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An Examination of the Empirical Validity of the Thirlwall 'Law': The Case of Egypt

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Abstract: The Balance of Payment constrained growth model was first introduced by Thirlwall in 1979, see [1-2]. According to him a country's growth rate cannot surpass the rate consistent with its balance of payment equilibrium unless it can finance its endlessly growing current account deficit, which is deemed impossible. In addition, this country's actual growth rate should be equal to its potential growth rate calculated based on its income elasticity of demand for exports and imports in the long run. Based on these assumptions, this paper examines the Thirlwall Balance of Payment (BOP) constraint growth model in the case of Egypt for the period of 1980 to 2016 using the bounds testing Auto Regressive Distributed Lag (ARDL) model. The model suggests the validity of Thirlwall's assumption of a long run relation between imports, gross domestic product (GDP) and relative prices having a negligible effect. The actual growth rate was found to be equal to the calculated potential growth rate given the BOP constraint assumption. The empirical results support the historical development of the Egyptian BOP analysis which shows how the external balance was and remains a major factor affecting Egypt's growth rate. Policy decisions aiming to achieve the calculated potential growth in Egypt should focus on sustaining a balanced current account, through promoting exports and external financial flows.

Keywords: Thirlwall's Law, Balance of Payments, Economic Growth, Auto Regressive Distributed Lag Model (ARDL)

1. Introduction

Theories addressing the factors affecting economic growth from different perspectives have tried to examine why countries remain at a certain stage of development and do not progress to a higher stage. Supply side economy and demand side economy theories have studied economic growth from different perspectives. The Neo-classical approach to economic growth viewed the supply side economy as a source of economic growth. Scholars viewed economic growth as a factor of capital accumulation [3-4], labour growth and growth in total factor productivity as explained in the Solow model [5]. The difference in the growth rate progress between countries was attributed to the difference in the growth rate affected by a nations supply curve. These analyses however do not answer the question of why the differentiation between developed and developing countries growth rates exist, even though developing countries might be more resource abundant than developed countries. This was the drive for the Keynesian and post-Keynesian theories which emphasise growth in demand as the driver which can explain a country's growth compared to other countries [6-10].

Thirlwall's law is based on the Harrod static foreign trade multiplier model [11], the centre-periphery model [12] and the dual gap model [13]. His proposition for constrained growth is based on the assumption that in the long run a country cannot sustain a current account deficit since imports are a function of domestic income. Therefore, national income growth cannot exceed the rate at which the imports growth rate is equal to the exports growth rate. Hence, if the growth rate in income required to keep the balance-of-payments at equilibrium is less than the actual growth rate under prevailing domestic demand and supply, then the country's growth is said to be balance of payment constrained. He also added the assumption of an infinite supply and demand elasticity of exports and imports and a negligible effect of relative prices in the long run. On these grounds the growth rate of domestic income must equal the ratio of the growth rate of exports to the income elasticity of

demand for imports [1].

Egypt is a developing country categorised by the World Bank (WB) and the World Economic Forum as an efficiency driven low middle income country. In spite of many attempts to elevate its growth rate and proceed to a higher stage of income Egypt still struggles to achieve this objective. In the 1980s Egypt suffered tremendous deterioration in its economic performance and had to undergo a series of structural economic policy reforms under the umbrella of the International Monetary Fund (IMF) and WB in what is known as the Economic Reform and Structural Adjustment Programme (ERSAP). Although the Egyptian economy has witnessed a rapid growth average of 8.5% during the 1970s and early 1980s, which was attributed to a high level of foreign investment, this progress quickly reversed into a severe macroeconomic imbalance starting in the mid-1980s – the GDP growth rate sharply fell to 2.6% in 1986 and debt accumulation rose rapidly to $11.4 billion by 1990.

The ERSAP had a package of policy reforms that targeted the public sector, investment policies, and external policies, monetary, fiscal and social policies. The main policies that targeted the BOP were tight monetary and fiscal policies that cut Government spending and reduced the demand for imports. In addition a change in the structure of exports was targeted with more weight on manufacturing exports and less on primary exports. This led to a switch in the current account from a deficit of $634 million in 1989 to a surplus of $4.5 billion in 1992 [14]

After the January 2011 revolution the Egyptian economy suffered external BOP shocks. The BOP recorded an overall deficit of US$ 11.3 billion in 2011 compared to $ 9.8. billion in 2010 which led to a sharp fall in net international reserves while the current account deficit increased to $7.9 billion in 2011 from $6.1 Billion in 2010. And the trade deficit also increased to US$ 31.7 billion in 2011 against US$ 27.1 billion in 2010. The main reason was the sharp increase in imports due to the fall in the value of the Egyptian pound. Merchandise imports rose by 8.5 percent while merchandise exports fell by 0.1 percent [15].

In November 2016, the IMF approved financial assistance for Egypt in the form of an Extended Fund Facility (EFF) arrangement for US$12 billion. Egypt had to undergo a series of monetary reforms again with extensive austerity measures. The latter began by cutting energy subsidies, raising taxes on imports and adopting a floating exchange rate system. This contributed to a sharp turnaround in the BOP, narrowing the current account deficit by 21.5% to reach $15.6 billion. Also the trade deficit declined by 8.4% with a rise in merchandise exports to $35.4 billion and a decline in merchandise imports to $265.6 million, the overall effect was a BOP surplus of $13.7 billion in 2017 [16]

Economic growth in Egypt has been investigated by a number of studies. A researcher found a long run relation between government expenditure, exports, investment and labour supply and the growth rate [17]. In the long run it was found that government consumption, private sector credit, and average growth in the OECD countries plays a direct and significant role in promoting growth in Egypt [18]. An empirical investigation about what range of inflation rate in Egypt can be considered acceptable to accelerate growth without having to risk uncontrollable inflation [19]. They found that an inflation rate higher than 15% has an adverse negative effect on the growth rate. Another research considered debt sustainability as an important factor to consider where their cointegration model showed there is a robust negative relation between public debt and economic growth in Egypt [20]. Additionally, it was found that economic growth in Egypt is positively associated with gross capital formation, FDI, infrastructure investment export growth using the Barro growth model [21].

Finally, a study conducted which is considered the closest to this current research paper investigated the validity of Thirlwall's law in MENA countries and found a long run relation between economic growth and real non-oil exports. As for the relation between actual and potential growth rate the results varied between two groups of countries. One group showed a positive difference between both growth rates due to high demand elasticity for imports and high capital outflows. The other group (including Egypt) showed a negative difference between the two growth rate calculations due to slower capital inflows and exports growth [22].

Studying Thirlwall's law was the target of this study due to its importance in providing an enlightening insight for developing countries (including Egypt) that are currently targeting long run sustainable growth rates. The majority of these countries have a high income elasticity of demand for imports, low income elasticity for exports, heavily dependent on primary exports and have weak export competitiveness. Moreover, most of them adopt unsound currency devaluations which stimulates inflation and worsens the external balance. Therefore, looking at growth through this BOP constraint window, adopting policies that do not widen the current account or the trade balance deficits would be a push toward a sustained growth target in the long run. Therefore, scrutinizing the key empirical studies in relation to economic growth in Egypt, to see why this country remains in the underdevelopment stage, it became evident that Thirlwall's law has not been previously tested to explain this phenomina. In addition, the historical overview of the Egyptian BOP and current account profile showed that it is quite essential that this BOP constraint is thoroughly tested for its validity to provide an insight to promoting economic growth in Egypt. The objective of this paper is thus to examine the validity of Thirlwall, s assumptions of a long run relation between imports, gross domestic product (GDP), relative prices, the nominal exchange rate and the equality of actual and predicted potential growth that may have been constrained by the Egyptian BOP.

Based on above explanation of the importance of this study, the objective is to test the validity of Thirlwall law in Egypt and to answer the key question why Egypt cannot sustain a long term economic growth, is it because of Thirlwall constraint?

The methodology to answer this question is by applying

the Thirlwall Balance of Payment (BOP) constraint growth model framework, utilizing the data from the Egyptian economy for the period of 1980 to 2016 using the bounds testing Auto Regressive Distributed Lag (ARDL) model.

Finally, this paper is structured as follows; the first section examines the relevant literature in detail, the second section presents the theoretical framework, section three outlines the methodology, section four presents the empirical results and discussion and section five offers the author's conclusions.

2. Literature Review

Empirical studies investigating Thirlwall's law were first conducted on a one country basis for Spain using two stage least square estimation and found that Spain's actual growth rate was to a great extent consistent with the estimated potential growth rate which achieves the balance of payment constraint equilibrium identified by Thirlwall law [23]. Studies focusing on groups of countries used standard ordinary least square estimation and included the debt service ratio in the model [24]. The study found that the BOP constrained growth model can predict long run growth for 13 countries out of their sample of 20 developing countries. Empirical application of the law was conducted and used the Johansen cointegration test for five central African countries where the 'law' was found to exist in three of these countries [25]. A similar approach was used for four Latin American countries (in addition to VAR analysis) which found that a higher rate of exports leads to a higher growth rate in these countries suggesting strongly that the Thirlwall law holds in these groups of countries [26].

The Thirlwall assumption that the growth rate is only affected by international differences in demand elasticities (see above) was criticized as it neglects the effect of non-price aspects that determine supply competitiveness such as quality, effective marketing, after sales services and other non-price competitive strategies, supply side factors that are totally ignored from the Thirlwall point of view [27-28]. another flaow in Thirlwal law discussed from a purely technical standpoint - that it only deducts the income elasticity of demand for exports by substitution equations which he named the 'weak version' of the Thirlwall law and recommended the estimation of export functions to obtain a stronger version of the postulated relation [29]. Thirlwall law was tested to determine the long run growth rate in Brazil. The main findings support the law by predicting the long run growth rate for Brazil [30]. Another test of the law used the ARDL bound test approach where the Thirlwall application revealed that the law holds for South Africa and its growth is constrained by its balance of payment [31]. Similarly the ARDL bounded test was used for Iran where the Thirlwall assumptions were rejected [32].

Moreover, a scholar has argued that the Thirlwall model ignores the differentiation between exportables and exports, importables and imports, and tradables and non-tradables [33]. This entails that real exchange rate changes (changes in the relative price of non-tradables to tradables), cannot be embedded in the Thirlwall analysis. This excludes factors affecting imports due to changes in internal economic structure. In other words, different demand side factors like sectoral composition, preferences and technology are not incorporated in the model in addition to the disregard of supply side conditions. The latter was further developed by adding relative prices, exchange rate and investment as an alternative robust theoretical framework for the Thirlwall balance of payment constrained growth argument [34].

The application of Thirlwall law in Portugal cocluded that the actual growth rate can be accurately predicted by the ratio of export growth to the income elasticity of demand for imports [35]. In addition they discovered that Portugal's growth rate grew slightly faster than the rate consistent with the balance-of-payments equilibrium constraint (which led to the increase of Portugal's current account deficit over the time of investigation). The study went further to compare the pre and post joining of Portugal to the EU and found that the growth rate slowed down after joining the EU due to the higher elasticity of imports and slower exports growth rate. An addition to the technical analysis using the ARDL model the Kalman filter method was also used to investigate the existence of balance of payment constrained growth in the Turkish economy [36]. They found that the balance of payments deficit from 2009 till 2011 has constrained Turkey's growth rates. However, when applying the model with different techniques they discovered the invalidity of balance of payments constrained growth in this economy.

Another contribution proposed a specification for export and imports functions for the industrial sector level to assess the factors that affect trade performance and income growth [37]. They found that the growth rate in exports and imports are determined mostly by total factor productivity, in addition to a marginal effect of income elasticity of demand which confirms Thirlwall's BOP constrained growth assumption. A research found that the assumption of a strong correlation between a country's long run domestic growth rate and foreign trade growth rate was invalid for his sample of 167 countries [38]. Another conducted a co-integration test using the Dynamic Ordinary Least Squares method for 59 countries from 1960 to 2012 [39]. His results suggest that Thirlwall's law could not hold for a majority of countries and that it can be a necessary condition to a balanced growth rate of output but not a sufficient one to be generalized across all countries. He also suggested 'parsimonious' changes to the model so that it can fit the data which he believes might have some inconsistences which lead to the invalidation of the law in such a wide range of countries as in his sample.

Concluding the empirical application of Thirlwall law a recent study applied the model on Nigeria using ARDL and their results revealed a long run dynamic relation between the variables in the Thirlwall framework and found the calculated potential growth rate was very close to the actual growth rate giving support for the Thirlwall law in the case of Nigeria [40].

3. Methodology and Theoretical Framework

Thirlwall developed his law further by introducing the assumption of constant relative prices in the long run, where the growth rate of domestic income must equal the growth rate of foreign income multiplied by the ratio of the income elasticity of export demand to the income elasticity of import [2].

The model starts with the assumption of a balance of payment equilibrium condition:

$$P_d X = P_f ME \tag{1}$$

Where P_D and P_F are the domestic price and foreign price respectively. X denotes export volume while M denotes import volume. E is the exchange rate in the domestic price of foreign currency,

The export demand function is expressed as a function of relative price and world income and the import demand function is expressed as a function of relative price and domestic income as in equations (2) and (3) below:

$$X = a\left(P_d \big/ P_f E\right)^{\eta} Z^{\varepsilon} \tag{2}$$

$$M = b\left(P_f E \big/ P_d\right)^{\psi} Y^{\pi} \tag{3}$$

$\eta, \psi < 0$ and $\varepsilon, \pi > 0$

Where a and b are constants, Y denotes domestic income and Z world income. ε and π represent the income elasticity of exports and imports respectively.

The differential logarithm of equation 2 and 3 with respect to time produces the growth rate of all variables expressed as lower case as below:

$$x = \eta\left(P_d - P_f - e\right) + \varepsilon z \tag{4}$$

$$m = \psi\left(P_f - P_d - e\right) + \pi y \tag{5}$$

Substituting equations 4 and 5 into equation 1 to obtain the growth rate function of domestic income which satisfies a balance of payments equilibrium gives:

$$y_B = \frac{[1+\eta+\psi)(P_d - P_f - \mathrm{e}) + \varepsilon(z)]}{\pi} \tag{6}$$

Applying Thirlwall's assumption of constant relative prices and constant exchange rate in the long run, their logs becomes zero and the constrained balance of payments equilibrium growth rate of domestic income is given as:

$$y_B = \frac{x}{\pi} \tag{7}$$

Where it is assumed if there is no external balance then;

$$y = y_B$$

Equation 7 expresses Thrilwall's law where the rate of growth of an economy that maintains equilibrium in the balance of payments is approximately the ratio of export growth relative to income elasticity of demand for imports and thus to avoid an external deficit should achieve actual growth in income y_t equal to y.

Therefore if $y < y_B$ the country will have an external deficit and can restore the balance by either increasing its export rate or decreasing income elasticity of demand for imports or a combination of both. However, these strategies require significant changes in output and/or significant changes in consumer spending preferences, both of which require long term adjustments in producer and consumer behaviour.

We can also rewrite equation 6 to obtain a different perspective as follows:

$$\frac{y}{z} = \frac{\varepsilon}{\pi}$$

This expression informs us that the relative income growth between a country and the rest of the world is determined be the ratio of income elasticity of demand for exports to income elasticity of demand for imports. This means if a country wants to grow faster than the rest of the world $> z$, without jeopardising the balance of payments equilibrium, then income elasticity of demand for exports should exceed that for imports $\varepsilon > \pi$.

Thirlwall extended his model to include capital flows as a parameter in equation 1. This is because if a country has a trade deficit it tends to finance it from capital flows [41-42]. This allows y_B to be derived again to reflect the extended model in equation 8 below. Here c < 0 for capital inflows and c > 0 for capital outflows.

$$y_B = \frac{[1+\theta\eta+\psi)(P_d - P_f - \mathrm{e}) + \theta\varepsilon(z) + (1-\theta)(c-P_d)]}{\pi} \tag{8}$$

Under the assumption that prices and exchange rate growth are zero in the long run then:

$$y_B = \frac{[\theta x + (1-\theta)(c-P_d)]}{\pi} \tag{9}$$

Where θ is the percentage of exports receipts in total receipts to pay for imports calculated in equation (10), the rest of variables in lower case denotes as c is the growth of nominal capital inflows and $(c - P_d)$ is the growth of real capital flows. x is the growth rate of exports, P_d is the growth rate of the CPI and π is the income elasticity of demand for imports.

$$\theta = \frac{\mathrm{P_d X}}{\mathrm{P_d X + C}} \tag{10}$$

Where, all variables in equation 10 above are written upper case denoted by X the volume of exports, C the value of Net capital inflows, $\mathrm{P_d}$ is the consumer Price index.

There were further contributions to this framework as in two research applications of Thirlwall's assumptions which

included debt and debt service components for estimating constrained growth [24, 43].

This paper is estimating the import function to obtain the demand elasticity for imports and estimate the level of domestic income growth for the Egyptian economy which satisfies the balance of payments constraint assumption and hence tests if the Thirlwall law does indeed hold in the case of Egypt. A scholar suggested that Thirlwall's law is best tested by first estimating demand and supply functions to obtain the corresponding elasticities; second, the income growth rate consistent with external equilibrium is calculated and finally a regression is made on the growth rate of income consistent with external equilibrium on the actual growth rate [44]. In addition to suggestion for the 'strong version' of the Thirlwall law (discussed above) [29].

4. Empirical Results and Discussion

4.1. Source of Dat

This study employed annual data that covers the period 1980 to 2016 for the Egyptian Economy. The data is collected from the World Bank data base for imports, gross domestic product, terms of trade and nominal exchange rates.

4.2. The ARDL Model

Since we are interested in the growth rate of the home economy, this is achievable by the import equation stated in equation 3 and taking the logarithm of both sides gives:

$$lnM_t = k + \psi\ ln\ P_tE + \ \pi\ ln\ Y_t + u_t \qquad (11)$$

Where Y = Gross Domestic Product

M= Volume of Imports

P_t = terms of trade $\left(\frac{p_f}{p_d}\right)$

π = income elasticity of imports

E=Nominal exchange rate

The effect of gross domestic product (Y), relative prices (P) times the nominal exchange rate (E) effect on imports (M) is estimated by utilizing regression analysis. Due to the intertemporal fluctuations of these variables, a dynamic approach is utilized to assess both short and long run effects through an Auto Regressive Distributed Lag model (ARDL), where lagged values of both dependent and independent variables can be included.

Since the model is a dynamic model the Augmented Dickey-Fuller (ADF) and Philip-Perron (PP) tests are conducted to check if they are stationary or not, in other words, if the time series suffers from the problem of a unit root or not that may hinder the process of forecasting. The null hypothesis assumes that the problem of unit root is present. One of the main key points while building dynamic models such as ARDL is to determine the number of lags for both dependent and independent variables to construct a reliable model. To do this several Bayesian measures are utilized. The number of lags is based on the maximum number of significant results in a particular lag.

To refrain from obtaining a spurious regression, an ARDL Bound co-integration test is conducted to be able to identify the presence of a long run relationship where the null hypothesis is assumed to be not co-integrated. The Error-Correction Model for ARDL is utilized to capture the presence of long run equilibrium/disequilibrium when using differenced variables.

Several tests are performed to investigate the reliability of the estimated model. Ramsey's test is used to determine whether the model is correctly specified and both the White and Breusch-Godfrey tests are conducted to investigate the presence of heteroscedasticity and autocorrelation respectively. The null hypothesis of the White test is that the error term observations are homoscedastic and for the Breusch-Godfrey test, its null suggests there is no autocorrelation among residuals. Finally, the normality test determines if the residuals extracted from the estimated model are normally distributed (or not).

The expected signs of the coefficients for variable in the estimated model derived from equation 11 are given in table (1) the Demand elasticity of imports is expected to have a high value as expected in developing countries and which is the main reason why these countries suffer a trade deficit. The positive sign of elasticity captures the positive relation between GDP and Imports demand. The sign of relative prices confirms with Thirlwall assumption that the effect of relative prices is negligible and insignificant in the long run.

Table 1. *Expected signs, magnitudes and significance of Demand for Imports regression.*

Variable Symbol	Sign	Magnitude	Significance
P_tE	negative	Very low	insignificant
π	positive	high	significant

Then the validity of the Thirlwall law is tested that $y_t = y_B$ by first calculating y_B in equation 9 given the net capital inflows for Egypt (c) and p_d (CPI for Egypt) and Egyptian Exports. The regression equation is:

$y_t = a + b\ y_B$ where H_0: a=0 and b=1

If H_0 is accepted then Thirlwall's law holds for Egypt.

4.3. Unit Root Test

Table 2. *Unit root tests.*

Variable	Variables at Level		Variables at first difference	
	ADF	PP	ADF	PP
lnY	0.8341	0.6156	0.0012*	0.0029*
lnM	0.3543	0.7395	0.0015*	0.0045*
lnP	0.5122	0.3282	0.0102**	0.0021*
lnE	0.4254	0.7631	0.000*	0.0080*

*, ** and *** refer to a 1%, 5% and 10% level of significance respectively.

The P-values of the ADF and PP test statistics for the variables in levels are greater than the level of significance thus confirming the presence of a unit root and their non-stationarity. In contrast, after taking first differences the P-values of the test statistics suggest that the time series for both variables under study and the set of covariates do not suffer from the problem of a unit root, in other words, they are stationary.

Table 3. *Lag criteria selection.*

Lag	LL	LR	DF	P	AIC	HQIC	SBIC
0	-611.321*	1511.83*	16	0.0098	64.5843	65.0656	355.69*
1	-625.585*	1732.38	16	0.0001	65.6807*	65.7847	6.5877*
2	-656.389*	1836.25	16	0.0012	75.4895*	6.5877	66.868
3	-649.404	1558.15	16	0.0010	65.9859	65.9859	46.695
4	-650.198	1919.39*	16	0.0000	67.668	67.4237	47.881*

*, ** and *** refer to a 1%, 5% and 10% level of significance respectively

Based on the above Table, lag one has the most significant Bayesian measurement results and therefore the model is built using only one lag on both the dependent and independent variables.

4.4. ARDL Bounds Testing to Co-integration

The Graph analysis for Imports, Exports and GDP growth rate initial view in Figure (1) reveals that both imports and exports have variant behaviour between, 1980 and 2005 with a fluctuated pattern. After 2007, there is a clear gap between them which infers a non-long run relationship between the usages of the variables at level.

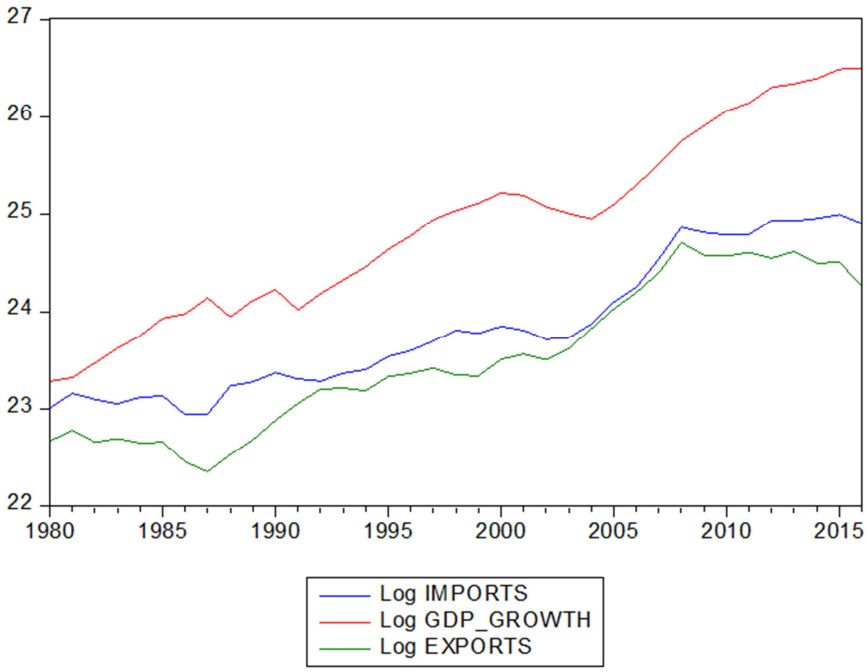

Figure 1. *The relation between Imports, Exports and GDP before difference transformation.*

After taking the difference transformation, Figure (2) is obviously demonstrates the existence of a similar behaviour for both imports and exports. As a result of that, a long-run relationship is expected to occur in the future given the selected sample.

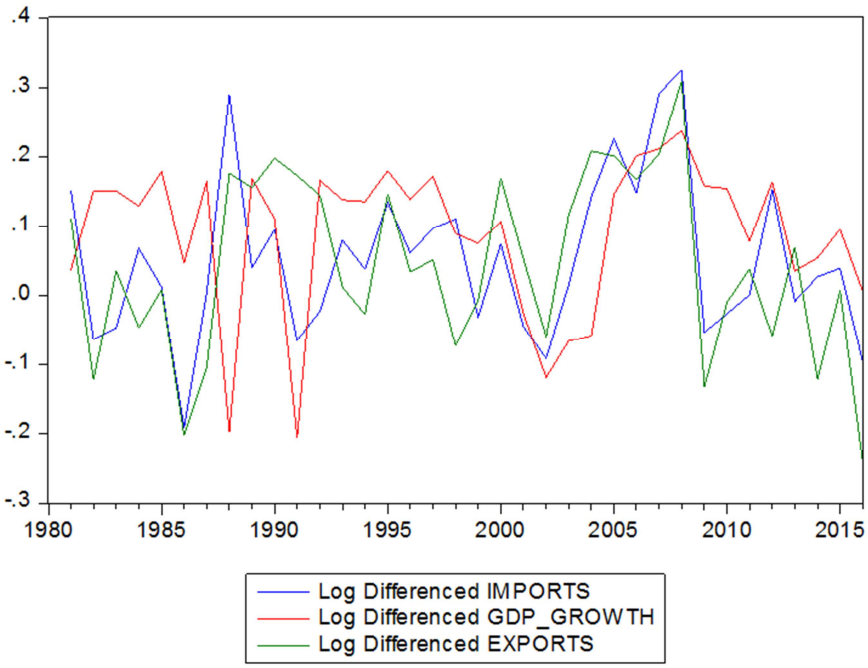

Figure 2. *The relation between Imports, Exports and GDP after difference transformation.*

Table 4. *ARDL Bounds Testing to Co-integration Results.*

	10%	5%	1%	p-value
	I(0) I(1)	I(0) I(1)	I(0) I(1)	I(0) I(1)
F	2.924 4.128	3.584 4.956	5.170 6.925	0.662 0.067
t	-2.550 -3.445	-2.905 -3.850	-3.633 -4.670	0.793 0.096

The [45] bounds test results for H0: no level relationship present are as follows: F = 5.615 Case 3 t = -4.928 with a finite sample (3 variables, 36 observations, 3 short-run coefficients).

The [46] critical values and approximate p-values results are also shown in Table (4). These are do not reject H_0 if both F and t are closer to zero than the critical values for I(0) variables (if p-values > desired level for I(0) variables) and reject H_0 if both F and t are more extreme than the critical values for I(1) variables (if p-values < desired level for I(1) variables). According to the above results (test outputs) the null hypothesis cannot be rejected when the variables are in levels, meaning that there is no co-integration among the variables when included in the model without any transformation. However, after taking the first difference the test statistics for F and t show that they are co-integrated which demonstrates the long-run relationship between them.

Table 5. *ARDL MODEL.*

	Coefficient	P-value
ADJ	- 0.239	0.014
Long-Run Effect		
lPE	- 0.052	0.012
lYGDP	0.904	0.000
Short-Run Effect		
ΔlPE	- 0.114	0.025
ΔlYGDP	0.131	0.054
cons	- 4.020	0.161
R-squared	0.596	
Adj R-squared	0.528	

The signs of the coefficients in the short run confirms the Thirlwall law. The coefficient of Y (the income elasticity of imports (π)) is found to be positive and significant. Table (5) shows that a 1% increase (decrease) in Y will lead to a 0.13% increase (decrease) in imports. This relationship is found to be significant at the 10% level which indicates that an increase in economic growth in Egypt would probably lead to a rise in imports in the short run. However, the demand elasticity for imports is relatively inelastic. In the long run however the effect is to raise import demand by 0.90%.

As for P which is captured by the terms of trade variable (representing relative prices) the coefficient also confirms the Thirlwall law, and has no statistically significant effect on the pattern of imports in Egypt in the long run. This also supports Thirlwall's assumption that relative prices have no effect on imports in the long run. It suggests that in the short run, a 1% increase (decrease) in the terms of trade will generate a 0.114% decrease (increase) in imports, however this effect is not statistically different from zero.

Moreover, the variable of study M will reach equilibrium in the long run at the growth rate of 23.92% and the p-value (0.014) shows this to be significant. In other words, the complete set of variables demonstrate the same behaviour in the long run again confirming Thirlwall's law and assumptions [2].

Table 6. *Diagnostics for the ECM.*

Test	Statistic	P-value
Ramsey Test	3.8928	0.5528
White test	5.2721	0.6998
Breusch-Godfrey test	5.8171	0.6711
Normality test	6.9281	0.7233

For the Ramsey test, since the p-value (0.5528) is greater than a significance level of 1% the model is correctly specified. For the White test, since the p-value (0.6998) is greater than a significance level of 1% the model does not suffer from the problem of heteroscedasticity and the variance of error terms observations is constant. The Breusch-Godfrey test result shows that the model does not suffer from the problem of autocorrelation among the residuals since the p-value (0.6711) is greater than the significance level of 1%. The Normality test shows the residuals are normally distributed satisfying the fundamental assumption of OLS.

4.5. Testing for Actual and Potential Growth Rate Long Run Equilibrium

We now test the Thirlwall law to determine if the joint liner restriction condition (y_t=0) (y_B =1) holds for the case of Egypt. The F-test to examine the joint restriction condition showed a P-value equal to 0.4136, which indicates that the null hypothesis cannot be rejected and the Thirlwall law that the actual growth rate will be equal to the calculated growth rate in the long prevails.

Equation $y_t = a + b\, y_B$ is estimated by ordinary least squares. Two constrains are tested jointly to check if the Thirwall law applies in Egypt over the time period selected. Since the p-value of the F-test statistic (0.4136) is greater than a level of significance of 1%, then both constraints apply jointly. In other words, the null hypothesis H_0: a=0 and b=1 cannot be rejected jointly. This is consistent with the Thirlwall law where the rate of growth of a country that maintains equilibrium in the balance of payments is approximately the ratio of export growth to income elasticity of demand for imports and thus to avoid an external deficit the actual growth in income y_t should be equal to its potential growth rate y_B . It also implies that Egypt is heavily dependent on the external balance as a factor in its economic growth trajectory and this requires policy orientation towards maintaining the external balance.

5. Conclusion

This paper examined the validity of the Thirlwall assumption of BOP constrained growth in the case of Egypt. First, the import demand function was estimated against income and relative prices multiplied by the nominal exchange rate using the ARDL framework to determine if there is a long run relation between these variables and to estimate the income elasticity of demand for imports in the long run and in the short run. The results show that there is a long run relation between these variables and that the income elasticity of demand for imports tends to be positive and more elastic in the long run and relative prices have negligible effects on imports in the long run in Egypt's case. This means that Egypt is very likely to generate more demand for imports in the long run with income growth thus raising pressure on the trade balance potentially leading to a higher deficit.

Second, a regression analysis was conducted to test the assumption that the potential growth rate is equal to the actual growth rate under the BOP constraint. The results show this assumption to be also valid and confirms the Thirlwall law in the case of the Egyptian economy. From these results this study recommends a set of export led policies that target export promotion and some (selective) control over imports. Egypt needs to improve its export competitiveness by a set of policies encouraging investment in the export sector, improving the export product mix by lowering the dependence on primary exports and raising the quality of export products to meet increasingly strong standards in international markets. Exchange rate policy also plays an important role in this area where excessive reliance on depreciation and/or devaluation is not recommended as this would lead to increasing the value of imports and increasing the current account deficit under greater inflationary pressures.

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