63 percent increase in exports. This means that a change in world income will be significantly affected by the export supply. This shows the global importance of Nigeria’s crude oil export.
This positive impact of world income on export growth is however in the short-run, only significant and sustainable. Again the unusual evidence of growth in export and exchange rate relationship may not be unconnected to the mono economy nature of the country. The right sign of the error correction term and 11% divergence between the equilibrium and actual value of exports suggest correction within the year. The ARDL method, given the diagnostic test results can be taken as being appropriate for the model.

4.2.3 Growth Equation

Stemming from the main findings of this study, the use of the ARDL method to predict the impact capital flow on the terms of trade is appropriate. Specifically, the extended BPC growth serves as a good predictor of economic growth performance of Nigeria in the long run. The deployment of ARDL technique to equation (19) shows a greater calculated F-statistic is (24.32) which at the 5 percent significance level exceeds the upper bound of the critical value of (4.25). The rejection therefore of the Null hypothesis of the absence of long run relationship among income growth in, capital inflows, exports, terms of trade and the real exchange rate becomes automatic.

The findings empirically reveal that with the exception of time, growth in exports is the only variable significantly determining income growth in in Nigeria. Hence, the validity of extended BPC growth model in Nigeria is therefore invalid. Export is the only factor that showed significant and positive long-term relationship with on the growth of income. Similar pattern of ECT export growth is to the long run equation has been observed. The probability values in Table (5) are insignificant statistically, signifying the absence of misspecification of the growth model.

This evidence of poor predictability of Nigerian growth performance by growth in real exchange rate, capital inflow, and terms of trade might have further expose the mono economy nature of the structure of Nigerian economy, that dependence on crude oil export as a major source of its income, which in turn depend directly on oil price level. This therefore, make promoter of non-oil export products such as exchange rate, capital inflow and terms of trade to have little or no impact on growth performance of economy of this nature.
Table V: Estimation Results of Growth Equation Using ARDL (1,0,0,0)

<table>
<thead>
<tr>
<th>Regressor</th>
<th>Long-run</th>
<th>ECM</th>
<th>Diagnostic Tests</th>
</tr>
</thead>
<tbody>
<tr>
<td>( LREXP )</td>
<td>0.117* (5.869)</td>
<td>0.062* (3.572)</td>
<td>Serial Correlation: 2.2465 (0.134)</td>
</tr>
<tr>
<td>( LRER )</td>
<td>-0.010 (-0.363)</td>
<td>-0.005 (-0.359)</td>
<td>Functional Form: 0.25802 (0.611)</td>
</tr>
<tr>
<td>( CFL )</td>
<td>-0.006 (-0.088)</td>
<td>-0.003 (-0.089)</td>
<td>Normality: 2.1625 (0.339)</td>
</tr>
<tr>
<td>( TOT )</td>
<td>-0.253 (-0.281)</td>
<td>-0.135 (-0.276)</td>
<td>Heteroscedasticity: 6.6180 (0.110)</td>
</tr>
<tr>
<td>( Constant )</td>
<td>9.620* (49.572)</td>
<td>5.121* (4.366)</td>
<td></td>
</tr>
<tr>
<td>( Trend )</td>
<td>0.057* (20.441)</td>
<td>0.030* (4.674)</td>
<td></td>
</tr>
<tr>
<td>( ECM_{(c,l)} )</td>
<td>-</td>
<td>-0.532* (-4.456)</td>
<td></td>
</tr>
<tr>
<td>( R^2 )</td>
<td>0.945</td>
<td>0.707</td>
<td></td>
</tr>
<tr>
<td>( DW )</td>
<td>1.482</td>
<td>1.482</td>
<td></td>
</tr>
</tbody>
</table>

Source: Author’s computation (2015)

Notes: t-statistics are shown in parentheses.

*, **, *** denotes significance of the coefficient at 1, 5, 10 percent respectively.

Variables in the long run equations are measured in log levels. The diagnostic tests show probabilities and they correspond to the ARDL models from which the ECM models and the long run coefficients are derived.

4.2.4 Testing the validity of the BPC Growth model

The essence of this test is to determine the predictive ability of the extended model of BPC growth of the long-run growth in Nigeria. The regression of actual growth rate (\( y \)) on a constant and the predicted growth rate (\( y_{bop} \)) was conducted using the McGregor and Swales method. The the predicted growth rate was however regressed on the actual growth rate and the constant term using the McCombie approach. The results of both the methods are presented in Table 6. These results confirms the predictive capavity of the extended BPC growth model. The regressand variables are almost close to one. The constants are not significantly different from zero. Furthermore, the t-statistic reveals that the slope coefficient is statistically equal to unity. Based on this, the extended BPC growth model adjudged a good estimate of the actual growth rates in Nigeria.
Table VI: Testing the Applicability of the extended BPC Growth Model

6a: McGregor and Swales’ text procedure

<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>Constant</th>
<th>y_{bop}</th>
<th>se</th>
<th>p-value</th>
<th>R²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Actual growth rate (y)</td>
<td>-0.1971</td>
<td>1.000</td>
<td>0.13907</td>
<td>0.999</td>
<td>0.99</td>
</tr>
<tr>
<td></td>
<td>(-0.001)</td>
<td>(81.201)</td>
<td>0.012315</td>
<td>0.000</td>
<td></td>
</tr>
</tbody>
</table>

6b: McCombies’s test procedure

<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>Constant</th>
<th>y</th>
<th>se</th>
<th>p-value</th>
<th>R²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Predicted growth rate (y_{bop})</td>
<td>0.051</td>
<td>0.995</td>
<td>0.13844</td>
<td>0.714</td>
<td>0.99</td>
</tr>
<tr>
<td></td>
<td>(0.370)</td>
<td>(81.201)</td>
<td>0.012215</td>
<td>0.000</td>
<td></td>
</tr>
</tbody>
</table>

Source: Author’s computation (2015)

Note: Figures in parentheses are the usual t-statistics.

The t-statistic based on the null hypothesis that the slope coefficient is unity.

Another fall out of this analysis concerns the validity of McCombie’s criticism of the McGregor and Swales test procedure which state that independent variable (y_{bop}) being an estimated parameter could suffer from a misspecification analogous due to an “error in variables” problem. This does not hold in Nigeria context. Both test procedures provide uniform evidence that validates the applicability of the extended BPC as a growth predictor in Nigeria.

5 Conclusion and Policy Recommendations

We argue that for typical developing countries like Nigeria, the extended BPC growth model that takes cognizance of capital flows is the appropriate model to explain their growth experience. Thus, we test for the validity of the extended BPC growth model for predicting long-run growth performance in Nigeria. Given the stability nature of the concern variables, which are often ignored in previous related studies, we used the ARDL approach to cointegration to investigate the short-run dynamics and the long-run relationship among growth rates in output, exports, capital flows, real exchange rate and terms of trade. We then used the framework to test for the applicability of the extended BPC growth model via the McCombie (1989) and McGregor and Swale (1985) test procedures.
The empirical analyses reveal that the demand for import is income elastic in Nigeria, thereby suggesting that import demand is a necessity to Nigeria. With respect to supply of export, it was revealed that Nigeria’s export is a direct function of world income, and that export supply is income elastic. This finding reflects the importance of crude oil export from Nigeria to the rest of the world in the short run. However, there is scant evidence of its importance in the long-run. The country’s over dependence on of crude oil exportation which is majorly determine by oil price is sustainable only in the short-run.

Furthermore, we find that an increase in the growth of exports leads to an increase in the growth rate of income. Growth in exports is the most important source of economic growth in Nigeria, while evidence from the long and short runs estimates reveal that, the growth in capital flows, the growth of real exchange rate as well terms of trade plays little or no significant role in determine economic growth performance in Nigeria. A uniforms evidence from the use of McGregor and Swale (1985) and McCombie (1989) test procedures for validating the applicability of the extended BPC model, tends to be suggesting that, beside growth in exports, growth in capital inflow, growth in real exchange rate and terms of trade are important to the growth process in Nigeria. The findings of the study offer many avenues that can be helpful to future policy changes.

The findings of the study offer many avenues that can be helpful to future policy changes. To this end, a policy change that could encourage the restructuring of the Nigerian economy from its mono economy nature is thus recommended. This may in reality induce the significance impact of these factors (i.e. capital flows, real exchange rate and terms of trade)
in determine economic growth in Nigeria, as statistically predicted by the extended BPC growth model considered in this study.

Reference


Marx, K. (1887). *Machinery and Large-Scale Industry*, 1, chapter XV


