Rev. humanid. cienc. soc. (St. Cruz Sierra) vol. 3 no.se 2007

# The balance of payments constrained growth model: empirical evidence for Bolivia, 1953-2002*

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**SUMMARY**

Much of the theoretical and empirical literature has focused on supply factors when studying economic growth determinants, leaving aside demand factors. The present study, instead, analyzes external demand factors as determinants of Bolivian economic growth between 1953-2002 utilizing models introduced by Thirlwall (1979). According to cointegration analysis, exports were an important determinant in Bolivian economic growth for the whole period. Later analysis of other variables showed that real exchange rates presented a negative relationship in respect to long term growth. Further results show that Bolivian imports are more elastic than exports before a growth of the GDP, producing a negative impact on the trade balance. Our hypothesis is that the economic model implemented since 1985 has increased the external constraint of the country causing a process of "deindustrialization".

> *Economists have inherited from physical sciences the myth that scientific inference is objective and free from personal prejudices. This is nonsense. All knowledge is a product of human conviction; stated in a more precise way, it is a product of human opinion.*
>
> –Leamer, Let's Take the Con Out of Econometrics

* Published originally in Spanish in *Revista de Humanidades y Ciencias Sociales*, Vol. 9, Nº 1-2 (June - December 2006), pp. 187-219. ISSN 1819-0545. The authors thank Professor Anthony Thirlwall and Benjamín García Páez for their commentaries to a preliminary version. Also, thank Alejandro Nadal and PROCIENTEC, El Colegio de México A.C., for the space provided during this research.
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## I) Introduction

The majority of studies on growth are based on traditional neoclassical models. Among these, it is possible to mention the endogenous type, such as those based on Solow (1956), or those of endogenous growth, such as Romer (1986) and Lucas (1988), among others. Both models are characterized by indicating as determinants of growth, variables that are provided by the supply side of the economy. In this way, the productive factors of physical and human capital, just like technology, are the principal causes of growth. This form of modeling growth will be valid under the assumption that demand adjusts rapidly to supply.

An alternative model to those mentioned above is the Thirlwall proposition (1979). Such a model of post-Keynesian style puts the accent on the factors of demand. Like this, Thirlwall's Law establishes that in an open economy, exports are a determining factor that clearly explains economic growth.

Exports are fundamental for any economy, because they not only generate employment but also contribute to collecting foreign currencies that are necessary to finance imports and development projects. Other variables also exist that can influence the long term growth of the economy, among them we can emphasize the terms of trade (TOT) and real exchange rates (RER). Real exchange rates have had a fundamental role on controlling inflation in macroeconomic stabilization policies applied to Latin-American economies.

It has to be stressed that few studies exist that empirically analyse Thirlwall's Law for developing countries, and even less for economies like that of Bolivia that suffer from a structural character of external restriction on economic growth, as we shall see shortly.

The principal objective of this study is to utilize Thirlwall's Law to verify if there exists a relationship between growth and exports in the case of the Bolivian economy during the period 1953-2002. Also there will be an analysis to see if the real exchange rate and the terms of trade played an important role on such an economy.

Then, in the second part of the study we will develop the basic model of Thirlwall. In the following section there will be a brief review of the empirical application of such a model on other Latin-American economies. Next, will be presented some stylized facts of the external vulnerability that have troubled the Bolivian economy. Following that, an analysis of cointegration will be made to detect if in the long term Thirlwall's Law has been accomplished in such an economy. After that, an empirical analysis will be made on variations of the model[1] in order to incorporate the effect of the real exchange rate and terms of trade on Bolivian growth. Finally, the conclusions will be presented.

## II) Thirlwall's Model

Thirlwall's model (1979) is based on Harrod's dynamic foreign multiplier (1939) which determines long term economic growth. Such model can be expressed in the following three equations:

[1] See Elliot and Rhodd (1999), Ferreira and Canuto (2001), Moreno-Brid and Perez (2000), Moreno-Brid (2003) and López and Cruz (2000), for variations to the original model.

$$x = \phi q + \rho z \qquad (1)$$

$$m = \alpha q + \pi y \qquad (2)$$

$$x + q = m \qquad (3)$$

Equation (1) is the function of exports, equation (2) is the demand for imports, and (3) shows the current account equilibrium. The variables are the real growth rate of: *x* (exports), *m* (imports), *q* (relative prices), *y* (national income), and *z* (world income).

Substituting equations (1) and (2) into equation (3) we obtain:

$$y^* = \frac{(1+\phi-\alpha)}{\pi} q + \frac{\rho}{\pi} z \quad (4)$$

Substituting equation (1) into (4), and bearing in mind the Marshall-Lerner condition, or assuming that relative prices are constant (that is its growth rate is zero, $q$=0), we obtain:

$$y^* = (1/\pi)x \qquad (5)$$

This equation is known in economic literature as Thirlwall's Law, which establishes that, an increase of income elasticity for the demand for imports ($\pi$) reduces the rate of growth of the product of equilibrium in respect to the balance of payments. Notice that the causality in this model goes from exports to the product, which is why, differently to the traditional models of growth; it is considered that an increase of external demand is an important source in the growth of an economy.

## III) Empirical Evidence of Thirlwall's Law for Latin-American Countries

Models of growth with restrictions of foreign currency have been thought over basically for developed countries. In this sense, McCombie (1997) analyzes the case of three developed economies: the United States, Japan, and the United Kingdom. The author concluded that although the United States like the United Kingdom fulfill the hypothesis that the restriction of the balance of payments and the rates of growth have been close to the rates of growth of equilibrium with the balance of payments, nevertheless this fails to be the case of Japan.

However, in the last few years there has been an increasing interest in his application for emerging economies. In the study of such model for Latin-American economies the work of Moreno-Brid (1998), (1999), and (2000), Loría (2001), Loría and Fujii (1997), López and Cruz (2000), Porcile, Higashi and Bittencourt (2000), Bértola, Higashi and Porcile (2002), Fugarolas and Matesanz (2003), Márquez (2006), García and Quevedo (2005), and Pardo and Reig (2002), should be emphasized.

Moreno-Brid (1999) analyzes the case of the Mexican economy during the period from 1950 to 1996, separated into two sub-periods: 1950 to 1975 and 1976 to 1996. Accordingly, we can capture possible differences in the relationship between growth rates of exports and the GDP

due to shifts in the regime of foreign exchange rates[2]. In the study it is stressed that the terms of trade and the current account deficit are not perfectly aligned to the Mexican reality during the period of 1950-96[3]. Thus, it proves the existence of a relationship of cointegration of long term and positive significance between the GDP and exports, in which the income elasticity of imports ($\pi$) is 1.04 from 1950-81 and 2.47 for 1982-86. As can be observed in equation (5), an increase of $\pi$ provokes a reduction of growth. In fact, Moreno-Brid (1999) points out that such increase in elasticity restricted the balance of payments, reducing Mexico's economic growth. Probably, this could have been the major reason for the long term fall in the expansion rate of its domestic activity in the last fifteen years. In a later study, Moreno-Brid (2000) analyzes what he calls the "three generations of Balance of Payment Constraint models" and evaluates the McCombie test[4] for the Mexican economy. This author stresses that most of the empirical studies on Mexican imports have been unable to capture the effects of commercial protection on import demands. Other authors have tried to capture such effects in different ways, among which are emphasized the inclusion of "dummy" variables such as regressors to catch the hysteresis effect on the change of import demands. Another alternative focus would be to include variables that reflect the incidence of non-tariff restrictions on commercial flow[5]. Following this logic, Moreno-Brid (2000) includes in his estimation of import demands an index of licenses on importations[6]. The lack of statistical significance of long term effects of relative prices on import demands found in his estimation for the period 1967-99, validates the Balance of Payment Constraint hypothesis. Such is pointed out by McCombie and Thirlwall (1999), in a country that is potentially constrained in its balance of payments, a change of relative prices has no significant effect on the growth of exports or imports. The authors conclude that during the period 1967-99, the balance of payments has restricted the long term growth of the Mexican economy. It was also pointed out that during those years the terms of trade did not play a significant role in the determination of Mexican economic growth.

Another study to be highlighted is that of López and Cruz (2000), who incorporated the real exchange rate in the model in order to analyze how it affected long term domestic output. These authors conclude that the real exchange rate is significant for product growth with external equilibrium. This means that those countries where the Marshall-Lerner condition is satisfied could achieve a faster rate of output growth if they pursue a policy whose real exchange rate is kept at competitive levels. However, the real exchange rate by itself does not guarantee that output will be higher.

Loría (2002) analyzed the external restriction to economic growth in the case of Mexico, covering the period 1980-1999, with panel data for 59 sectors of goods. He studied the Mexican

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[2] The first sub-period was characterized by a system of fixed Exchange rate between the peso and the US dollar. The second for a system of administered flotation (Moreno-Brid, 1999 pp. 153).

[3] During the period 1950-91 to 1995-96 the terms of trade, measured according to the correct price of exports/imports, registered an accumulated fall of 16%.

[4] Such test was based on the developed methodology of McCombie (1997), and is known as the proof for BPC models of the third generation, which catch the potential effects of the capital flows in long term economic growth and accumulated external debt (Moreno-Brid, 2000 p.2)

[5] Among other observations made by Moreno-Brid and other studies on import demands, the stationary properties of the series were not considered, which were subject to spurious regression criteria (Granger and Newbold, 1974).

[6] Import demands were estimated as:

$$\ln(m_t) = \beta_0 + \beta_y \ln(y_t) + \beta_p \ln(p_t) + \beta_q q_t + \upsilon_t$$

Where *q* is the index of customs protection. Which remains between 0 and 1, being 0 when all the requirements for licenses have been eliminated and 1 when applying to all goods with or without import services?

economy in three divisions[7] in order to detect which sector is restricting economic growth. The leading hypothesis is that the manufacturing sector has not generated nor developed nor transferred resources to the rest of the economy. The results obtained are such that the real exchange rate, like the GDP of the United States, is a factor that corrects the Mexican trade balance. Finally, he concludes that sectors such as automobiles have increased exports and at the same time imports; this by itself has not generated any spillover effects.

Bertola, Higashi and Porcile (2002) made a study about Brazil. This work covered a large period of the economic history of the country, covering the primary export growth period and industrialization based on import substitution. The study came to a close in 1973 because the decade of the 1970's represented a new and particular phase from the perspective of capital flows and qualitative changes in the degree of external debt. The authors, after seeing that the series GDP, TT, and Z[8] are integrated processes of the first order (that is to say they are I(1)), when applying cointegration analysis using the Johansen procedure; at least two cointegration vectors can be found. Then, by obtaining the relationship over a long term can estimate an error correction model in order to see the dynamic that follows the process in the short term. Finally, they conclude by finding a relationship between GDP, exchange terms, and world income, thus verifying Thirlwall's Law.

Fugarolas and Matesanz (2003) showed that the traditional version of Thirlwall is a useful analytical framework to explain the slow growth of Argentina during the period 1968-2003. Observing that before the crisis of 2002, just as in the period 1968-2000 and of 1980-2000, the real growth rate was greater than the theoretical, what it was pointing out is that the country was capable of overcoming its restriction of balance of payments during a short period of time.

In the case of Colombia, Márquez (2006) concluded that Thirlwall's Law is more adequate to explain the relation between foreign commerce and economic growth. On the other hand, there is no evidence to show that international prices exercise an effect on the level of exports, although there exists a growing tendency of the real exchange rate. However, this inclusion in the model has almost zero effect. For their part, García and Quevedo (2005) analyzed the period of 1952-2000 verifying Thirlwall's Law for the Colombian economy, as having a growth rate of 4.4% the center of gravity towards which the country tended in the long term.

Pardo and Reig (2002), analyzed the case of Uruguay for the period 1960-2000, finding empirical evidence supporting Thirlwall's Law, they were suggesting the existence of a situation of restriction of the balance of payments on the growth during this time.

## IV) The Bolivian External Vulnerability: Past and Present

From 1985, Bolivia implemented a series of structural reforms that have formed a model of development characterized by deregulation, privatization and commercial liberalization[9] that have influenced not only exports and imports of goods and services, but also other balance of payment variables.

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[7] Those sectors are agriculture, mining, and manufacturing.

[8] These represent the product, terms of trade and world income. For world income the markets most representative for Brazil were taken, among them are found Argentina, Belgium, France, Germany, Holland, Italy, the United Kingdom and the United States.

[9] Elimination of import prohibitions, exemptions for volume and value, special and temporary licenses, among others.

The new commercial policy also sought to expand exports. From 1985, obstacles to exports were eliminated and a neutral taxation environment was instituted, also institutions were created to facilitate and promote such policies.[10] The external openness was not only focused on the commercial trade balance but also on the capital account of the balance of payments, eliminating restrictions to movement of capital in or out of the country, establishing free exchange and convertibility and forming environments of economic institutions in favor of receiving foreign investment.

In spite of external orientation, Bolivia has not changed its productive structure characterized by being primarily an exporter[11] (Arevilca, 2003).

According to Jordan (1993),[12] to understand Bolivian economic growth during the last two centuries is to return to the past of the mining crises in a process of dialectical synthesis. The reflection of these crises was seen in the shortage of foreign currencies, on the side of exports, and its impact on the balance of payments; also compared with other sectors of the economy it was losing force in its contributions to the GDP. For example, it is possible to mention that exports of natural gas doubled in value compared to exports of minerals between 1985 and 1986.

According to Nina and Brooks (2001), during 1986 hydrocarbons continued being the largest contributors to the General Treasury of the Nation. Therefore, there are two sectors of primary products regarding the total level of exports to explain the evolution of revenues of foreign currencies. During the first half of the decade of the eighties, their participation rose to 92.2% of the yearly average, while for the period 2000-2003 the average fluctuated around 47%, being evidence of the changes in the structure. In this last case hydrocarbons grew between 9% and 22% with respect to the total export (see Table 1).

[10] At the time of liberalizing exports, procedures and institutions were implemented that facilitated the processes of exporting. For example, the creation of the Ministry of Exports. The implementation of tax neutrality based on the devolution of tax among those highlighted the Value Added Tax (IVA), and the Specific Consumption Tax (ICE), and others.

[11] A clear example can be appreciated in Morales, Espejo and Chávez (1992), showing that between 1950 and 1990 exports of three primary natural resources (RNP), tin, zinc and natural gas, had constituted an average of 65% of the value of exports of merchandise from Bolivia. In the study of Loza (2002), it was shown that,, in real values, exports had fallen by 5.7% over 10 years and their deterioration had been registered in two parts: between 1990 and 1992; with a fall of 27% as a consequence of the reduction of gas exports to Argentina, and in 1998 to 1999, due to the international crisis, with an accumulated fall of 16%.

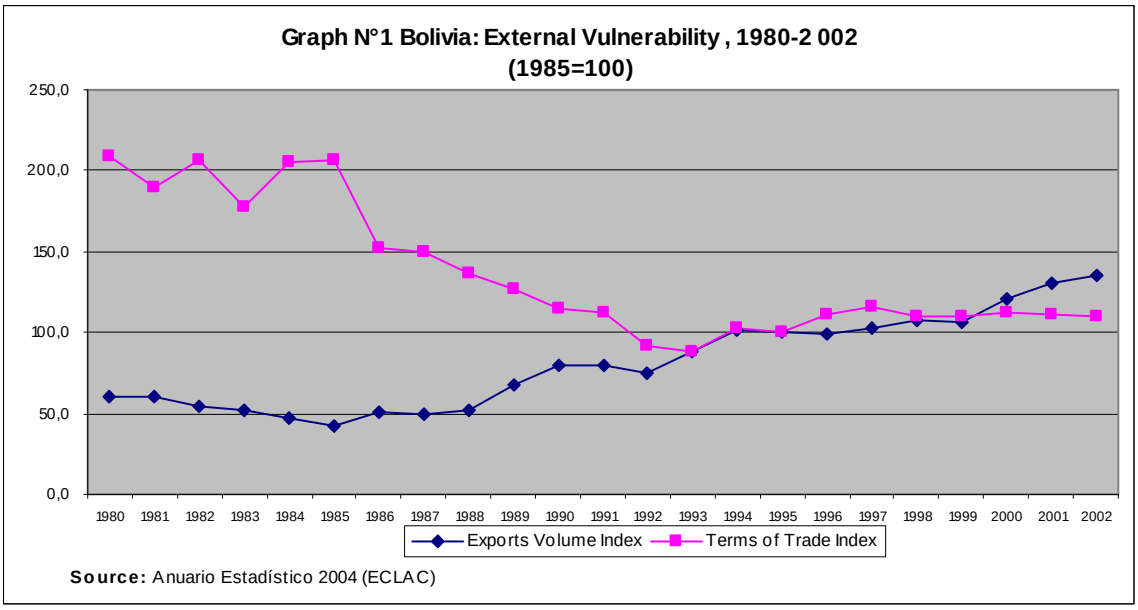
[12] In the 16th, 18th, and 19th centuries the country had been through devastating crises of employment, production and the global function on the colonial and national economy. This calls our attention equally to the actual crisis, the macroeconomic context had been the determinant that accentuated and/or deepened the economic crisis.

**Table 1. Participation of primary goods in the total exports (percentages)**

| Year | Hydrocarbons | Minerals | Total |
|---|---|---|---|
| Average | | | |
| 1980-1985 | 43.2 | 49 | 92.2 |
| 1986-1990 | 36.9 | 41.4 | 78.3 |
| 1991-1995 | 16.5 | 45.3 | 61.9 |
| 1996-1999 | 9 | 39.2 | 48.2 |
| 2000-2003 | 22.1 | 25.3 | 47.4 |

Source: Self elaboration based on Nina and Brooks (2001), INE (2004).

Although it is certain, as many analysts point out, that exports have grown after the liberalization process; these did not change significantly in their structural content, since basically the country was continuing to export *commodities*. So the Prebisch-Singer Thesis (a permanent deterioration in the terms of trade, see Prebisch (1950)) holds valid for such economies, as emphasized by Larrazábal et al. (2002) and Arevilca (2003) (See graph No. 1).




As indicated by Larrazábal et al. (2000), the foreign debt has been a restriction to the long term growth of the Bolivian economy, transforming itself into a concern of State after the crisis in the decade of the eighties. For example, as pointed out by Cariaga (1994), in 1984 there was an agreement with the Central Obrera Boliviana (COB – the principal labor union in Bolivia)) to designate 25% of exports for paying the foreign debt.

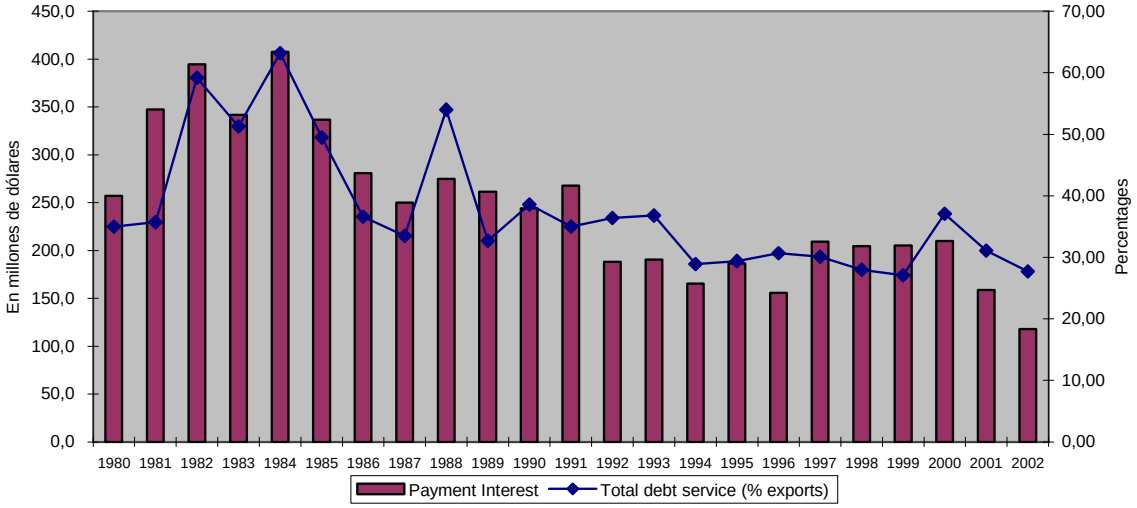
Although the HIPC[13] program has helped to reduce the foreign debt service (See graph No. 2) these are conditioned to the application of counter-productive policies such as the structural reforms. Also the use of such funds was destined to a greater social expense and the fight

[13] Heavily Indebted Poor Countries.

against poverty[14]; by this it does not mean to say that it is such a bad purpose, but on the contrary, it could be used more productively with greater multiplying effects on the economy.

A great part of these resources (62.8% of the debt relief) are provided by bilateral sources, while the remaining 37.2% are derived from the participation of international cooperation at a multilateral level.

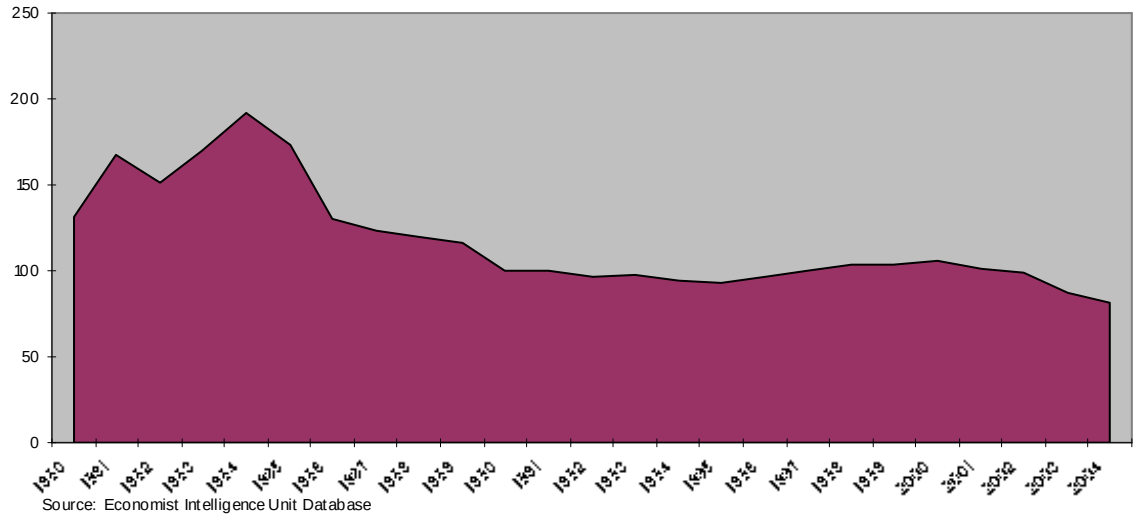
**Graph N°2 : Bolivia: Foreign Debt Service, 1980-2 002**




**Source:** Anuario Estadísitico, 2004 (CEPAL) y World Development Indicators, 2004 (CD-Rom)

Another relevant aspect has been the handling of the exchange rate. Schweickert (2001) indicates that this instrument has two objectives in economies like that of Bolivia: a) to help generate expectations against inflation; and b) to preserve external competitiveness. One of the author's conclusions is that although the exchange rate helped to reduce inflationary expectations, it did not help, and on the contrary, it was a negative factor on the performance of exports.

**Graph N°3 Bolivia: Real Exchange Rate, 1982-2004**




Source: Economist Intelligence Unit Database
Nota: Trade-weighted basket of currencies converted to an index (1997=100) and adjusted for relative price movements

[14] The country had benefited by a relief of 1,137 millions of dollars on its external debt. Under the initiative of HIPC II, Bolivia benefited from an additional debt relief of the order of 1,543 millions of dollars, as a result of the approbation of the Bolivian Strategy of the Reduction of Poverty (EBRP).

According to Loría (2003) and Elliot and Rhodd (1999), the high cost of servicing the foreign debt, the misalignment of the exchange rate (overvaluation) and the influence of the terms of trade are factors that have influenced the long term performance of economies like that of Bolivia.

Next, a table is presented which summarizes the balance of payment constraint growth model, besides the graphical representation applied to the Bolivian economy, in order to understand with greater accuracy the changes on the path of long term growth and how the availavility of foreign currencies influenced their performance. For this purpose, the period under analysis is divided into six sub-periods that were crucial for the economic and political history of Bolivia.

**Table 3. Bolivia: Real GDP, Exports and Imports 1953-2002**

| | 1953-62 | 1963-71 | 1972-82 | 1983-88 | 1989-95 | 1996-2002 |
|---|---|---|---|---|---|---|
| GDP Growth Rates (Y) | 1.86 | 5.6 | 2.29 | 0.88 | 4,08 | 1.51 |
| Exports (X) | -1.44 | 10.39 | 16.84 | 0.44 | 8 | 5.53 |
| Imports (M) | 5.11 | 7.09 | 13.7 | 7.93 | 9.98 | 2.9 |
| Income Elasticity of imports<br><br>X' =(M/Y) | 2.75 | 1.27 | 5.98 | 9.01 | 2.44 | 1.92 |
| Balance of Payment with external Equilibrium (Yca)=X´/X | -0.52 | 8.21 | 2.81 | 0.05 | 3.28 | 2.88 |
| Growth Gap (Y-Yca) | 1.34 | -2.61 | -0.52 | 0.83 | 0.81 | -1.37 |
| Terms of Trade (2000=100) | 10.51 | 15.88 | 161.12 | 200.58 | 156.65 | 97.25 |
| Current Account (% GDP) | -2.94(*) | -5.48(**) | -9.73 | -7.89 | -5.57 | -5.58 |

Source: Self elaboration based on World Bank, *World Development Indicators*, CD 2004, OXLAD, Oxford University y CEPAL, *Anuario Estadístico*, On line, 2004. Nota: *) Solo para el año 1976 y **) solo para el año 1977.

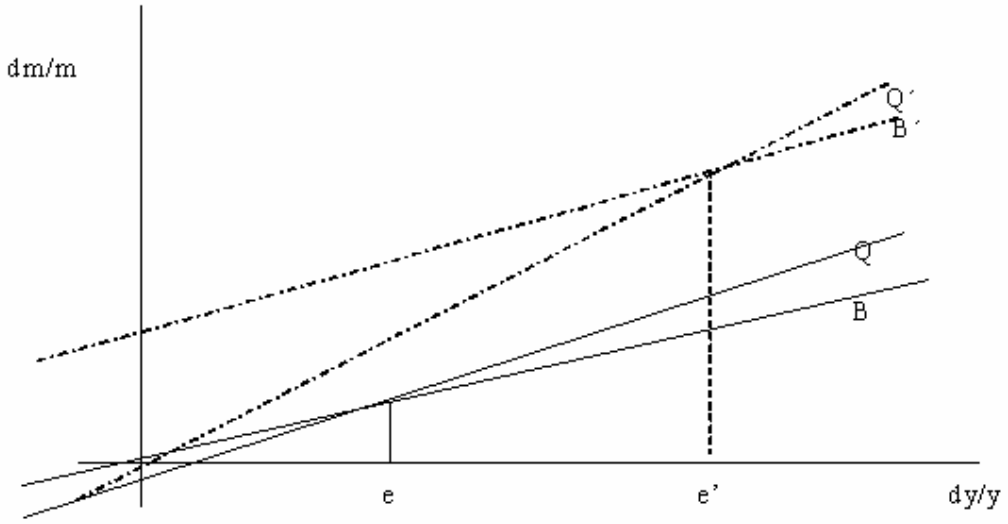
The first period covers 1953 to 1962, coinciding with the process of the national revolution and the later macroeconomic stabilization; the *boom* exporter will manifest itself during 1963 – 1971, a period in which the prices of the main export products rallied. For example, it is enough to see the rate of growth of exports, which rose to 10.39% compared with those during 1953-62, that show a clear decline.

The following sub-period is one of the most important in the contemporary life of the country, not only economically but also politically. It began in 1972 with the dictatorship of the then Colonel Banzer, this period is characterized for its positive *shock* in terms of trade, such as international financial help thanks to the support of the United States, that endorsed this

government. The favorable situation did not last too long, and then began signs of economic recession as an effect of the already important load of debt and pressure from international private creditors. Without saying more, such period was characterized as "the lost decade" that affected the majority of Latin-American countries. Another important date is 1985, a year in which the Supreme Decree (D.S.) 21060 became valid, and this changed the actual model of development until the present time. During the period 1989 to 1995 important events took place such as the wave of the first generation policies of structural reforms and the deepening of privatization policies. These have not been modified during the following years, now that the premarket reforms have been deepened as much in the economic context as the institutional.

Continuing with Moreno-Brid (1998), the model is exemplified in a graphic representation of the period 1953-62 and 1963-71, when, as was already explained shows a process of social revolution at the onset of the 1950's and later, a process of *boom* exporter for the following period.

**Figure 4. Bolivia: Economic Balance according to Balance of payments movements 1953-62 y 1963-71**[15]




The upward movement of the line B towards B' reflects the accelerated expansion of exports. The income of foreign currencies for exports makes for an improved economic situation and accelerated rate of growth. On the other side, the line Q towards Q' reflects the increment in the income elasticity of imports, and their upward movement gains the effect of improving terms of trade.

## V) Empirical Evidence for Bolivia (1953-2002): Application of Thirlwall's Model.

### V.1) Econometric specification

[15] With the purpose of illustrating that the diagram only represents that period and not those that follow (See further details in Arevilca, 2004).

This section basically aims to test Thirlwall's model in the case of the Bolivian economy. Considering the fundamental equation (5) given in section II, an econometric specification is proposed:

$$Ln(GDP)_t = \alpha_0 + \alpha_1 Ln(X)_t + \varepsilon_t \qquad (6)$$

Equation (6) is known as the econometric specification of Thirlwall's Law and tells us that the GDP is determined by exports plus an error term. Where the coefficient $\alpha_1$ is the inverse of the income elasticity of imports.

Afterwards, some modifications are made to estimate the real exchange rate (RER) effect on the economic growth as shown in equation (7).

$$Ln(GDP)_t = \beta_0 + \beta_1 Ln(RER)_t + u_t \qquad (7)$$

The objective of equation (7) is to see if other variables considered as insignificant in Thirlwall's model are relevant. The RER has been important in developing economies when applying stabilization policies; therefore, the significance of coefficient $\beta_1$ will be considered.

Equations of trade balance (TB), imports (M), and exports (X) will be estimated to analyze the level of external constraint, see equations (8), (9) and (10).

$$TB_t = \delta_0 + \delta_1 Ln(GDPUSA)_t + \delta_2 Ln(GDP)_t + \delta_3 Ln(RER)_t + v_t \qquad (8)$$

Note that in equation (8) it is important to test the Marshall-Lerner condition checking to see if RER is of significance in the model, otherwise Thirlwall's supposition would be invalid.

$$Ln(X)_t = \gamma_0 + \gamma_1 Ln(GDP)_t + \gamma_2 Ln(TOT)_t + z_t \qquad (9)$$

$$Ln(M)_t = \varphi_0 + \varphi_1 Ln(GDP)_t + \varphi_2 Ln(TOT)_t + h_t \qquad (10)$$

By equations (9) and (10) the impact of the GDP on exports and imports can be seen, also they can be used as a test to see the equality between the ratio of income elasticity of exports and imports with the average domestic and foreign growth ratio, as in equation (11) (see Moreno-Brid 2003).

$$\frac{\gamma_1}{\varphi_1} = \frac{y}{y_{rm}} \qquad (11)$$

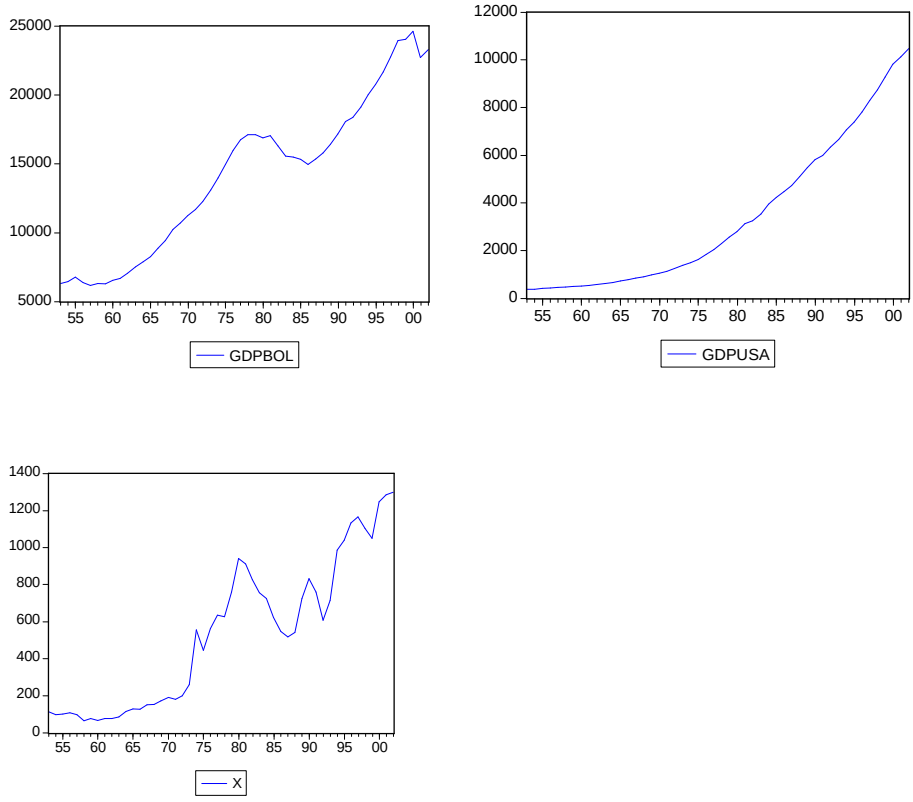
Where y is the average domestic growth and $y_{rm}$ the foreign growth (the rest of the world).

**V.2) Data Set**

We will begin the empirical analysis with the revision of the statistical series that will be used as being the Gross Domestic Product of Bolivia at the constant prices of 1970, the United States product in billion of dollars, the volume of exports and imports in millions of dollars, the nominal exchange rate, the service of the foreign debt and lastly the terms of trade. The data of the series to calculate the import and export functions come from the International Monetary Fund (International Financial Statistics), World Development Indicators, 2004 of the World Bank (CD-Rom), the database of the OXLAD (Oxford University)[16], besides the Annual Statistics Yearbook 2004, ECLAC.

Note, it can be appreciated in figure 5 that the series seem to follow a tendency in time[17], suggesting that they are not stationary. Moreover, it can be observed that the series of the Bolivian GDP follows a continuous process of *stop and go* cycles possibly influenced by external factors such as, for example, the terms of trade.

**Figure 5. GDP of Bolivia and the USA, and Bolivian Exports**




---x

Source: Self elaboration based on the data set.

[16] **http://oxlad.qeh.ox.ac.uk/.** In this webpage can be found a hundred years of series statistics of various Latin American countries.

[17] It is important to show the discussion which tries to elucidate if the economic series have a deterministic tendency (TS) or are stationary in difference (DS). A discussion on this theme can be found in Nelson and Plosser (1982).

**V.3) Unit-Root Analysis**

As a preliminary step to study the existence of one or more cointegration relationships, it is necessary to analyse the integration order of the variables to include in the model. That is why it is important to know if the variables are stationary or not, and if not then what order of integration do they have. Therefore, the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests are applied.

To carry out the study, the logarithmic expression of the following series are considered: the Gross Domestic Product (GDP), real exports (X), real imports (M), real exchange rate (RER), terms of trade (TOT), and GDP of the United States (GDPUSA). In addition the Trade Balance (TB) was defined as the difference between the logarithm of exports and imports, a study that was made during the period 1953-2002, and all the series appear to behave as I(1) processes.

ADF and PP test results are shown in Tables 3 and 4 for the three traditional models (without both constant and trend, with constant and without trend, and with constant and trend) for both variables of level and difference, respectively.

**Table 3. Unit Root Tests* (Levels of the logarithm of the variables)**

| Variable : | Ln(GDP) | Ln(GDPUSA) | Ln(X) | Ln(M) | Ln(RER) | Ln(TOT) | TB |
|---|---|---|---|---|---|---|---|
| *Model without both constant and trend* | | | | | | | |
| ADF-test : | **1.13** | **0.59** | **1.81** | **-0.56** | **-1.97** | **0.80** | **-1.24** |
| PP-test : | **2.94** | **8.74** | **1.78** | **-0.41** | **-1.80** | **0.59** | **-1.34** |
| *Model with constant and without trend* | | | | | | | |
| ADF-test : | **-1.09** | **-1.24** | **-0.46** | **-0.54** | **-0.82** | **-1.32** | **-0.60** |
| PP-test : | **-0.92** | **-0.42** | **-0.48** | **-0.28** | **-0.93** | **-1.33** | **-0.45** |
| *Model with constant and trend* | | | | | | | |
| ADF-test : | **-2.24** | **-0.13** | **-1.87** | **-2.17** | **-1.65** | **-0.24** | **-2.21** |
| PP-test : | **-1.51** | **-1.26** | **-1.98** | **-1.91** | **-1.98** | **-0.48** | **-1.85** |

Source: Self elaboration based on obtained results.

* Augmented Dickey-Fuller and Phillips-Perron tests. (a) Null Hypothesis rejection at 1%.

(b) Null Hypothesis rejection at 5% or 10%. Based on obtained results.

| **Table 4. Unit Root Tests* (First difference of the logarithms of the variables)** | | | | | | | |
|---|---|---|---|---|---|---|---|
| Variable : | ΔLn(GDP) | ΔLn(GDPUSA) | ΔLn(X) | ΔLn(M) | ΔLn(RER) | ΔLn(TOT) | ΔTB |
| *Model without constant and without trend* | | | | | | | |
| ADF-test : | **-1.86** | **-0.63** | **-6.16(a)** | **-3.53(a)** | **-5.32(a)** | **-5.89(a)** | **-3.64(a)** |
| PP-test : | **-2.90** | **-0.89** | **-6.17(a)** | **-3.48(a)** | **-5.33** | **-5.96(a)** | **-3.60(a)** |
| *Model with constant and without trend* | | | | | | | |
| ADF-test : | **-2.18** | **-4.87 (a)** | **-6.60 (a)** | **-3.90 (a)** | **-5.54 (a)** | **-6.00 (a)** | **-3.83 (a)** |
| PP-test : | **-3.88 (a)** | **-5.15 (a)** | **-6.60 (a)** | **-3.92 (a)** | **-5.53 (a)** | **-6.07 (a)** | **-3.82 (a)** |
| *Model with constant and trend* | | | | | | | |
| ADF-test : | **-2.20** | **-4.93 (a)** | **-6.52 (a)** | **-3.86 (b)** | **-5.47 (a)** | **-6.21 (a)** | **-3.81 (b)** |
| PP-test : | **-3.88 (b)** | **-5.16 (a)** | **-6.52 (a)** | **-3.88 (b)** | **-5.47 (a)** | **-6.20 (a)** | **-3.80 (b)** |
| Source: Self elaboration based on obtained results.<br>* Augmented Dickey-Fuller and Phillips-Perron tests. (a) Null Hypothesis rejection at 1%.<br>(b) Null Hypothesis rejection at 5% or 10%. Based on obtained results. | | | | | | | |

**V.4) Estimation of Thirlwall's Law**

According to Espasa and Cancelo (1993), from a strictly economic point of view, the study of the existence, or not, of a relationship of cointegration between the variables that are analyzed is one of the fundamental results of the modeling process, also to what level the analysis explains the behavior of the variables over the long term through the explicative variables that are considered in the process of modelization.

Following Jayme (2001), firstly, a cointegration study between the Bolivian GDP and exports is made for the whole period (1953-2002). Such is the first step to discover whether it is possible to have the existence of a long term relationship, as was proposed by Thirlwall.

Table 5 shows the cointegration relationships for the entire period and for different sub-periods. The Johansen cointegration test (Johansen, 1988) was applied, which is preferable to the two stage method of Engle and Granger due to one advantage: in case of more than one relationship of cointegration, the Johansen test estimates all of the vectors.

**Table 5. Cointegration equations for Johansen between the logarithm of the Bolivian GDP and that of exports**

| | Intercept | Log of exports | Lags |
|---|---|---|---|
| *Period 1953-2002* | | | |
| coefficient | 6.66442 | 0.464067 | 1 |
| t-statistic | [-52.3226] | [-22.2709] | |
| *Period 1953-1971* | | | |
| Coefficient | -2.384026 | -1.497793 | 2 |
| t-statistic | [-2.57979] | [-7.32917] | |
| *Period 1971-1990* | | | |
| Coefficient | 7.70214 | 0.302836 | 3 |
| t-statistic | [-79.4384] | [-20.1245] | |
| *Period 1953-1989* | | | |
| coefficient | 6.745292 | 0.449918 | 2 |
| t-statistic | [-72.5334] | [-28.2449] | |
| *Period 1953-1982* | | | |
| coefficient | 6.647231 | 0.471281 | 2 |
| t-statistic | [-55.0970] | [-20.5892] | |
| *Period 1982-2002* | | | |
| coefficient | 5.351271 | 0.662718 | 1 |
| t-statistic | [-13.9863] | [-11.6540] | |
| *Period 1966-1985* | | | |
| coefficient | 6.052821 | 0.568114 | 5 |
| t-statistic | [-21.3182] | [-11.4750] | |
| *Period 1985-2002* | | | |
| coefficient | 5.63427 | 0.625675 | 1 |
| t-statistic | [-23.9750] | [-17.9058] | |

Source: Self elaboration based on obtained results. Econometric program Eviews 4.1 was used.

The results show the existence of a cointegration vector for every period. Accordingly, we obtain a necessary condition that defends Thirlwall's Law for the Bolivian economy.

However, in order to analyze the period it will be recommendable to consider the explicative variable (exports) as being weakly exogenous in the model. As suggested by Espasa and Cancelo (1993), a variable is exogenous in the analysis being made, if it can be done without the need of modelling the explicative equation of the presumed exogenous variable. Therefore, Table 6 shows the cointegration relations obtained after testing for weak exogeneity of the exports.

**Table 6. Cointegration after weak exogeneity of the exports**

| | Intercept | Log of the Exports | Lags |
|---|---|---|---|
| *Period 1953-2002* | | | |
| coefficient | 6.249349 | 0.517585 | 1 |
| t-statistic | [-21.4557] | [-10.8623] | |
| *Period 1953-1971* | | | |
| Coefficient | 5.942119 | 0.63402 | 2 |
| t-statistic | [-19.6591] | [-9.48537] | |
| *Period 1971-1990* | | | |
| coefficient | 8.157586 | 0.233790 | 3 |
| t-statistic | [-27.6481] | [-5.10539] | |
| *Period 1953-1989* | | | |
| coefficient | 6.655979 | 0.463577 | 2 |
| t-statistic | [-61.2632] | [-24.9103] | |
| *Period 1953-1982* | | | |
| Coefficient | 6.538935 | 0.490452 | 2 |
| t-statistic | [-18.5210] | [-46.8493] | |
| *Period 1982-2002* | | | |
| Coefficient | -9.380896 | 2.68332 | 1 |
| t-statistic | [ 0.37940] | [-0.73018] | |
| *Period 1966-1985* | | | |
| Coefficient | 5.929265 | 0.588508 | 5 |
| t-statistic | [-18.8801] | [-10.7468] | |

| *Periodo 1985-2002* | | | |
|---|---|---|---|
| Coefficient | 5.985599 | 0.578888 | 1 |
| t-statistic | [-13.0633] | [-8.49697] | |
| Source: Self elaboration based on obtained results. Econometric program Eviews 4.1 was used. | | | |

Note that Table 6 permits the study of the long term implicit elasticity of imports ($\pi$) for each period. For the period 1953-2002, the income elasticity of imports is 1.92 (represented by a coefficient of 0.52). During the period 1953-1971, the income elasticity of imports is 1.59 (represented by a coefficient of 0.63). In comparison with the period 1985-2002, when the coefficient is 0.58 and the income elasticity of imports is 1.72, it is possible to appreciate an increment of 8.18% in such elasticity. This suggests to us that the actual economic model (implemented since 1985) has been harmful to the Bolivian economy increasing the external constraint of economic growth.

**V.5) Effects of the RER on the Bolivian GDP**

López and Cruz (2000) suggested that the exchange rate has played an essential role in the long term growth of the Bolivian economy. It can be highlighted that after trade and financial liberalization according to the Washington Consensus (WC), the exchange rate took an essential role not only in fomenting exports but also controlling inflation generating a trade-off in terms of economic policy; that means violating Tinberger's rule: an instrument and two objectives; see Tinberger (1952), Fernández et.al. (2002), Martner (2000), and Arevilca (2004).

In Table 7, it can be observed that the relation of cointegration proportioned for Johansen's test, has 5% significance. Such vector of cointegration represents a stable long term relationship between the product and the exchange rate, as in López and Cruz (2000).

| **Table 7. Cointegration relationship between the GDP and the real exchange rate** | | |
|---|---|---|
| Sample(adjusted): 1957-2000 | | |
| Lags interval (in first differences): 1 to 3 | | |
| 1 cointegrating relation found | | |
| Ln(GDP) = | 10.48197 | -0.051540.Ln(RER) |
| t-statistic | [-39.2248] | [ 3.47680] |
| Source: Self elaboration based on obtained results.<br>Eviews 4.1 program was used. | | |

However, in order to do an inference analysis during the period, it is necessary to see if the RER is an exogenous variable in the model. Table 8 shows the cointegration relationship obtained, assuming that the RER is weakly exogenous. Note that the exogeneity test does not reject such hypothesis, having similar coefficients in both specifications.

| **Table 8. Test of Weak Exogeneity over the RER** | | |
|---|---|---|
| Cointegration relationship | | |
| $H_0$) RER is weakly exogenous | | |
| LR-statistic: | 0.085231 | |
| Probability : | 0.77033 | |
| New cointegration relationship considering exogeneity | | |
| Ln(GDP) = | 10.45345 | -0.053275.Ln(TCR) |
| t-statistic | [-41.1528] | [ 3.78077] |
| Source: Self elaboration based on obtained results<br>EViews 4.1 program was used. | | |

Without rejecting that the TCR is weakly exogenous in the model, it is possible to make an inference analysis for the whole period.

In all cases the signs are what are expected and it is possible to affirm that an increment in the RER has reduced the long term rate of growth for the product in the whole period. In order to confirm such a hypothesis a cointegration relationship for the trade balance is estimated to prove if the Marshall Lerner condition is fulfilled.

**V.6) Cointegration relationship for the Bolivian trade balance**

When including the trade balance (in constant dollars), the world product (taking as a reference the GDP of the USA, in constant dollars), the domestic product (in constant units), and the real exchange rate (in logarithms), a cointegration vector is found of 5%.

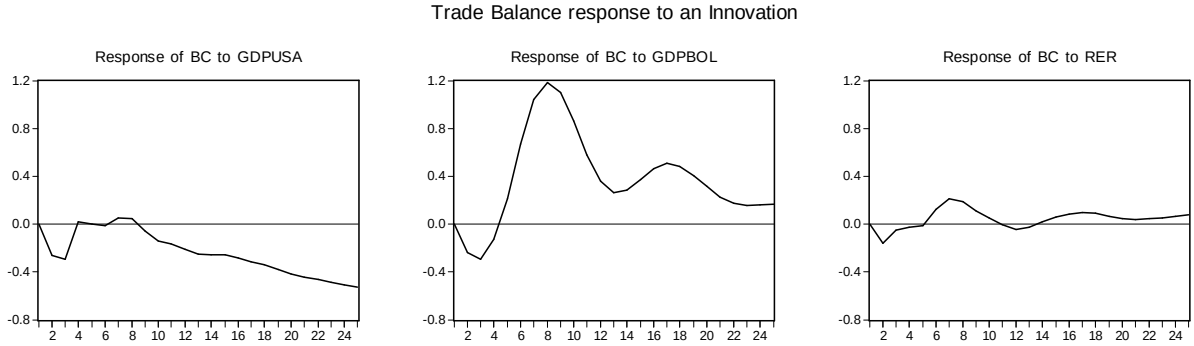
According to Tables 9 and 10, the trade balance is positively related to the Bolivian GDP and negatively with the GDP of the USA and the RER.

| **Table 9. Cointegration relationship between the TB, the GDPUSA, the domestic GDP, and the RER** | | | | |
|---|---|---|---|---|
| Sample(adjusted): 1962-2000 | | | | |
| Lags interval in the first difference: 1 a 3 | | | | |
| 1 Cointegrating Equation found | | | | |
| TB= | -45 | - 11.45.Ln(GDPUSA) | +14.5821.Ln(GDP) | - 0.008.Ln(RER) |
| t-statistic | [ 3.99255] | [ 10.4689] | [-6.75939] | [ 0.14616] |
| Source: Self elaboration based on obtained results.<br>Eviews 4.1 program was used. | | | | |

| **Table 10. Weak exogeneity on the US GDP, the domestic GDP, and the RER** | | | | |
|---|---|---|---|---|
| Sample(adjusted): 1962-2000 | | | | |
| Lags interval (in first differences): 1 a 3 | | | | |
| 1 Cointegrating Equation found | | | | |
| TB= | -47 | - 11.18.Ln(GDPUSA) | +14.45.Ln(GDP) | - 0.004.Ln(RER) |
| t-statistic | [3.98338] | [ 9.95095] | [-6.51935] | [-0.67647] |
| Source: Self elaboration based on obtained results<br>EViews 4.1 program was used. | | | | |

Note that the RER coefficient is of little significance, almost equal to 0. Since the *Marshall-Lerner* condition is satisfied, and then in order to obtain larger growth rates of products it is necessary to maintain the RER at competitive levels. Finally, an impulse-response function is made to study the innovation effects of the mentioned variables on the trade balance.

**Figure 6. Impulse-response: Effects of an innovation on the US GDP, the domestic GDP and the RER on the trade balance**




Source: Self elaboration based on obtained results.

A final comment is due on the TB model, from the graph: the signs are confirmed, it can be appreciated that the US GDP has a negative effect. Also, the Bolivian GDP has a long term positive effect on the trade balance, while the RER has an almost insignificant effect. This brings us to conclude that depreciation could have a negative effect on the domestic demand in the long term but an almost null effect on the trade balance.

Following Moreno-Brid and Pérez (2000; 2003), Table 11 shows the analysis of the effect of TOT on long term growth. Thus we can estimate the functions of imports and exports.

| **Table 11. Cointegration vectors for imports and exports** | | |
|---|---|---|
| Import equations | | Export Equations |
| *Period 1953-2002* | | *Period 1953-2002* |
| Ln(M)= -193.21 + 21.32Ln(GDP) – 1.38Ln(TOT) | | Ln(X)= -10.81 + 1.69Ln(GDP) + 0.18Ln(TOT) |
| (5.10) (-4.62) (5.11) | | (14.46) (-18.53) (-5.50) |
| *Period 1953-1985* | | *Period 1953-1985* |
| Ln(M)=-30.25 + 2.64Ln(GDP) + 0.15Ln(TOT) | | Ln(X)= -10.20 + 1.61Ln(GDP) + 0.22Ln(TOT) |
| (30.25) (4.21) (0.75) | | (6.53) (3.70) (8.41) |
| *Period 1985-2002* | | *Period 1985-2002* |
| Ln(M)=-125.55 + 11.23Ln(GDP) + 4.91Ln(TOT) | | Ln(X)= -17.47 + 2.26Ln(GDP) + 0.39Ln(TOT) |
| (21.71) (-24.43) (-18.70) | | (9.78) (-15.76) (-4.92) |
| Source: Self elaboration based on obtained results. | | |

The results indicate the existence of at least one cointegration vector at a level of 5% in all the cases. It calls our attention to the high income elasticity of imports for the whole period of the study, which represents a magnitude of 21.32.

If the two traced periods are compared, it is seen that the income elasticity of imports has increased in an important way during the period 1953-1985 and 1985-2002, from 2.64 to 11.23 respectively. In the case of exports, the results show us an income elasticity of 1.69 for the whole period; presenting a variation for the periods 1953-1985 and 1985-2002, that goes from 1.61 to 2.26, correspondingly.

The above-mentioned explains the negative elasticity that the Bolivian GDP presents on the trade balance. This arises from the fact that imports react in a stronger way when faced with a change of GDP, than exports. In this way, an increment of 1 point of the GDP would increase imports by 21.3 points, but exports by only 1.69 points; the net balance is negative, pointing to a fall in the trade balance.

**Table 12. Income elasticity of imports, exports, and the growth ratio**[18]

| | Income elasticity of imports | Income elasticity of exports | Elasticity ratio | Growth ratio |
|---|---|---|---|---|
| 1953-2002 | 21.32 | 1.69 | 0.08 | 0.40 |
| 1953-1985 | 2.64 | 1.61 | 0.61 | 0.35 |
| 1985-2002 | 11.23 | 2.26 | 0.20 | 0.47 |

Source: Self elaboration.

[18] This table follows the methodology employed by Moreno-Brid and Pérez (2003).

The empirical validity of the model can be verified by means of a comparison of the ratio of elasticity that arises from the cointegration equations with the ratio between the average growth of the national GDP and that of the USA. Note that income elasticity of imports for the period 1953-2002, affects the estimation of the ratio of elasticity and of growth. A clear justification of this fact could be applied to the decade of the seventies, when Bolivia received not only a positive influx of capital but also foreign support. (See Arevilca, 2003)

## Conclusions

Most of the studies about economic growth have focused on the analysis of productive factors (physical and human capital), as well as technology, as determinants. Thirlwall (1979), from a post-Keynesian point of view, proposed a model of growth that was focused on factors of external demand (exports, imports, and demand from the rest of the world).

This paper intends to contribute to the empirical study of the Bolivian economy. Accordingly, statistical and econometric analysis was carried out, without rejecting the validity of Thirlwall's Law for the Bolivian economy during the period of 1953-2002. Additionally, this approach suggests that there exists a situation of constraint on the balance of payment, associated with a slow evolution of the export growth rate in relation to the income elasticity of the demand for imports, which indicates the importance of the above-stated constraint in explaining the low effective long term rate of product growth.

To this study, were added some variations of the model, such as the suggestions by Moreno-Brid and Pérez (2000; 2003), and by López and Cruz (2000). Also, the effect of the real exchange rate was analyzed, this is crucial to understand the long term growth of the Bolivian economy, since it has been an important variable in the policies of stabilization. It was observed that this had a negative effect on the long term product growth. On the other hand, it had a null effect on the trade balance, which is in agreement with the assumptions of Thirlwall's model. A curious result is that the Bolivian GDP has a negative effect on the trade balance. While estimating the functions of exports and imports, two conclusions can be obtained. Firstly, imports are more elastic to the GDP than exports, which explain the negative sign of the trade balance; it means that an increase of the Bolivian GDP causes the growth of imports to be above that of exports, resulting in a negative trade balance. Secondly, it can be appreciated that income elasticity of imports and exports present a close relationship with the growth ratio between domestic and foreign income, verifying the assumptions of Thirlwall's model.

Considering that Bolivia has specialized principally in exporting raw materials (non-traditional), while the demand for imports of manufactured products has increased more than exports, before the growth of GDP, then the model applied since 1985 increased the income elasticity of imports, augmenting the external constraint of the country. A hypothesis could be that Bolivia has followed a "deindustrialization" process (increasingly importing overseas manufactured products), while losing competitivity to the rest of the world. Then, we need to consider about the strategy that the country has bet on since 1985 that has not contributed to any modification of productive conditions, stressing even more foreign constraint.

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Translated by Jeremy Jordan
Translation from **Revista de Humanidades y Ciencias Sociales (Santa Cruz de la Sierra)**, Santa Cruz de la Sierra, v.9, n.1-2, p.187-219, June/Dec. 2006.