

TESTING THE VALIDITY OF THIRLWALL'S LAW AND THE ENDOGENEITY OF NATURAL RATE OF GROWTH: EVIDENCE FROM NIGERIA

By

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ABSTRACT

This study seeks to examine the validity of Thirlwall's 'Law' which contends that actual growth of domestic income must be compatible with equilibrium growth rate determined by balance of payments (BoP) to avoid crises on its external account. It also attempts to verify whether natural rate of growth is endogenously determined in the Nigerian context. The study blends autoregressive distributed lagged model (ARDL) and Toda-Yamamoto (TY) Granger econometric methods for the analysis. To achieve research objectives, study first estimate the balance-of-payments-constrained growth (BPCG) rate as well as the natural rate of growth for the period spanning 1982 to 2015. Then, it makes comparison between the estimated growth rates and actual growth of the economy. As a side test of the endogeneity hypothesis, we also test for the direction of causality between, exports, national output and labour productivity for the country. The outcome of the study showed that the Thirlwall's Law holds for Nigeria. We equally found that the natural rate of growth adjusts towards actual growth of domestic income; and since Thirlwall's is valid, natural rate is endogenous to BoP conditions. The results bring to the fore the importance of focusing on demand pressures in the understanding of long-run growth experience of the Nigerian economy.

Keywords: Balance of payments constraint, relative prices, exports, demand components, natural rate of growth.

1.0 INTRODUCTION

Thirlwall (1979) introduced the theory BPCG, a sub-field of post-Keynesian macroeconomic theory, which focuses on long-term expansion. The theory is based on the idea that most countries are constrained to have either balanced trade or a sustainable rate of net capital inflows over the long run, and that this constraint imposes legally binding limits on the rate of growth of national income over the long run in majority of countries. The BPCG framework, like other Post-Keynesian growth models (Blecker and Setterfield, 2019), makes the assumption that aggregate demand drives output in both the short and long run period, while potential output on the supply side is endogenous and adjusts (within bounds) in response to demand pressures. Unlike other Post-Keynesian models, the BPCG approach is distinguished by a focus on external rather than internal sources of demand.

The BPCG framework can alternatively be thought of as a particular kind of export-led growth model that places more emphasis on how exports help to relieve balance-of-payments (BP) restrictions than on other advantages of export activity (although those other benefits are recognised in some of the recent extensions of the model, Blecker, 2021). The long-run equilibrium growth rate consistent with BP equilibrium (hereinafter

referred to as the "BP-equilibrium growth rate") equals the ratio of the (long-run average) growth rate of exports to the income elasticity of demand for imports. This law has come to be known as "Thirlwall's law" and is solved by the BPCG model in its most basic form. In an alternative version of this law, the BP-equilibrium growth rate equals the (long-run average) growth rate of foreign (rest-of-world) income multiplied by the ratio of the home country's income elasticity of exports to its income elasticity of imports in the home country.

The original formulation of Thirlwall (1979), relative prices as well as capital flows are treated as constant or play negligible roles in long run equilibrium adjustment. This Law has survived refutation for the past 50 years and was shown to be relevant in many countries (See, Panshak, Civcir and Huseyin, 2019; 2021; Thirlwall, 2012; for history and a survey of empirical studies)

Another important preoccupation within the demand-led paradigm that requires some verifications, is the proposition that natural rate is not exogenously determined by actual growth of output as forwarded by supply-side economists but it is endogenous to demand pressures which is at the core of the method developed by León-Ledesma and Thirlwall (2002). The authors had used Okun's Law (1962) to argue that the two components of natural rate (growth of labour force and labour productivity) respond directly to higher growth in demand in periods of an economic boom.

According to Vogel (2009) the endogenous relationship between the major variables that determine actual income growth had been studied for more than eight decades. Historically, Harrod (1939) officially established in economic literature that natural rate of growth exogenously determined the actual growth of an economy. Harrod, based on the assumption of full employment at all times, defined natural rate of growth as the summation of constant or exogenously given growth rates of labour force and labour productivity. This tends to explain the endogenous relationship between natural rate of growth and demand in periods of higher economic expansion and to variations in the actual rate of growth. Thus, the Post-Keynesians concluded that, it is, demand factors associated with rising prices and balance of payments imbalances, and not supply factors that determine actual growth and occur ahead of supply factors.

Based on the framework advanced by León-Ledesma and Thirlwall (2002) several researches have shown that natural rate of growth is endogenous to actual growth since growth rates of both labour force and labour productivity are affected by the pressure of both domestic and foreign demand (Libânio, 2009; Vogel, 2009; Dray & Thirlwall, 2011; Lanzafame, 2014; Perrotini-hernández & Alberto, 2017).

Contributing to the above, this research seeks to achieve two basic objectives. (i) To investigate whether actual growth of the Nigerian economy is explained on the demand side by the application of Thirlwall's model. (ii) To show whether natural rate responds to the actual growth rate of domestic income over the period, 1982 to 2015. (iii) To our sincere knowledge, there is no ex ant studies that have combined Thirlwall's Law and Okun's Law for same period using diverse econometric methodologies in Nigeria.

Note that more than 90% of revenue of the country comes from oil exports; accordingly, the present investigation is firmly anchored on the conviction that Nigeria represents an ideal economy where growth is restricted by external factors. The demand-led theory indicates that increasing returns are a crucial component of economic growth and

development; therefore this model undoubtedly gives valuable insights into Nigeria's growth structure throughout the time period. It is, thus, a suitable framework to test growth patterns affected by unfavourable balance of payments. The study would substantially add to available literature on the subject matter. Therefore, the outcome of the study has enormous implications regarding the approach in which the actual growth process is usually perceived and treated in Nigeria. As noted by Anoka and Takon (2014), most national policies of the Nigerian economy since 1980 are often supply-side oriented and has not significantly produced the most desired results of positioning the country on a sound and stable growth path. Therefore, the outcome of the study would be useful in reshaping and redirecting national economic policies for an overall growth performance of the economy.

The remainder of the paper is structured as follows. Section 2 reviews the original Thirlwall's model and natural rate of growth theoretical standpoints. Section 3 focuses on the estimation procedure. Section 4 is on interpretation, discussion of results as well as computation of BPCG growth rate and the natural rate of growth. Section 5 gives the conclusion and policy implications of the study.

2.0 THEORETICAL FRAMEWORK

As earlier indicated, the first objective of this paper is to examine whether the actual growth of domestic income for Nigeria is balance of payment constrained. To address this, an important level to start is by specifying and explaining the influential model advanced by Thirlwall (1979), which comprises two equations and a BoP equilibrium identity:

$$X = A \left(\frac{P_f E}{P_d} \right)^{\varepsilon_{xp}} Y^{*\varepsilon_{xy}} \quad \text{Export demand function} \quad (1)$$

$$M = B \left(\frac{P_f E}{P_d} \right)^{\varepsilon_{mp}} Y^{\varepsilon_{my}} \quad \text{Import demand function} \quad (2)$$

$$P_d X = P_f M E \quad \text{Trade balance identity} \quad (3)$$

Where, X captures the level of exports, P_d represents the domestic price level of exports, M represents the level of imports, P_f represents foreign price level of imports and E represents the nominal rate of exchange. Y , represents real GDP of Nigeria and Y^* represents world real income. ε_{xp} is the price sensitivity of demand for exported commodities, ε_{mp} is the price sensitivity of import demand; ε_{xy^*} represents the income sensitivity of export demand; ε_{my} represents the income sensitivity of imports.

The first difference of the variables in Equation (1) and (2) in logarithmic form yields, Equation (4) and (5):

$$\dot{x} = \varepsilon_{xp} (\dot{p}^* - \dot{e} - \dot{p}) + \varepsilon_{xy^*} \dot{y}^* \quad \text{Export equation} \quad (4)$$

$$\dot{m} = \varepsilon_{mp} (\dot{p}^* + \dot{e} - \dot{p}) + \varepsilon_{my} \dot{y} \quad \text{Import equation} \quad (5)$$

Where, $(\dot{p}^* + \dot{e} - \dot{p})$ is the rate of real depreciation of the domestic currency.

When we substitute Equations (4) and (5) into trade balance identity (3) and reordering them, the equilibrium condition to trade balance over the long term can be specified as:

$$(\varepsilon_{xp} + \varepsilon_{mp} - 1)(\dot{p} + \dot{e} - \dot{p}^*) - \varepsilon_{my}\dot{y} + \varepsilon_{xy^*}(y^*) = 0 \tag{6}$$

If the price sensitivities are sufficiently high to meet the requirements of Marshall-Lerner (ML) condition ($\varepsilon_{xp} + \varepsilon_{mp} > 1$), we can obtain the equilibrium growth rate by solving for domestic income growth (\dot{y}) in Equation (6).

$$\dot{y}_A = \frac{(\varepsilon_{xp} + \varepsilon_{mp} - 1)(\dot{p} + \dot{e} - \dot{p}^*) + \varepsilon_{xy^*}(y^*)}{\varepsilon_{my}} \tag{7}$$

Where, \dot{y}_A is the balance payment constrained growth rate. Note, ML condition states that for a devaluation of domestic currency to improve the balance of payments, the sum of the price elasticities of demand for exports and imports must be greater than one. However, BPCG growth assumes that this is always impossible.

There are two straightforward techniques to demonstrate that the long-term effects of relative prices are negligible. First, it is plausible to claim that the ML criterion is not met because $\varepsilon_{xp} + \varepsilon_{mp} \approx 1$ rather than the assumption of elasticity pessimism as stated in Blecker (2021). Therefore, relative price would have little of an effect over time. Second, given the law of one price, actual exchange rate effects can be disregarded even when the ML condition is met, i.e., when $\varepsilon_{xp} + \varepsilon_{mp} > 1$; this is the case when prices have a tendency to be stable over the long run. In this regard, policy initiatives designed to boost local demand can only temporarily speed up growth because they would increase import propensity, which will contaminate the equilibrium situation in Equation (3).

Either manner, the relative price variable would be removed from Equation (7), allowing the growth rate of the balance of payments equilibrium to be calculated:

$$\dot{y}_A = \frac{\varepsilon_{xy^*}\dot{y}^*}{\varepsilon_{my}} \tag{8}$$

Once more, if assumption of change in real exchange rate $(\dot{p} + \dot{e} - \dot{p}^*) = 0$ holds, export Equation (4) reduces to $x = \varepsilon_{xy^*}\dot{y}^*$; and Equation (8) could be rewritten as:

$$\dot{y}_A = \frac{\dot{x}}{\varepsilon_{my}} \tag{9}$$

Therefore, economic growth positively depends on the amount of export growth and negatively on the aggregate income elasticity of demand for imports over a long period of time. Equations (8) and (9) are the BPCG rates; they are also known as strong and weak versions of Thirlwall's law, respectively, (Perraton, 2003).

2.1. The León-Ledesma and Thirlwall (2002) model and estimation procedure

As earlier noted, the second aspect of this paper follows León-Ledesma and Thirlwall (2002) estimation procedure which starts by obtaining the value of natural rate of growth from Okun's law, as follows:

$$\Delta^{\%} u = \alpha 1 - \beta 1 \dot{y} + u 1 \tag{10}$$

Where, $\Delta\%u$ represents the percentage rate of change in unemployment, \dot{y} is the actual growth rate of domestic output, α_1 is the intercept while v is error term. Given that the natural rate is expressed as the summation of labour productivity and labour force growth rates, unemployment will increase each time the actual rate of growth of domestic income decreases lower than the natural rate of growth, while it will decrease once the actual growth rate of domestic income growth rises more than natural rate of growth. Therefore, we can assert that the natural rate of growth represents that specific growth rate compatible with a constant rate of unemployment. The implication of this is that $\Delta\%u$ must be equated to zero in order to obtain specific natural rate of growth from equation (10) like α_0/β_1 .

León-Ledesma and Thirlwall (2002) had earlier identified that the application of Equation (10) -Okun'slaw -is often characterised with the problem of correlation between labour force participation on the growth rate of output as well as the consequences of labour hoarding, which could make the values of both α_1 and β_1 downward biased. Resolving this challenge, the authors opined that the regressand and the regressor be reversed in Equation (10) such that the efficient model to be estimated becomes:

$$\dot{y} = \alpha_2 - \beta_2 \Delta\%u + u_2 \tag{11}$$

From the above, if we set $\Delta\%u = 0$, then α_2 in Equation (11) indicates the estimate of the natural rate of growth (\dot{y}_N). It becomes unproblematic for us to formally investigate the proposition that the natural rate of growth is endogenously related to the growth rate by employing:

$$\dot{y} = \alpha_3 + \lambda_3 Dum - \beta_3 \Delta\%u + u_3 \tag{12}$$

$$Dum = \begin{cases} 1, & \dot{y} > \dot{y}_N \\ 0, & \dot{y} < \dot{y}_N \end{cases}$$

Natural rate of growth (\dot{y}_N) Equation (12) arises because of the inclusion of a dummy variable (*Dum*) into Equation (11) to allow for a differential autonomous component each time \dot{y} is greater than the natural growth rate. The endogeneity proposition would be upheld when the value of λ_3 , i.e. the estimated coefficient of the intercept dummy variable (*Dum*), is statistically significant. Libânio (2009) clearly notes that since the intercept α_2 represents the natural rate of growth for the whole sample period, irrespective of moments of booms and contractions; the issue becomes whether the autonomous components diverge or remain constant once we distinguish between the periods when $\dot{y} > \dot{y}_N$ and $\dot{y} < \dot{y}_N$. A reasonable conclusion can be advanced if there is a divergence between them. This essentially implies that the natural rate of growth is superior in periods of expansion ($\alpha_3 + \lambda_3$) than in slumps (α_3), and therefore, it is endogenous.

Palley (2003) earlier presented one of the earliest studies on the nature of the relationship that exists between the natural rate of growth (\dot{y}_N), and the balance of payment constrained growth rate. The authors' theoretical observation was that \dot{y}_N must be either identical to BPCG (\dot{y}_A) or approximately equal.

Similarly, Setterfield (2006), in line with the equality of natural rate of growth with balance of payment constrained growth hypothesis, contends that since \dot{y}_N reflects the rate of growth of productive capacity or the level of an economy, the gap or disparity between BPCG and \dot{y}_N will unavoidably causes overcapacity utilization (particularly when BPCG is greater than \dot{y}_N). On the other hand, when BPCG is less than \dot{y}_N , a situation of undercapacity will be inevitably created, except there are some correcting or adjustment mechanisms working to equilibrate the two growth rates. It is noteworthy that Palley's opinion regarding these two growth rates suggests that BPCG may possibly adjust to \dot{y}_N through some variations in the income sensitivity of import demand, which depends on the extent of capacity utilization and increases with overcapacity utilization. Based on this idea, when actual growth rate of domestic income, (\dot{y}), is faster than natural rate (\dot{y}_N); BPCG (\dot{y}_A) falls or adjust towards \dot{y}_N . Palley's perspective ultimately reveals that the actual growth of domestic income in the long-run is supply constrained, which inherently reverses the theoretical 'hard core' and 'protective belt' underpinning Thirlwall's Law. However, Palley (2003) similarly forwarded an exciting direction for further research by stating that there could be some adjustment processes or mechanisms on the supply side that have some likelihood of making actual growth of domestic income to adjust towards demand in the long-run.

Setterfield (2006) exploited this gap and tendered a different demand-driven adjustment mechanism through which it is \dot{y}_N that adjusts towards BPCG in the long-run by explicitly modelling productivity growth as a positive function of the degree or extent of capacity utilization. This submission indicates that at any given time, when BPCG is greater than \dot{y}_N , the actual growth of domestic income induced by productivity pulls \dot{y}_N towards BPCG. The implication of this theoretical stance is that if the actual growth rate of domestic income tends towards BPCG, and \dot{y}_N is endogenously related \dot{y} , then when BPCG is greater than \dot{y}_N , then \dot{y} must be greater than \dot{y}_N as well, pulling the \dot{y}_N towards BPCG. In empirical terms, the demand-determined hypothesis will be upheld if empirical evidence shows that \dot{y} tends towards BPCG and \dot{y}_N is endogenously related to it, is significantly different from zero. Note, Palley and Setterfield both show that in real life situations, supply and demand constraints may possibly perform a function. This belief authenticates the idea that for a long-run equilibrium to be attained, BPCG and \dot{y}_N must be equal or approximately identical.

In order to support the León-Ledesma-Thirlwall hypothesis, Libânio (2009) provides two empirical exercises for 12 Latin American nations using panel data. The findings imply that gross domestic product series are non-stationary and that shocks to the economy (from both supply and demand) have long-lasting consequences. The second exercise examines the possibility of an endogenous natural rate of growth and contends that the level of economic activity in Latin American nations has an impact on potential output. This outcome supports the idea that aggregate demand affects the economy over the long term. The primary take away from the study for growth theory is that treating growth as solely influenced by supply-side factors is erroneous because aggregate demand and output growth influences the trajectory of labour supply and productivity in the long run.

Similarly, Dray and Thirlwall (2011) have empirically demonstrated that the real growth rate has a tendency to be identical to BPCG rate in the long-run period; and the process of adjustment is determined by demand (demand-led). With the assumption that the natural rate of growth is endogenously determined by changes in the actual rate of growth, Vogel (2009) examined the sensitivity of the natural rate of growth to the actual

rate of growth for a sample of 11 Latin American countries. A system of SUR estimates is used to estimate the natural rates of growth for the years 1986 to 2003. The findings support the idea that the natural rate of growth is endogenous.

2.2 Econometric methods: ARDL approach and OLS estimation procedure

The main objective of this section is to econometrically examine the endogeneity of natural rate of growth and independent of the effects of demand following León-Ledesma and Thirlwall (2002) and to ascertain whether the original Thirlwall (\dot{y}_A) set limits to actual growth of domestic income (\dot{y}) in the long-run.

This section specifically uses autoregressive distributed lag (ARDL) cointegration as well as ordinary least squares econometric techniques. The rationale behind ARDL approach is that it outperforms other cointegration techniques when the sample size is small and when the variables are integrated of different order, as in our case. Bound testing methodology proposed by Pesaran, Shin & Smith (2001) gives unbiased parameter estimates of the long-run estimates, irrespective of the endogeneity of some of the regressors- a fact that apparently affects all macroeconomic variables. The use of OLS is to give more confirmation to the outcomes of the research.

For cointegration investigation; it is expected that ΔY_t will be modelled as a conditional error correction model (ECM):

$$\Delta Y_t = \sum_{j=1}^n \alpha_j \Delta Y_{t-j} + \sum_{j=1}^k b_{i,j} \Delta Z_{i,t-j} + \sigma Y_{t-1} + \sum_{i=1}^k d_i Z_{i,t-1} + dum(13)$$

Where Δ represents the first difference of the series, and σ captures the speed of adjustment of the variable toward the long-run equilibrium. Note that the dependent variable Y could represent any equation used in the calculation. The set of Z variables comprises three potential determinants: $\% \Delta$ in unemployment rate, drift parameter (a measure of capacity rate) and dummy variable when (\dot{y}) is greater than natural rate (\dot{y}_N).

In order to investigate the path of causality between BPCG (\dot{y}_A) and \dot{y}_N , as well as between \dot{y} and BPCG. Here, we employ Toda-Yamamoto (TY) test given the non-stationarity of the data. To examine the direction of causality between the variables, we revert to the original specification advanced by Thirlwall (1979) as expressed $\dot{y}_A = \dot{x} / \epsilon_{m,y}$, which defines the BPCG as the rate of growth of exports divided by income elasticity of import. Similarly, since we defined the natural rate of growth as the summation of growth rates of labour force and labour productivity in efficiency units (lfe), it becomes straightforward to conduct causality analysis. The direction of causality between natural rate of growth and balance of payment constrained growth rate could be determined by investigating the direction in which \dot{x} and lfe are causally related. A one-way causality running from \dot{x} to lfe would mean that it is \dot{y}_N that adapts to or adjusts to BPCG. This argument is in tandem with the postulations of Palley (2003) and Satterfield (2006). However, an opposite conclusion could be made if the direction of causality runs from lfe to \dot{x} . In a similar format, a two-way causality between the variables (\dot{x} and lfe) would both be in agreement with classical/neo-classical and Keynesian/Post-Keynesian adjustment processes performing some functions.

With the use of TY Granger causality analysis, the study proceeds to determine the causal relationship between \dot{x} and \dot{y} . Here, the hypothesis is that real domestic income growth (\dot{y}) is externally constrained by \dot{x} in the long-run. The research shall uphold the

hypothesis if there is an empirical substantiation that \dot{x} Granger causes \dot{y} . The outcome from the Granger causality between \dot{x} and \dot{y} will be a confirmation of the results obtained using the research methodologies above.

Therefore, the study conducts Granger causality by estimating the following Vector autoregressive (VAR) models:

$$\dot{y}_t = \alpha_0 + \alpha_1 \dot{y}_{t-1} + \dots + \alpha_p \dot{y}_{t-p} + b_1 \dot{x}_{t-1} + \dots + b_p \dot{x}_{t-p} + u + \omega t \quad (14)$$

$$\dot{x}_t = c_0 + c_1 \dot{x}_{t-1} + \dots + c_p \dot{x}_{t-p} + d_1 \dot{y}_{t-1} + \dots + d_p \dot{y}_{t-p} + u + v t \quad (15)$$

And Granger causality between \dot{y} and \dot{x} :

$$\dot{y}_t = \varphi_0 + \varphi_1 \dot{y}_{t-1} + \dots + \varphi_p \dot{y}_{t-p} + \eta_1 \dot{x}_{t-1} + \dots + \eta_p \dot{x}_{t-p} + u + \varepsilon t \quad (16)$$

$$\dot{x}_t = c_0 + c_1 \dot{x}_{t-1} + \dots + c_p \dot{x}_{t-p} + \psi_1 \dot{y}_{t-1} + \dots + \psi_p \dot{y}_{t-p} + u + \varepsilon t \quad (17)$$

For the first analysis, we investigate the null hypothesis of non-causality, $H_{01}: b_1 = \dots = b_p = 0$, against H_{A1} : that \dot{x} does not Granger-cause \dot{y} .

Similarly, we test $H_{02}: d_1 = \dots = d_p = 0$, against H_{A2} , that \dot{y} does not Granger-cause \dot{x}

Following the TY (1995) Granger causality procedure, we start by initially determining the order of integration of the variables. We set up VAR models using levels of the data despite the consequences of the orders of integration of the variables. Furthermore, we proceed to select the most preferred model using Schwartz information criterion. Moving further, we carry out the LM test for serial correlation to ensure that errors are white noise. Note that u is unemployment rate incorporated into the regression equations as a control variable to account for omitted variable bias, which often affects the causal relationship and efficiency of bi-variate Granger causality. This is in line with the established knowledge in economic literature that conducting Granger causality tests, as in the present investigation, ought to incorporate several likely adjustment mechanisms liable to bring equilibrate demand and supply growth, consequently affecting the causal relations between the endogenous variables (Lanzafame, 2010). To be specific, the incorporation of unemployment rate as an appropriate control variable in the VAR specifications follows Palley's method (2003) to solve omitted variable bias. The ARDL and OLS, and Granger causality test results are presented in Tables 1 and 2 respectively.

In line with the model specification in Equation (13) we made use of Equation (11) to obtain the natural rate of growth for the Nigerian economy and later proceed to estimate Equation (12) with coefficient of $(\alpha_2 = \dot{y}_N)$.

3.0 INTERPRETATION AND DISCUSSION OF RESULTS

From Table 1, the natural rate of growth (\dot{y}_N) obtained using Equation (11) for the time series is 4.489%, which is very close to the OLS result, which supplied 4.394% as the natural rate of growth. We conclude that the Thirlwall model is robust in explaining, and supporting the hypothesis that actual growth rate (\dot{y}) tends towards natural rate of growth (\dot{y}_N) in the long-run. Moreover, since actual growth of domestic income ($\dot{y} = 4.26\%$) is largely identical to \dot{y}_N (4.489%), the equality of balance of payment constrained growth

and natural rate of growth hypothesis is upheld. The McCombie test also provides support for the hypothesis given that import elasticity (ϵ_{my}) is very close to the estimated long-run import elasticity of demand, ($1.36 \cong 1.453$).

Table 1: ARDL and OLS estimation of León-Ledesma and Thirlwall (2002), \dot{y} = dependent variable

	ARDL		OLS	
	Equation (11)	Equation	Equation	Equation
Constant ($\alpha_i =$	4.489***	1.214	4.394***	1.967
$\Delta\%u$	-0.031744	-0.0528	-0.068	-0.045
Dum	—	6.993***	—	5.331***
<i>ECM</i>	-0.634***	-0.694***		
\dot{y}	4.26			
\dot{y}_N	4.489 Type equation here.		4.394	
<i>Slow growth \dot{y}_N</i>		1.214		1.967
<i>High growth \dot{y}_N</i>		8.207***		7.298***
\dot{x}	6.19			
ϵ_{my}	1.362956			
$\dot{y}_A = \dot{x} / \epsilon_{my}$	4.541			
McCombie	1.453			

Source: Own computation

Endogeneity between natural rate of growth \dot{y}_N and actual growth rate \dot{y} , was confirmed for the Nigerian economy. Specifically, the coefficients of dummy variable λ_3 , from both *ARDL* and *OLS* are highly elastic and statistically significant. This indicates that actual growth rate, increased by 6.993 and 5.331 percentage points, respectively, once \dot{y} is greater than \dot{y}_N . A combination of this outcome with the evidence demonstrating that the actual growth rate has a tendency to move towards BPCG rates in the long-run, the proposition by Setterfield (2006) and Dray and Thirlwall (2011) that the process of adjustment regarding BPCG rate and \dot{y}_N is determined by demand (demand-led) was further affirmed. In other words, the actual growth rate has the tendency to correct itself towards BPCG rates, and \dot{y}_N adjust endogenously to it such that, when BPCG is greater than \dot{y}_N the actual growth rate will rise above \dot{y}_N , consequently drawing the natural rate of growth (\dot{y}_N) towards BPCG. This implied that, it is the natural growth rate that adjusts to the balance of payment constrained growth rate, not the opposite. Similarly, since the addition of the dummy variable (λ_3) coefficient and the constant (α_3) is significantly higher (i.e., high growth value of 8.207) than the original constant (α_2) in Equation (11), it means that the rate of growth, to keep the unemployment rate constant has risen. It is evident that this is not an entirely cyclical effect since the cycle effect is accounted for by the variable u in the equation.

The values of the error correction mechanism (ECM) are negatively signed and statistically significant (−0.634 and −0.694), at 0.01 levels respectively. This also accentuates the position that aggregate demand causes economic growth in the long run, by influencing the behaviour of labour supply and productivity in the long run.

Table 2: Granger causality test results

<i>Causal relationship between BPCG (\dot{y}_A) and \dot{y}</i>		
	With u as control variable	Without u as control variable
Null hypothesis	Chi-sq.	
$\dot{y} \not\rightarrow \dot{x}$	0.0064	3.007
$\dot{x} \not\rightarrow \dot{y}$	2.763*	0.109*
<i>Causal relationship between BPCG(\dot{y}_A) and \dot{y}_N</i>		
	With u control variable	Without u as control variable
Null hypothesis	Chi-sq.	
$lfe \not\rightarrow \dot{x}$	15.161*	27.064***
$\dot{x} \not\rightarrow lfe$	18.757**	12.216
Test statistics on the null hypothesis $H_0: \delta_1 = \dots = \delta_i = 0$		
*/**/** Shows significance at 0.1, 0.05 and 0.01 levels respectively		
$\not\rightarrow$ Means does not granger-cause		

From Table 2, a look at the outcome of Granger causality concerning BPCG and actual growth reveals that the results are straightforward. We discovered significant evidence of one-way Granger causality running from export growth (\dot{x}) to actual domestic income growth (\dot{y}) when we include, and exclude the unemployment rate as a control variable at 0.10 significant level. In the same manner, our time series data does not accept the hypothesis that \dot{y} Granger causes \dot{x} with and without the control variable (u). Considering the causality between BPCG rate and natural rate of growth (\dot{y}_A and \dot{y}_N), we found a significant causality running from \dot{y}_N to BPCG (\dot{y}_A) at 0.01 level when the effect of unemployment rate in the model is ignored. However, when the unemployment rate is incorporated as a control variable, the outcome suggests that a bi-directional causality exists running from BPCG (\dot{y}_A) to \dot{y}_N at 0.05 level of significance and from \dot{y}_N to BPCG (\dot{y}_A) at 0.10 level.

This outcome of causality running from to BPCG (\dot{y}_A) to \dot{y}_N and \dot{x} to \dot{y} are largely in conformity with the proposition that it is the BPCG rate (\dot{y}_A) that places limits or boundary towards which the actual domestic income growth rate (\dot{y}) adapts in the long-run. In general, the Granger causality test upholds the demand-side hypothesis forwarded by Palley (2003) and Setterfield (2006) and several empirical evidences in this area (Dray & Thirlwall, 2011; Lanzafame, 2009, 2010, & 2014; Libânio, 2009; Vogel, 2009). Therefore, it is appropriate to assert that natural rate of growth adjusts to balance of payments constrained growth and, it is supply that responds to demand.

Although the present study only relates to one country, it would be beneficial to conduct a comparative analysis on the outcome of the study with those obtained by some previous studies, particularly the results supplied by León-Ledesma and Thirlwall (2002) in respect of 15 advanced economies as well as by Libânio (2009) in respect of 10 selected developing economies of Latin America. Given the results, it is undisputable that the natural rate of growth of the Nigerian economy is highly elastic and hence, responds highly to changes in the real domestic income growth rates compared to the

advanced economies in León-Ledesma (2002). Similarly, the natural rate of growth in Nigeria is close or identical to those obtained by Libânio (2009) for the developing countries. In line with Libânio (2009), we conclude that the likely explanations for this outcome might include: (i) the significance of informal markets in absorbing large part of the over 104.3 million economically active work force for Nigeria, which functions as a reserve of labour to be utilised in times of booms (National bureau of statistics, 2015). This perhaps accentuates the mobility and accessibility of labour in the Nigerian case, as does its developing countries counterparts in different periods of the business cycle. (ii) Another important reason is related with the influence of output growth on productivity, which is likely to be more considerable in less technologically advanced economies, as explained by Voldrom's Law (Kaldor, 1966). (iii) Given that Nigeria is a developing economy, there is a likelihood that it attained some levels of faster technology advancement in periods of boom relative to the advanced economies as a result of its attempts or quest to imitate and catch up with the advanced countries.

4.0 CONCLUSION AND POLICY IMPLICATION

In this paper, we explained Nigeria's economic growth path from demand side. We equally showed that natural rate is endogenously given. The econometric results show that the coefficients of the variables are largely in conformity with a priori expectation in terms of signs, magnitude and significance. The equilibrium growth rate obtained from the original BPCG model is close to the actual growth of the economy. Therefore, the study achieved its first objective by establishing that Nigeria is balance of payment constrained.

We also make use of ARDL model to investigate the hypothesis that BPCG rate must be close to or equal to natural rate of growth. Based on the empirical result, the estimate of natural rate of growth is found to be close to BPCG rate. Hence, there is a substantial confirmation that the natural rate of growth is endogenous to actual growth rate for the Nigerian economy. Since natural rate depends on of actual growth of domestic income or output, then natural rate indirectly depends on balance of payments constrained. This is because we had earlier found in the preceding section that actual growth is determined by BoP equilibrium.

We corroborate our findings with Granger causality test and give more support to the demand-led debate forwarded by Palley (2003) and Setterfield (2006) that it is natural growth (\hat{y}_N) that tends towards actual growth of domestic income and, thus, it is supply that adapts to demand before full-employment is reached.

The endogeneity of the natural rate of growth for the Nigerian economy suggests that cumulative causation could be instigated, such that as a result of increases in demand during high growth (boom) periods, the abundant labour force in the country could be absorbed and growth of productivity could be enhanced within the system.

In nutshell, mainstream growth theory contends that the natural rate of growth is exogenously determined. We have however shown in the Nigerian context that it would be erroneous to regard the natural rate of growth as exogenous. Because the expansion of the labour force and productivity is responsive to demand and output growth, it grows during boom times and lowers during recessions to maintain a fixed percentage level of unemployment. Testing for causal relationships between increases in labour productivity and export production also supports this.

One of the policy implications of the study is that efforts should be made towards improving incomes of households and also to reduce income inequality. Second, the need for sound government policy in order to raise the quality of manpower. This calls for massive higher expenditure on education; such that the labour force acquires the necessary skills for employment during boom periods. These will increase domestic demand for locally made goods and services. Third, the Nigerian policy makers must appreciate the role of world income in driving exports, especially, the manufacture of export-oriented goods. Fourth, the implication for growth theory and policy is that it is counterproductive from an economic standpoint to consider growth to be supply-constrained when demand may, to a certain extent, generate its own supply. Therefore, process of growth can only be effectively understood in terms of variations in the strength of demand and limitations on demand if factor inputs (including productivity increases) react endogenously. This is not to suggest that input growth is not crucial for output growth, but it does not follow that growth in inputs is causal in the neo-classical sense. Supply bottlenecks, which contribute to the nation's problems with inflation and the balance of payments, are also likely to be tied to demand restraints.

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APPENDIX A: EXPLANATION OF THE SERIES AND SOURCES OF DATA USED

m_t — Imports of goods and services (annual % growth) is based on constant local currency (1982 to

x_t — Yearly average growth of real exports—Exports of goods and services based on constant local currency (1982 to 2015 from the WorldBank data base)

\dot{y}_t —Annual percentage growth rate of GDP at market prices based on constant local currency. Aggregates are based on constant 2010 U.S. dollars (extracted on January, 28, 2017)

y_t^* — Annual growth rate of real foreign income (OECD countries) ((Extracted on March 11, 2017)

lfe — Log of GDP per person employed plus growth rate of labour force represents labour productivity in efficiency units (constant 2011 PPP \$) from 1991 to 2015 was retrieved from ILOSTAT on the 23rd August, 2017 at:www.ilo.org/ilostat,

$\Delta\%u$ — percentage changes in unemployment rate from 1991 to 2015 was extracted from ILOSTAT retrieved on 23rd August, 2017 at:www.ilo.org/ilostat. Data from 1982 to 1990 was obtained from NBS and National planning commission

B. 3: ARDL Cointegrating and Long Run Form estimation of import growth on aggregate domestic income growth 1982-2015

Model: ARDL (2, 2, 3)

Cointegrating Form

Variable	Coefficien	t	Std. Error	t-Statistic	Prob.
D(M(-1))	0.472699		0.200131	2.361947	0.0344
Domestic income, D(y)	1.651966		1.252681	1.318745	0.2100
D(Y(-1))	3.324716		1.102860	3.014632	0.0100
D(DUM_2007)	85.704107		21.191728	4.044225	0.0014
	-				
D(DUM_2007(-1))	14.147405		35.140444	-0.402596	0.6938
D(DUM_2007(-2))	54.628905		27.901856	1.957895	0.0721
CointEq(-1)	-1.947174		0.320858	-6.068654	0.0000

Cointeq = M - (1.3695*Y -15.1650*DUM_2007 + 2.9050)

Long Run Coefficients

Variable	Coefficien	t	Std. Error	t-Statistic	Prob.
Domestic income, y	1.369518		0.618669	2.213651	0.0453
	-				
DUM_2007	15.165014		5.069040	-2.991693	0.0104
C	2.904957		4.363379	0.665759	0.5172