

*Full Length Research Paper*

# **An application of Thirlwall's law to the South African economy: Evidence from ARDL bounds testing approach**

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Accepted 16 November 2009

**This paper applies Thirlwall's basic balance-of-payments constraint growth model to South Africa economic growth for the period of 1984:1 - 2006:1 by using Autoregressive Distributed Lag (ARDL) Bounds Testing approach. The empirical results reveal that import is cointegrated with relative price and income, and the equilibrium growth rates coincide with actual growth rates. Our empirical results also support the Thirlwall's hypothesis which states that balance of payments position of the South African economy is the main constraint on its economic growth. As a policy implication, a successful economic growth policy will permit South Africa to have a rapid growth in demand and supply without suffering deterioration in its balance of payments.**

**Key words:** Growth, balance of payments, Thirlwall's Law, bounds testing approach, South Africa.

## **INTRODUCTION**

The balance of payments constrained growth model, originally due to Thirlwall (1979), has generated considerable interest among Post Keynesians. Post-Keynesian authors have emphasized in the last decades that the balance of payments constitutes the main constraint to growth. In this respect, Post-Keynesians have refuted neoclassical views that assume a supply-constrained economy and have extended Keynes's principle of effective demand into the long run. Hence, growth is seen as being demand-led (Razmi, 2005).

The balance of payment constrained growth model states that the rate of growth in an individual country is restrained by the balance of payment as the economy cannot grow faster than what is consistent with the balance of payment equilibrium, or at least consistent with a sustainable deficit in the balance of payments. The theoretical basis for this relationship is that if a country's

growth rate results in a rate of import growth exceeding that of exports, the resulting deterioration in the balance of payments, impedes the process of economic growth and consequently reduces economic growth. The interpretation of this result is that balance of payments deficits restrict the rate of growth to a level consistent with a sustainable position in the external sector. The resulting rate of economic growth is called the balance of payments equilibrium growth rate to distinguish it from the actual rate of economic growth. The fact that the two growth rates differ provides an explanation of why growth rates differ between countries (Thirlwall, 1979). In this case overall economic growth can be accelerated by manipulating Harrod's foreign trade multiplier.

Thirlwall's model emphasizes that the Dynamic Harrod foreign multiplier determines long-term economic growth. While the neoclassical approach links variations in growth rates among countries to differences in the growth of factor supplies and productivity, Thirlwall's model stresses that demand factors induce economic growth. In an open economy, the dominant constraint upon demand is the balance of payment (BOP). The basic idea of Thirlwall's approach highlights how BOP affects the growth

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performance of countries (Jayme JR, 2003:67). He introduced a simple analytical model to show that if a country's external indebtedness cannot expand indefinitely then its long-run rate of economic growth will be restricted by its foreign trade performance, more precisely by the size of the income elasticity of its imports relative to the pace of expansion of its exports. In its simplest expression the model is referred to as Thirlwall's law. His analytical contribution here referred to as the balance of payments constrained growth (BPCG) model was later extended to allow for the influence of foreign capital flows on economic growth (Thirlwall and Hussain, 1982). In recent years it has been further revised to ensure that the economy's long-run growth is consistent with a sustainable path of foreign indebtedness (McCombie and Thirlwall, 1994; Moreno-Brid, 2003).

Several researchers have attempted to test Thirlwall's law empirically, see McGregor and Swales (1991), Bairam (1988), Andersen (1993), Atesoglu (1993), McCombie (1997), Moreno-Brid and Perez (1999), Christopoulos and Tsionas (2003) and Perraton (2003). Single country studies which are supportive for Thirlwall's law are for Mexico (Moreno-Brid, 1999; Lopez and Cruz, 2000; Pacheco-Lopez and Thirlwall, 2005); for Brazil (Ferreira and Canuto, 2003); and for India (Razmi, 2005), among others. With a few exceptions (ex. McGregor and Swales, 1991; Acaravci and Ozturk, 2009) all these studies do not reject the hypothesis that a country's economic growth is not subject to the long-run balance of payments constraint.

Nowadays, balance of payment deficit become very important issue for developing countries. The purpose of this paper is to analyze the prospects for economic growth in South Africa on the basis of the balance of payment constrained growth theory for the period of 1984:1 - 2006:1. This study has explored elasticities of demand for imports for South Africa using Autoregressive Distributed Lag (ARDL) Bounds Testing method and tested the Thirlwall's hypothesis of balance of payments constrained growth.

The remainder of the paper is organized as follows: the model, data and methodology are presented in Section 2; the empirical results are discussed in Section 3 and last section summarizes the findings of the paper.

## MODEL SPECIFICATION, DATA AND METHODOLOGY

### Model and data

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

$$m = \alpha(p_f - p_d) + \pi y \quad (1)$$

$$x = \phi(p_d - p_f) + \sigma z \quad (2)$$

$$p_d + x = p_f + m \quad (3)$$

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.  $(p_d - p_f)$  is the growth rate of relative prices and  $\alpha, \pi, \phi, \sigma$  are elasticities. We have restrictions  $\alpha, \phi < 0$  and  $\pi, \sigma > 0$ . Substituting (1) and (2) into (3), we have the following equilibrium rate of growth equation:

$$y^* = \frac{(1 + \phi + \alpha) \cdot (p_d - p_f) + \sigma z}{\pi} \quad (4)$$

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

$$y^{**} = \frac{x + (1 + \alpha) \cdot (p_d - p_f)}{\pi} \quad (5)$$

Supposing that the Marshall-Lerner condition holds or that relative prices do not change in the long-run, then equation (4) and (5) become:

$$y^{**} = \frac{x}{\pi} \quad (6)$$

Equations (5) and (6) represent the basic form of Thirlwall's hypothesis. Following the empirical literature, we start from an import demand equations in level.

$$\ln M_t = a + \alpha \ln(P_t) + \pi \ln(Y_t) + \varepsilon_t \quad (7)$$

Where  $M_t$  and  $Y_t$  are the volumes of import and GDP (2000=100), respectively;  $P$  is the relative prices for import as  $(P_M / P_X)$  respectively. Here,  $P_M$  is import unit value and  $P_X$  is export unit value.  $\varepsilon_t$  is error term.  $\alpha$  and  $\pi$  are the long-run elasticities. Estimates of  $\alpha$  is expected to be negative and  $\pi$  is expected to be positive.

The quarterly time series data for South Africa are taken from the IMF's International Financial Statistics (IFS) database for 1984:1 - 2006:1 period. All variables are employed with their natural logarithms form.

### Methodology

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 conventional cointegration procedures. Finally, the ARDL procedure employs a single reduced form equation, while the conventional cointegration procedures estimate the long-run relationships within a context of system equations. Equations (7) may be presented at the following ARDL form:

$$\Delta \ln M_t = a + \sum_{i=1}^{n_1} \theta_i \Delta \ln(M_{t-i}) + \sum_{i=0}^{n_2} \alpha_i \Delta \ln(P_{t-i}) + \sum_{i=0}^{n_3} \pi_i \Delta \ln(Y_{t-i}) + \delta_1 \ln M_{t-1} + \delta_2 \ln P_{t-1} + \delta_3 \ln Y_{t-1} + \mu_t \quad (8)$$

Where  $\mu_t$  and  $\Delta$  are the white noise term and the first difference operator, respectively. The ARDL method estimates  $(p + 1)^k$  number of regressions in order to obtain the optimal lag length for each variable, where  $p$  is the maximum number of lags to be used and  $k$  is the number of variables in the equation. An appropriate lag selection based on a criterion such as Akaike Information Criterion (AIC) and Schwarz Bayesian Criterion (SBC). The null of no cointegration,  $H_0 : \delta_1 = \delta_2 = \delta_3 = 0$ , is tested against the alternative of  $H_1 : \delta_1 \neq 0, \delta_2 \neq 0, \delta_3 \neq 0$ . Two sets of critical values are generated, the upper bound critical values refers to the I(1) series and the lower bound critical values to the I(0) series. If the calculated  $F$ -statistics lies above the upper level of the band, the null is rejected, indicating cointegration. If the calculated  $F$ -statistics is below the upper critical value, we cannot reject the null hypothesis of no cointegration. Finally, if it lies between the bounds, a conclusive inference cannot be made without knowing the order of integration of the underlying regressors. The upper limit of the critical values for the  $F$ -test (all I(1) variables) can be obtained from Pesaran *et al.* (2001). Recently, the set of critical values for the limited data (30 observations) to 80 observations) were developed originally by Narayan (2005). If there is a cointegration between the variables, the following long-run model (equation 9) is estimated:

$$\ln M_t = a_1 + \sum_{i=1}^{n_1} \theta_{1i} (\ln M)_{t-i} + \sum_{i=0}^{n_2} \alpha_{1i} (\ln P)_{t-i} + \sum_{i=0}^{n_3} \pi_{1i} (\ln Y)_{t-i} + \mu_t \quad (9)$$

The short-run dynamics can be derived by the following model (equation 10):

$$\Delta \ln M_t = c_2 + \sum_{i=1}^{n_1} \theta_i \Delta (\ln M)_{t-i} + \sum_{i=0}^{n_2} \alpha_i \Delta (\ln P)_{t-i} + \sum_{i=0}^{n_3} \pi_i \Delta (\ln Y)_{t-i} + \psi ECM_{t-1} + \xi_t \quad (10)$$

Where  $\psi$  is the coefficient of error correction model (ECM). ECM is defined as:

$$ECM_t = \ln M_t - c_1 + \sum_{i=1}^{n_1} \beta_i \ln(M_{t-i}) - \sum_{i=0}^{n_2} \alpha_i (\ln P)_{t-i} - \sum_{i=0}^{n_3} \pi_i (\ln Y)_{t-i} \quad (11)$$

The coefficient of ECM,  $\psi$ , shows how quickly variables converge to equilibrium and it should have a statistically significant coefficient with a negative sign.

## EMPIRICAL RESULTS

### Estimated long-run coefficients

According to Pesaran and Shin (1999), the SBC is generally used in preference to other criteria because it tends to define more parsimonious specifications. The

ARDL (2,0,2) models selected here are based on SBC for the long-run import demand equation (Table 1). After selecting the ARDL model, we estimated the long-run coefficients with their asymptotic standard errors and the ECM term. The estimated model has passed several diagnostic tests that indicate no evidence of serial correlation, heteroscedasticity and any specification errors for models. Besides this,  $F$ -test results indicate that there is evidence of a long-run relationship between the variables at 5% significance level. The estimated ECM coefficient is negative and statistically significant at 1% significance level. Any deviation from the long-run equilibrium of import demand is corrected about 27% for each period and takes about 4 periods. Finally, the ADF unit root test for the residuals revealed that they are stationary.

The relative price elasticity of demand for import is negative (-0.77), the income elasticity of demand for import is positive (1.80), and ECM is negative (-0.27). These coefficients are statistically significant at 1% confidence level. ECM term for long-run import demand equation is also negative (-0.27) and statistically significant at 1% confidence level. ECM indicates that any deviation from the long-run equilibrium of import demand is corrected about 27% for each period and takes about 4 periods to return the long-run equilibrium level.

### Tests of Thirlwall's hypothesis

Table 2 presents the equilibrium growth rate, actual growth rates and difference between the two growth rates. The equilibrium growth rate ( $y^*$ ) calculated from equation (7) for the test of Thirlwall's hypothesis. If equilibrium growth rates coincide with actual growth rates or difference between two growth rates,  $(y^* - y)$  close to zero, Thirlwall's law holds. The other way to explore the validity of Thirlwall's law is to regress equilibrium growth rates as a function of the actual growth rates. If Wald test cannot reject the joint hypothesis that intercept coefficient is zero and the slope coefficient is unity, the Thirlwall's law holds. McCombie and Thirlwall (1994, ch.5) suggest that it is more appropriate to regress predicted growth rates as a function of actual growth rates. Because, the predicted growth rate is derived from estimates of the parameters, it is subject to errors.

The results derived from Table 2 and Table 3 support the Thirlwall's law for the South African economy. The estimated income elasticities of demand for imports and demand for exports are high, but the calculated export growth rate is very low. The differences between two growth rates are close to zero (-0.0006). On the other hand, equilibrium growth rates regressed against the actual growth rates and the Wald test cannot reject the joint hypothesis that intercept coefficient is zero and the slope coefficient is unity. All results support that the balance of payments position of the South African economy is the main constraint on its economic growth.

**Table 1.** Estimated long-run coefficients of the import demand equation.

Model: ARDL (2,0,2)			
Regressor	Coefficient	Standard Error	T-Ratio [Prob]
$\ln P$	-0.7727	0.1630	-4.7403 [0.000]
$\ln Y$	1.7951	0.1927	9.3137 [0.000]
$a$	-3.7176	0.8608	-4.3189 [0.000]
$ECM$	-0.2728	0.0692	-3.9430 [0.000]
R-Squared	= 0.3771	LM = 6.6743 [0.154]	ADF = -9.4379 (-4.9152)
R-Bar-Squared	= 0.3298	RESET = 0.4217 [0.516]	F-test = 4.1488

Notes:

LM is the Lagrange multiplier test for serial correlation. It has  $\chi^2$  a distribution with four degrees of freedom.

RESET is Ramsey's specification test. It has a  $\chi^2$  distribution with only one degree of freedom.

P-values are in [ ].

ADF is unit root test statistics for residuals and its %5 critical value is in ( ).

F-test is the ARDL cointegration test. The upper limits of the critical values based on Narayan (2005) are 4.053 and 3.453 for %5 and %10 significance levels, respectively.

**Table 2.** Test of Thirlwall's hypothesis.

$\sigma$	$\pi$	$y$	$x$	$x / \pi$	$y^{**} - y$
1.5563	1.7951	0.0054	0.0087	0.0048	-0.0006
	Income elasticity of demand for exports				
$\sigma$	Income elasticity of demand for imports				
$\pi$	Actual economic growth rate				
$y$	Export volume growth				
$x$	Predicted economic growth rate				
$x / \pi = y^{**}$	Differences between predicted and actual economic growth rates				
$y^{**} - y$	All growth rates computed as the first differences of logarithm of series.				

**Table 3.** Regressions of equilibrium growth rates.

$y^* = -0.0007 + 1.0185 y$	
(0.8956) (0.00853)	
$R^2 = 0.034$	Adjusted $R^2 = 0.022$
SEE = 0.040	Wald (2) = 0.0206 (0.9897)

Notes: p-values are in ( ).

Wald is joint test that constant term is zero and the slope coefficient is unity. It has a  $\chi^2$  distribution with two degrees of freedom.

## Conclusion

This 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. As a policy implication, a successful economic growth policy, which reduces income elasticity of imports and promotes export, will permit South Africa to have a rapid growth in demand and supply without suffering deterioration in its balance of payments.

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