

Economic growth and external constraints: Evidence of Thirlwall's Law for Paraguay 1994-2012

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Abstract

This paper addresses the economic growth of Paraguay in the period 1994-2012 by Thirlwall's Law which states that stable growth must be consistent in equilibrium in the balance of payments. Three estimates of model Thirlwall are made, the first considering only to Brazil which is the main trading partner of Paraguay was estimated by univariate OLS, in a second model is considered to Argentina, Brazil and Mexico in an MCO multivariate system, and the last estimate a VAR model between imports and GDP. In the case Portugal is no external constraint is observed, due to the sustained surplus in the trade balance, mainly associated with the sale of energy.

Economic growth, law, Paraguay

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Introduction

On the theoretical level is still unknown what determine economic growth, there is a set of theories which partly explain the phenomenon, however the reality is that none has been able, by itself, provide a convincing explanation. Economic growth, explained mainly by the supply side, is determined by the accumulation of physical capital (Solow (1956)), Investment (Harrod (1939) -Domar (1947)) and human capital (Lucas (1988)), Romer (1986)), however these optical leave out the demand and its approach considers a closed economy (without trade or smoothing course of balance in the current account), ie, in an interconnected world these Theories explain only partial and insufficient economic growth.

The neoclassical theories with empirical tests have had mixed results confirm the theory and some other invalidate. Solow (1956) does not explain the economic phenomenon because it is based on unrealistic production function as input provides a measure of the capital stock of hard to build and has received mixed reviews during the discussion of the two Cambridge.

Harrod's model (1939) -Domar (1946) works to "knife edge", any mismatch leads us to a continuing imbalance and indefinitely us away from the path of stable equilibrium, this model predicts a downward spiral during crises and explosive growth during the boom, in reality none of these situations is observed.

The human capital model based on the assumption that the skilled labor increases production, work of Romer (1986) is not considered only the accumulation of physical capital but also knowledge.

It is that when a company invests it generates learning process (due to practice) that all firms in the economy is disseminated without the possibility that individual company will avoid the problem of job Romer (1986) is that conflicts with Cycle Theory Product Life that successfully explains technological change through processes of innovation from a company patent new technology to the same company, the phase of technological temporary monopoly company, a phase of imitation of technology by other companies, technological socialization phase to the other companies and the abandonment of the technology by the innovator, who always invested in innovation to generate new technology and thus the cycle of continuous product. Romer (1986) think in an ideal world where technology is shared, that does not happen in reality, but that technology is protected by a country to maintain its technological advantage over the other, the same logic applies to a company. In this case there is a choice between putting a distortionary tax of the economy or allow the existence of technological monopoly power implies a market distorting.

In the same vein Lucas (1988) considers human capital externalities, when an individual increases its stock of human capital in turn increases the overall technique of the same individuals, shows that human capital could measure the level of technology available in a country therefore the human capital in each country will be independent of what happens in the other.

However there is no guarantee that the accumulation of human capital produces adequate employment growth in the absence of the knowledge and technology obtained, Lucas explains the phenomenon, but does not provide tools to leverage human capital empirically or under what conditions this leads to economic growth, further work is based on Lucas neoclassical production function that was widely criticized in the debate both Cambridge and therefore applied the same criticism as the Solow (1956). When considering neoclassical theory the logical result is that growth is determined by technology, but the way this technology is achieved is not explained.

Previous models used the approach of the offer, assuming compliance with Say's Law ("every supply creates its own demand"), the aggregate level that proposal was denied by Keynes (1936) to demonstrate that the 1929 crisis was over-production and demand not "adjusted" to absorb the supply, the main constraint was the lack of "effective demand", which Say's proposition is rejected and the analysis starts from the demand. As part of the criticism of these models, the work done by Thirlwall (2000) considered the engine of growth both external and domestic demand, in this essay is to use this approach to analyze the economic performance of Paraguay.

Thirlwall's Law

Thirlwall's model (2000) implies a continuity with the model of Harrod (1939) -Domar (1947), including the famous law of Thirlwall is called the dynamic Harrod multiplier, and is also a break with the neoclassical models (in particular the Solow model (1956) -Swan (1956) since it considers the demand as the main engine of the economy.

This model begins with lifting the course of a closed economy as from now begin our analysis incorporating the elements of foreign trade economy. Having a positive balance in the trade balance have a positive effect on the economy whenever our products are vented to the outside market, the conclusion is simple global demand for domestic products stimulates the production of a country, this is one of the elements used by Thirlwall (2000, pp. 40, 83-85) stating that "all claims (within certain limits) creates its own supply", that is, the international demand stimulates domestic production to meet the demand for domestic goods this is achieved by three characteristics of exports in the first place is the only component of the autonomous demand (not dependent on the GDP), it is the only means of attracting foreign exchange and capital that allow imports of other goods and the third factor is imports (provided by exports) induce economic growth because they can be more productive as some technological goods.

The primitive version of the model of Thirlwall (2000) relates output growth to the growth of the components of demand (investment, consumption, government spending and net exports), but as the first 3 elements are depending on the output growth relationship can condense expression "output growth is a function of increased exports".

From that basic idea of the model is built, the big question being asked is Thirlwall Is there any way to get a stable growth with a balanced budget in the trade balance? What is this path of expansion?

Importantly, the analysis that Thirlwall (2000) on the need for a balanced balance of the balance of payments, Clavellina (2011, pp 53-54.) There are three risks of maintaining an imbalance:

1. Risks arising from unexpected cessation of capital flows.
2. Risks of an unfair competitive advantage (which involves maintaining undervalued exchange rates and current account surplus).
3. Risks of global demand (if the world is immersed in a liquidity trap).

The balance of payments consists of the capital account and trade balance, in this model it is assumed that no capital transactions, so the trade balance and the balance of payments are equivalent.

Thirlwall The first thing is to find the balance of the trade balance (SBC), if it is in equilibrium means that exports (X) are equal to imports (F).

$$SBC = X_R - F_R = 0 \leftrightarrow X_R = F_R \quad (1)$$

$$P_d X = P_f E F \quad (2)$$

Exports (X) are valued at a price of demand (P_d), imports (F) in value are the result of the import price (P_f) and exchange rate (E). In logarithms the equilibrium expression is:

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

Exports (X) are given by an expression of the relative price (the price of demand abroad price, both expressed in a common currency) and income from abroad (Y_E):

$$X = \left(\frac{P_d}{EP_f} \right)^\eta Y_E^\varepsilon \leftrightarrow x = \eta(p_d - p_f - e) + \varepsilon y_E \quad (4)$$

If the terms of trade improve $\left(\frac{P_d}{EP_f} \right)$ exports are reduced because the price elasticity of exports (η) is negative, on the other hand if foreign income increases (Y_E) increase exports so that the income elasticity of exports is positive (ε).

Imports (F) are given by the income of the country (and elasticity) and the selling price abroad valued at local currency:

$$F = \left(\frac{P_f E}{P_d} \right)^\psi Y^\pi \leftrightarrow m = \psi(p_f + e - p_d) + \pi y$$

$$\pi > 0; \psi < 0 \quad (5)$$

The price elasticity of imports (ψ) indicate that if the price increases then imports (F) shall be made, on the other hand if it increases national income (Y) a larger volume of imports since the income demand elasticity is positive (π).

Substituting equations exports [0-4] and imports [0-5] in the equation of balance of payments [0-3] can express GDP growth based on the growth rate of exports:

$$\begin{aligned} p_d + \eta(p_d - p_f - e) + \varepsilon z \\ = p_f + e + \psi(p_f + e - p_d) \\ + \pi y \\ p_d + \eta(p_d - p_f - e) + \varepsilon z \\ - (p_f + e + \psi(p_f + e - p_d)) \\ = \pi y \\ y = \frac{(1 + \eta + \psi)(p_d - e - p_f) + \varepsilon z}{\pi} \end{aligned} \quad (6)$$

Equation [6] represents the GDP according to equilibrium in the balance of payments and has several implications for the growth of a:

The terms of trade (p_{d-e-P_F}) represent the change in the purchasing power of exports. And allow analyzes the extent that export volume allows a country to access the same volume of imported products, with reference to the same base year (Alvarez & Durán Lima, 2009, pp. 29-30). If they improve the terms of trade ($\Delta (p_{d-e-P_F}) > 0$) improves the growth rate of a country when weighing the price elasticities is positive $(1 + \eta + \psi) > 0$.

Currency depreciation increases the rate of growth if the exchange situation is positive. However, the increase in the growth rate can only be temporary, unless depreciation is continuous. In subsequent periods, when the exchange rate stabilizes at its new level, the growth rate should revert to its initial level (Aravena, 2005, p. 28).

The growth rate of a country is in inverse proportion to the income elasticity of imports function.

Equation [6] is known as the weak version of Thirlwall model because it allows the variation in the terms of trade. In the final version of Thirlwall model assuming constant prices keep bringing the model reduces to the following equation applies:

$$y = \frac{\varepsilon Z}{\pi} = \frac{x}{\pi} \quad (7)$$

Equation [7] is the strong version of Thirlwall model since the adjustment is restricted in prices, which shows that the growth of a country depends on the growth of exports if the country increased their exports will be able to raise their level of production. On the other hand, reducing the elasticity of imports is often the best alternative to ensure proper performance of the economy.

About Bernal (2011, p. 44) states that "the growth of countries occurs at different rates because in open economies is no restriction of the balance of payments, that is, low exports, thereby generating problems of unemployment and low utilization of installed capacity. "

Applications of Thirlwall law

The work of Carlos Contreras Paz (2010) aims to analyze the effect of openness to trade, analyze the case of Peru, in his empirical analysis makes a modified estimate of Thirlwall's Law using the generalized least squares method, the Main conclusions of its analysis relating to the terms of trade, to maintain the same growth rate to an increase in the marginal propensity to import is necessary that the rate of export increase, also to the drop in the rate of growth exports need to be adjusted downward marginal propensity. Also makes a cointegration test Johansson and the result was that the number of output growth is related to the export growth, this translates into a stable long-term relationship.

His analysis of the terms of trade of a situation with import substitution model (1960-1989) to a situation with economic liberalization (1990-2010), the evidence shows that trade liberalization resulted in a decreased rate growth of exports and an increase in the marginal propensity to import. Thirlwall's model predicts that the growth rate should decrease but in reality this increased 3.09% (on average during the import substitution model) to 4.62% (for the adoption of the neoliberal model).

A priori Thirlwall's Law is not met, but consider that in this model a balanced trade balance is assumed, Contreras (2010) justifies this apparent inconsistency by showing that during the period analyzed Peru has incurred current account deficit, this means that the economic growth achieved is unstable, the evidence in that sense alone is sufficient to determine that the growth of Peru is unstable, but does not reject the law of Thirlwall since the cointegration test shows the ratio of long-term variables .

Aravena's work (2005) to analyze the performance of Thirlwall's Law for Argentina and Chile, the method used was to build cointegrating vectors (specifically VEC's) of exports and imports using quarterly data from 1996 to 2004. analysis looking for the integration order of the series, for the series in first differences the test DFA rejects the existence of unit roots and KPSS test cannot reject stationarity in the series of each country, so it is assumed start the integration order is I (1). The Johansen cointegration test suggests that there is one cointegrating vector in each variable studied to 5% of significance. According to the analysis Argentina with high income elasticity imports (3.62) and not very high growth rate of exports in the long term only get growth rates not much above 2%. Unlike Chile, under the same analysis would achieve rates of 6% since its low income elasticity of imports (86). The author concludes that Argentina despite being less open to the world that Chile is more vulnerable to external shocks.

The work of Bismarck and Risso (2007) on Bolivia used as various regression estimation technique, at first used a simple model of GDP depending on exports, then the model would be extended allowing the incorporation of the real exchange rate.

Subsequently imports and exports as it is presented in the first section of this work would model. From these results Cointegration technique was applied, the results show the existence of a cointegrating vector in all periods. This yields a necessary to defend the validity of Thirlwall's Law for the Bolivian economy condition. The effect of the real exchange rate, which would be crucial to understanding the long-term growth of the Bolivian economy, was analyzed because it has been an important variable in the stabilization policies. It was noted that this had a negative effect on output growth in the long term. On the other side it would have zero effect on the trade balance which would agree with the assumption of the model of Thirlwall.

A curious result is that the Bolivian domestic product has a negative effect on the trade balance. By estimating the export and import function is able to obtain both. First imports are more elastic than exports to GDP, an increase of Bolivian GDP grew well above imports than exports grew resulting in a negative effect on the trade balance. If we compare the two paths periods we see that the income elasticity of imports is increased in a major way during the period 1953-1985 and 1985-2002 from 2.64 to 11.23 respectively. In the case of exports, the results show a export income elasticity of 1.69 for the entire period.

Featuring a variation for the periods 1953-1985 and 1985-2002, going from 1.61 to 2.26 correspondingly. Secondly it can be seen that the income elasticities of imports and exports are closely related with the growth ratio between domestic revenue and the rest of the world, verifying the model of Thirlwall course.

An estimate of Thirlwall's Law for the case of Uruguay was made by Alvarez and Falkin (2008), the first step of your job is to build sets for estimating the income of the rest of the world (the weighted sum of the main trade partners of Uruguay They associated with their participation in the Uruguayan trade) and real exchange rate (calculated multilaterally) that as imports and Uruguayan exports have an order and integration I (1), the equations of imports and exports were estimated exactly as They were made by Thirlwall (2000). In the case of imports income and price elasticities were 2.69 and -0.21 respectively. These results are consistent with the theory in both signs and values being significant price elasticity to 5% and significant revenue elasticity for any reasonable level of significance. The model R 2 was 0.64. To calculate the income elasticity of imports estimates are made by courts (1939-1968, 1940-1969, ..., 1977-2006), from 1939 to 1988, the income elasticity of imports is increasing, from 1989 to 2006 is stable estimation . In the case of exports the model R 2 was 0.71 and the leading coefficient (28.91) between exports and global income it was significant. With the above come to calculate the growth rate is 52% for the Uruguayan economy and the authors conclude that there exists an external constraint to the growth of the Uruguayan economy.

An analysis is performed by Nicaragua Saballos (2009) during the period from 1937 to 2008, the author begins by testing stationarity in all statistical series by DFA, we proceeded to perform Granger causality contrast showing that GDP and type Granger real change are grounds for imports, the same result as in exports. Applying the cointegration Johansen is obtained that there is one cointegrating vector and the series are related in the long run.

To estimate the model import function is a function of the extent of price competitiveness considering the real exchange rate, as measured by household income Nicaragua's Gross Domestic Product and the terms of trade variables as exogenous variable. Exports are considered a function of gross domestic product in the US, the real exchange rate, the terms of trade and a dummy variable adjustment for the years CACM. The annual average growth of the Nicaraguan economy was 2.95% which was lower compared to that obtained decrease growth rate model constrained by the balance of payments (3.98%), this figure is obtained by multiplying the average annual rate of economic growth in the United States for the same period (3.40%) by the ratio of income elasticities of export demand function (1.732778) and import (1.476653) of the Nicaraguan economy.

Bastourre, Casanova and Spore (2011) analyze the relationship between exchange rates and economic growth, this research is important because broadcast channels analyzed, of particular interest is the effect on trade and diversification of exports that are just relevant bridges Thirlwall's Law. The results of his research involving a currency undervaluation increases economic growth because it makes goods more competitive a country, its sample found that the effect is not of the same magnitude in all countries but depends on structural factors, regions have benefited from an undervalued exchange are South Asia and North Africa region where the currency undervalued growth explains 73% and 25% for developed with strong currencies such as Europe and Central Asia economies power its currency depressed growth in 12%.

The panel data model presented by the authors for 125 countries shows a positive relationship between undervaluation and exports as a share of GDP.

The authors conclude that the competitive exchange indeed have a positive impact on exports. However, the low value of the elasticity found suggests that the increase of exports which can be induced by devaluation is limited and therefore seems insufficient as the sole explanatory element of the relationship between real exchange rate and growth.

Alonso & Garcimartín (1999) analyze Thirlwall's Law in an attempt to show that it is consistent with the results of convergence. The sample used by the authors are the OECD countries, convergence is defined as the decrease over time of the dispersion of per capita income and the growth rate of a country is negatively related to income level, the convergence parameter is significant (-.199 with a value of 4.8 t), the convergence time would take 50 years. To test Thirlwall's Law equation arises exports, relative prices have been built as the ratio of export prices relative to XP weighted price index of the countries competing with the Spanish sales (P^*), while foreign income (Y^*) refers to the weighted income OECD countries, in both cases using as weights the weight of each country in the Spanish exports. Regarding the import equation, relative prices are defined as the ratio of import prices (MP) to domestic prices (P). The regressions are all explanatory parameters, but low R^2 of .52 and .58 in exports for imports equation, Thirlwall's Law is checked to establish that the series are cointegrated 95% according to the test Johanssen .

Frias Diaz and Iglesias (2012) perform a test for the Eurozone, although the estimate of Thirlwall's law only made to Spain, during the period 2000-2007, first they found growth rates of imports and exports by Country: Germany, Austria and Portugal were the only economies where sales abroad grew further purchases abroad.

To explain the situation of countries in international trade Harmonised Competitiveness Index and the Grubel-Lloyd index, according to the analysis United Kingdom, France, Germany, Austria, Holland and Belgium recourse countries had a higher proportion were intra-industry trade and Greece and Portugal were the countries where inter-industry trade was more important. The application of Thirlwall's Law was through the mechanism of cointegration Johanssen, the series were I (1) so the estimate was made in first differences, the price elasticity of Spanish imports is high (-2.8) and although smaller, is also important the income elasticity (0.75), with respect to the results obtained for exports, the income elasticity estimated is very high (3.2) and there is a negative effect derived from the prices (- 2.8). The authors conclude that "exports of all the States of the EU have shown a strong performance, despite weak growth in the core countries of the Eurosystem and the deterioration in the nominal competitiveness of the economies of the South."

Tadeu Rocha (2013) conducted an empirical evaluation of Thirlwall's law modified to consider multiple sectors through analysis of panel data for 90 countries in the period 1965-1999. For the overall sample 11 economic sectors (oil, primary inputs, forest products, tropical agriculture, animal products, cereals, labor, capital, machinery, chemical industry and others) for both exports and imports were considered to be obtained elasticities income is positive. Applying Thirlwall's Law in a non-parametric analysis of growth rates for each country in the sample are obtained. For Mexico the model predicts a growth of 2.38%, when the observed value was 1.88% in the analysis period.

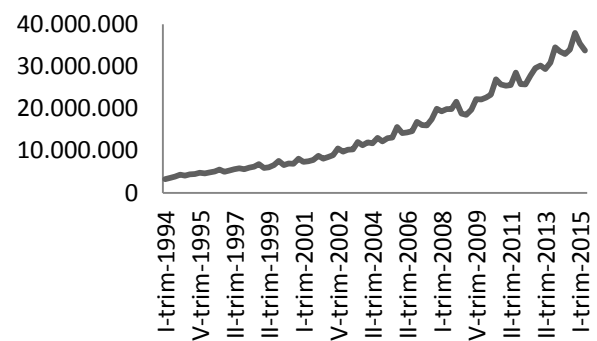
Carton and Slim (2014) conducted an analysis of economic growth and the balance of payments for the period 1982-2012, its empirical application is to test Thirlwall's law and expanded the original version made by Nell (2003) where it is considered exchange blocs. The existence of multilateral trade requires a weighted multilateral GDP estimate, the relative proportions of imports and exports of each country by its GDP used in this sense the authors' analysis is among Mexico, Europe (Germany, Spain and the UK), North America (Canada and USA), Asia (Japan, China and India) and Latin America (Brazil, Colombia, Chile and Venezuela). To test the long-term relationship between economic growth and external demand cointegration methodology ARDL (autoregressive distributed lag model) to test levels, in a second step using the error correction model is not restricted performed to analyze Short-term relationship, this analysis is not possible using the t statistic, use the Joint F-statistic that is more demanding. For Mexico, the authors find that in the long term growth in North America and Asia have a positive impact and restrict the growth of the country and an increase of 1% of GDP in the Asian region ($(\varepsilon/\pi) \text{ _Asia} \wedge \text{ LP} = 0.41$; t-ratio = 3.21) or North American ($(\varepsilon/\pi) \text{ _AN LP} \wedge = 0.53$; t-ratio = 4.67) induce growth of 0.53 and 0.41%, in the case of Latin America ($(\varepsilon/\pi) \text{ _Al LP} \wedge = .45$; t-ratio = 2.02) and Europe ($(\varepsilon/\pi) \text{ LP}_E \wedge = .13$; t-ratio = 1.16) growth is not significant for development from the country. In the short-term analysis it shows that North America ($(\varepsilon/\pi) \text{ _AN} \wedge \text{ CP} = .59$; t-ratio = 3.35) is again the region with the greatest respect, the role of Asia in the short term is reduced widely ($(\varepsilon/\pi) \text{ _Asia} \wedge \text{ CP} = .18$; t-ratio = 1.27), Europe has a more important role ($(\varepsilon/\pi) \text{ _E} \wedge \text{ CP} = .77$; t-ratio = 2.55) and relationship Latin American block ($(\varepsilon/\pi) \text{ _LN} \wedge \text{ CP} = .074$; t-ratio = 0.28) is still not significant, the correction coefficient mistake behind shows rapid adjustment ($\text{ECM}_{(t-1)} \text{ CP} \wedge = - .68$; ratio-t = -4.59).

With this analysis, the authors finally find that the growth rate according to the balance of the balance of payments is 4.03% when observed was 3.58% in the analysis period.

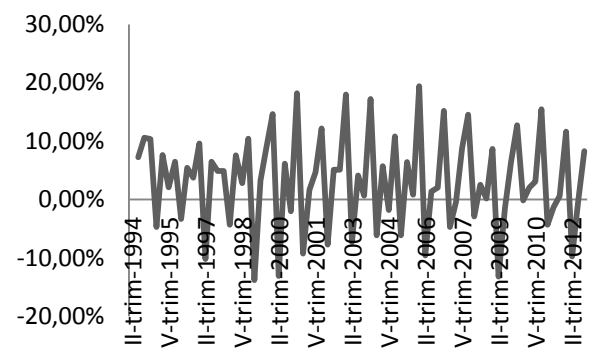
Economic growth and external constraints in Paraguay

GDP growth of Paraguay has a positive trend as seen in Figure 1, stands the fact that in the first quarter of 1994 the GDP was 3 283 343 000 Gs and the second quarter of 2015 GDP amounted to 33 747 641 000 Gs representing GDP grew 9.2 times in 21 years.

However, growth has been relatively unstable, the quarterly growth rates contained in Figure 2 shows that growth is more erratic and variable-sharp and linear.



Graphic 1 Paraguay's gross domestic product at constant prices, 1994-2015



Graphic 2 Quarterly growth rate of GDP of Paraguay, 1994-2012

Empirical law enforcement Thirlwall

The application of Thirlwall's Law is done by estimating export functions [0-3] and imports [0-4] for the income elasticities of imports and exports that are required to estimate the GDP according to the balance of payments displayed in the [0-7] function.

Verifying Thirlwall's Law is done through three alternative methods, the first is to estimate export and import independently considering as exogenous variable GDP of Brazil which is the main trading partner of Paraguay, the method to be used is Least Squares Ordinary (MCO) which ensures minimization of model errors.

The second method is to incorporate the GDP estimate for Argentina and Mexico in the functions of exports and imports and re-estimate equations via MCO.

The third method is deeper and involves determining whether there is causality and a long-term relationship between exports and GDP, this ratio is important because Thirlwall's law is based on this relationship is significant and stable in the long run. The Granger causality test, cointegration test Johansen and Vector Autoregressive to explain the growth in Paraguay were used.

Method 1 function estimation of exports and imports

The estimate function performed considering exports to Brazil's GDP as exogenous variable, as already noted the estimate shall be effected in logs and considering that the terms of trade are constant.

Dependent Variable: LOG(X)				
Method: Least Squares				
Date: 11/27/15 Time: 10:46				
Sample: 1994Q1 2012Q3				
Included observations: 75				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
LOG(YBRASIL)	3.525133	0.075185	46.88597	0.0000
C	-27.96437	0.927746	-30.14225	0.0000
R-squared	0.967860	Mean dependent var		15.52960
Adjusted R-squared	0.967419	S.D. dependent var		0.627770
S.E. of regression	0.113313	Akaike info criterion		-1.491020
Sum squared resid	0.937309	Schwarz criterion		-1.429220
Log likelihood	57.91324	Hannan-Quinn criter.		-1.466344
F-statistic	2198.294	Durbin-Watson stat		0.993731
Prob(F-statistic)	0.000000			

Table 1 Estimated export function

Exports are an increasing function of Brazil's GDP, which was expected to be the main trading partner of Paraguay, in a study by the Latin American Integration Association (ALADI-SEC, 2013) states that trade with Brazil has had a surplus explained by large exports of electricity. The model has a higher coefficient of determination ($R^2 = .96$) than the estimate reveals that explains 96% of changes in exports, both the t test and the F test allow us to note that the relationship is found Explanatory 99% confidence.

The income elasticity of exports indicates that if Brazil's GDP increased by 1% then Paraguay exports should grow by 3.5% this because the Brazilian economy more dynamic population may have higher incomes to consume products imported from Paraguay and as energy consumption could be higher. As the value of elasticity is greater than one, it is said that exports are elastic external entry, in this case, the level of production of Brazil.

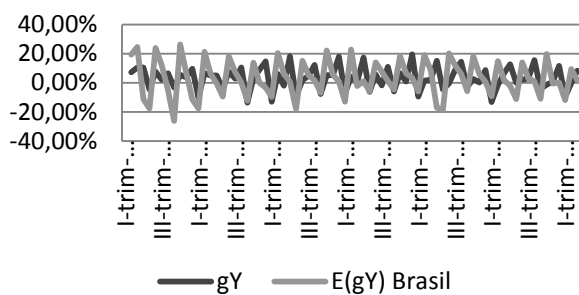
In the case of the import function is estimated using GDP as an argument Paraguay, the idea is that the higher the national income to import larger volumes of goods.

Dependent Variable: LOG(F)				
Method: Least Squares				
Date: 11/27/15 Time: 14:37				
Sample: 1994Q1 2012Q3				
Included observations: 75				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
LOG(YPARAGUAY)	0.990733	0.030537	32.44398	0.0000
C	-0.633831	0.493707	-1.283820	0.2033
R-squared	0.935146	Mean dependent var		15.37241
Adjusted R-squared	0.934258	S.D. dependent var		0.634101
S.E. of regression	0.162585	Akaike info criterion		-0.768928
Sum squared resid	1.929672	Schwarz criterion		-0.707128
Log likelihood	30.83479	Hannan-Quinn criter.		-0.744252
F-statistic	1052.612	Durbin-Watson stat		0.321857
Prob(F-statistic)	0.000000			

Table 2 Estimated exports function

The function of the estimate of imports accounts for 93% of the variations in endogenous, by the F-test and t-test is accepted that the explanatory variable is used. The income elasticity of imports is positive and close to 1, which characterizes a function and allow unit elasticity indicate that if the GDP increases by 1% Paraguay then imports would increase one .99%.

Substituting the obtained income elasticities and export growth in the equation [0-7] is possible to obtain the estimate of GDP growth for each period, as noted this growth rate is the one that satisfies equilibrium in the balance payment.



Graphic 3 Growth in Paraguay: Estimation Method 1 vs Observed

The estimate using the first method is inaccurate and also the correlation coefficient between the two series is .33 seen in Figure 3.

Method 2: Estimation of the role of exports Mexico, Argentina and Brazil

This method 2 tries to improve the estimation method 1 inserting in the equation of exports to other trading partners, thereby reformulated and inserted estimating the GDP of Mexico and Argentina as regressors.

Dependent Variable: LOG(X)				
Method: Least Squares				
Date: 11/26/15 Time: 11:30				
Sample: 1994Q1 2012Q3				
Included observations: 75				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
LOG(YBRASIL)	3.433086	0.251544	13.64808	0.0000
LOG(YARGENTINA)	-0.276048	0.127337	-2.167846	0.0335
LOG(YMEXICO)	0.514972	0.259517	1.984348	0.0511
C	-31.66724	1.959499	-16.16089	0.0000
R-squared	0.971287	Mean dependent var		15.52960
Adjusted R-squared	0.970074	S.D. dependent var		0.627770
S.E. of regression	0.108599	Akaike info criterion		-1.550456
Sum squared resid	0.837351	Schwarz criterion		-1.426856
Log likelihood	62.14209	Hannan-Quinn criter.		-1.501104
F-statistic	800.5907	Durbin-Watson stat		0.992226
Prob(F-statistic)	0.000000			

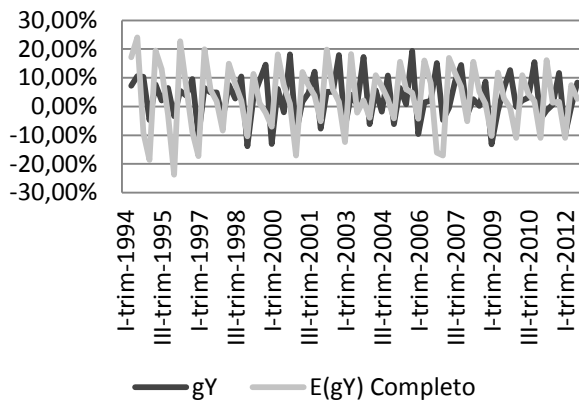
Table 3 Estimated exports expanded function

The results in Table 3 confirm the positive relationship between exports of Paraguay and dynamism in the Brazilian economy, in addition to Mexico one income elasticity of 0.51 was obtained far below Brazil obtained with 3.43, which reveals the weight each economy on exports. Argentina's case is complicated given that theoretically a positive relationship to be an important trading partner would be expected.

The model explains 97% of changes in exports, all explanatory variables are the 90% confidence and F test will reject the hypothesis that estimated coefficients are simultaneously different from zero.

The estimated growth rate is performed again by replacing the elasticities in equation [0-7] together with GDP growth rates of Argentina, Brazil and Mexico.

Graphic 4 shows the estimates for the forecast period and the rates of growth have a correlation coefficient of 0.38, higher than the model where only considered Brazil's GDP.



Graphic 4 Growth in Paraguay: Estimation Method 2 vs Observed

Method 3: estimate by a VAR

The third method is based on the causal relationship between exports and imports, for which the Granger causality test was evaluated, the results in Table 4 CONDESAN.

Pairwise Granger Causality Tests			
Date: 11/27/15 Time: 10:57			
Sample: 1994Q1 2012Q3			
Lags: 2			
Null Hypothesis:	Obs	F-Statistic	Prob.
YPARAGUAY does not Granger Cause X	73	6.43719	0.0028
X does not Granger Cause YPARAGUAY		19.6455	2.E-07

Table 4 Granger causality test between exports and GDP of Paraguay

The test provides two scenarios, the first is that the GDP of Paraguay is not Granger-causal exports and the second is that exports did not cause GDP. Both hypotheses are rejected at the 99% confidence level, so that exports satisfactorily explain GDP.

The next step is to evaluate the relationship between GDP and exports are cointegrated and therefore having a long-term stable relationship, this can be contrasted with the test Johanssen, this step is important to have a support that gives certainty that the obtained relationship is not spurious.

Johanssen test are presented in Table 5, it can reject the hypothesis that there is no cointegrating vector and cannot reject the hypothesis that there is at least one cointegrating equation. Therefore it is concluded that there is a stable and long term relationship between GDP and exports relationship.

Date: 11/26/15 Time: 15:33				
Sample (adjusted): 1994Q3 2012Q3				
Included observations: 73 after adjustments				
Trend assumption: Linear deterministic trend				
Series: YPARAGUAYX				
Lags interval (in first differences): 1 to 1				
Unrestricted Cointegration Rank Test (Trace)				
Hypothesized		Trace	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None *	0.263792	24.37309	15.49471	0.0018
At most 1	0.027258	2.017425	3.841466	0.1555

Trace test indicates 1 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level

**MacKinnon-Haug-Michelis (1999) p-values				
Unrestricted Cointegration Rank Test (Maximum Eigenvalue)				
Hypothesized		Max-Eigen	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None *	0.263792	22.35567	14.26460	0.0021
At most 1	0.027258	2.017425	3.841466	0.1555

Max-eigenvalue test indicates 1 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Table 5 Granger Causality Test between exports and GDP of Paraguay

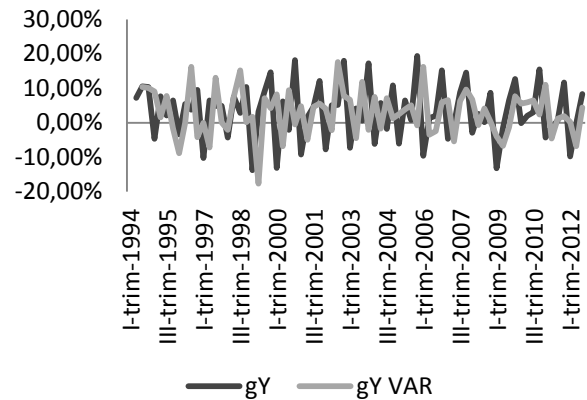
The Granger causality test to ensure causality (a feed-back effect) between GDP and exports, while the cointegration test Johanssen infer a stable long-term relationship with these inputs is possible to build a Autoregreivo Vector (VAR) the results of this estimation are concentrated in Table 6.

Vector Autoregression Estimates		
Date: 11/26/15 Time: 15:34		
Sample (adjusted): 1994Q2 2012Q3		
Included observations: 74 after adjustments		
Standard errors in () & t-statistics in []		
	YPARAGUA Y	X
YPARAGUAY(-1)	0.455082 (0.08644) [5.26475]	0.062377 (0.05246) [1.18911]
X(-1)	1.036004 (0.15957) [6.49248]	0.894264 (0.09684) [9.23472]
C	180311.9 (205185.) [0.87878]	102736.2 (124519.) [0.82506]
R-squared	0.985768	0.982037
Adj. R-squared	0.985367	0.981531
Sum sq. resid	5.64E+13	2.08E+13
S.E. equation	891157.9	540811.9
F-statistic	2458.915	1940.803
Log likelihood	-1117.291	-1080.331
Akaike AIC	30.27813	29.27923
Schwarz SC	30.37153	29.37263
Mean dependent	12584859	6761206
S.D. dependent	7367032.	3979482.
Determinant resid covariance (dof adj.)		2.18E+23
Determinant resid covariance		2.00E+23
Log likelihood		-2195.229
Akaike information criterion		59.49268
Schwarz criterion		59.67950

Table 6 Estimation of VAR

The value of VAR coefficients has a theoretical explanation, however represent the level of correction of deviations in each period, in the case of equation GDP GDP coefficient is behind a period of 45 whereby the 45% of the errors are corrected in a period.

The estimate of GDP (and Thirlwall's Law) is strong to make projections with a determination coefficient of 0.98 (the model explains 97% of changes in GDP). With this model and thus GDP growth rates expected was calculated. The observed and expected rates of growth are shown in Figure 5. The correlation coefficient between the two series is 95%, which represents a proper fit between the estimate and the actual value.



Graphic 5 Growth in Paraguay: Estimation Method 3 (VAR) vs Observed

Existence of the restriction

So far, various schemes have been used to estimate the growth potential according to the balance of payments rate. The average quarterly growth rate of Paraguay from 1994-2012 is 3.23% per quarter, the estimate of the potential growth rate with balance of payments according to Method 1 is 2.96% and according to method 2 is 2.91% the estimated model 3 rate is 2.95% but the correlation with actual growth is the highest of the various estimates.

Quarterly growth rate:	GDP	exports	Estimation Method 1	Estimation Method 2	Estimation Method 3
	gY	gX	E (Gy) Brazil	E (Gy) Full	VAR gY
Average quarterly rate	3.23%	3.20%	2.96%	2.91%	2.95%
Correlation with gY	1.00	0.12	0.33	0.38	0.91

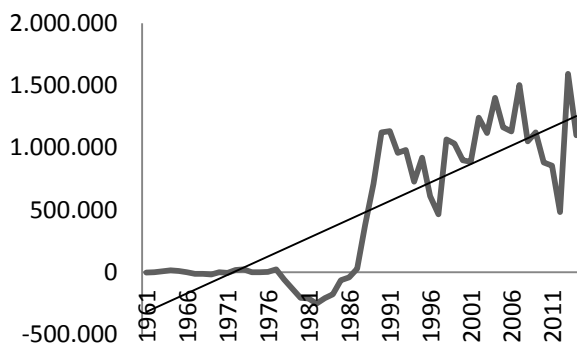
Table 7 Estimation results

The quarterly growth rate in Paraguay is high compared to those in Mexico (67%), Brazil (83%) and Argentina (1.19%), this would conclude that there is no external constraint to growth in Paraguay.

The difference between actual growth and the observed can be explained by various causes, Thirlwall (2000) points 3:

(i) Persistent surplus in trade balance;
 (ii) the estimated value of the price elasticity of imports used in the estimate may be lower than their true value and (iii) adverse changes in prices and elasticities.

In the case of Paraguay's surplus in the trade balance it has been held since 1987 and a positive trend in the surplus is presented as shown in figure 6.



Graphic 6 Balance of Trade Balance of Paraguay, 1961-2014

Concluding Remarks

This work has exposed the major theories that address economic growth and triggers in the first section highlighted the contrast between the current Keynesian (which considers that the growth is unstable nature, does not accept functions production aggregated and their focus is on the demand), the neoclassical (considering convergence between countries, the stability of the balance, the existence of a steady state and its emphasis is on the supply side) and the flow of endogenous growth (which considers that there may be constant returns, incorporating innovation, technological change and human capital). For the above, it is considered that economic growth is multifactorial and depends on so many different aspects such as physical capital, labor, technology, human capital, savings and innovation.

In the modern theory of economic growth is assumed that the main supply is limited from the current level of technology, the main theoretical contribution of the model is analyzed to establish that there is also a demand restraint from this point follows Thirlwall John M. Keynes considering that the demand cannot absorb an unlimited supply of goods but demand (effective) acts as limiting supply.

Thirlwall's law is in the post-Keynesian spectrum, considered essential growth factors income and price elasticities of exports and imports, which together with the terms of trade, determines a level of growth that satisfies the balance the balance of the balance of payments. Thirlwall's Law contrasts with other models openly state that autarky is untenable, in that sense it is a continuation of the theory of David Ricardo on international trade as a mechanism to expand the production-possibility frontier and avoid economic stagnation, having results in interdependence with the outside (measured by global income) as is the current globalizing world.

The medium of interaction with the outside is through exports which are the only autonomous component of demand to be independent of the level of production, additionally are the only way to attract foreign currency and resources to enhance productive capacity, and it is also a mechanism to finance imports that can be used as intermediate inputs to enhance production levels.

The first estimation method consists of estimating equations imports and exports independently and get the price and income elasticities. Estimates of the strong version of Thirlwall's Law were made with coefficients greater than .95 determination, with the significant variables to 95% and an F test that allows to reject the hypothesis that the coefficients are simultaneously zero.

In the estimation method 1 A 3.52 income elasticity for exports and imports obtained an income elasticity of 0.99 was obtained. These income elasticities left in Paraguay found that demand fewer imports in terms of income that demand for Paraguayan exports depending on the income of Brazil.

The second model that incorporates Mexico and Argentina as plaintiffs of Paraguayan exports no big differences since Brazil remains the most important factor with an income elasticity of 3.43, elasticity with Mexico's GDP amounted to 0.5 and in the case of Argentina the opposite sign to economic theory was observed. The opposite sign can be caused by the dominant role of Brazil.

To apply the VAR technique is required to prove that the series are Granger-causal, not causal hypothesis is rejected in the sense of Granger 99% confidence and a feed-back effect was evident. Johansen in the test found that there was a single cointegrating vector and the ratio of exports to GDP is stable in the long run.

The application of the VAR model with a lag had significant coefficients and represents the best fit, given that the growth estimate and the observed value had a correlation of .91.

The estimates are close in value (2.96%, 2.91% and 2.95%) but differ from the actual observed value (3.23%), which can be explained by a persistent surplus in the trade balance.

An external constraint is no evidence that the growth of Paraguay is higher than that observed in their partners.

Statistical Annex

	Paraguay GDP	PBI Argentina	Brazil GDP	Mexico GDP	Exports	Imports
	Million Guaraní	Million pesos	Million reais	Millions of pesos MXN	Million Guaraní	Million Guaraní
	Y Paraguay	Y Argentina	Y Brazil	Y Mexico	X	F
I-trim-1994	3,283,343	232,945	168,720	8,301,870	1,916,710	1,868,566
II-trim-1994	3,520,305	257,477	177,856	8,505,143	2,177,646	2,171,793
III-trim-1994	3,892,545	253,468	190,123	8,453,306	2,406,226	2,458,824
IV-trim-1994	4,296,139	257,342	184,116	8,809,228	2,617,807	2,834,889
I-trim-1995	4,093,862	237,968	174,969	8,210,632	2,779,139	2,504,237
II-trim-1995	4,406,621	248,094	186,669	7,817,381	3,012,960	2,657,354
III-trim-1995	4,498,215	242,215	193,118	7,867,116	2,884,330	2,542,446
IV-trim-1995	4,790,447	244,468	190,390	8,212,461	2,312,820	2,309,304
I-trim-1996	4,630,924	236,566	176,365	8,345,328	2,386,832	2,128,677
II-trim-1996	4,883,233	260,752	189,394	8,341,360	3,019,469	2,644,411
III-trim-1996	5,066,718	262,167	192,974	8,408,905	2,712,403	2,648,130
IV-trim-1996	5,551,987	267,020	186,676	8,898,243	2,499,469	2,704,538
I-trim-1997	4,985,743	256,388	177,366	8,708,280	2,382,443	2,414,524
II-trim-1997	5,309,023	281,770	187,931	9,050,661	2,861,896	2,604,217
III-trim-1997	5,568,149	284,092	191,121	9,075,963	2,752,316	2,591,405
IV-trim-1997	5,839,951	287,515	190,885	9,525,885	2,522,671	2,691,016
I-trim-1998	5,388,720	271,702	185,758	9,422,001	3,030,635	2,609,188
II-trim-1998	6,011,428	301,208	195,284	9,452,294	3,704,217	3,068,427
III-trim-1998	6,180,825	293,315	199,190	9,488,798	3,642,793	3,021,567
IV-trim-1998	6,824,421	286,268	199,251	9,709,323	3,471,163	3,212,235
I-trim-1999	5,883,925	265,025	192,298	9,634,883	2,713,903	2,139,207
II-trim-1999	6,075,585	286,412	199,800	9,851,310	3,017,190	2,447,849
III-trim-1999	6,824,231	278,473	199,748	9,750,116	3,023,016	2,313,932
IV-trim-1999	7,593,229	283,566	197,874	10,049,450	3,097,624	2,538,674
I-trim-2000	6,598,841	264,556	192,484	10,158,428	3,084,724	2,322,019
II-trim-2000	7,004,339	285,275	203,556	10,241,666	3,490,466	2,718,538
III-trim-2000	6,861,788	276,788	207,179	10,313,099	3,317,016	2,975,130
IV-trim-2000	8,108,932	278,092	207,490	10,442,733	3,291,877	2,912,524
I-trim-2001	7,360,409	259,200	196,983	10,166,159	3,273,974	2,564,135
II-trim-2001	7,483,998	284,796	203,340	10,184,475	3,526,523	2,713,380
III-trim-2001	7,832,082	263,127	208,372	10,205,384	3,759,764	2,979,377
IV-trim-2001	8,785,389	248,865	209,310	10,350,232	3,643,464	2,941,103
I-trim-2002	8,108,147	216,849	205,301	9,997,764	3,773,234	2,771,757
II-trim-2002	8,521,364	246,315	218,064	10,330,184	4,918,631	3,300,608
III-trim-2002	8,938,805	237,417	221,439	10,238,405	5,415,646	3,361,888
IV-trim-2002	10,587,897	240,381	222,022	10,454,340	5,341,923	3,484,033
I-trim-2003	9,801,820	228,396	213,848	10,254,249	5,218,489	3,679,472
II-trim-2003	10,206,569	265,402	227,507	10,371,677	6,188,112	4,279,696
III-trim-2003	10,272,602	261,335	226,116	10,279,756	5,935,835	4,556,599
IV-trim-2003	12,043,228	268,561	226,765	10,637,747	5,952,131	4,338,499
I-trim-2004	11,304,129	254,330	223,113	10,884,434	6,082,456	4,266,377
II-trim-2004	11,849,911	284,376	231,898	10,799,663	6,600,364	4,530,020
III-trim-2004	11,738,623	284,392	236,857	10,703,782	6,848,774	5,319,528
IV-trim-2004	13,006,380	293,487	237,754	11,140,137	6,388,631	5,646,745
I-trim-2005	12,212,664	274,595	234,631	10,842,331	7,420,886	5,314,666
II-trim-2005	12,999,004	313,927	246,798	11,179,667	7,737,535	5,866,533
III-trim-2005	13,105,043	310,593	251,203	11,067,923	7,584,548	6,423,984
IV-trim-2005	15,645,616	319,939	253,616	11,352,049	8,664,592	7,218,078
I-trim-2006	14,150,400	298,696	249,396	11,469,030	8,770,646	6,829,616
II-trim-2006	14,348,911	338,244	262,730	11,725,051	8,307,344	7,008,000
III-trim-2006	14,638,091	337,742	269,077	11,685,637	9,034,554	7,556,049
IV-trim-2006	16,859,104	347,379	256,031	12,014,949	9,102,449	8,029,579
I-trim-2007	16,070,028	322,449	242,830	11,804,324	8,540,366	6,814,543
II-trim-2007	16,004,089	367,492	256,423	12,047,213	9,556,682	7,574,883
III-trim-2007	17,412,701	367,339	263,129	12,033,956	10,537,144	8,834,600
IV-trim-2007	18,939,444	379,200	269,650	12,464,910	10,693,555	9,307,157
I-trim-2008	19,385,811	349,943	265,301	12,037,342	10,814,260	9,406,383

II-trim-2008	19,860,321	396,227	278,901	12,418,358	11,407,808	10,022,441
III-trim-2008	19,891,902	393,039	283,488	12,225,310	11,466,283	11,043,786
IV-trim-2008	21,616,720	394,565	284,029	12,325,944	9,916,051	9,320,293
I-trim-2009	18,766,638	357,096	276,356	11,427,213	9,839,231	8,137,810
II-trim-2009	18,488,396	393,181	288,148	11,432,364	9,740,640	7,896,369
III-trim-2009	19,880,497	391,879	289,307	11,666,112	10,601,097	8,962,764
IV-trim-2009	22,181,639	404,861	287,910	12,197,308	10,376,141	10,415,271
I-trim-2010	22,146,375	381,222	278,741	11,849,839	11,798,810	10,171,440
II-trim-2010	22,601,864	439,767	289,733	12,203,118	12,999,943	11,542,728
III-trim-2010	23,293,329	425,323	292,246	12,300,747	13,244,363	12,613,061
IV-trim-2010	26,892,487	442,209	293,154	12,756,911	14,263,983	14,331,231
I-trim-2011	23,733,347	419,023	284,013	12,377,242	13,381,848	12,324,227
II-trim-2011	23,393,654	479,964	299,756	12,597,463	14,037,224	13,132,443
III-trim-2011	23,532,744	464,883	299,338	12,813,924	14,449,707	13,538,234
IV-trim-2011	28,323,289	474,413	299,334	13,308,342	13,200,346	13,888,643
I-trim-2012	23,743,792	440,884	289,461	12,982,273	12,654,788	12,041,117
II-trim-2012	23,697,180	479,966	297,156	13,164,130	13,758,529	13,054,065
III-trim-2012	27,832,266	468,141	298,617	13,222,137	14,306,896	13,488,347
IV-trim-2012	29,339,022	484,213		13,763,649	13,432,487	14,423,308
I-trim-2013	30,182,442	454,313		13,064,787	14,822,477	12,773,349
II-trim-2013	29,331,322	519,609		13,374,408	16,457,237	14,270,915
III-trim-2013	30,835,779	494,042		13,406,776	16,007,963	14,971,331
IV-trim-2013	34,303,213			13,854,994	14,361,213	14,273,399
I-trim-2014	33,523,233			13,310,049	16,310,230	13,670,194
II-trim-2014	32,894,348			13,583,626	17,105,740	14,990,424
III-trim-2014	33,933,645				14,975,178	14,756,240
IV-trim-2014	37,889,041				14,082,019	14,990,373
I-trim-2015	33,393,393				15,714,964	13,430,041
II-trim-2015	33,747,641				13,298,002	12,172,400

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