EXPORT LED-GROWTH AND BALANCE OF PAYMENTS CONSTRAINED. NEW FORMALIZATION APPLIED TO CUBAN COMMERCIAL REGIMES SINCE 1960

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EXPORT LED-GROWTH AND BALANCE OF PAYMENTS CONSTRAINED. NEW FORMALIZATION APPLIED TO CUBAN COMMERCIAL REGIMES SINCE 1960.

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Abstract

This paper investigates the casual relationships between the current account and the economic growth during different commercial policy regimes in Cuban economy spanning over the period 1960 to 2004. We formalize the so called augmented Export led-growth hypothesis in the well-established framework of the Thirlwall´s balance of payments approach. By using Granger causality and VAR modelling, we find causality running from imports to economic growth and evidence of balance of payments constraint economic growth path in most of the commercial periods we have analysed. Our demand formalization takes into account for indirect effects on the links between exports and growth modelling causality in a novel fashion in the empirical literature.

Keywords: Cuba, commercial agreements effects, Thirlwall's model, Import-led Growth, cointegration, Granger causality and augmented VAR modelling.

JEL classification: C22, C32, C52, F31, F43.

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1. Introduction

Though since the ninetieth century connections between openness and growth have been an issue of interest, it is in the last thirty years when this traditional economic area of analysis has produced a great amount of works and a strong attention from the development international institutions. This reappearance coincides, on one hand, to the long time rapid growth achieved by the Asian newly industrialized countries (NICs) which have implemented since the seventies a (successful) outward oriented development strategy; on the other hand, the Latin American import substitution development strategy showed by the same time both their limits and their economic malfunction, especially when they are compared with economic growth dynamic of Asian countries.

Empirically, the relationship between exports, imports and economic growth has been a primary topic of research in the openness growth issue and, till now, it is an ongoing debate in the economic development literature[1]. In particular, exports have been considered the main channel through which openness increases the economic growth performance. For its implication in economic policy strategies, one of the main questions is the causal relationship between the external sector and output and, more precisely, the export-growth issue testing whether causality goes from exports to economic growth, labelled Export-led Growth (ELG) hypothesis which is suggesting an export promotion policy to grow or, contrary, if causality flows from growth to exports, namely Growth-led Exports (GLE) hypothesis implying for the country a certain degree of development to increase its exports and, therefore, previous internal economic growth policies. In addition, growth has been analysed through the demand-side approach of the balance of payments restrictions to grow in the traditional Thirwall´s spirit. Not only exports can promote growth but also the balance of payments situation can constrain it in the long term (Thirlwall, 1976).

[1] Krugman (1987); McCombie and Thirlwall (1994) and Giles and Williams (2000) are good and deep surveys regarding to external sector as a generator of economic growth.

In this paper we consider this demand approach in the external sector-economic growth issue related to different commercial regimes in developing countries. Among the set of developing countries, the Cuban economy is an appealing example due to *special* trade agreements periods in their unique economic growth and development path and political and social systems[2]. Regarding the external sector, the period running from 1960 to 1991 was overbear by the integration of Cuba in the Council of Economic Mutual Assistance (COMECON in the soviet acronym), formed by socialist countries. This period implied for Cuba the definition of all the relevant aspects of the external sector: its international commercial partners, the prices of exports and imports, and what is even more important, the pattern of goods to be exported and imported. The COMECON implied special financial facilities for trade flows and commercial preferences for the Cuban economy and moved away from the country external capital flows. In this long period, the external sector was in fact no open and import and export flows were no price market directed. After the rupture of the socialist block in 1989, Cuban output and exports suffered an intense crisis and begun a period of structural reforms searching for macroeconomic stability and a "new" international pattern into the world economy. This new guide of international integration has been based more intensely in the services, mainly associated to tourism exports, rather than in deep changes in the goods trade flows.

In this work, we jointly analyse the connexion among the external sector variables and growth in terms of Granger causality and the Balance of payments approach to growth in the Cuban economy since 1960. From the theoretical and empirical point of view this combination of hypothesis is a novelty in the empirical literature in the issue. In this sense, we can observe in the Balance of payments empirical literature a vast amount of works applied to other developed

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[2] The authors are conscious about the implications of the Cuban socialist economy system, the US embargo and the foreign investment restriction in the island economy. However, our interest by using the Cuban example to analyse the suggested formalization, is precisely to test the differences that could be find in the external sector relationship with economic growth in different commercial regimes that the disappearance of the soviet block implied to the Cuban economy, although the US embargo is still on. In this sense, we understand that the aggregate export and import data are reflecting these "special" facts in the economy.

and developing countries (Garcimartín et al. (2008), Fugarolas and Matesanz (2008), Porcile et al. (2007), Pacheco López and Thirlwall (2006) are only some of the most recent ones) showing that in the long run the predicted economic growth are consistent with the balance of payments equilibrium fitted to the actual ones. The empirical literature on the casual link dealing with the ELG hypothesis has been vastly studied and can be divided in two big strands. One of them, has tried to reveal causality from exports to growth or vice versa by estimating production functions augmented with exports (for instance, Ghatak et al. (1997) and Awokuse (2003)) or augmented with exports and imports (Herzer et al. (2006); Siliverstovs and Herzer (2006) and Awokuse (2007)). The other one has included other variables to the traditional bivariate approach[3] to take into account for indirect effects such as imports (Tang, 2006) or imports and openness (Kónya, 2006). In general, this strand has failed in providing a consistent theoretical and formalized model to insert the empirical validations. In addition, causal tests of ELG models are mixed and non conclusive empirical results are found in the existing literature (Awokuse, (2005a and 2005b) Bahmani Oskooee et al. (2005) and Siliverstovs and Herzer (2006), among many others).

In this fashion, the aim of this study is to provide a theoretical model supporting a balance of payments framework in the analysis of external sector-growth casual relationship in the spirit of Thirwall´s model (1979)[4]. Therefore, our point is to formalize the indirect effects in the more traditional ELG empirical literature in a well-established demand model very close to the Post Keynesian literature. We have tested this new, and more formalized and "augmented ELG" hypothesis, to the Cuban economy to investigate the role of the COMECON economic integration process for the Cuban economy in the long period, 1960-2004. For that, we test different periods in our model taking into account the COMECON era and post Berlin Wall

[3] For example, Kravis (1970), Balassa (1978) and Ram (1985)

[4] We know that long-run growth consistent with balance of payments equilibrium also depends on capital movements (see Thirlwall and Hussain (1982) for an extended model). However, in our Cuban application we have no capital data available and during this long period severe restrictions to international capital movements were implemented. Therefore, we do not take into account capital movements but when available should be included in the specifications because could be very important especially in the causality validation.

fallen since 1990. From this point of view our approach investigates the role of commercial regimes in the Cuban development, providing future guidelines for external economic strategies related to development performance.

Our empirical validation is based on multivariate tests on VAR-based models. Firstly, in supporting our version of Thirlwall's Law we use multivariate cointegration procedure of Johansen and Juselius (1990) to test for the existence of long-run relationships on the basis of non-stationary time series-data and error correction estimations on the speed of adjustment to past disequilibrium and in addition, parameters stability is checked. Secondly, and in keeping with an ELG hypothesis but in a well specified balance of payments framework, we extend the traditional two-variable basis model (see Mañalich (2007)) into a multi-variable demand model with the inclusion of imports of goods and services. For it, Granger causality is implemented by means of the modified-Wald test (MWALD) for augmented level VAR model with integrated and cointegrated processes introduced by Toda and Yamamoto (1995) and Dolado and Lutkepohl (1996) (TYDL henceforth).

The rest of the paper is organized as follows. Section 2 presents the data and a descriptive analysis for the Cuban economy. In Section 3 we present the model and the methodology. Section 4 shows the integration properties of the data series (section 4.1); the econometric estimates of the empirical validation for the Thirlwall´s Law (section 4.2) and the econometric estimates for causality among growth, exports, imports and terms of trade (section 4.3). Finally, Section 5 concludes the paper.

2. Data and Descriptive Analysis for the Cuban economy

The database consists of annual time series covering the period 1960-2004 from Oficina Nacional de Estadística (ONE), Comité Estatal de Estadísticas (CEE), Instituto Nacional de Investigaciones Económicas (INIE) and Ministerio de Economía y Planificación. The variables considered in our modelling are real gross domestic product (GDP), exports of goods and services (X), imports of goods and services (M) and the terms of trade (TOT) which are defined by the ratio price index (1997=100) of imports and price index of exports P_m / P_x . All the variables are expressed in logarithmic terms. As long as the beginning of the seventies and the nineties steer two exogenous cutt-off points in the Cuban policy-making, three different sub-periods- 1960-1989, 1970-1989 and 1990-2004- are also examined from now on.

Figure 1 depicts the evolution of real GDP, imports and exports in Cuba during 1960-2004 (Table 1 shows their corresponding average annual rates of growth for the whole and selected periods). All variables followed upwards trends, but with different rhythm. The long term slope of GDP severely dropped after the collapse of communism system in East Europe in 1989 (real GDP dropped 35% between 1990 and 1993); in fact, it is in 2005 when the Cuban economy retrieved real GDP levels of 1989, implying fifteen years of stagnation in this period. During 1970-1989 the economy rate of growth was relatively high based on the COMECON arrangements which specified exports and imports goods, volumes and prices. After Berlin Wall fallen, Cuban economy enters in a stage of sector, institutional and openness reforms trying to face up the negative effects of soviet collapse; agrarian reform to increase output, tourism openness to foreign investment, biotechnology sector recommendations and exports financial support were policies implemented to improve economic performance in this difficult period (González, 1993). Since 1994, the economy recovered a positive path not only in its economic growth but also in its export and import performance; however absolute levels in 2004 do not reach 1989 levels.

We note that exports have shown a more volatile path with a long period of rapid growth in 1970-1989, an intense dropped in the rate of growth from 1990 to 1995 and a quite fast recover of the slope of growth after 1995. 1972-1985 was the golden period of Cuban exports and imports: the annual rate of growth was of around 16% and 15%, respectively and economic growth reached almost 7% annual rate of growth. In this period, Cuban economy was integrated in the COMECON with preferential prices for Cuban most important exported products, especial access to soviet markets and other facilities such as import credits and others. From 1960 until 1989 more than around 80% of exports were sugar, nickel, fish products, citrus fruits and tobacco and COMECON countries received almost three quarters of the global Cuban exports. Later on, after the disintegration in 1991 of socialist area and Soviet Union and subsequently the end of the COMECON commercial agreements, Cuban exports had to be diversify in terms of exports products and commercial partners: medicaments and tourism were the principal exports hereafter and Canada and Latin America the regions of destination.

Table 1. Cuba: GDP, exports and imports (1960-2004 and selected periods)

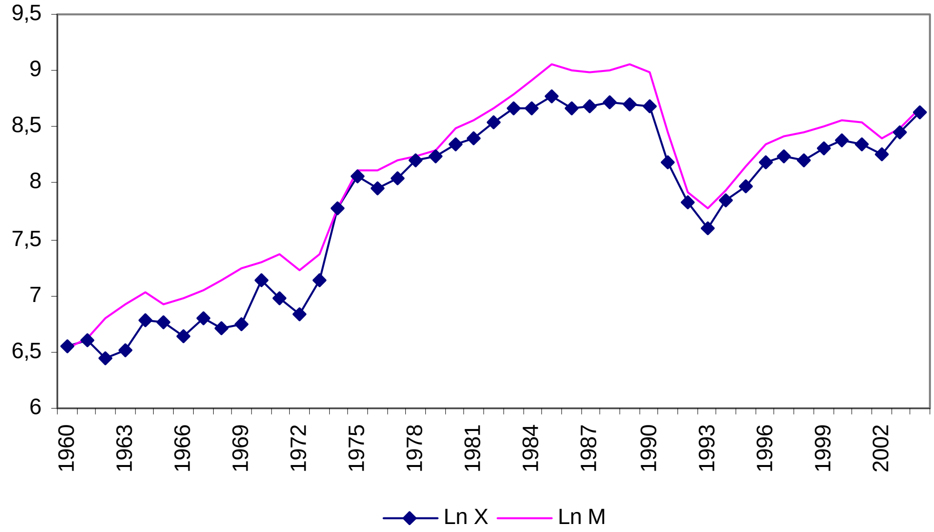
Period	$\dot{gdp}$ (1)	$\dot{x}$ (1)	$\dot{m}$ (1)	$\dot{tot}$ (1)
1960-2004	3.03	4.87	5.00	0.26
1960-1989	4.91	7.71	9.14	-0.81
1970-1989	5.47	8.53	9.74	-0.82
1990-2004	-0.1	-0.38	-2.24	2.83

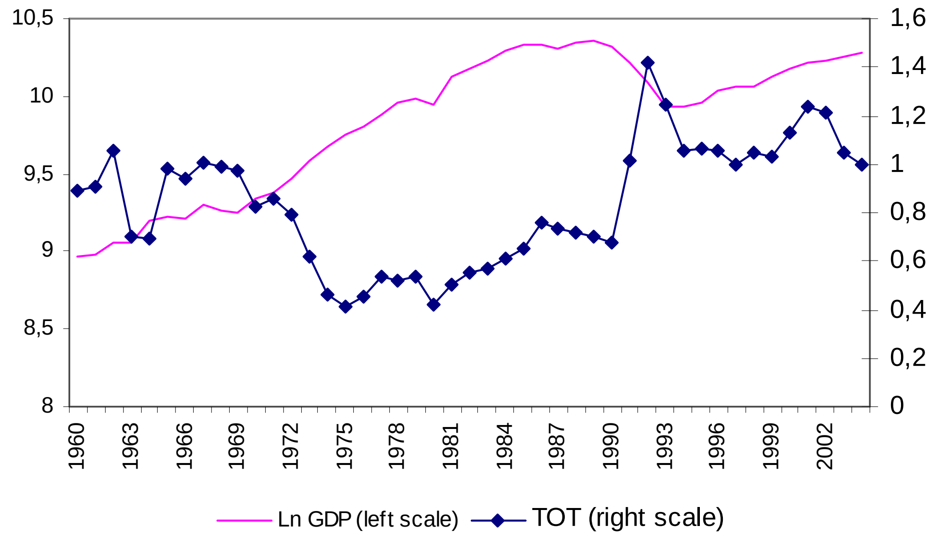
Notes: (1) Denotes average annual rates of growth of real GDP, exports and imports, respectively.
Source: Own calculations based on data from CEE (1989) and ONE (1996 and 2004)

Also imports followed a rapid rate of growth during the COMECON period, a collapse in the first years of the nineties and a slow recuperation after 1994. During the COMECON period just about the 90% of imports were composed by capital and intermediate goods: one third of the capital goods were necessary for industrialization process of the Cuban economy and petrol was the most important intermediate goods for production arriving from the Soviet block. After 1989, imports pattern was diversified in terms of products. Capital goods and fuel imports were substantially reduced due to the economic crises and consumption imports were elevated in order to complete the basic food basket of Cuban population, attaining more than 20% of imports during these years. On the other hand, traditional East commercial partners began to be substituted for Latin America, Asian and European countries.

Finally, terms of trade have shown a slightly improvement during COMECON period, coinciding with those faster periods of exports and imports expansion[5]. Hereafter, the collapse of the Soviet Union implied a continuous deterioration of terms of trade moving away from administer prices of the previous rules and adjusting Cuban external sector prices to more realistic international market conditions.

Figure 1. Cuba 1960-2004: real GDP (left scale), Terms of trade (TOT, right scale) and exports and imports of goods and services (right scale).





[5] Note that terms of trade are constructed as the ratio of imports prices to exports prices so, a negative rate of growth implies an improvement of terms of trade and, vice versa, a positive rate of growth implies deterioration.

In all these periods it is observed a common trend among exports, imports and output with an evident and deep break in their long run expansion in the end of the eighties. Hence, our task is to econometrically validate such connexion and, what is most important in our work, to test for causal influence in the sense of Granger among trade and economic growth.

The kinship between external sector and growth path for Cuba has been previously study in a econometric scenario. In fact, there exist three internal contributions tying up exports and output in keeping with the balance of payments constrained model but while Mendoza and Roberts (2000) and Triana (2005) find support of a positive association only making allowance for goods in the export variable, Fundora and Vidal (2006) reckoned services together with terms of trade and current account deficit. Regarding our major causality concern in this paper and, as far as we know, there is no research including the case of Cuba in a cross country study dealing with the ELG hypothesis. Only Mañalich (2007) is dealing with this pattern but in the most basic two-variable case and this is precisely our starting point in this paper.

3. Modelling specifications and econometric techniques.

Assuming that a country's output growth is external influenced, Thirlwall (1979) developed a seminal hypothesis assessing that a country's economic growth rate can be approximated by the inverse of import income elasticity times the rate of growth of exports. This balance of payments constrained growth model has been applied to developed and developing countries, showing that the actual growth rates are very close to the predicted ones and, therefore, that the economic growth is balance of payments influenced (McCombie and Thirlwall (1994); Atesoglu (1995 and 1997); Hieke (1997); Moreno-Brid and Pérez (1999); Turner (1999); López and Cruz (2000); Perraton (2003); Pacheco López and Thirlwall (2006) and Fugarolas and Matesanz (2008) are some cites in the vast amount of works).

For this purpose, Thirlwall assumes, on one hand, that current account equilibrium will be maintained over time if the currency values of imports and exports spread at the same rate and, on the other hand, that the demand of import and exports are stable functions of income and their relative prices, i.e., $M_t = f(Y_t, P_{m,t}, P_{x,t})$ and $X_t = h(Y_t*, P_{m,t}, P_{x,t})$ being Y* and Y, international and domestic values of output respectively.

Following recent empirical contributions for other Latin American countries (among others, Lopez and Cruz (2000), Moreno-Brid and Pérez (1999), Pacheco López and Thirlwall (2006) and Fugarolas and Matesanz (2008)), it is essential to consider the impact of terms of trade on the output path in any developing country context. In this scenario, the balance of payments equilibrium income (Y_{BP}) level performance results on the following log-linear output growth

$$\ln Y_{BP,t} = \alpha_0 + \alpha_1 \ln X_t + \alpha_2 \ln\left(P_m / P_x\right)_t + \varepsilon_t \quad (1)$$

where ε_t represents a random error term. In the spirit of Thirlwall's Law, parameter α_2 measuring the effect of a change in terms of trade is defined by the rate of price elasticity of demand for imports divided by the income elasticity of demand of imports (π) which is precisely given by the inverse of α_1.

In Section 4.2, testing for the possibility of a long-run relationship as the one depicted in equation (1) is dealing with the multivariate Johansen and Juselius (1990) method used to determine the number of cointegrating vectors as their estimates. Based on the maximum-likelihood estimation procedure and essentially depending on the Gaussian properties of the error terms of the underlying three-variable vector autoregressive (VAR) model, this analysis basically provides two statistics known as the *trace statistic*, λ_{trace}, and the *maximal-eigenvalue statistic*, $\lambda_{\max}$: starting with the null of no-cointegration both sequentially test the supposedly highest order of cointegration which is assumed to be at most the number of endogenous variables in our model. Lastly, when series are found to share a common stochastic trend, Granger representation theorem assumes that the natural approach is to compute vector error correction (VEC) modelling. More specifically, *k*-dimensional VECs to be estimated in each of the samples are

$$\Delta \ln Y_{BP,t} = \delta_0 + \sum_{i=1}^{k} \theta_i \Delta \ln Y_{BP,t-i} + \sum_{i=1}^{k} \gamma_i \Delta \ln X_{t-i} + \sum_{i=1}^{k} \chi_i \Delta \ln (P_m / P_x)_{t-i} + \lambda \varepsilon_{t-1} + u_t \quad (2)$$

Where Δ indicated the first difference operator, ε_{t-1} are the lagged stationary residuals from equation (1), λ represents the speed-of-adjustment coefficient to long-run equilibrium and u_t is a white noise process.

The subsequent analysis on those casual relationships discussed above is hence built upon the augmented VAR levels framework that can be associated to equation (1). We should remark that as long as we have found support for Thirlwall's Law as an explanation for growth in Cuba and taking into account the extremely high correlation of 96.79%, 99.06%, 98.23% and 80.75% observed between actual and predicted income levels for the periods 1960-2004, 1960-1989, 1970-1989 and 1990-2004 respectively, all these estimates empower us to assume that the variable Y_{BP} can be drafted in equation(1) by the actual output Y performance. Into the bargain, two main reasons lead us to enlarge the basis information set in a formal causality modelling: firstly, they are at the centre of the spirit of Thirlwall's hypothesis and, in fact, the analysis rely on the calculation for income elasticity demand for imports; secondly, imports have represented the main channel of capital goods incorporation in Cuban economy. Henceforth, causality analysis finally runs over the expanded model defined by

$$\ln Y_t = m[\ln X_t, \ln(P_m / P_x)_t, \ln M_t] + u_t \qquad (3)$$

Where u_t is an independent random error.

In testing causal relationships in the sense of Granger in Section 4.3, we employ the augmented level VAR technique with integrated and cointegrated process which does not call for pre-testing unit roots and cointegration before causality testing avoiding results that may suffer from size distortions and inference biases leading to an over rejection of the non-causal null hypothesis. The TYDL procedure consists on over-fit a levels VAR specification with a total of *p=(k+dmax)* lags being *k* the lag-length chosen by using some information criteria and *dmax* the maximal order of integration for the time series data involved in the system. The asymptotic chi-squared distributed MWald test proposed is applied to the first *k* VAR coefficient matrix while the coefficient matrices of the last *dmax* lagged vectors in the model are ignored. More precisely, the underling intuition of this approach to Granger Causality is that whenever the elements in at least one of the coefficient matrices are not restricted at all under the null hypothesis of non-causality or non-significance of the coefficient of the lagged independent variables it is enough to add extra and redundant lags in estimating the parameters of the structure to ensure the standard asymptotic properties of the Wald statistic which maintains its usual limiting χ^2 distribution. Therefore, the TYDL enables the proposed MWALD statistic to test linear or nonlinear restrictions on these *k* coefficient matrices using the standard asymptotic theory.

To sum up, the conclusive specification tested is defined by the following four variable *(k+dmax)* order VAR structural modelling linking exports, economic growth, terms of trade and imports

$$\begin{bmatrix} \ln X_t \\ \ln GDP_t \\ \ln(P_m/P_x)_t \\ \ln M_t \end{bmatrix} = \begin{bmatrix} \alpha_{10} \\ \alpha_{20} \\ \alpha_{30} \\ \alpha_{40} \end{bmatrix} + \sum_{i=1}^{k} \begin{bmatrix} \alpha_{11,i} & \alpha_{12,i} & \alpha_{13,i} & \alpha_{14,i} \\ \alpha_{21,i} & \alpha_{22,i} & \alpha_{23,i} & \alpha_{24,i} \\ \alpha_{31,i} & \alpha_{32,i} & \alpha_{33,i} & \alpha_{34,i} \\ \alpha_{41,i} & \alpha_{42,i} & \alpha_{43,i} & \alpha_{44,i} \end{bmatrix} \begin{bmatrix} \ln X_{t-i} \\ \ln GDP_{t-i} \\ \ln(P_m/P_x)_{t-i} \\ \ln M_{t-i} \end{bmatrix} +$$

$$+ \sum_{j=k+1}^{k+1+d\max} \begin{bmatrix} \alpha_{11,j} & \alpha_{12,j} & \alpha_{13,j} & \alpha_{14,j} \\ \alpha_{21,j} & \alpha_{22,j} & \alpha_{23,j} & \alpha_{24,j} \\ \alpha_{31,j} & \alpha_{32,j} & \alpha_{33,j} & \alpha_{34,j} \\ \alpha_{41,j} & \alpha_{42,j} & \alpha_{43,j} & \alpha_{44,j} \end{bmatrix} \begin{bmatrix} \ln X_{t-j} \\ \ln GDP_{t-j} \\ \ln(P_m/P_x)_{t-j} \\ \ln M_{t-j} \end{bmatrix} + \begin{bmatrix} \varepsilon_{X_t} \\ \varepsilon_{GDP_t} \\ \varepsilon_{(P_m/P_x)_t} \\ \varepsilon_{M_t} \end{bmatrix} \quad (4)$$

4. Econometric estimates of the model

This section presents and interprets the results of the econometric estimations and tests of the stochastic formulations of equations (1), (3) and (4). Before running any multivariate analysis, it is essential to examine time series univariate properties

4.1. Integration properties of the data series

Most of the economic time series are nonstationary and its use can falsely imply the existence of a meaningful economic relationship. In this paper the data univariate characteristics are examined using the Dickey-Fuller (DF) and the Augmented Dickey Fuller (ADF) unit root approaches. On the basis of independently not serial correlated and identical distributed errors, this parametric procedure is assuming a stochastic part modelled by an autoregressive representation testing the null hypothesis of a unit root against the alternative of stationary. Lag-length is selected to ensure non-autocorrelated error terms and the decision tree proposed by Charemza and Deadman (1992) is implemented to check the significance of time trend and drift terms together with non-stationary.

The results of the univariate Dickey and Fuller test applied to the level and the first differenced data over the period 1960-2004 are summarized in Table 2[6] (in the Appendix) assuming that the optimal lag length minimizes information criteria of Akaike and Schwarz and avoids residual autocorrelation. We observe that at 5% or even 1% levels of significance not

[6] Cuban commercial policy making result in three small sub-periods exogenously fixed. MacKinnon (1996)'s critical values for the ADF test are not valid for samples containing less that twenty observations, so the ADF test for the period 1990-2004 is not available. In this term, we note that cointegration is itself testing for the unit roots as long as if the series do not have a unit root then the number of cointegrating vectors should be equal to the number of endogenous involved variable (three in this study).

only neither trends nor drifts should be entered in the cointegration space but also that all the variables are not level stationary but they are integrated of order one, that is, I(1)[7].

4.2. Three variable cointegration analysis in Thirlwall's validation

Our causality analysis between current account and growth is based on the balance of payments constraint framework so we firstly need to validate the Thirlwall´s Law for the Cuban economy. In each of the considered periods, fitting the optimal three-variable VAR basis modelling requires to specify the appropriate number of lags ensuring Gaussian errors. By relying on the Akaike (AIC) and Schwarz (BIC) and Hannah-Quinn (HQ) information criteria at the 5% significance level, and as Table 3 shows (in the Appendix), optimal autoregressive systems are governed by a one-year lagged structure for those longer periods beginning in the sixties while two-years are selected for the shorter ones, 1970-1989 and 1990-2004. In the diagnostic view of the properties of the error terms use is made of residual Portmanteau (Q) and Breusch-Godfrey Lagrange Multiplier (LM) autocorrelation tests, White heterocedasticity and Jarque-Bera nonnormality test via Cholesky (JB_{CHOL}) and Urzua (JB_{URZ}) factorizations; well-behaved residuals are accepted in all samples.

Concentrating on Table 4 (in the Appendix), we gather that the null hypothesis of no cointegration among all variables that enter in equation (1) can be rejected at the 5% level of significance by both λ_{trace} and $\lambda_{\max}$ tests in most periods. Only in the sub-sample 1970-1989, both statistics give conflicting results; those scenarios assessing a cointegration relationship quite close to nonstationarity boundary lead to low power tests but, as suggested by Johansen

[7] The authors are concerned about the well-known problem of size distortion and low power properties of unit roots in finite sample time series; in fact, so many unit root test arise as long as there is no uniformly powerful test for finite sample series (see recent contributions of Stock (1994) and Gonzalo and Lee (1996). In this empirical validation, the commercial policy making determines the short span subperiods and, thought a longer size would be better especially in the 1990-2004 period, the estimate procedures are sufficiently robust. Cointegration itself trustily confirms the non-stationary property of the series (in any other case, it would lead to a number of cointegrating vectors equal to the number of endogenous variables) and parameter stability is in addition checked. The maximal order of integration used in the Granger causality tests it is already given by the three-variable cointegrating set.

and Juselius (1990), it is better to made decisions based on the maximum eigenvalue. Henceforth, Johansen (1991) procedure results evidence that generally there exist one cointegrating vector among the log form of GDP, exports of goods and services and terms of trade.

Table 5. Cointegrating estimates, elasticities, VEC adjustment and growth rates

Period	Cointegrating coefficients a_0	a_1	a_2	Elasticity π	Speed λ	Growth rates (%) y_{BP}	y
1960-2004	5.444	0.565 [41.913]	0.131 [3.81]	1.767	-0.2465 [2.259]	4.806	2.965
1960-1989	5.179	0.6057 [30.60]	0.2827 [4.456]	1.650	0.0118 [0.082]	4.232	4.737
1970-1989	5.044	0.625 [69.80]	0.315 [13.232]	1.598	0.0648 [0.147]	4.484	5.191
1990-2004	2.576	0.917 [15.926]	0.441 [7.866]	1.089	0.434 [0.626]	0.843	-0.292

Notes: The vectors are normalized for lnGDP; a_1 and a_2 are the export and terms of trade elasticities of GDP; π is the income elasticity of imports (the inverse of a_1) and y_{BP} denotes the sustainable rate of growth. Figures in parentheses represent asymptotic absolute values of the *t*-statistic. Results carried out by Eviews 4.1.

By arbitrarily setting the estimated coefficient of $\ln GDP$ at -1, cointegrating vectors are normalized and the estimates of α_1 and α_2 respectively carry out their long-run elasticity with respect to exports and terms of trade. From Table 5, we note that, as expected, all estimations indicate highly statistically significant positive relationships between income and exports. One interesting finding is that in all the phases the sign of terms of trade are positive, revealing that those significative increase in terms of trade were tending to increase Cuban growth path. This sign is contrary to the rest of the papers that have included terms of trade in their analysis (among others; Lopez and Cruz (2000) and Perraton (2003)) and it is probably related to the fact that Cuban economy has shown for our time period an external model of growth in which imports causes growth, in contrast with the traditional export led growth hypothesis. Precisely, in Section 4.3 we validate, for all the terms considering the COMECON period, an Import-Led growth model for the economy.

The long-run elasticities estimated are finally used to calculate income elasticities of demand of imports (π) and the equilibrium rate of growth (y_{BP}). No great differences can be discerned among the low values observed for π but in the 1990-2004 period the income elasticity of imports clearly decreases. This situation is not due to an improvement in imports substitution but probably reveals the incapacity for Cuba to get import goods necessary to grow because its scarcity of foreign assets (exports growth dropped -0,3% in this period and imports -2,24%)

We also observe that the actual growth rates are very near from the TL estimated ones in the 1960-1989 period (and 1970-1989). Moreover, actual growth rates are above the estimated ones, suggesting that Cuban economy was able to surpassing its balance of payments constraint during COMECON period. After that, we can see how the actual growth rate is far below the TL rates revealing how the disappearance of the soviet period induced an output adjustment much more intense than balance of payments required recovering the equilibrium. The contraction of the economic activity from 1989 to 1993 was so intense that in the whole period, 1960-2004, the actual growth rates are quite below from the TL estimated ones for that period. This simple analysis is suggesting that Cuban economy was working during the soviet period in a *fictitious*[8] competitive sense and when in 1989 the wall fallen this situation induced an intense activity crises in the economy. We can observe that in 1990-2004 period the actual and estimated growth rates are much lower than previously (more than 3.5 points below)

Finally, in the short-run, error correction estimates for λ are only evidencing for the whole period a significant (at the 95% confidence level) speed of adjustment of about 24% for the Y_{BP} towards its equilibrium level. Although in all sub-samples disequilibria have been even up in the same year, swiftness is especially low in those phases before 1989 but increases up to

[8] By *fictitious* we mean no market directed, but administer prices within the COMECON.

around 64% in 1990-2004 once the COMECOM agreement finishes. Again, this short term result is addressing not only that the severe adjustment induced for the soviet block disappearance modified the competitive situation of the economy in Cuba but is also revealing its difficulty of rapidly recover a “new” and successful economic growth path after 1989.

To conclude, we should remark that essential events in Cuban commercial policy-making have exogenously broken up the forty-four annual observations sample running from 1960 to 2004 into the three studied phases. Although cointegration relations have been assumed with individually significant elasticity coefficients, stability must be analyzed. In so doing, formal checking of both the long-run and short-run parameter constancy use the single-equation CUSUM-type tests introduced by Brown et al. (1975). Based on recursive residuals of each estimated VEC modelling displayed in equation (2), CUSUM and CUSUMQ represent its cumulative sum and its cumulative sum of squares. For each sample, Figure 2 (in the Appendix) plots the test statistic representation together with the 5% level critical bounds. Generally, and in the majority of terms, they are inside the uncritical region and, therefore, the null hypothesis of parameter constancy cannot be rejected as long as both CUSUM and CUSUMQ statistics. Concerning about the stability of the model only arises in 1990-2004 as CUSUMQ test is falling outside the area between the two critical lines.

4.3. Four variable model in the causality test.

Once we have shown the validation and goodness of fit of the Thirlwall´s hypothesis in the commercial regimes analyse for the Cuban economy, we are now able to check for the causality connections between the current account and growth in this demand framework.

The augmented VAR procedure proposed by Toda and Yamamoto (1995) and Dolado and Lutkepohl (1996) which allows for causal inference (by testing general restrictions on the parameter matrices) on the basis of an augmented level VAR with integrated and cointegrated vectors. Before testing for Granger causality an essential issue is to specify the lag-length in each of the considered periods. The general approach is to fit VAR(m) models with orders

$m = 0,\ldots, j_{\max}$ and to choose an estimator of the order j that minimizes the criterion. In so doing, the distance between the "true" model and the Kullback-Leiber quantity of information contained in a proposed model is measured by the log-likelihood function with *h* parameters given by

$$l = -\frac{TR}{2}(1 + \ln 2\pi) - \frac{T}{2}\ln\det(\hat{\Omega}(m))$$

Where $\det(\cdot)$ denotes the determinant, R is the number of equations and $\hat{\Omega}(m) = T^{-1}\sum_{t=1}^{T}\hat{e}_t\hat{e}_t'$ is the residual covariance matrix estimator for a VAR of order m. In measuring the goodness of fit and parsimonious of a model specification, the information criteria of Akaike (AIC), Schwartz (BIC) and Hannah-Quinn (HQ) are defined on the basis of -2 times the average log-likehood function adjusted by a penalty function. Table 6 (in the Appendix) shows the optimal lag selection in the four vector autoregressive structures estimated by OLS over each of the considered periods. In this fashion, we prefer lag structures which are the more parsimonious but still long enough to whiten the residuals. Lag selection is based on the AIC and HQ criteria which indicate two lag for those long periods starting in the sixties and one for the shorter ones - 1990-2004 and 1970-1989.

Given that VAR(k) has been selected, the last point is to determine the maximal order of integration that might occur in the process. As long as all the variables have been found to be at most I(1), an extra lag may be added in each of the periods so *dmax*=1 in both three and four variable modelling.

To conclude, and overfitting the true VAR order, we estimate a levels VAR with a total of *p=(k+dmax)* lags. For the Granger-Causality tests, we apply standard Wald test to the first *k* VAR coefficient matrix excluding the extra parameters in testing for Granger causality. Table 7 reports all the results of the MWALD test for the augmented VAR models (4). We can conclude that, at least in the Granger sense, either the ELG hypothesis or the GLE phenomenon can be strongly rejected at the 5% and even 10% significance level. Only in 1990-2004 we have found a positive causality running from growth to exports. Interestingly, the GDP equation results show a positive casual relationship in Granger's sense going from imports of goods and services to the Cuban growth path in all the periods but 1990-2004. This finding is implying that imports are Granger causing growth in Cuba suggesting Import-led Growth (ILG) causality and therefore, imports are more important for Cuban economy to grow than exports.

Table 7. GDP. Exports, TOT, Imports. Granger causality Test. Augmented VAR model

Period	Dependent variables	MWALD-Statistics: *Source of causation* $\ln GDP$	$\ln X$	$\ln(P_m/P_x)$	$\ln M$
1960-2004	$\ln GDP$	n.a.	0.3200 (0.5073)	0.093(0.793)	4.1304 (0.0421)
	$\ln X$	0.095 (0.7575)	n.a.	4.6063(0.0319)	0.5981(0.4393)
	$\ln(P_m/P_x)$	7.3428 (0.0067)	3.8247 (0.0505)	n.a.	0.0012(0.9719)
	$\ln M$	0.005938(0.9399)	1.491(0.2220)	0.04285(0.8359)	n.a.
1960-1989	$\ln GDP$	n.a.	0.0192 (0.8997)	0.0849 (0.770)	4.6991(0.032)
	$\ln X$	0.8679 (0.3515)	n.a.	4.906(0.0259)	1.971(0.1603)
	$\ln(P_m/P_x)$	5.905 (0.0151)	1.98(0.1593)	n.a.	2.744(0.097)
	$\ln M$	0.051(0.813)	0.05375(0,8166)	0.048(0.9442)	n.a.
1990-2004	$\ln GDP$	n.a.	1.0297 (0.3120)	0.5634 (0.4529)	0.1147 (0.748)
	$\ln X$	4.343 (0.0372)	n.a.	0.9808(0.3220)	3.3632(0.060)
	$\ln(P_m/P_x)$	23.050 (0.000)	20.56(0.0000)	n.a.	3.70(0.0544)
	$\ln M$	0.0809(0.7760)	0.1022(0.7492)	5.3095(0.025)	n.a.
1970-1989	$\ln GDP$	n.a.	7.69e-05(0.9930)	0.7702 (0.380)	3,8444(0.0499)
	$\ln X$	0.8058 (0.399)	n.a.	0.0606(0.1013)	0,3125(0.5761)
	$\ln(P_m/P_x)$	8.363 (0.0038)	8.8001(0.030)	n.a.	6,2252(0,0126)
	$\ln M$	0,387(0,5336)	0.327 (0,5071)	0.0603(0.8060)	n.a.

Notes : The $[k + d(\max)]$th order level VAR has been estimated with $d(\max) = 1$. Lag length selection follows Table 6 results. Values in parentheses are p-values

In 1990-2004 we do not find an ILG causality pattern but a direct causality flowing from output to exports (GLE) and, interestingly, Granger causality from imports to exports. Possible explanations and implications of these results are exposed in the next section.

5. Conclusions

This paper reports new empirical developments in international trade literature and, more precisely, on the crucial role of a country's external sector position on its growth performance and the so-called export-led growth phenomenon. We have introduced for the first time a formalization of the indirect effects in the ELG hypothesis based on the balance of payments constrained framework exposed by Thirlwall (1979) in the tradition of Verdoon and Hicks, among others. Previous works have included different variables to test for these indirect effects (Tang (2006) and Kónya, (2006)) but have failed in providing an alternative theoretical framework to the production function approach for the inclusion of these effects.

Our approach is different but complementary with the traditional approach through the production function framework used in works such as (Awokuse (2003) Ghatak et al. (1997) Herzer et al. (2006) and Awokuse (2007)) and provides a new and systematic demand framework to validate the ELG hypothesis from a demand side approach including the indirect effects in the verification. We have applied our model to the appealing example of the Cuban economy trying to investigate the effects of different commercial regimes in growth during 1960-2004.

In order to formalize our ELG demand approach, we need to first verify the Thirlwall's Law. In Section 4.2 we demonstrate that the long term economic growth in the Island has been balance of payments constraint. In all those phases including the soviet-oriented pattern (that is, 1960-2004, 1960-1989 and 1970-1979), the causality link, at least in Granger's sense, between export expansion and growth does not exist and whenever exports and imports of goods and services show high correlated movements, economic growth in Cuba is responsive to import expansion. Imports seem to be more important for Cuban economic growth than exports suggesting an Import Led Growth (ILG) hypothesis[9]. This result suggests that during the COMECON period the economy could overcome this limitation due, as we have empirically verified, to its ability to import capital and intermediate goods and, in general, of more technological advance inputs for Cuban production, from the soviet block and these were the base of the Cuban output expansion and which were precisely causing growth. The COMECON period, therefore, supports the hypothesis exposed by Krugman (1984) and, in general, for the technological approaches of international trade and development and endogenous models (Dosi and Soete (1988) and Coe and Helpman (1995)) where technology is the key factor to gain advantages and, therefore, to export. At the same time, primary exports to the soviet block financed Cuban imports at preferential prices.

Once the Berlin Wall fell in 1989, which implied the lost of these preferential markets for Cuba, the international competition (jointly with capital restrictions and, of course, the US sanctions) induced an intense economic adjustment. Only in 1994 the economic growth begun to recover a positive path, revealing the inconsistence of the previous performance in its external sector and in the commercial policy implemented. In 2004 the real output reached 1990 levels and, therefore, the economy of the isle has observed fifteen years of stagnation due to the balance of payments constraint. When the *administered* international trade period ended for Cuban economy in 1990, ILG hypothesis is rejected. In this last period, 1990-2004, we obtain that growth causes exports and that imports causes exports, reflecting again the importance of imports in the economic growth path in this case directly linked to exports growth. In this fashion, this period represents the stage in which the Cuban economy had to adjust its economy to equilibrate the balance of payments that was overcome in the administered COMECON regime.

[9] Awokuse (2007) found the same ILG causality but in this case in a production function framework.

APPENDIX

Table 2. Augmented Dickey-Fuller test (ADF).

PERIOD 1960-2004

variable	k	Model (i) $\tau_{\beta\delta}$	Model (i) t_{tc}	Model (ii) $\tau_{\alpha\mu}$	Model (ii) t_c	Model (iii) t_{nc}
$\ln GDP$	1	0.481	-1.423	1.996	-1.909	1.715
$\Delta \ln GDP$	1	n.a	n.a	n.a	n.a.	-2.550*
$\ln X$	1	1.571	-1.946	1.257	-1.131	1.193
$\Delta \ln X$	1	n.a.	n.a.	n.a.	n.a.	-4.324* **
$\ln(P_m/P_x)$	1	1.247	-2.131	-1.026	-1.803	-1.484
$\Delta \ln(P_m/P_x)$	1	n.a.	n.a.	n.a.	n.a.	-5.504* **
$\ln M$	1	0.562	-1.737	1.970	-1.911	0.603
$\Delta \ln M$	1	n.a	n.a	n.a	n.a.	-4.097* **

PERIOD 1960-1989

variable	k	Model (i) $\tau_{\beta\delta}$	Model (i) t_{tc}	Model (ii) $\tau_{\alpha\mu}$	Model (ii) t_c	Model (iii) t_{nc}
$\ln GDP$	0	1.582	-1.657	0.872	-0.633	4.967
$\Delta \ln GDP$	0	n.a	n.a	n.a	n.a.	-3.239 * **
$\ln X$	1	2.443	-2.549	0.870	-0.671	1.622
$\Delta \ln X$	1	n.a.	n.a.	n.a.	n.a.	-4.136* **
$\ln(P_m/P_x)$	0	-0.340	-1.506	-1.475	-1.622	-0.721
$\Delta \ln(P_m/P_x)$	0	n.a.	n.a.	n.a.	n.a.	-5.004* **
$\ln M$	1	0.121	0.385	1.480	-1.449	0,172
$\Delta \ln M$	1	n.a.	n.a.	n.a.	n.a	-2.153*

PERIOD 1970- 1989

variable	k	Model (i) $\tau_{\beta\delta}$	Model (i) t_{tc}	Model (ii) $\tau_{\alpha\mu}$	Model (ii) t_c	Model (iii) t_{nc}
$\ln GDP$	0	0.1050	-0.5409	2.691	-2.4830	4.999
$\Delta \ln GDP$	0	n.a	n.a	n.a	n.a.	-2.1937*
$\ln X$	1	1.279	-1.799	2.003	-1.846	1.449
$\Delta \ln X$	1	n.a.	n.a.	n.a.	n.a.	-3.397* **
$\ln(P_m/P_x)$	0	1.771	-1.866	-2.105	-2.056	-0.340
$\Delta \ln(P_m/P_x)$	0	n.a.	n.a.	n.a.	n.a.	-3.230* **
$\ln M$	1	-0.7244	0.229	1.782	-1.785	-0,104
$\Delta \ln M$	1	n.a.	n.a.	n.a.	n.a	-1.761***

Notes: *k is* the lag structure order chosen to guarantee white noise residuals; subscripts *tc*, *c* and *nc* indicate if trend and intercept. intercept or none is included in test model (i), (ii) and (iii) respectively. $\tau_{\beta\delta}$, $\tau_{\alpha\mu}$ denote statistics for individual or joint significance of trend and intercept assuming unit root. *, **, *** show 5% ,1% and 10% significance level in accordance to MacKinnon (1996) critical values; n.a is non available. Results implemented using Eviews 4.1.

Table 3 VAR. Lags structure and residuals

		Information criteria				Residuals-Diagnostic Views				
						Ho: non autocorrelation		Ho: normality		Ho: homocedasticity
Period	Lag	LR	AIC	BIC	HQ	Q	LM	JB_{Chol}	JB_{Urz}	White
1960-2004	1	253.58*	-5.47*	-4.98*	-5.29*	100.26	4.44	4.94	47.66	44.67
1960-1989	1	158.93	-5.74*	-5.18*	-5.56*	77.35	9.4	2.4	19.77	30.74
1970-1989	2	19.45*	-7.30*	-6.26*	-7.10*	44.91	8.59	7.07	20.34	81.27
1990-2004	2	52.06*	-7.02*	-6.46*	-7.03*	31.12	6.49	10.5	17.23	83.98

Notes: LR, AIC, BIC and HQ stand for sequential modified LR test, Akaike, Schwarz, Hannan-Quinn information criteria respectively; * indicates lag order selection. Following Box and Jenkins (1970) approach lags for autocorrelation tests are taken as the third part of the observations . Results carried out by Eviews 4.1

Table 4. Johansen and Juselius Cointegration Test

		Johansen Test		
Period	Lags	Number of cointegration relations under Ho	Statistics λ_{trace}	$\lambda_{\max}$
1960-2004	1	None	41.72 * (**)	34.80 * (**)
		At most 1	6.91	5.29
		At most 2	1.93	1.63
1960-1989	1	None	33.95*	23.24 *
		At most 1	10.71	9.11
		At most 2	1.59	1.59
1970-1989	2	None	52.73 * (**)	31.43* (**)
		At most 1	21.30* (**)	12.26
		At most 2	9.04 * (**)	9.04* (**)
1990-2004	2	None	42.52 * (**)	30.23* (**)
		At most 1	12.28	12.01
		At most 2	0.18	0.18

Notes: Lag structure is drawn in each period from Table 3 results. *(**) denotes rejection of the hypothesis at the 5%(1%) level taking into account Osterwald-Lenum critical values. Trace and Max-eigenvalue test indicates 1 cointegrating equation(s) both 5% level. Results computed with Eviews 4.1

Table 6. VAR model. Lag selection and Information Criteria

VAR Model : $\ln GDP, \ln X, \ln(P_m / P_x), \ln M$

Period	*Lags(k)*	*l*	*AIC*	*SC*	*HQ*
1960-2004	2	194.03	-7.35*	-5.87*	-6.80*
1960-1989	2	143.31	-7.66*	-5.95	-7.14*
1990-2004	1	82.55	-8.34*	-7.39*	-8.35*
1970-1989	1	97.31	-7.73*	-6.73*	-7.53*

Notes: * indicates lag-order selected by the criterion; *l* is the log of the likelihood function with *h* parameters estimated using *T* observations and the information criteria of Akaike, Schwarz and Hannah-Quinn are defined by

$$AIC = -2(l/T) + 2(h/T)$$
$$BIC = -2(l/T) + h\log(T)/T$$
$$HQ = -2(l/T) + 2h\log(T)/T$$

Figure 2. Plots of Cumulative Sum of Recursive Residuals (CUSUM) and Cumulative Sum of Squares of Recursive Residuals (CUSUM of Squares)

Figure 2.1. 1960-2004

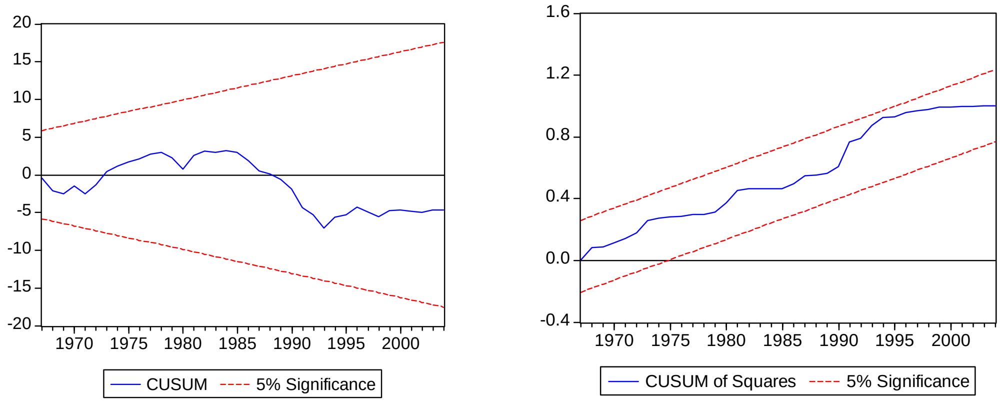


Figure 2.2. 1960-1989

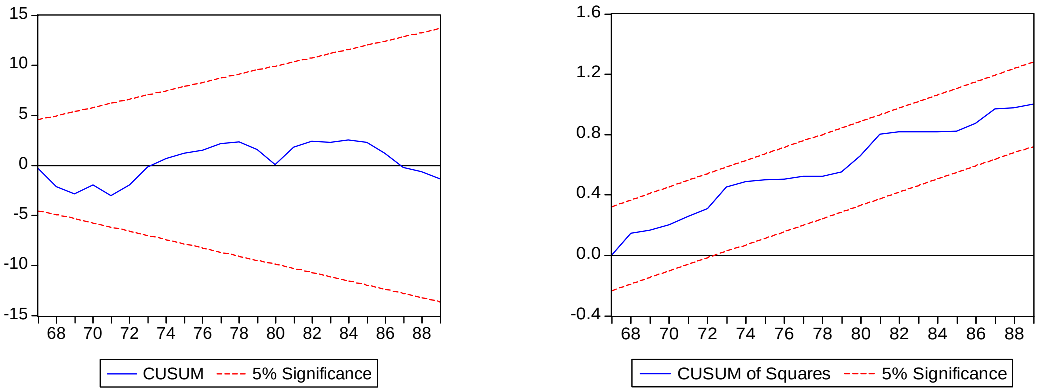


Figure 2.3. 1970-1989

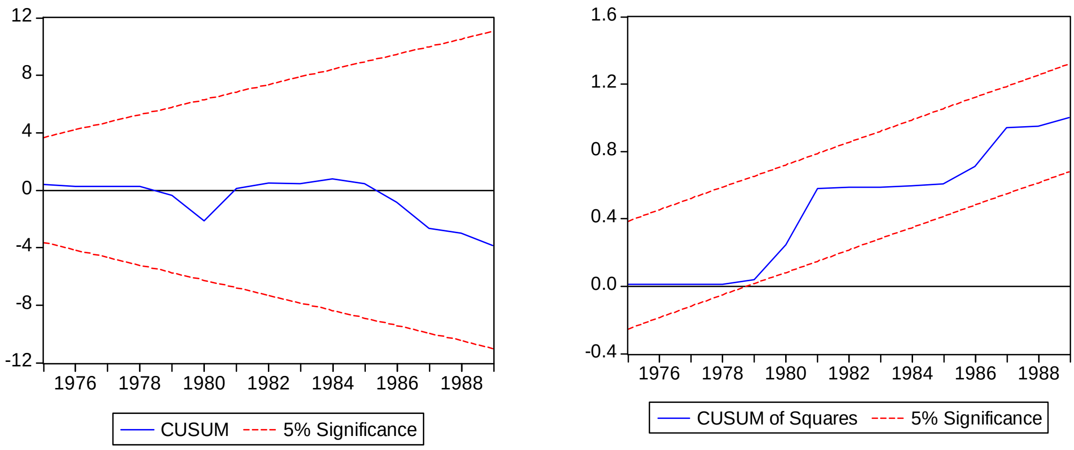
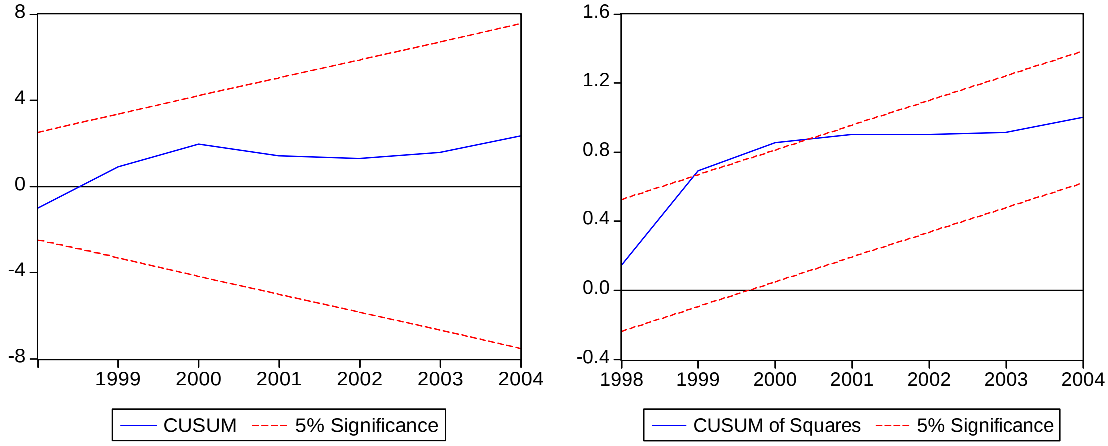


Figure 2.4. 1990-2004



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