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Foreign Trade and Economic Growth: Evidence of Thirlwall's Law in Iran

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Abstract: Thirlwall's law establishes a relation between the long-run growth rate, the growth of exports and the long-run income elasticity of imports. This paper applies Thirlwall's basic balance-of-payments constraint growth model to Iranian economic growth for the period of 1971-2007 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. However, our 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. The reason may be due to the fact that Iran is a member of OPEC and its oil export plays a significance role in the country's foreign trade.

Keywords: *Balance of payments, Thirlwall's Law, Bounds testing approach, Growth, Iran*

1. Introduction

Thirlwall's (1979) balance of payments constrained growth model, which is also known as Thirlwall's Law, demonstrates that neither trade nor financial liberalization and export promotion strategy necessarily lead to better growth performance. Rather, one should consider not only exports of goods and services, but also the income elasticity of imports. The balance of payments constrained growth model describes that the rate of growth in any country is constrained by its balance of payment as the economic growth cannot be higher than the consistent level of the balance of payment equilibrium, or, in other words, 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 (Bairam, 1988).

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 performance of countries (Jayme, 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).

Earlier researchers were interested in the application of balance of payments constraint growth model to developed countries (Atesoglu, 1993, Heike, 1997). However, in the last few years, the research attention has been diverted to examine the validity of this model in developing countries, especially in Latin America and in Asian countries (see e.g. McCombie, 1997; Moreno-Brid, 1998, 1999; Elliot and Rhodd, 1999; Ferrenira and Canuto, 2001). Yongbok (2006) empirically tested the validity of Thirlwall's law in case of China during the reforms period 1979 to 2002. The study estimated the income elasticity of imports

demand using ARDL-VEC model and the bounds test. The results of the study showed that Chinese economy has grown in accordance with the predictions of Thirlwall's law and that the growth of GDP and exports are cointegrated over the sample period. Similarly, Hansen and Virmantas (2004) examine the balance of payments constrained growth model in the three Baltic countries. The study found that based on the estimation of income elasticities of imports and assumptions about export growth, GDP growth rates are consistent with the balance of payment equilibrium. More recently, Alvarez et al. (2008) investigate whether the balance of payments has been important determinant of the Cuban long run economic growth over the period 1960 to 2004. The study employed cointegration technique and the results revealed that economic growth, exports of goods and services, and terms of trade are driven by a common stochastic trend. The study concludes that economic growth is constrained by the country's own external demand position. To be brief, different studies have tested the validity of the balance of constrained growth model in different countries using different econometric techniques for different time periods and most of them have find supports in favor of this model.

Some empirical studies [(such as Atesoglu (1993), Mc Combie and Thirlwall (1994)] show that this model is an efficient framework for analyzing economic growth in accordance to a country's international payments positions. Since 1979, there have been a mass of studies exploiting the model in its different forms to individual countries and groups of countries. These studies are presented in the table 1.

Table 1: Thirlwall's law in different countries

Author(s)	Year	Region or country
Beko	2003	Slovenia
Ramzi	2005	India
Bertola, Higachi and Porcile	2002	
Ferreira and Canuto	2003	
Jayme	2003	Brazil
Carvalho, Lima and Santos	2008	
Carvalho and Lima	2009	
Britto and McCombie	2009	
Garcimartin, Rivas and Sarralde	2008	Ireland
Alvarez-Ude and Gomez	2008	Argentina
Jeon	2009	China
Acaravci and Ozturk	2009	Turkey
Felipe, McCombie and Naqvi	2010	Pakistan
Antunes and Soukiazis	2011	Portugal
Holland, Vieira and Canuto	2004	Latin America
Lopez and Cruz	2004	Latin America
Perraton	2003	Developing Countries
Pacheco and Thirlwall	2005	Latin America
Kvedaras	2010	twenty-two OECD countries
Garciamartin, Rivas and Martinez	2011	Portugal and Spain
Gouvea and Lima	2011	Asian and four Latin American

One interesting feature of the studies is that through time the econometric methods of estimation have become much more sophisticated; the tests of the model more difficult, and various implicit assumptions embodied in the CES export and import demand functions have been relaxed e.g. the homogeneity and common elasticity of substitution assumptions (Ramzi, 2005). But the most notable shift of all has been towards the use of cointegration techniques to establish long-run relationships between levels of variables, and the use of the Alonso (1999) technique of taking a long series of growth rates consistent with balance of payments equilibrium and testing if this series and actual growth rates are correlated (as discussed earlier). Britto and McCombie (2009) adopt a similar approach for Brazil using Johansen's (1988) cointegration procedure which jointly models several endogenous variables in a VAR framework. First they carry out unit root tests on all the variables; then they find the lag order of the VAR system and the rank order to determine the number of cointegrating vectors, and finally estimate the vector and error correction terms. Having estimated the Long-run elasticity of demand for imports, and the hypothetical value of to make actual growth equal to the balance of payments constrained growth rate, the Alonso test shows the existence of a significant relationship between actual growth and predicted growth with a constant term close to zero and a slope coefficient close to unity.

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 Iran on the basis of the balance of payment constrained growth theory for the period of 1951 - 2007. This study has explored elasticities of demand for imports for Iran using Autoregressive Distributed Lag (ARDL) Bounds Testing method and tested the Thirlwall's hypothesis of balance of payments constrained growth (Thirlwall, 2011). The rest of the paper is organized as follows; the second part pins down the Thirlwall's model in its simple version for developing countries. The third part explains the data and the empirical procedure for the study. The fourth part describes the estimation results. Finally, we make some conclusions and comments about the economic policies implications of the model for the economy of Iran.

2. Thirlwall's Law

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 dominant constraint upon demand is BOP.

The basic idea of Thirlwall's approach highlights how BOP affects the growth performance of countries. As a matter of fact, mainstream versions of economic growth generally neglect not only the demand side of the economy, but also external constraints. Even new growth theories are supply-oriented and, in general, are closed models. Keynesian models along Kaldorian lines, such as Thirlwall's BOP- constrained growth model, link trade to growth because exports pull demand. Indeed, trade represents a crucial constraint to economic growth when there are BOP problems. Static trade models suggest that movements toward openness can temporarily increase the rate of growth due to short-run gains from the reallocation of resources, which would imply a positive relationship between changes in openness and GDP growth. The new growth literature also identifies a number of avenues through which openness might affect long-run growth. Some of these channels are technological change and technological gaps. The idea behind these new growth models is that countries, which are more backward, actually provide more opportunities to absorb new ideas, and will converge on international norms more quickly, allowing them to benefit from technological change. Nevertheless, even open new endogenous growth models, such as that of Grossman and Helpman (1990, 1991); focus only on trade and growth and neglect BOP constraints. A one-gap model in the Keynesian and structuralist traditions reveals the demand and external constraints in an open economy.

Indeed, Thirlwall's approach stresses that neither trade and financial liberalization nor strategies of export promotion necessarily lead to better growth performance. The Keynesian and structuralists traditions take into consideration both current account and capital account equilibrium. Therefore, one should consider not only exports of goods and services, but also — and very importantly — the income elasticity of demand for imports. Export performance and income elasticity of demand for imports imply that trade and capital account liberalization do not necessarily lead to economic growth through technological gains or through an increase in total factor productivity (TFP). Furthermore, export led growth does not necessarily lead to better economic performance.

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

$$x = \varphi (p_d - p_f) + \rho z \quad (1)$$

$$m = \alpha (p_d - p_f) + \pi y \quad (2)$$

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

Where ρ , π , and $\alpha > 0$ and $\varphi < 0$. Income elasticity of exports and imports are ρ and π respectively, price elasticity of exports and imports are, respectively, φ and α . x is the growth rate of real exports, m is the growth rate of real imports, z is the growth rate of the-rest-of-the-world real income, y is the growth rate of real domestic income, $(P_d - P_f)$ is the rate of growth of relative prices (rate of growth of domestic prices less the rate of growth of prices in the rest of the world). Equations (1) and (2) are, respectively, export and import demand functions, whereas equation (3) is current account equilibrium. Solving equation (3) for the growth of real income:

$$y^* = [(1 + \varphi - \alpha) / \pi] * (P_d - P_f) + (\rho / \pi) z \quad (4)$$

Substituting for the growth rate of the world real income, z , from equation (1) yields:

$$y^* = [(1/\pi) (1 - \alpha)]^* (Pd-Pf) + (1/\pi) x \quad (5)$$

Supposing that the Marshall-Lerner condition holds or that relative prices are constant if measured in common currency, then $(Pd - pf) = 0$, (5) becomes:

$$y^* = (1/\pi) x \quad (6)$$

Equation (6) is BOP-constrained growth, a version of the Harrod foreign trade multiplier. This equation, or Thirlwall's law, states that the higher the income elasticity of demand for imports (π) the lower the BOP equilibrium growth rate.

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

Where M_t and Y_t are the volumes of import and GDP (1997=100), respectively; P is the relative prices for import as (PM/PX) respectively. Here, PM is import unit and PX is export unit value. ε_t is error term and π are the long run elasticities. Estimation of α is expected to be negative and π is expected to be positive. The time series data for Iran are taken from the International Finance Statistics (IFS) and Central Bank of Iran data base for 1971 – 2007 period.

3. Methodology and Data

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:

$$\Delta \ln M_t = a + \sum_{i=1}^n \theta_i \Delta \ln M_{t-i} + \sum_{i=0}^n \alpha_i \Delta \ln PM_{t-i} + \sum_{i=0}^n \pi_i \Delta \ln YD_{t-i} + \sigma_1 \ln M_{t-1} + \sigma_2 \ln PM_{t-1} + \sigma_3 \ln YD_{t-1} + \mu_t \quad (8)$$

Where μ and Δ are the white noise term and the first difference operator, respectively.

The null hypothesis 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). If there is a cointegration between the variables, the following long-run model is estimated:

$$\Delta LM_t = a + \sum_{i=1}^n a_i \Delta LM_{t-i} + \sum_{i=0}^n a_i \Delta LPM_{t-i} + \sum_{i=0}^n \pi_i \Delta LYD_{t-i} + \varepsilon_t \quad (9)$$

Where LM is the log of Import; LPM the log of relative prices for import; LYD the log of GDP; m the white noise error term and Δ the first difference operator.

In the first step, the order of lags on the first differenced variables in Eq. (9) can be obtained from the unrestricted models by using an Akaike Information Criterion and Schwartz Bayesian Criterion. Having established the optimal lag length for Eq (9) the next step is to apply a bounds F-test to this equation in order to establish a long-run relationship between the variables under study. The bounds testing

procedure is based on the joint F-statistic (or Wald statistic) for cointegration analysis. The asymptotic distribution of the F-statistics is non-standard under the null hypothesis of no cointegration between examined variables. Once the long-run relationships have been identified in equation (9), the next step is to examine the short-run relationship between the variables.

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

$$\Delta LM_t = a_0 + \sum_{i=1}^n a_{1i} \Delta LM_{t-i} + \sum_{i=0}^n a_{2i} \Delta LPM_{t-i} + \sum_{i=0}^n a_{3i} \Delta LYD_{t-i} + \lambda ECM_{t-1} + \varepsilon_t \quad (10)$$

Where ECM_{t-1} is the lagged error-correction term obtained from the long-run equilibrium relationship. The time series data for Iran are taken from the International Finance Statistics (IFS) and Central Bank of Iran data base for 1971 – 2007 periods.

4. Results:

Stationary Test: The estimation of the import function as well as the tests of Thirlwall's Law was carried out taking into consideration the stationary of the variables included in the models. The results of the stationary tests on differenced variables based on Augmented Dickey-Fuller (ADF) tests are presented in Tables 2.

Table 2: Stationary tests of variables on first difference adjusted Dickey fouler(ADF) test

Variables	ADF statistics	Stationary status
LX	-2.151	Non-Stationary
LYW	-1.307	Non-Stationary
LPX	-1.955	Non-Stationary
LYD	0.030	Non-Stationary
LM	-3.118	Stationary
DLX	-4.616	Stationary
DLYW	-3.171	Stationary
DLPM	-3.911	Stationary
DLYD	-3.159	Stationary

Each ADF tests uses an intercept and no trend.

The critical value for ADF with constant(no trend) at 5% is -2.94

The ADF unit root test for the residuals revealed that they are stationary.

Long run Export Demand Model: The estimated based on SBC for the long-run export demand equation presented in table 3.

Table 3: Estimated long-run export model

Variable	Coefficient	t-statistic	Prob. Value
LYW	1.574	2.324	0.029*
LP	-0.242	-4.322	0.000**
C	28.614	4.222	0.000**

Note: * and** represents 1 and 5 percent level of significance

The relative price elasticity of demand for import is negative (-0.24), the Income elasticity of demand for exports is positive and 1.57.

Long run Import Demand Model: The estimated based on SBC for the long-run Import demand equation presented in table 4.

Table 4: Estimated long-run Import model

Variable	Coefficient	t-statistic	Prob. Value
LYD	1.728	2.971	0.006*
LP	-1.129	-2.535	0.017**
C	0.422	0.773	0.446**

Note: * and** represents 1 and 5 percent level of significance

Result of cointegration tests show that there is a stable long-run relationship between variables. In the other word output and imports could not be considered exogenous at 5%. As the Table show the relative price elasticity of demand for import is -1.12, and the Income elasticity of demand for Imports is 1.72.

Tests of Thirlwall's hypothesis: Having estimated the import function, the next step is the testing if the Thirlwall's hypothesis holds for Iranian economy. If equilibrium growth rates coincide with actual growth rates or difference between two growth rates, $(y^{**}-y)$ close to zero, Thirlwall's law holds. Table 4 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.

Table 5: Test of Thirlwall's hypothesis

Variable		coefficient
ρ	Income elasticity of demand for exports	1.574
π	Income elasticity of demand for imports	1.728
y	Actual economic growth rate	0.067
x	Export volume growth	0.02
$y^{**}=x/\pi$	Predicted economic growth rate	0.013
$y^{**}-y$	Differences between predicted and actual economic growth rates	-0.054

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. Table 6 presents the result of Wald test.

Table 6: Test of Thirlwall's hypothesis

$y^* = -0.590 + 0.074 y$		
$R^2 = 0.036$	Adjusted $R^2 = 0.007$	Wald Statistic = 275 (0.00)
Notes: p-values are in (). Wald is joint test that constant term is zero and the slope coefficient is unity. It has a χ^2 distribution with two degrees of freedom.		

The results derived from Table 5 and Table 6 rejects the Thirlwall's law for Iran economy. The differences between two growth rates are not close to zero (-0.054). The Wald test can reject the joint hypothesis that intercept coefficient is zero and the slope coefficient is unity. Results support that the balance of payments position of the Iran economy is not the main constraint on its economic growth. This indicates that the economy of Iran is exogenous with respect to the rest of the world and also that long-run growth of real GDP will also depend on some other variables that are not included in our model.

5. Conclusion

In this paper we empirically analyzed the Thirlwall's model for Iran using annual data for the period 1951 to 2007. We examined this model 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, our 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. The reason may be due to the fact that Iran is a member of OPEC and its oil export plays a significance role in the country's foreign trade. We can argue that in order to grow under balance-of-payments equilibrium condition government policies must be guided towards overcoming external sector constraints, mainly by increasing the rate of growth of exports and reducing the income elasticity of imports and also pay attention to non-oil exports.

The results also suggest that a policy of export promotion combined with an import substitution strategy could not help the economic growth, since both strategies do not lead to moderate balance-of-payments

constraints in the long run. It also shows that long-run growth of real GDP depends on some other variables that are not included in our model such as capital flow, economic structure and etc.

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