

Thirlwall's Law: the export sector and economic growth in Mexico, 1993-2016

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Abstract

This paper applies the basic balance-of-payments constraint growth (BPCG) model, to the analysis of Mexico's economic growth using data from BIE (INEGI) over the period 1993-2016. Hence, following Moreno Brid (1999), a VAR model with cointegration is applied to estimate the long-run relation between the exports and real output in 1993-2016. Also, this research provides an overview of the change in the external sector during the period of trade liberalization in order to improve export competitiveness and achieve better integration into the international market. The results show that there is a positive cointegration between these two variables and, therefore, it's plausible to consider the Thirlwall's Law as a hypothesis capable of explaining the economic growth of Mexico in the long run.

Balance of payments, foreing trade, exports, economic growth

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Introduction

Nowadays, economic growth is one of the topics that more debate generates within the academic circles, as there are different schools of economic thought that try to explain their causal factors from a particular perspective. Specifically, Thirlwall (1979) proposes that growth analysis be developed from a demand-driven approach to understanding the role of exports within the economic system. In fact, the contribution made by Thirlwall stands out because it establishes how the supply of productive factors responds in an endogenous way to an expansion of production and aggregate demand.

These studies are summarized in the Thirlwall's Law (or Harrod-Thirlwall's Law), which establishes that the rate of income growth of a country is equal to the quotient that results from dividing the income elasticity of the exports between the elasticity income of the imports. This idea is based on the assumption that a country can't resort to foreign capital to sustainably finance its trade deficit, in addition to the fact that there is no influence on the terms of trade or other price effects.

In particular, this research applies the basic balance-of-payments constrained growth (BPCG) model to the analysis of Mexico's economic growth to determine if the export sector has been able to transfer its success to the rest of the local economy, as proposed by neoclassical theory.

The methodology applied consist in a VAR model with cointegration to estimate the long-run relation between the exports and real output in 1993-2016, introducing two dummy variables to capture the structural changes that occurred in Mexico due to the devaluation of the local currency in 1995 and the international financial crisis in 2008.

The structure of this research is organized as follows: the first section presents the theoretical basic model of the Thirlwall's Law. Second section shows a brief description of the Mexican economy during the period of trade opening. The next section present the econometric results of this study. Finally, the last section provides conclusions and economic policy advices.

Thirlwall's Law. Theoretical elements

The original version of this model (1979)² can be expressed using the following equations. These are:

$$x = \eta[p - p^* - e] + \varepsilon z \quad (1)$$

$$m = \psi[p^* + e - p] + \pi y \quad (2)$$

$$p + x = p^* + m + e \quad (3)$$

Equations (1) and (2) represent the demand functions for exports and imports. While (3) represents the current account balance. Where x , p , m , p^* , e , y , z represent continuous rates of change of the following variables: exports, domestic prices, nominal exchange rate, domestic income and world income. In addition, $\eta < 0$ and $\varepsilon > 0$ are the price and income elasticities of exports, $\psi < 0$ and $\pi > 0$ are the price and income elasticities of imports.

To solve the system of equations (1) - (3) and thus find the growth rate of the economy in the long run, be replaced (1) and (2) in (3):

$$p + [\eta(p - p^* - e) + \varepsilon z] = p^* + [\psi(p^* + e - p) + \pi y] + e \quad (4)$$

² Does not include capital flows.

It follows that:

$$(1 + \eta + \psi)p - (1 + \eta + \psi)p^* - (1 + \eta + \psi)e + \varepsilon z = \pi y \quad (5)$$

Ordering in terms of $(1 + \eta + \psi)$, we have:

$$(1 + \eta + \psi)(p - p^* - e) + \varepsilon z = \pi y \quad (6)$$

Finally we get:

$$\frac{(1 + \eta + \psi)(p - p^* - e) + \varepsilon z}{\pi} = y \quad (7)$$

Taking equations (1) and (7), and considering that relative prices are constant in the long term (i. e. $p, p^*, e = 0$), we obtain:

$$\frac{\varepsilon z}{\pi} \Leftrightarrow \left(\frac{\varepsilon}{\pi}\right)z = y_B \quad (8)$$

According to Thirlwall (2003), in the long run the actual growth rate (y) equals the growth rate consistent with the equilibrium of the balance of payments (y_B) and this is known as *the fundamental law of growth*:

$$y_B = y = \left(\frac{\varepsilon z}{\pi}\right) = \left(\frac{x}{\pi}\right) \quad (9)$$

So, this is the proposed approach to study the case of Mexico for the period 1993-2016

A brief characterization of the Mexican economy under the open economy regime

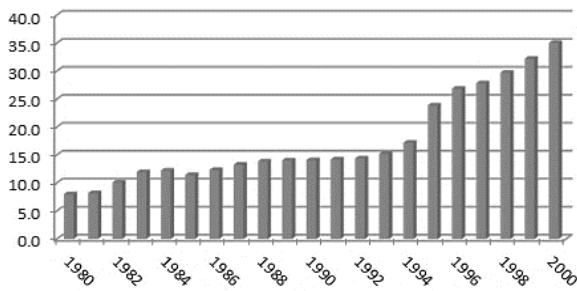
With Mexico's entry into GATT in 1986, trade began a phase of liberalization in which it was intended to integrate the country in a different way in the world market. Thus, the economy was oriented towards the foreign with the intention of achieving greater competitiveness through trade, boosted by the dynamics of exports.

This way, the Mexican government hoped to get a higher GDP growth.

That's how it began the construction of the trade structure that Mexico used in the following years. Then, to consolidate the process of opening-up and encourage capital inflows, Mexico negotiated with the United States and Canada, the trade integration through NAFTA, which began in 1994.

This trade agreement has been considered as a pioneer because of the inclusion of some disciplines that did not often form part of the free trade agreements until that time, in the sense that it not only advocated the elimination of tariffs and non-tariff barriers to agricultural products, but also promoted the liberalization of trade in services and foreign investment flows; rules for the protection of intellectual property rights and new mechanisms for the settlement of disputes in order to protect both the rights of member countries and the investor's and exporter's rights. In this sense, NAFTA represented a watershed in terms of Mexico's trade policy because it established a new approach to trade negotiations (López and Zabludovsky, 2010).

According to Ruiz Nápoles and Moreno-Brid (2006), all these mechanisms aimed at the liberalization of trade and capital were part of a policy whose purpose was to boost economic growth through the increase in manufacturing exports, without any subsidy by the Mexican government. Thus, by increasing exports, aggregate demand would also increase, which would lead to increases in domestic production and employment

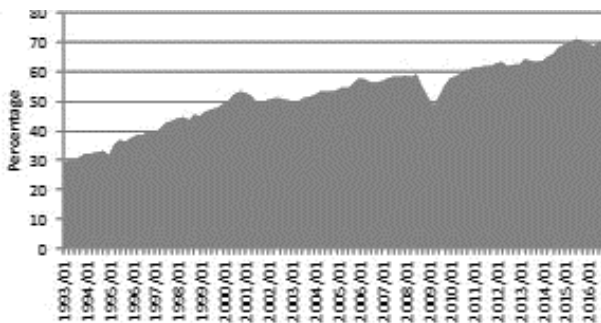


Graphic 1 Total volume of exports as a proportion of GDP, 1980-2000

Source: own elaboration with information from INEGI

As can be seen in graphic 1, exports have increased their share of GDP during the period 1980-2000. In 1980, these represented only 8% of GDP, while by the end of that decade exports represented 14% of total production. Finally, in 1995, these increased to 35% as a share of GDP.

The accelerated growth of exports is explained by the evolution of the degree of trade opening, since from 1993 it's observed that it has deepened by passing from 25% in 1993 to 61% in 2010 and the continuous trend upward. This behavior shows that from the beginning of NAFTA, foreign trade has acquired great economic relevance by becoming the development pole of the Mexican economy (see Graphic 2).

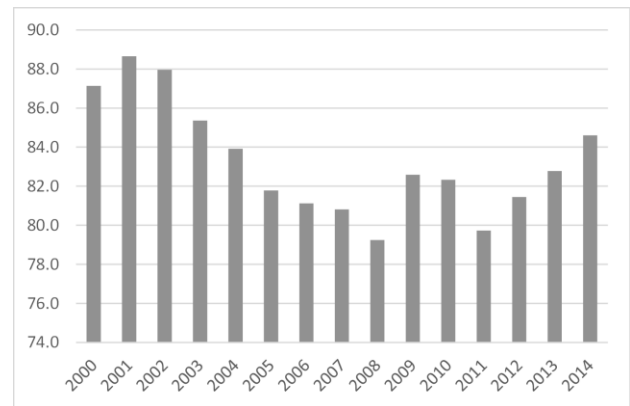


Graphic 2 Trade Opening of Mexico: 1993-2016, (X+M)/GDP

Source: own elaboration with information from INEGI

Within the total exports, the most dynamic component is the manufacturing exports, which have experienced a huge boom since 1980 and which prevails until today. In particular, these exports suffered some decline in their participation during the period corresponding to the financial crisis of 2008, which originated in the sub-prime mortgage problem (see Graphic 3).

This behavior clearly reflected the Government's commitment to the open economy model, whose axis is the relatively diversified manufacturing sector and dominated by FDI flows (Salinas and Tavera, 2007).



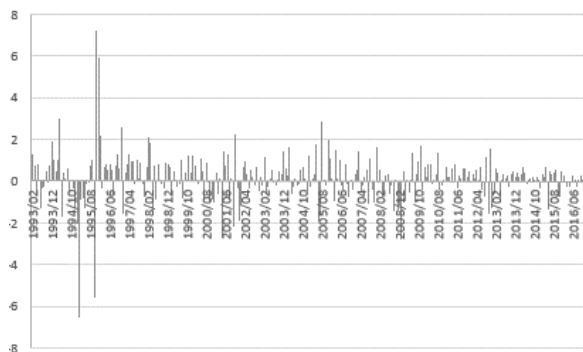
Graphic 3 Share of manufacturing exports with respect to total exports, 2000-2015

Source: own elaboration with information from CEFP

In summary, during the commercial opening process it was promoted to the industrial sector as a key part of achieving growth. This is verified by analyzing the performance of the industry through industrial GDP, because it includes activities such as the extractive industry, energy, construction and of course, manufactures, which currently serve as the engine of economic growth by boosting sales and domestic production, also provide the necessary currencies to finance the acquisition of intermediate and capital goods necessary for the productive process.

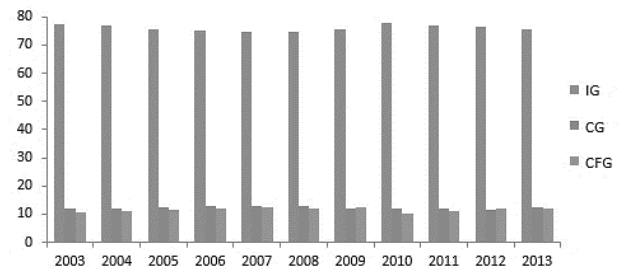
According chart 4, in 2007 the Mexican economy experienced a lower growth compared to previous years due to a slowdown in US demand, caused by the slow growth of its industrial activity and, in the second instance, by the reduction in domestic spending. It should be noted that this trend was maintained towards 2008, as a result of the contraction in the motor, materials and construction activities, among others. In addition, manufacturing production was influenced by the lower dynamics of its exports, as well as the slowdown in domestic demand for its products.

In other words, this kind of exports began to dwindle because of America's economic downturn, which also affected other developed regions of the world. However, in 2009 Mexico experienced a severe contraction in its levels of productive activity, explained by a more critical decline in external demand (mainly from the United States), which impacted directly on the domestic market.



Graphic 4 Growth rate of industrial production, 1993:01-2016:12
Source: own elaboration with information from INEGI

The final reflection is as follows: While the growth of this industrial sector has been highlighted, the truth is that it has not had the capacity to transfer its positive effects to the economy as a whole because it's accompanied by a strong increase in the volume of imports (particularly intermediate and capital goods), which implies the existence of a high income elasticity of imports (see Graphic 5).



Graphic 5 Import of goods by destination (%), 2003-2013
Source: own elaboration with information from INEGI

In particular, the manufacturing sector functions as an enclave because of the emergence of transnational corporations, which tend to promote intra-industry trade, implying that by increasing exports, imports also increase in a similar or larger proportion, thus generating insufficient effects on the internal productive dynamics.

Empirical evidence: Theoretical proposal of the econometric model, methodology and results

The variables used for the study are: the domestic output (Y) and the exports (X). All expressed in millions of pesos at 2008 prices. The database has been taken from the *Banco de Información Económica* (BIE), the INEGI and has a quarterly frequency for the period 1993-2016³.

³ <http://www.inegi.org.mx/sistemas/bie/>

The starting point for the construction of the econometric model is equation (8'), which defines the long run equilibrium economic growth rate of a country as a linear function of three variables: the income elasticities of exports and imports and the growth rate of the rest of the world (Davidson, 1991). Hence, given the income elasticities of the external sector, a higher growth of the world economy would allow a higher rate of output growth without affecting the current account equilibrium or assuming the economic growth of the rest of the world as an exogenous variable, an increase in the ratio of income elasticities of exports and imports would lead to a higher long run real output growth rate (Guerrero de Lizardi, 2006).

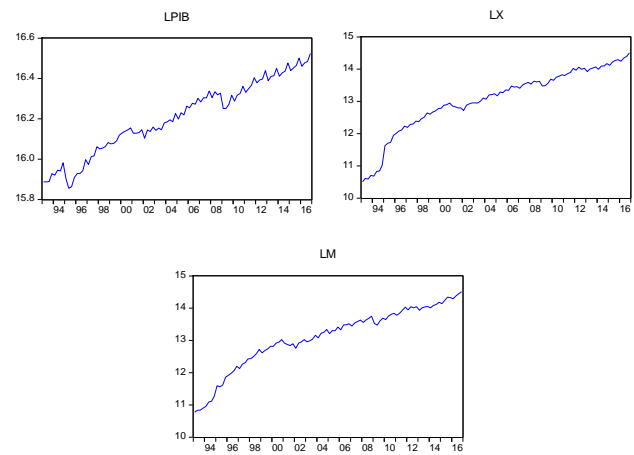
Then, following Moreno-Brid (1999), the stochastic equation used is defined as:

$$\text{Log}(\text{PIB}_t) = \alpha_0 + \alpha_1 \text{Log}(X_t) + \mu_t \quad (9)$$

Where $\log(\text{PIB}_t)$ and $\log(X_t)$ are logs of the real GDP and the real exports of goods, respectively. Also, it's important to note that the variables are in logarithms to work with their elasticities.

As part of the econometric methodology, the first step is to make a brief descriptive analysis on the development and behavior of the variables used for the econometric estimation in order to determine if there is any kind of long-term relation between them: according to chart 6, it's observed that the dynamics of GDP follow a trend quite similar to the performance of imports. The evidence show that by increasing the economic activity, the imports also do so because of the strong dependence that exists of the intermediate goods and of capital, that are necessary to promote the national productive activity.

By incorporating into the analysis the export behavior, it is observed that they also seem to follow a trend similar to the one described earlier by the previous two. Consequently, the three variables seem to be integrated in the long term, coinciding the periods of larger expansion of exports and imports with those of real production.



Graphic 6 Development of GDP, exports (X) and imports (M)

Source: own elaboration with information from INEGI

When using the cointegration approach, it is important to consider the order of integration of the variables used; That is, the number of times to differentiate a time series to make it stationary. Therefore, to determine the integration of the variables, standard root-unit tests of Dickey Fuller (ADF) (1981) and Phillips Perron (PP) (1988) are used. As well as the KPSS test (Kwiatkowsky, Phillips, Schmidt and Shin) (1992). The first two tests work under the H_0 of unit root, while the KPSS test does it under the H_0 of stationarity.

The results are:

Variables	ADF Test (Ho: Unit Root)			PP Test (Ho:Unit Root)			KPSS Test	
	C & Trd	C	No C & Trd	C & Trd	C	No C & Trd	C & Trd	C
$\ln PIB$	-3.639809 [*]	-2.018535	4.071703	-3.050723	-0.237590	3.061971	0.296358	1.279259
$\Delta \ln PIB$	-7.230597	-7.270673	-6.338558	-14.17087	-14.246900	-13.047655	0.026644	0.026309
$\ln X$	-3.278244	-3.144225 [*]	1.899834	-3.238297	-3.395738 [*]	4.366129	0.701991	4.296607
$\Delta \ln X$	-3.5628081	-3.15890814	-2.290743	-10.631084	-8.298915	-8.425983	0.171107 [*]	0.65635 [*]

The term "^{*}" indicates that H_0 is rejected at a level of 5%. For the "1" model that includes intercept and trend, the critical values at the 5% level for the ADF and PP tests are 3.45. In Model 2 (intercept only), the values used for these tests are 2.89. Also, for the purely random model (Model 3), the ADF and PP tests assume the value of -1.9446. As for the test KPSS, the critical value for the case of the intercept and trend is 0.1460, whereas for the intercept, the critical value is 0.4630. Both values at a level of 5%.

Table 1 Unit Root Tests

Source: Own elaboration with information from Eviews 9

According to the results in Table 1, all time series are integrated of order I(1). Therefore, it's necessary to specify the vector autoregressive (VAR) with these.

The above results suggest to differentiate once the variables to induce stationarity and, at the same time, to avoid spurious results based on the proposed estimate. However, under the presence of unit roots, differentiating variables as often as necessary may result in a loss of information that the series at levels can provide (Matesanz et al, 2007).

About that, Sims, Stock y Watson (2009: 136) comment that the common practice of attempting to transform models to stationary form by difference or cointegration operators whenever it appears likely that the data are integrated is in many cases unnecessary. Even with a classical approach, the issue is not whether the data are integrated, but rather whether the estimated coefficients or test statistics of interest have a distribution which is nonstandard if in fact the regressors are integrated.

It will often be the case that the statistics of interest have distributions unaffected by the nonstationarity, in which case the hypotheses can be tested without first transforming to stationary regressors.

After determining the order of integration of the variables, the technique of multivariate cointegration is used by the method of Johansen (1988). Immediately, it is possible to find a cointegration vector from the model that only includes intercept and VAR type 1, it's to say, $\Delta y_t = \beta_1 + \delta y_{t-1} + \sum_{i=1}^m (\alpha_i \Delta y_{t-i}) + \varepsilon_t$.

On the other hand, to determine the optimal number of lags, the criteria of akaike and Schwarz are used, which determined 8 lags to obtain a statistically consistent model. Additionally, an exogenous dichotomous variable⁴ has been incorporated to capture atypical observations (Loría, 2007).

After obtaining the VAR model, it's important to do the residuals tests to prove that there are no problems of autocorrelation, heteroskedasticity and verify fulfillment of the normality assumption. So, then, Table 2 presents a summary of the results:

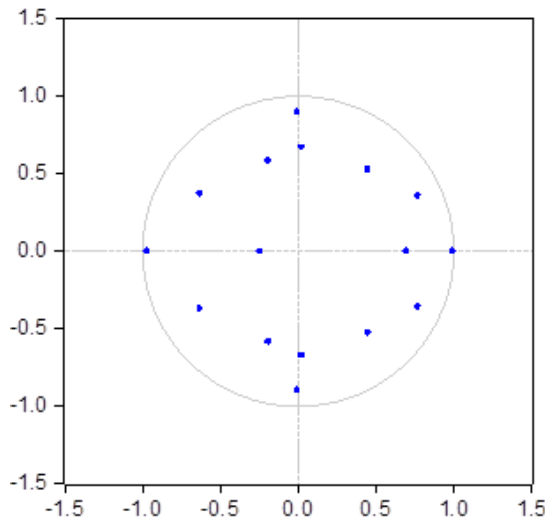
VAR Model			Lags: 8
Tests	Statistic	Probability	H_0
Autocorrelation	LM	0.9396	Accept
Heteroskedasticity*	Ch-Sq	0.1758	Accept
Normality*	JB	0.0738	Accept

(*) denotes the joint test

Table 2 Residual Tests

Source: own elaboration using Eviews 9.0

⁴ the dichotomous variables are not evaluated in terms of their order of integration, only incorporated in the models from an *ad hoc* theoretical approach. In this case, dum: 1995Q1, 2009Q1=-1



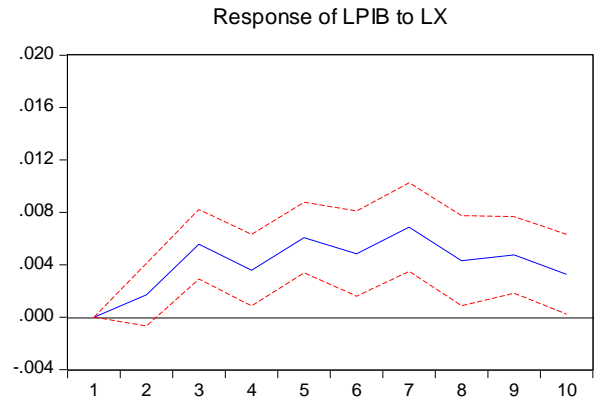
Graphic 7 Unit Inverse Roots of AR Characteristic Polynomial

Source: own elaboration using Eviews 9.0

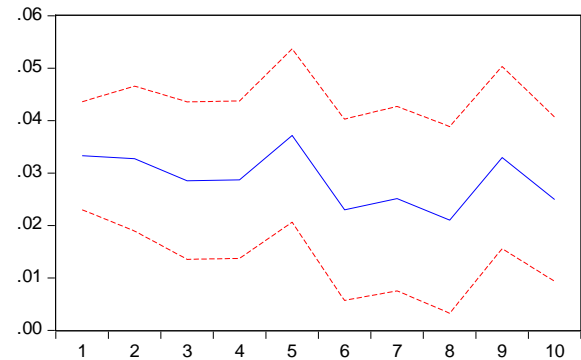
Also, it's important to examine the inverse roots of characteristic polynomial, which is used to analyze the stability of the estimated model. In this case the graphical representation of the eigen-values shows that all values are within the unit circle (see Graphic 7). Therefore, it's possible to say that there is stability in the proposed model.

Next, the signs of the cointegration vector are verified by the impulse-response functions. These functions allow us to observe the dynamic response of a variable "y" to shocks or unexpected changes in an "x" variable, on which it depends.

Response to Cholesky One S.D. Innovations ± 2 S.E.



Response of LX to LPIB



Graphic 8 Impulse Responses Functions

Source: own elaboration using Eviews 9.0

An unexpected shock over exports generates an immediate effect on GDP, which persists over ten periods. This trend is explained because, under an open economy scheme, exports represent the main concept of the economy.

By the other hand, an exogenous impact on GDP generates positive effects on long-run exports, which is explained by the fact that they're part of domestic production (see Graph 8).

To finish this analysis, it use the Granger's Causality Test. This test determines whether an endogenous variable can be treated as exogenous. Additionally it's useful to determine how much some variables improve the forecasting of others.

<i>H0: Prob.> 0.05, does not Granger Cause</i>			
Sample: 1993Q1 2016Q4			
Included observations: 88			
Dependent variable: LPIB			
Excluded	Chi-sq	df	Prob.
LX	76.0167211	8	3.09E-13
All	76.0167211	8	3.09E-13
Dependent variable: LX			
Excluded	Chi-sq	df	Prob.
LPIB	37.2789992	8	1.02E-05
All	37.2789992	8	1.02E-05

Table 3 VAR Granger Causality/Block Exogeneity Wald Tests

According Table 3, there is a feedback effect between GDP and exports which is explained by the increase in exports that favors economic growth as a result of efficient allocation of resources, while output growth has a positive impact on exports through improvements in competitiveness in international markets, as proposed by Jung and Marshall (1985) and Chow (1987), among others. Finally, there is a log-log equation in the cointegration vector, which is standardized to be resolved in terms of gross domestic product (GDP). Therefore, the result is the following:

$$\log(\text{PIB}) = 13.135 + 0.2333 \log(X)$$

$$\text{Std. Error} = (0.00507) \quad (0.06981)$$

Econometric results show a positive and significant cointegration between real exports and GDP, with an estimation that indicate an upward trend in the long term income-elasticity of imports. Over the period 1993:01-2016:04, a multiplier of the export of 0.2333 was obtained, which corresponds to an implicit estimate of the income elasticity of the imports (π) of 4.28.

Similar research applied to Mexico also supports the results obtained in this research, for example, Moreno-Brid (1998, 1999), estimated that the value of π doubled (from 1.57% to 3.14%) over the period 1967- 1999, severely restricting long-run growth (from 6 to 2.6%). On the other hand, Loría (2001) determined the historical value of π around 3.5%, while Matesanz et al. (2007) determined the values of π for different subperiods, obtaining the following results: 1968-2003: 3.97%, 1968-1994: 4.32%, 1968-1981: 3.86% and 1982-2003: 4.26%.

In short, this research is part of the literature of balance-of-payments constrained growth and also proposes the possibility of inducing a structural change that seeks to reduce the value of import income (π) significantly.

Conclusions

In general terms, the analysis confirms that Mexico's growth is explained by the demand orientation, and validates compliance with the Thirlwall Law during the period analyzed, in terms of the restriction to growth through the balance of payments.

In the framework of an open economy, despite the dynamics of exports, the problem of external constraint on growth hasn't been solved. The results support this argument, because when exports increase by 1%, real production increases by 0.23 %.

This result is an insufficient multiplier in terms of the generation of economic growth by the exports sector, since it behaves as a sector of enclave oriented mainly towards the world market.

So, the growth of exports, which are a means of obtaining consumption, has not been enough to finance the growth of imports. Hence, the unbalance in the trade balance is mainly explained by the importation of capital goods that have greater elasticity of demand.

In fact, the exports have increased their coefficient imported because they're based largely on the production of corporations that can have a large content of *Inter-Industrial Trade* (IIT), while the rest belongs to the maquila system, which works with limited value added due to the assembly of imported parts. Therefore, in both cases there is a low domestic production chained.

Also, as a result of a predominant specialization in the assembly by local manufacturing companies and the growing tendency to import intermediate inputs, as well as machinery and equipment to carry out this process, the aggregate value generated with respect to global manufacturing production is insufficient.

In fact, as manufacturing exports increase and generate economic growth, the import requirement grows even more due to the very dynamics of manufacturing exports. If this trend continues, by increasing the rate of growth, the Mexican economy will exacerbate its foreign-exchange requirements and therefore of foreign capital, so the viability of the current model is complicated in the long run.

Therefore, it's necessary to design policy measures for changing the income elasticities of foreign trade. One of these may be the creation of an industrial development plan that links the manufacturing sector with the rest of the domestic economy and it's capable of generating internal productive chains to strengthen domestic production and thus achieve real growth for the Mexican economy.

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