EMPIRICAL EVIDENCE OF THE BALANCE OF PAYMENTS CONSTRAINED GROWTH IN CUBA. THE EFFECTS OF COMERCIAL REGIMES SINCE 1960.

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Abstract: This paper seeks to investigate whether the balance of payments has been a key determinant of the Cuban long-term economic growth during different commercial policy regimes spanning over the period 1960 to 2004. We focus here on built the impact of terms of trade movements into a specification of Thirlwall's hypothesis. Cointegration multivariate tests for non-stationary series reveal that economic growth, exports of goods and services and terms of trade are driven by a common stochastic trend and finding support for an economic growth path constrained by the country own external demand position

Keywords: Cuba, Thirlwall's model and cointegration.

JEL Classification: C22, C32, F31, F43.

I. Introduction.

Economic performance of Cuba has been much linked to the external sector in the long socialist revolution time. From 1970 to 1989 its economy was overbear by the integration of Cuba in the Council of Economic Mutual Assistance (COMECOM), formed by socialist countries. This period entailed for Cuba the definition of all the relevant aspects of the external sector; the direction of the imports and exports flows, the prices of exports and imports and, therefore, its international trade specialization pattern. Besides, the COMECON implied special financial facilities for trade flows and commercial preferences for the Cuban economy. After the Berlin Wall fallen in 1989, Cuban output suffered an intense crisis (output losses in real terms reached up to 35% until 1993) and a period of structural reforms began searching for both 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 (see table 1).

In this paper we analysed the role of the external sector in the Cuban economy by means of the restriction to growth that balance of payments (BP) and in this context probably, the most traditional demand approach is that exposed by Thirlwall (1979) and Thirlwall and Hussain (1982). Essentially, Thirlwall's Law (TL) point out that a country's economic growth rate can be approximated by the inverse of import income elasticity times the rate of growth of exports. So, balance of payments position can work as a limitation (or not) to economic growth. Among others, Atesoglu (1995 and 1997), Hieke (1997), McCombie and Thirlwall (1994), Moreno-Brid (1999), López and Cruz (2000), Perraton (2003) Bairam (1988), Turner (1999), have verified different versions of the TL model showing robust results of the estimated economic growth consistent with the equilibrium of the BP and the real output growth in either developed or developing countries.

Though Cuban economy is an appealing example due for its *special* arrangements in the international trade, little work has been done in analyzing its external sector pattern and its consecuences on it own growth path. To the best knowledge of the authors, only three recent papers have used this demand model, namely Mendoza and Roberts (2000), Cribeiro and Triana (2005) and Fundora y Vidal (2006). In this letter, we deal with a long-run analysis from 1960 up to nowadays discerning three different short terms defined by two exougenously cuttoff points in keeping with Cuban commercial policy-

making: 1970 when the Cuba joined to the COMECON system and 1990 when this economic system exploited with the dissolution of the Soviet Union and consequently the disappearance of the external trade Cuban preferences. This paper firstly extends the strongest form of this hypothesis in Cuba by adding the essential impact of terms of trade in a trivariate framework where not only goods but also services are included also in the export variable.

The objectives and contributions of the paper are twofold. The first is to present original structural demand insights in the Cuban performance in different and relevant periods since 1960, especially we want to reveal the role of the COMECON period and the post soviet era. The second is to include the services in the analysis, for the first time, due to the great importance of tourism in the Cuban economy since the beginning of the nineties. For it, we use multivariate cointegration preocedures 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. In addition, parameters stability is checked.

The rest of the paper is organized as follows. Section 2 describes the data and the methodology. In Section 3 we present the econometric estimates of the model. Finally, Section 4 concludes the paper.

II. Data and Methodology

Tha dataset consists of Cuban observations on real gross domestic product (GDP_t), exports of goods and services (X_t) and prices of imports ($P_{m,t}$) and exports ($P_{x,t}$). Commodity and services terms of trade (1997=100) is defined as $\left(P_{m,t}/P_{x,t}\right)\times 100$. Annual data from 1960 to 2004 are collected from Oficina Nacional de Estadística (ONE), Comité Estatal de Estadísticas (CEE), Instituto Nacional de Investigaciones Económicas (INIE) and Ministerio de Economía y Planificación (MEP). All variables are measured in Cuban pesos and expressed in natural logarithms.

Our point is to build the impact of terms of trade movements into Thirlwall's formulation. Accordingly, the long-run equation explaining the balance of payments equilibrium income Y_{BP} behaviour is given by following log-linear model in levels

$$\ln Y_{BP,t} = \alpha_0 + \alpha_1 \ln X_t + \alpha_2 \ln\left(P_{m,t}/P_{x,t}\right) + \varepsilon_t \quad (1)$$

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.

Prior to testing for the possibility of a long-run relationship as the one despicted in equation (1), it is important to examine time series univariate properties. In particular, the order of integration of the series is determined here by the Augmented Dickey and Fuller (1979) procedure following the sequential decision tree process proposed by Charemza and Deadman (1992) to test for the significance of trend and drift under the null hypothesis of non-stationary.

The multivariate Johansen and Juselius (1990) method is then 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 autorregressive (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

$$\Delta \ln Y_{BP,t} = \delta_0 + \sum_{i=1}^{k} \theta_i \Delta \ln Y_{BP,t-i} + \sum_{i=1}^{k} \gamma_i \Delta \ln X_{t-i} + \sum_{i=1}^{k} \chi_i \Delta \ln\left(P_{m,t-i}/P_{x,t-i}\right) + \lambda \varepsilon_{t-1} + u_t \quad (2)$$

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.

III. Econometric estimates of the model

Before any estimation to ascertain the existence of long-run relationships we check the level of stationary of each of the three series. 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[1] assuming that the optimal lag lenght minimizes information criteria of Akaike and Schwarz and avoids residual autocorrelation. We observe that not 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).

In each of the considered periods, fitting the optimal three-variable VAR basis modelling requires to specify the appropiate 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, optimal autorregressive 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, 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 scenearios assesing a cointegration relationship quite close to nonstationaty boundary lead to low power tests but, as suggested by Johansen and Juselius (1990), it is better to made decisions based on the maximum eigenvalue. Henceforth, Johansen (1991) procedure results evidence that generally there exists one cointegrating vector among the log form of GDP, exports of good and services and terms of trade.

[1] Cuban comercial policy making result in three small subperiods 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).

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 probably is 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 (Fugarolas, Mañalich and Matesanz, 2007)

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*[2] competitive sense and when in 1989 the wall fallen this situation induce 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)

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

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 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 1 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.

IV. Summary and Conclusions.

In this paper we have analysed the role of the external sector, including terms of trade, in the Cuban economic growth in the long sample running from 1960 to 2004. By using cointegration and VEC methodology our results suggest that Cuba overcomes its balance of payments constraint during the COMECON period. 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 have observed fifteen years of stagnation due to the balance of payments constraint.

APPENDIX

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)

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* **
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* **
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* **

Notes: *k i*s 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. * and ** show 5% and 1% 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

Period	Lag	Information criteria				Residuals-Diagnostic Views				
						Ho: non autocorrelation		Ho: normality		Ho: homocedasticity
		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

Period	Lags	Johansen Test		
		Number of cointegration relations under Ho	Statistics λ_{trace}	Statistics $\lambda_{\max}$
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

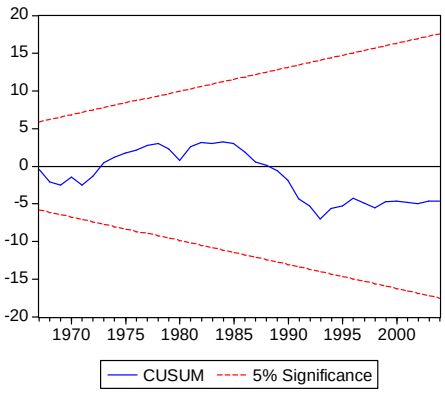
Table 5. Cointegrating estimates, elasticies, VEC adjustment and growth rates

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.

Figure 1. Plots of Cumulative Sum of Recursive Residuals (CUSUM) and Cumulative Sum of Squares of Recursive Residuals (CUSUM of Squares)

Figure 1.1. 1960-2004



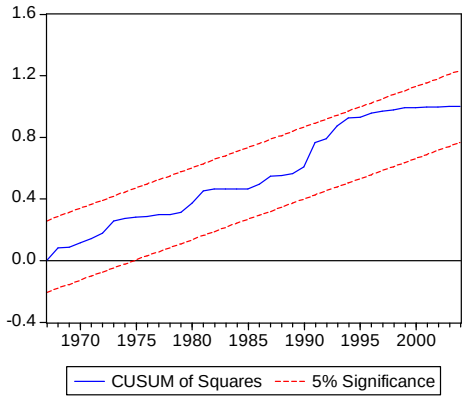
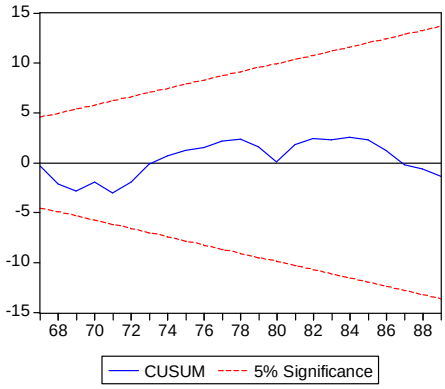


Figure 1.2. 1960-1989



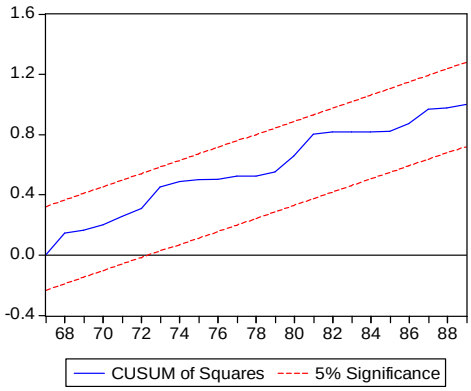
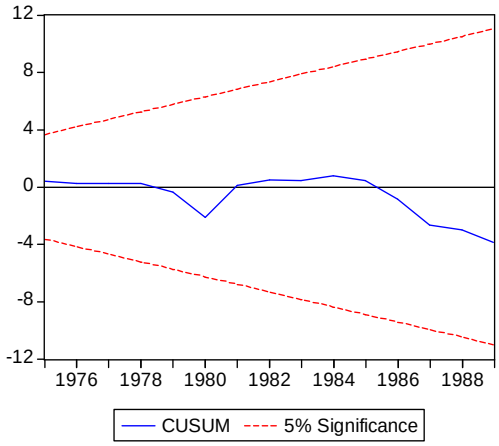


Figure 1.3. 1970-1989



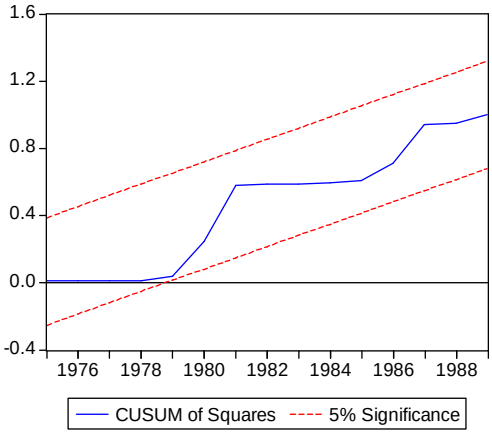
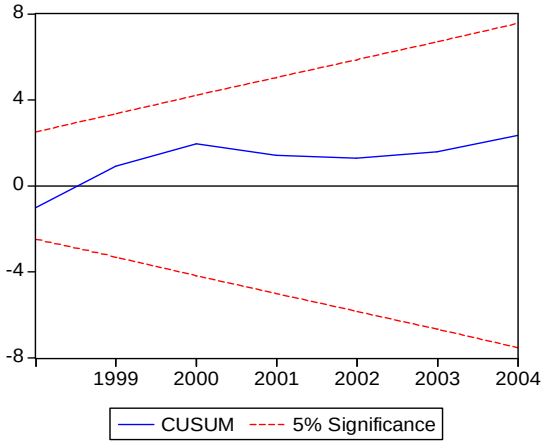
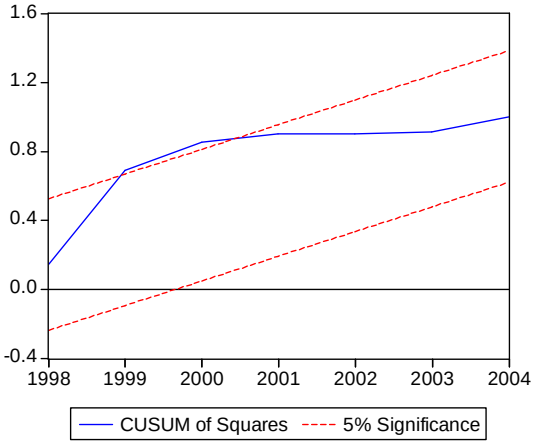


Figure 1.4. 1990-2004





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