Thirlwall Law: Validity of the Law in Nigeria

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March 2018

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ABSTRACT

The thirlwall law is also called the balance of payment constraints model. The basic model is anchored on the dynamic Harrod foreign trade multiplier, which is also known as Thirlwall law or the 45 degree rule, developed through the pioneer efforts of Thirlwall (1979). On the assumption of constant relative prices and absence of capital flows, the basic dynamic Harrod foreign trade multiplier postulates that the rate of growth of a country can be predicted by considering the ratio of the rate of growth of a country's exports volume to its income elasticity of demand for imports (that is growth rate of exports volume divided by income elasticity of demand for imports can be used as a basis for predicting a country's growth rate). Thereby this law concludes that the growth rate of a country is balance of payment constrained.

The broad objective of this study is to test for validity of Thirlwall law on the Nigeria economy that is to check if this law is applicable to the economy of Nigeria as a whole . The specific objectives of the study are:

- to check if there is long run balance of payment equilibrium.
- to examine if Nigeria economic growth is balance of payment constrained.
- To determine elasticity of import and export of Nigeria.

This law has been tested in several countries including developed and developing countries of the world but very few study has been done on it in Nigeria. Therefore, this study seeks to test if the Thirlwall law is relevant to Nigeria economy. This study also aims to fill the knowledge gap in that:

- is Nigeria balance of payment constrained ?
- is there a long run balance of payment equilibrium in Nigeria ?
- what is the elasticity of import and export of Nigeria ?

This study employs a recently developed autoregressive distributed lag (ARDL) cointegration procedure by Pesaran and Shin (1999) and Pesaran et al to estimate the import function. The Wald test statistic and graphical plotting of the actual growth rate and predicted growth rate is used as the test for thirlwall hypothesis. Augmented dickey fuller test is used to test for stationarity of the series and variables are differenced in a case of non-stationarity of the series.

CHAPTER 1

INTRODUCTION

Thirlwall law was propounded by Anthony Thirlwall in 1979 . The thirlwall law is also called the balance of payment constraints model. The basic model is anchored on the dynamic Harrod foreign trade multiplier, which is also known as Thirlwall law or the 45 degree rule, developed through the pioneer efforts of Thirlwall (1979). On the assumption of constant relative prices and absence of capital flows, the basic dynamic Harrod foreign trade multiplier postulates that the rate of growth of a country can be predicted by considering the ratio of the rate of growth of a country's exports volume to its income elasticity of demand for imports (that is growth rate of exports volume divided by income elasticity of demand for imports can be used as a basis for predicting a country's growth rate). Thirlwall's law establishes a relation between the long-run growth rate, the growth of exports and the long-run income elasticity of imports. Thirlwall's model emphasizes that the Dynamic Harrod foreign multiplier determines long-term economic growth. Thirlwall's model stresses that demand factors induce economic growth. In an open economy, the major constraint of the economy is balance of payment.

The balance of payment constraint model can be seen at the theoretical level, as a fundamental proposition that no country can grow faster than the rate consistent with balance-of-payments equilibrium on current account unless it can finance ever-growing deficits, which in general it cannot". (A. P Thirlwall). The BoP constrained growth model postulates that overall growth of an open economy is primarily constrained by the need to generate foreign exchange, and emphasises the role of demand as the driving force for domestic growth. According to Thirlwall (1979), the relationship between the growth rate of a country and its Balance of payment is the fundamental law for growth because the Balance of payment sets an upper limit to growth compatible with trade balance equilibrium. In contrast to the other components of aggregate demand, export is the only one whose expansion stimulates economic growth without leading into a deterioration of the Balance of payment. The role of export performance is then emphasised because no other component of aggregate demand provides the foreign exchange to pay for import requirements associated with the expansion of output (Hussain, 1999). The law (which is also referred to as balance of payment constrained growth model) states that if long run balance of payment equilibrium on current account is a requirement and real exchange rate stays relatively constant , then the long run economic growth of a country can be approximated by the ratio of percentage

change in export to income elasticity of demand for imports . Thirlwall argues that in the long run , no country can growth faster than rate of growth of its balance of payment if and only if that country can finance its ever growing deficit . The growth of a country is said to be balance-of-payments constrained if the growth rate consistent with a current account equilibrium (or a sustainable growth of overseas borrowing) is below the maximum growth of the economy determined by the maximum growth of supply-side factors. This law is otherwise known as "dynamic Harrod trade multiplier" . The balance of payment constrained growth model is based on the idea that the primary constraint to economic growth of a country is the balance of payment position of that country. The basic idea of this law is that export performance and import behaviour determine the rate of economic growth in a longer term. According to Thirlwall's Law, the economic growth of outward economies is constrained by the income elasticity of import and export . Therefore, according to Thirlwall, growth in domestic demand results in a constraint on the balance of payments of the country depending on increasing import. Consequently, balance of payments will have a restrictive effect on growth. It states further that no open economy can grow faster, in the long run, than the rate consistent with balance of payments equilibrium on current account unless it can finance ever-growing deficits. Further, the model emphasises the importance of exports performance in the growth process, as exports is the only component of aggregate demand that provides the foreign exchange needed to procure imports (raw materials and capital goods) that are required for output expansion and growth . In addition, the validity of the model is then verified by examining the closeness of the estimate growth rate to the actual growth rate (i.e. assessing the extent to which the estimated growth rate approximates the actual growth rate)

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CHAPTER 2

REVIEW OF EMPIRICAL STUDIES

Bairam(1988) estimates the model for a large sample of developed countries and concluded that the growth performance of a country is a function of the values of both its income elasticity of import and export .

Perraton(1990) estimates the model for 59 developing countries for the period between 1970 and 1984 and arrived at the conclusion that the model provides a good fit almost one half of the sampled countries. This study suggests that a country growth performance depends on income elasticity of imports and exports.

Hussain (1999) applied both the basic and extended forms of the model to a sample of both African and Asian countries (including Nigeria). He applied both the traditional import function and the adjustment to equilibrium specification and reports that Burundi, Egypt, Gabon, Kenya, Niger, Senegal and Zimbabwe are the countries where the stock adjustment specification yield best results. This implies that the traditional import equation gives the best fit for all other countries in the sampled countries, including Nigeria. He submits that the basic form of the model provides a good prediction of the actual growth rate of the sampled African countries. The same findings was revealed in the case of the sampled Asian countries. However, he reports inconclusive result for basic model solved for the full sample of both African and Asian countries pooled together. On the other hand, he submits that the extended model seems to be superior when predicting the actual growth rate of the full sampled countries (both African and Asian taking together). He infers from the tests that both the basic and the extended forms of the model can be considered as good predictors of the actual growth rates.

Fatukasi and Olagboyega(2008) final result shows that from the error correction model (ECM) ECM(-l) is significant and possess negative sign. This conforms to our earlier conclusion that there exist a long-run relationship between import demand and its independent variables. Thereby Nigeria economic growth rate is balance of payment constrained.

Gustavo and McCombie(2009) estimation results shows that balance of payment has been a significant constraint to Brazillian gross domestic product(GDP) growth rate for over half a century.

Ozturk et al(2010) study has explored elasticities of demand for imports for the South African economy using Autoregressive Distributed Lag (ARDL) Bounds Testing method and tested the Thirlwall's hypothesis of balance of payments constrained growth. The main findings of the paper can be summarized as follows: i) Import is cointegrated with relative price and income, ii) the estimated income elasticities of demand for imports and demand for exports are high, but the calculated export growth rate is very low, iii) the equilibrium growth rates coincide with actual growth rates, and iv) results from Wald test support the Thirlwall's hypothesis for South Africa.

Jafari et al(2011) estimated using the Autoregressive Distributed Lag (ARDL) Bounds Testing approach. Empirical results reveal long-run cointegration relationship between import, income and relative price. The estimated income elasticity of demand for imports and demand for exports are high. Also, the calculated export growth rate is high. However, the estimated findings reveal that the Thirlwall's law has been rejected in Iran. In other words, balance of payment doesn't hinder economic growth in this country.

Adewuyi et al empirical analyses reveal that the demand for import in Nigeria is price inelastic. This finding confirms that Nigeria is highly import dependent. It was also revealed that the demand for import is income elastic in Nigeria. This finding corroborates the earlier findings because it suggests that import demand is a necessity to Nigeria. With respect to supply of export, it was revealed that Nigeria's exports face unfavourable terms of trade in the world market. It was further shown that Nigeria's export supply 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. This study empirical result shows that the Nigerian economy has been unable to achieve the potential growth rates of most years in the study period. Therefore Balance of payments position constitutes a structural problem that can hinder attainment of potential growth in Nigeria.

CHAPTER 3

METHODOLOGY

3.1 DATA

All data to be used for this study will be sourced from worldbank database which would cover a time period of between 1980-2012.

3.2 ANALYTICAL TECHNIQUE

UNIT ROOT TESTS AND COINTEGRATION TEST

The development in time series modelling points to the need to exercise some caution by first examining the statistical properties of the series and incorporating these in the final model specification where necessary , so as to guarantee non-spurious regression (Granger and Newbold,1974).The first step in the analysis is to identify the order of integration of the variables . In this study the Augmented Dickey Fuller test will be used to check for the presence of unit root in the variables , in case variables do not follow AR(1) process . Variables will be further differenced until stationarity is attained in the variables.

Given that this is annual time-series data, we need to pre-test for stationarity and the existence of a cointegration vector before we move on to the model specification. We estimate the equation with relevant technique.

The unit root test is utilized in order to determine the order of integration for the variables under consideration. Another test employed for testing the order of integration is the Augmented Dickey-Fuller (ADF) test which involves the below equation and hypothesis also to test for stationarity

$H_0 : \delta = 0$ (non-stationary time series)

$H_1 : \delta \neq 0$ (stationary time series)

$$\Delta Y_t = \beta_1 + \beta_2 t + \delta Y_{t-1} + \alpha_i \Delta Y_{t-i} + e_t$$

After all this test are conducted to test for stationarity of the series to be considered , Co-integration test would also be carried out to test for long run relationship among the series

3.3 THE BASIC MODEL

A traditional version of Thirlwall's (1979) model can be presented in the following three equations :

$M = \alpha(P_f - P_d) + \pi_y$ ----------(1)

$X = \phi(P_d + P_f) + \sigma_z$ ----------(2)

$P_d + X = P_f + M$ ----------(3)

Equations (1) and (2) are export and import demand functions, respectively. Equation (3) is current account equilibrium. where X and M are the growth rates of real export and real import, Y and Z are the growth rates of domestic and world income, respectively.

$(P_f - P_d)$ is the growth rate of relative prices and α, ϕ, π, σ are elasticities. We have restrictions , α, $\phi < 0$ and , σ, $\pi > 0$. Substituting (1) and (2) into (3), we have the following equilibrium rate of growth equation:

$$\acute{y} = \frac{(1+ \phi + \alpha)(P_f - P_d) + \sigma_z}{\pi} \quad \text{----------(4)}$$

Substituting (2) into (4), we get following equation:

$$\ddot{y} = \frac{\alpha + (1+ \alpha)(P_f - P_d)}{\pi} \quad \text{----------(5)}$$

Supposing that the Marshall-Lerner condition(condition that exchange rate devaluation or depreciation will only cause balance of trade improvement if the absolute sum of the long-run export and import demand elasticities equal to or greater than one) holds or that relative prices do not change in the long-run, then equation (4) and (5) become:

$$\ddot{y} = \frac{X}{\pi} \quad \text{----------(6)}$$

$\ddot{y}$ .....Growth rate of gross domestic product.

Equations (5) and (6) represent the basic form of Thirlwall's hypothesis.

3.3.1 MODEL SPECIFICATION

Ozturk and Acaravci(2010) estimated using evidence from empirical literature with the following equation which will be adopted in this study:

$\ln(M_t) = a + \alpha\ln(P_t) + \pi\ln(Y_t) + e_t$ ----------(7)

3.4 ESTIMATION PROCEDURE

This study employs a recently developed autoregressive distributed lag (ARDL) cointegration procedure by Pesaran and Shin (1999) and Pesaran et al. (2001). They argue that the ARDL cointegration procedure has several advantages over the commonly practiced cointegration procedures like Engle-Granger (1987) and Johansen (1988), and Johansen and Juselius (1990). First, the ARDL procedure can be applied whether the regressors are I(1) and/or I(0). This means that the ARDL procedure has advantage of avoiding the classification of variables into I(1) or I(0) and no need for unit root pre-testing. Second, while the Johansen cointegration techniques require large data samples for validity, the ARDL procedure is the more statistically significant approach to determine the cointegration relation in small samples. Third, the ARDL procedure allows that the variables may have different optimal lags, while it is impossible with convential cointegration procedures. Finally, the ARDL procedure employs a single reduced form equation, while the convential cointegration procedures estimate the long-run relationships within a context of system equations. Equations (7) may be presented at the following ARDL form:

$d\ln(M_t) = a + d\ln(M_{t-1}) + d\ln(P_t) + d\ln Y_t + \ln(P_{t-1}) + \ln(Y_{t-1})$

Long-run model: If there is a cointegration between the variables, the following long-run model (equation 8) is estimated:

$\ln(M_t) = a + \alpha\ln(P_t) + \pi\ln Y_t + \mu_t$ ----------(8)

Short-run model: The short-run dynamics can be derived by the following model (equation 9):

$d\ln(M_t) = a + \beta d\ln(P_t) + \pi d\ln Y_t + pECM_{t-1} + \varepsilon_{t-1}$ -----(9)

M_t ------volume/value of import at time t.

Y_t ------Gross Domestic Product.

P_t ------Relative price for import(P_M/P_X) or terms of trade.

P_M -----value of import.

P_X -----value of export.

β, α, π -elasticities

$\alpha < 0$, $\pi > 0$, $p < 1$

CHAPTER 4

4.0 ESTIMATION AND INTERPRETATION OF RESULTS

4.1 PRE-ESTIMATION ANALYSIS

4.1.1 UNIT ROOT TEST

S/N	VARIABLE	BEFORE DIFFERENCING	AFTER DIFFERENCING
1	Log(GDP)	Not stationary	Stationary
2	Log(IMP)	Not stationary	Stationary
3	Log(EXP)	Not stationary	Stationary
4	Log(TOT)	Not stationary	Stationary

S/N	VARIABLES	CONCLUSION
1	GDP	Stationary after taking logarithm and first difference
2	IMP	Stationary after taking logarithm and first difference
3	EXP	Stationary after taking logarithm and first difference
4	TOT	Stationary after taking logarithm and first difference

4.1.2 ESTIMATION

IMP_t ---------- total import expenditure of Nigeria at time, t.

TOT_t ----------Terms of trade of Nigeria in percentage terms at time, t.

GDP_t ----------Gross domestic product of Nigeria at time, t.

Dependent Variable: DLOG(IMP)
Method: Least Squares
TABLE1
Sample (adjusted): 1982 2012
Included observations: 31 after adjustments
DLOG(IMP) = C(1) + C(2) * DLOG(IMP(-1)) + C(3) * DLOG(TOT) + C(4) * DLOG(GDP)

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	-0.024496	0.062206	-0.393787	0.6968
C(2)	0.092282	0.161619	0.570988	0.5727
C(3)	-0.292519	0.298468	-0.980070	0.3358
C(4)	0.962308	0.284365	3.384065	0.0022

R-squared	0.347877	Mean dependent var	0.042710
Adjusted R-squared	0.275419	S.D. dependent var	0.388164
S.E. of regression	0.330414	Akaike info criterion	0.742975
Sum squared resid	2.947687	Schwarz criterion	0.928006
Log likelihood	-7.516115	Hannan-Quinn criter.	0.803291
F-statistic	4.801083	Durbin-Watson stat	2.348010
Prob(F-statistic)	0.008306		

The result above in table 1 was estimated using Autoregressive distributed lag model based on empirical evidence in that it is more appropriate than the normally used cointegration techniques such as Engle-granger(1987) and Johansen and Juselius (1990) cointegrating regression and it also does not require pre-testing for unit root or stationarity of the series.

In table 1, Nigeria import is seen to be price inelastic and it also follows the appriori expectation of a negative value but coefficient of terms of trade is not statistically significant that is, it is not statistically different from zero.

Nigeria import is also income inelastic and statistically significant because the probability value(0.0022) is less than 5% . That is if there is a 1% increase(decrease) in Nigeria gross domestic product there would be a 96.2% significant increase(decrease) in Nigeria total imports.

Nigeria total imports at time, t-1 is also not statistically influencing Nigeria total import because probability value for IMP_{t-1}(0.5727) is greater than 5%.

Johansen co-integration test also confirms there is co-integration between Nigeria import, gross domestic product and terms of trade after differencing this variable once at because probability values for import, gross domestic product and terms of trade is less than 5%. Thereby we accept the alternative hypothesis that there is long run equilibrium.

Durbin watson statistic also confirms that there is absence of autocorrelation because the durbin watson stat value(2.3480) is less than 2.5. Probability value of the F-statistic also indicates that the above equation is statistically significant. R^2 value also indicates that 34.8% of variation in Nigeria import according to the model is explained by terms of trade, previous value of Nigeria imports and gross domestic product.

Dependent Variable: DLOG(IMP)
Method: Least Squares
TABLE 2
Sample (adjusted): 1983 2012
Included observations: 30 after adjustments
DLOG(IMP) = C(1) + C(2) * DLOG(IMP(-1)) + C(3) * DLOG(TOT) + C(4) * DLOG(GDP) + C(5)*ECM1(-1)

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	-0.037743	0.057743	-0.653647	0.5193
C(2)	0.632269	0.242188	2.610648	0.0151
C(3)	-0.580066	0.287641	-2.016630	0.0546
C(4)	1.108355	0.266881	4.152991	0.0003
C(5)	-0.870274	0.322873	-2.695404	0.0124

R-squared	0.486305	Mean dependent var	0.058885
Adjusted R-squared	0.404114	S.D. dependent var	0.384027
S.E. of regression	0.296445	Akaike info criterion	0.557101
Sum squared resid	2.196989	Schwarz criterion	0.790633
Log likelihood	-3.356509	Hannan-Quinn criter.	0.631810
F-statistic	5.916754	Durbin-Watson stat	1.564821
Prob(F-statistic)	0.001713		

After confirming the evidence of long run equilibrium in all the variables in the import function. We thereby estimate the error correction model which is shown in table 2 above.

In the table above, IMP_{t-1} , GDP_t and ECM coefficients are all statistically significant that is they are all statistically different from zero but TOT(terms of trade) coefficient is not statistically different from zero that is it is not statistically significant.

This error correction model also conforms with the three basic rule of error correction model coefficient:

(1) ECM coefficient value(-0.87024) above is statistically significant at 5%($0.0124 < 0.05$).

(2) ECM coefficient value(-0.87024) is negative.

(3) ECM coefficient absolute value is less than one($0.87024 < 1$)

Ascertaining that the coefficient of the error correction model(ECM) meets the three condition, the coefficient of the error correction model indicates that about 87.024% of disequilibrium was corrected within one year because annual data is been used in this study. That is the rate or speed of adjustment from short-run disequilibrium to long run equilibrium is 87.024%.

TEST OF THIRLWALL'S HYPOTHESIS.

USING WALD TEST STATISTIC

GDPP = 0.096645 + 0.183625(GDPA)

(0.9363) (0.0000)

GDPP----------predicted economic growth rate.

GDPA----------actual gross domestic product growth rate.

$R^2 = 0.440413$, Adj $R^2 = 0.421117$, Wald(2) = 0.007309(0.9964)

Using wald test statistic by regressing predicted growth rates on the actual growth rates and testing for the structural differences between this two, it shows that Thirlwall law holds because the probability value of wald statistic at two degrees of freedom indicates that constant term is not significantly different from zero and the slope coefficient is unity. Otherwise the probability value of chi-square of wald statistic is greater than 5% which indicates that we would accept alternative hypothesis that wald statistics holds.

CHAPTER 5

CONCLUSION AND RECOMMENDATIONS

This study has explored elasticities of demand for imports for the Nigeria economy using Autoregressive Distributed Lag (ARDL) Bounds Testing method and tested the Thirlwall's hypothesis of balance of payments constrained growth. The main findings of this study can be summarized as follows:

(1) Nigeria total import is cointegrated with terms of trade proxy to relative price and gross domestic product proxy to Nigeria income. Nigeria total import is also cointegrated with Nigeria export ,thereby there is long run relationship between import and export which confirms that there is long run balance of payment equilibrium.

(2) The estimated income elasticity of demand for import is statistically significant and high in table 1 and very high in the error correction model.

(3) Nigeria Import is income inelastic and statistically significant in table 1, and income elastic and statistically significant in the error correction model which is table 2.

(4) Predicted growth rates coincide with the actual growth rates according to the regression that was run to estimate the wald test statistic.

(5) Result from wald statistics indicates that thirlwall hypothesis holds in Nigeria.

(6) Conclusively, Nigeria economic growth rate is balance of payment constrained.

Based on the following Nigeria is recommended to increase her export which would help increase her export growth rate and reduce her income elasticity of import ,which would in turn help increase Nigeria economic growth rate without deteriorating her balance of payment.

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