Terms of trade, exports and economic growth in Central America: a long-term view *

ESTEBAN PÉREZ and JUAN CARLOS MORENO-BRID

Introduction

Building on the work of Roy Harrod (1933), A.P. Thirlwall developed in the late Seventies an analytical framework known as the balance-of-payments-constrained growth model (BPC-model hereafter) stating that, in the long run, economic growth is mainly determined by the evolution of exports, the terms of trade, and the elasticities of imports. This line of thought complements earlier research based on the so-called 'GAP' models, that identify the lack of foreign exchange as a key restriction to economic growth (see Chenery and Bruno 1962, Bhagwati and Chakravarty 1969, Taylor 1979 and 1991).

The purpose of this paper is to assess the significance of exports and the terms of trade as determinants of the long-term economic growth of Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua, Panama and two Caribbean countries (Dominican Republic and Haiti) for 1950-97, taking as analytical framework the BPC-model. In the sample of countries here selected, long-term economic growth has been very moderate and subject to severe shocks due to significant macroeconomic policy shifts, civil strife and even natural disasters.

□ United Nations, Economic Commission for Latin America and the Caribbean, Mexico (Mexico);
Harvard University, David Rockefeller Center for Latin American Studies, Cambridge, Mass. (USA).

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In the 1960s and 1970s Central America experienced high economic growth that came to a halt in the 1980s with the debt crisis (Conroy, Murray and Rosset 1996). Jointly with the economic slowdown, a political crisis took shape as the military control began to falter (Pérez Brignoli 1993). The assassination of Joaquín Chamorro (January 1978) by the Somoza regime is typically considered the beginning of the Central American political crisis (Torres Rivas 1993, p. 35).

During this time, both Nicaragua (1978-79) and El Salvador (1980-85) experienced civil wars and Guatemala continued its armed struggle. Costa Rica and Honduras did not suffer domestic armed conflict, but the latter was a center for anti-sandinista operations.

In the 1980s the region undertook a shift away from import substitution and implemented orthodox stabilization policies. Nicaragua was an exception and it was hit by hyperinflation during 1987-90; it finally tamed down inflation as a result of the Lacayo stabilization package in 1991. El Salvador in 1992 and Guatemala in 1996 engaged in political negotiations leading to peace agreements.

The Dominican Republic experienced during the 1960s balance of payments crisis as its import substitution strategy – implemented since the late 1930s – lost steam. Following armed struggle (1966-73), and a series of shifting macroeconomic policies including state-Keynesianism (1978-82), stabilization attempts (1982-86) and major public works program (1986-88), it entered a recession in the 1990s (see Pons 1995). In 1992 it undertook a program of macroeconomic stabilization and institutional reform.

Finally, in Haiti, the Duvalier dictatorship ruled for 36 years (1950-86) with progressively worsening social conditions: malnutrition and infant mortality reaching alarming proportions. Its collapse in 1986, coupled with failed attempts at political stabilization, led to the military takeover of Raoul Cédras (September 1991). The United States embargo (November 1991) had devastating consequences for GDP growth (-14% in 1992), and lasted until October 1994, one month after a United Nations peace-keeping mission started its operations in Haiti (Ridgeway 1994).

The shocks have too frequently caused major disruptions in investment and business climate, slowing down economic activity. Our hypothesis is that, notwithstanding the relevance of these shocks, the long-term growth path of these economies since 1950 may be explained by the evolution of their real exports and, to a lesser extent,

their terms of trade (see Table 1). To test this hypothesis we apply modern time-series techniques explicitly developed to estimate long-term economic relationships.

TABLE 1

REAL GDP, EXPORT VOLUME AND TERMS OF TRADE, 1950-97
(annual average growth rates, %)

Country	GDP	Exports	Terms of trade
Costa Rica	4.7	6.2	0.2
El Salvador	3.4	3.8	0.0
Guatemala	3.8	4.4	-1.2
Honduras	3.8	3.2	-0.3
Nicaragua	2.5	3.5	-1.2
Panama	4.2	4.2	-0.2
Dominican Republic	4.8	1.8	-0.0
Haiti	1.1	2.4	-2.3

Note: The data for the Dominican Republic comprise the years 1950-92. From 1993 on the Dominican Republic's export data includes free trade zone statistics.

The present paper extends our previous research on Central American economies in two directions (Moreno-Brid and Pérez 1999). First, it includes a larger and revised data set and extends the sample of countries.[1] Second, and most important, it tests for the statistical significance of the terms of trade on the long-term economic growth of these countries. This issue has been the subject of an important debate within the balance-of-payments constraint and the Structuralists analytical perspectives (McCombie and Thirlwall 1994). The Structuralist School in Latin America, led by Raúl Prébisch, hypothesizes that the main obstacle to sustained growth in less developed economies is the persistent decline in the terms of trade given by their specialization in the production of goods with low income elasticity of world demand.[2]

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[1] There are few empirical studies that examine the relevance of the BPC-model for LDCs.

[2] Prébisch, while being Executive Secretary of the Economic Commission for Latin America and the Caribbean (1948-62), put forward the Center-Periphery paradigm to explain the gap between developed and developing countries. The Center exports manufactures goods made with modern techniques, and the Periphery exports primary goods, produced with backward methods of low productivity. Within this framework the Periphery's economic decay may be ultimately traced to its deterio-

Contrary to this viewpoint the BPC-model in its core version, known as Thirlwall's Law, argues that the terms of trade generally do not exert a relevant influence on long-term economic growth. Our previous work (Moreno-Brid and Pérez 1999) validated this train of thought for Central American countries by decomposing growth into its exports and terms of trade components. In the present paper we further refine our empirical research by carrying out formal econometric tests to evaluate Thirlwall's hypothesis for the eight Latin American economies above mentioned.

The paper is divided into four sections. After this introduction, the second section presents the concise version of Thirlwall's theoretical model that served as the basis for our empirical analysis of the determinants of the Central American and Caribbean economies' growth trajectories. The third section tests the validity of the BPC-model through unit-roots and cointegration techniques to examine the evidence of a long-term linear association between the log-levels of real output, exports and the terms of trade. After corroborating the existence of such stable long-term relation, the paper proceeds to test – for each of these eight economies – the individual significance of the terms of trade on their long-term growth. Such tests were carried out by applying likelihood ratio statistics (LRS) to compare the restricted and unrestricted versions of the trivariate cointegrating vectors previously identified. The conclusions and final reflections are presented in the fourth section.

2. Analytical framework

Thirlwall built in the late Seventies a parsimonious analytical model, based on Harrod's work on the foreign-trade multiplier,[3] that conclu-

rating terms of trade, in turn caused by its much lower income elasticity of its exports (Center's imports) relative to its imports (Center's exports). See Prébisch (1985), Oman and Wignaraja (1991) and Ground (1986).

[3] Initially conceived in Harrod's first edition of *International Economics* (1933), the foreign trade multiplier provided a critique to Keynes's endorsement of public works as set forth in the *Treatise* (1930). For Harrod a public works policy does not necessarily boost employment because the increase in income and imports may result in external disequilibrium (Young 1989). But as the foreign trade multiplier focuses on changes in income, rather than in prices, as equilibrating mechanism, it was later incorporated into the theory of effective demand (Coutts 1987).

des that the availability of foreign exchange may set an upper limit to the long-run rate of economic growth. His pioneering model, based on the assumptions that the long-term balance of the current account must be zero and on standard specifications of export and import demand functions, showed that a country's long-term rate of economic growth is bounded by the evolution of its foreign demand and its terms of trade. In its simple, and by now most popular, version – known as Thirlwall's Law – it argued that if a country's terms of trade remain constant, then its long-term rate of economic expansion is determined by the ratio of the rate of growth of exports and the income elasticity of import demand (Thirlwall 1979).

The analytical perspective introduced by Thirlwall and his colleagues, in contraposition to the neoclassical views' emphasis on the supply of factors, identifies aggregate demand and the availability of foreign exchange as the driving and binding forces of long-term economic growth.[4] Its focus seems useful to understand the growth path of developing economies, whose gross capital formation's critical dependence on imported equipment makes them vulnerable to changes in their availability of foreign exchange.

The following six equations express the BPC-model in its most general version as formulated by Thirlwall and Hussain (1982):[5]

$$(1)\quad p\,x + e\,f^* = p^*\,e\,m$$

$$(2)\quad \theta = px\,/\,(px + e\,f^*)$$

$$(3)\quad \hat{n} = \hat{p} - \hat{p}^* - \hat{e}$$

$$(4)\quad \theta^*(\hat{p} + \hat{x}) + (1-\theta)(\hat{f}^* + \hat{e}) = \hat{p}^* + \hat{e} + \hat{m}$$

$$(5)\quad \hat{x} = \eta\hat{n} + \pi\hat{w}, \text{ with } \eta < 0, \pi > 0$$

$$(6)\quad \hat{m} = -\phi\hat{n} + \xi\hat{y}, \text{ with } \phi < 0, \xi > 0.$$

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[4] The "New Growth" literature, triggered by the contributions of Romer (1986) and Lucas (1988), ignores the impact of the availability of foreign exchange on long-term economic growth. For very different perceptions of the contributions of this literature see, on the one hand, Aghion and Hewitt (1998) and, on the other hand, Kurz and Salvadori (1995) and Skott and Auerbach (1995).

[5] The assumption of being a small open economy allows to take prices of tradables as exogenously given; that is to say, as independent of the country's supply of exports or demand of imports. For notation purposes large-capitals X denote variables in current prices, small-capitals x in constant prices; asterisks denote variables measured in units of foreign currency, and hats denote rates of change of the letters where it stands.

The balance of payments accounting identity is given by equation (1), where x stands for real exports, m for real imports, p for the price of domestic goods (exports) in local currency, p^* for the price of imports in units of foreign currency, and f^* the current account deficit of the balance of payments in units of foreign currency; e is the nominal exchange rate in units of local currency per unit of foreign currency. The second and third expressions are definitional identities introduced to simplify the algebraic notation. The former defines θ as the initial share of exports in the inflow of foreign exchange, in units of domestic currency. The latter defines $\hat{n}$ as the rate of change of the terms of trade.

Equation (4) is obtained by differentiating equation (1) with respect to time. The last two equations, (5) and (6), specify the rates of change of the demand for real exports x and of real imports m as a function of the standard income and relative-price determinants, where η and π are the price and income elasticities of exports, ϕ and ξ the corresponding ones of imports, y stands for real domestic income, and w for foreign income. The solution of equations (1) to (6) gives:

$$(7) \qquad \hat{y}_b = \frac{\theta\pi\hat{w} + (1-\theta)(\hat{f} + \hat{e} - \hat{p}) + (\theta\eta+\phi+1)(\hat{n})}{\xi}.$$

This formulation, originally put forward by Thirlwall and Hussain (1982), shows that the long-term rate of growth of domestic income $\hat{y}_b$ is determined as a weighted average of the rates of growth of foreign income $\hat{w}$, of external capital flows in real terms $\hat{f} + \hat{e} - \hat{p}$, and of the terms of trade $\hat{n}$ where the weights are given by the price and income elasticities of foreign trade and by the initial share of exports in the availability of foreign exchange.

The case of $\theta = 1$ in equation (7) gives the rate of economic growth consistent with the assumption that in the long run the current account of the balance of payments must be zero:

$$(8) \qquad \hat{y}_b = \frac{\pi\,\hat{w} + (\eta+\phi+1)\,\hat{n}}{\xi}.$$

Substituting here the expression $\pi\hat{w}$ of equation (5) gives the balance-of-payments-constrained rate of economic growth $\hat{y}_b$ as a linear combination of the growth of exports $\hat{x}$ and of the terms of trade $\hat{n}$:

$$\hat{y}_b = \frac{\hat{x} + (\phi + 1)\hat{n}}{\xi} \quad (9)$$

If the terms of trade do not show significant long-term variation, the balance-of-payments constrained rate of economic growth is given by the growth rate of exports and the income elasticity of imports, in the expression known as Thirlwall's Law:

$$\hat{y}_b = \frac{\hat{x}}{\xi} \quad (10)$$

The following section tests the empirical validity of equation (9) as an analytical tool to explain the long-term growth during 1950-97 of the eight Central American and Caribbean economies here selected. Following standard practice within the BPC tradition, the empirical tests are here carried out on the log-level formulations of equations (9): [6]

$$\log (y_b) = \alpha \log (x) + \beta \log (n) + \gamma \quad (11)$$

where, by construction, $\alpha = 1/\xi$, $\beta = (\phi + 1)/\xi$ and γ is a constant term.

When the LRS test applied to the estimated long-term vector given by equation (11) indicated that the β coefficient was not significant, cointegration analysis was again applied to re-estimate the BPC-model in its simpler formulation given by the log-linear version of equation (10):

$$\log (y_b) = \alpha \log (x) + \gamma . \quad (12)$$

3. Testing the BPC-model for the Central American Isthmus, Haiti and the Dominican Republic

The BPC model hypothesizes a stable linear relationship between the long run rates of growth of GDP, exports and the terms of trade (see equation 11).[7] According to modern time-series methodology, a linear

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6 Atesoglu (1997) introduced a similar log-linear specification of the balance-of-payments constrained growth model in his analysis of the US economy.

7 Equation 11 assumes away the influence of the terms of trade on exports. Aware of this limitation, we will examine in the future a more comprehensive model allowing for exports to be endogeneously determined.

relationship of a given subset of variables is stable over time if it exhibits a tendency to return to its mean and its variance is bounded. In this case, the linear relationship is said to be *stationary*. Empirically, the *stationarity* of a linear combination of a set of time-series variables can be ascertained by cointegration analysis (Engle and Granger 1991).

Cointegration analysis requires that the individual time-series variable are stationary at the same – or, at least, compatible – orders of integration.[8] To determine the order of integration of the relevant time series we relied on the Dickey-Fuller (DF hereafter) or Augmented Dickey-Fuller statistics (ADF hereafter). After identifying the order of integration of such variables, the Johansen procedure was used to test for the existence of at least one stationary linear combination of the corresponding sets of variables.

Table 2 shows the results of the DF/ADF unit root tests for the logarithms of GDP, the volume of exports 'VOLX' and the terms of trade 'TOT' in levels, first differences and, when required, second differences for the countries selected for 1950-97 (except for the Dominican Republic where, as mentioned, data limitations forced us to restrict the time span of the analysis to 1950-92). Following standard practice, the optimal lag structure for the DF/ADF tests was ascertained on the basis of the Akaike and the Schwartz criteria (AC and SC hereafter). With the few exceptions of Costa Rica, Panama, and Haiti, all variables were found to be integrated of order one, I(1), in log-levels at the 5% level of significance (see Table 2). For Costa Rica and Panama the log-levels of the terms of trade variable 'LTOT' was found to be integrated of order zero, i.e., I(0). In the case of Haiti, the DF/ADF yielded different orders of integration for LGDP, LVOLX and LTOT. The former turned out to be I(2), and the latter ones I(0) and I(1) respectively. Instead of excluding Haiti from the sample, we applied an alternative method to its unit root testing: the Perron-Phillips semi-parametric type procedure (Pesaran 1997).[9] Table 3 shows for Haiti both the DF/ADF and Perron-Phillips unit root tests for LGDP, LVOLX, LTOT. According to the latter test all variables are I(1).

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[8] The order of integration of a variable is the minimum number of times it must be differenced to become stationary (Charezma and Deadman 1992, p. 128).

[9] This procedure relaxes the assumption of the DF statistic regarding the error term as independent, identically distributed, with a zero expected value and constant variance σ^2. It does not require to choose an optimal lag length, and thus avoids the loss of power that characterize the ADF test when such lag is misspecified (Holden and Perman 1994).

TABLE 2

DF/ADF AND PERRON PHILLIPS UNIT ROOT TESTS FOR THE CENTRAL AMERICAN ISTHMUS, HAITI AND THE DOMINICAN REPUBLIC, 1950-97

Country	Variable	DF(ADF)
Costa Rica	LGDP	-1.46
	σLGDP	-5.68*
	LVOLX	-2.36
	σLVOLX	-3.20*
	LTOT	-3.10*
	σLTOT	-5.15*
El Salvador	LGDP	-2.36
	σLGDP	-2.98*
	LVOLX	-2.74
	σLVOLX	-5.34*
	LTOT	-2.17
	σLTOT	-6.32*
Guatemala	LGDP	-1.83
	σLGDP	-3.82*
	LVOLX	-1.68
	σLVOLX	-3.81*(n)
	LTOT	-2.48
	σLTOT	-5.96*
Honduras	LGDP	-1.60
	σLGDP	-4.97*
	LVOLX	1.20
	σLVOLX	-4.68*
	LTOT	-2.17
	σLTOT	-3.94*
Nicaragua	LGDP	-1.56
	σLGDP	-4.68*
	LVOLX	-1.81
	σLVOLX	-6.60*
	LTOT	-2.02
	σLTOT	-5.85*
Panama	LGDP	-1.23
	σLGDP	-4.25*
	LVOLX	-2.71
	σLVOLX	-7.36*
	LTOT	-3.32*
	σLTOT	-5.79*
Dominican Republic	LGDP	-1.27
	σLGDP	-6.03*
	LVOLX	-1.74
	σLVOLX	-7.10*
	LTOT	-2.56
	σLTOT	-5.30*
Haiti	LGDP	1.56
	σLGDP	-2.80
	σ^2LGDP	-18.79*
	LVOLX	-3.69*
	σLVOLX	-5.62*
	LTOT	-1.80
	σLTOT	-6.40*

Note: * denotes significant at the 5% level. The critical value used to determine the existence of unit root in levels corresponded to the Dickey-Fuller equation with intercept and a linear trend. The critical value used to determine the existence of unit root of the rate of change of a given variable corresponded to the Dickey-Fuller equation with only an intercept. The resulting critical value in the former is higher than that of the latter.

TABLE 3

DF/ADF AND PERRON-PHILLIPS UNIT ROOT TESTS FOR HAITI, 1950-97

Variable	DF(ADF)	Perron-Phillips
LGDP	1.56	-1.84
σLGDP	-2.80	-4.83*
σ^2LGDP	-18.79*	-
LVOLX	-3.69*	-1.91
σLVOLX	-5.02*	-9.06*
LTOT	-1.80	-0.73
σLTOT	-6.40*	-13.52*

Note: * denotes significant at the 5% level.

The Johansen cointegration procedure requires first to choose the optimal lag structure for the corresponding vector autoregression system (VAR hereafter) and to check its individual equations for residual serial correlation. The AC and the SC criteria served to identify the VAR optimal lag structure; and the Lagrange multiplier statistic – distributed as a chi-square with one degree of freedom – to test for autocorrelation.

These tests were carried out on each trivariate VAR (given by logs of GDP, exports and the terms of trade) as well as on the corresponding bivariate VARs excluding the terms of trade (i.e. with only LGDP, LVOLX), for all countries considered. Their results are reported in Table 4. Dummy variables were added in the cases of El Salvador to take into account the armed struggle (1979-92); of Haiti, to capture the influence of the embargo imposed by the United States (see, again, footnote 2) and of Panama because of the change in trade data methodology computations from 1980 on.[10]

In order to reduce the risk of overparametrization – given by the relatively small number of observations – when the AC and the SC criteria differed, we tended to choose the shortest optimal lag-length identified. In some cases, the choice of lag was influenced too by economic considerations regarding the coefficients of the estimated cointegrating vector. In nine out of the 42 individual cases examined (for the corresponding VARs), the Lagrange multiplier tests did not reject the null hypothesis of autocorrelation at the 5% level of significance.

[10] The dummy variables were incorporated into the cointegration equations as exogenous variables.

TABLE 4

TRIVARIATE AND BIVARIATE VAR'S OPTIMAL LAG STRUCTURE AND TESTS OF RESIDUAL SERIAL CORRELATION OF SINGLE EQUATIONS

Country	VAR variables	Test Diagnostics/Lag order			Lagrange Multiplier Test $\chi^2(1)$		
		AC/Lag	SC/Lag	ALR/Lag chosen	LGDP	LVOLX	LTOT
Costa Rica	LGDP, LVOLX, LTOT	170.2/1	159.6/1	44.7/1	0.3	2.1	0.1
	LGDP, LVOLX*	125.0/1	119.7/1	39.2/1	0.2	2.1	–
El Salvador	LGDP, LVOLX, LTOT	155.6/4	137.1/1	49.1/1	1.3	0.68	0.14
	LGDP, LVOLX	121.5/1	116.2/1	22.4/1	5.2*	0.68	–
Guatemala	LGDP, LVOLX, LTOT	186.8/1	176.4/1	46.6/1	8.9*	0.01	1.8
	LGDP, LVOLX	152.7/1	145.6/1	10.9/1	8.8*	0.00	–
Honduras	LGDP, LVOLX, LTOT	183.4/1	173.0/1	44.3/1	0.24	1.6	0.90
	LGDP, LVOLX	145.2/4	137.5/1	24.3/1	0.59	0.99	–
Nicaragua	LGDP, LVOLX, LTOT	103.2/2	91.7/1	32.2/2	1.6	0.00	0.18
	LGDP, LVOLX	73.1/2	65.3/1	9.5/1	1.1	0.21	–
				19.2/2	3.3	0.09	–
Panama	LGDP, LVOLX, LTOT	107.3/4	88.3/1	52.8 /1	5.5*	0.11	1.27
	LGDP, LVOLX	68.4/4	57.5/1	26.7/1	4.7*	0.12	–
Dominican Republic	LGDP, LVOLX, LTOT	115.1/2	104.4/1	24.6/2	0.11	0.20	0.07
	LGDP, LTOT	72.7/2	69.3/1	7.2/2	0.06	0.04	–
Haiti	LGDP, LVOLX, LTOT	132.4/1	119.4/1	36.8/1	5.6*	6.3*	0.4
	LGDP, LVOLX	97.7/4	88.5/1	27.7/1	6.3*	11.4*	–

Note: Optimal order selection of VARs according to Akaike information (AC), Schwartz (SC) criteria and the adjusted likelihood ratios (ALR), calculated with up to a five-year lag. In the results of the Lagrange Multiplier Tests of residual serial correlation, the asterisk indicates significance at a 5% level.

TABLE 5

TRIVARIATE JOHANSEN COINTEGRATION PROCEDURE FOR THE CENTRAL AMERICAN ISTHMUS' COUNTRIES, THE DOMINICAN REPUBLIC AND HAITI, 1950-97

Country	Lag	Johansen cointegration test results				Estimated cointegrating vectors	χ^2 LTOT (1)
Costa Rica	1	H_0	H_1	LRS	5%CV	LGDP=0.51+0.64LVOLX+0.52LTOT	1.50
		r=0	r=1	53.4	22.0	(1.97) (0.075) (0.42)	
		r=1	r=2	9.4	15.9		
El Salvador	1	H_0	H_1	LRS	5%CV	LGDP=-4.5+1.05LVOLX+0.72LTOT	7.2
		r=0	r=1	66.2	22.0	(2.05) (0.12) (0.32)	
		r=1	r=2	10.1	15.9		
Guatemala	1	H_0	H_1	LRS	5%CV	LGDP= 4.28+ 1.04 LVOLX+ 0.99LTOT	3.4
		r=0	r=1	69.3	22.0	(4.26) (0.23) (0.74)	
		r=1	r=2	5.7	15.9		
Honduras	1	H_0	H_1	LRS	5%CV	LGDP=-21.8+2.16LVOLX+3.92LTOT	3.3
		r=0	r=1	56.4	22.0	(28.07)(1.48) (5.00)	
		r=1	r=2	6.2	15.9		
Nicaragua	2	H_0	H_1	LRS	5%CV	LGDP=3.21+0.52LVOLX-0.20LTOT	1.9
		r=0	r=1	24.3	22.0	(0.66) (0.064) (0.11)	
		r=1	r=2	6.6	15.9		
Panama	1	H_0	H_1	LRS	5%CV	LGDP= 1.14 + 1.16LVOLX- 0.03LTOT	0.01
		r=0	r=1	61.1	22.0	(1.15) (0.12) (0.26)	
		r<=1	r=2	31.1	15.9		
		r<=2	r=3	5.2	9.2		
Dominican Republic	2	H_0	H_1	LRS	5%CV	LGDP=-4.78+2.07LVOLX+1.64LTOT	0.07
		r=0	r=1	27.5	22.0	(9.65) (0.53) (2.03)	
		r=1	r=2	14.3	15.9		
Haiti	1	H_0	H_1	LRS	5%CV	LGDP=1.71 + 1.18LVOLX + 0.27LTOT	0.7
		r=0	r=1	26.5	22.0	(2.05) (0.20) (0.30)	
		r=1	r=2	20.3	15.9		
		r=2	r=3	5.9	9.2		

Note: The values in parentheses in the fourth column correspond to the asymptotic standard errors. χ^2 LTOT (1) refers to the chi-square test with one degree of freedom under the null hypothesis of a zero long-term coefficient of the terms of trade in the cointegrating vector. The χ^2 critical value at the 5% significance level for 1 degree of freedom is 3.84.

At the 1% level, the Lagrange Mutiplier detected autocorrelation only in three cases.

Johansen cointegration tests were performed on the trivariate VARs given by the log-levels of GDP, exports and the terms of trade. As Table 5 shows, in all cases, the Johansen tests found evidence of at least one long-term cointegrating vector between the log-levels of GDP, exports and the terms of trade, at the 5% significance level.

The next step was to examine the individual statistical significance of exports and of the terms of trade in the trivariate cointegrating vectors by normalizing them by LGDP, and calculating the as-

ymptotic standard errors corresponding to their estimated long-term coefficients. As can be seen in Table 5, with the exception of Honduras, in all the trivariate cointegrating vectors here reported the ratio of the estimated long-term coefficient of exports (LVOLX) and its asymptotic standard error was significant at the 5% level. In the case of Honduras the said ratio was significant, but at the 10% level.

In turn, the estimated long-term coefficient for the log-level of the terms of trade (LTOT) was found to be significant only for El Salvador and Nicaragua. To further examine this issue, we carried out formal tests of the significance of the terms of trade as a determinant of long-term economic growth by applying likelihood ratio statistics to assess the overidentifying restriction given by imposing a zero-coefficient of the terms of trade in the normalized trivariate cointegrating vectors reported in Table 5. Except for El Salvador, the corresponding chi-square statistic failed to reject, at a 5% critical level, the null hypothesis of a zero coefficient of the terms of trade. Within the analytical framework here adopted, these results suggest that the long-term economic growth in 1950-97 of the Central American and Caribbean countries here examined may be explained by their real exports and the income-elasticity of imports, with no statistically significant influence of their terms of trade.

To obtain better estimates of the long-term parameters of the linear association, we applied Johansen cointegration tests to the bivariate VARs given by the log-levels of GDP and exports for each country (excepting El Salvador). The results confirmed, without exception, the existence of one cointegrating vector (see Table 6).

Finally, the *ex post* accuracy of the BPC-model was assessed by comparing the estimated long-term growth of real GDP – as given by the cointegrating vectors here calculated – with the growth rates actually observed in 1950-97. Note that according to the BPC-model presented in Section 2 above, the estimated cointegrating parameters of exports and of the terms of trade relative to GDP may serve to derive estimates of the long-run income and price elasticities of import demand. But, as equation (11) shows, only if the terms of trade parameter is significant in the cointegrating vector will it be possible to estimate the price elasticity of imports. As examined before, in the current sample only for El Salvador did the preferred cointegrating vector show a significant influence of the terms of trade.

TABLE 6

BIVARIATE JOHANSEN COINTEGRATION PROCEDURE FOR THE CENTRAL AMERICAN ISTHMUS' COUNTRIES, THE DOMINICAN REPUBLIC AND HAITI, 1950-97

Country	Lag	Johansen cointegration test results				Estimated cointegrating Vectors
Costa Rica	1	H_o	H_1	LRS	5%CV	LGDP= 2.15+0.59LVOLX
		r=0	r=1	20.5	15.9	(0.56) (0.097)
		r=1	r=2	1.8	9.2	
Guatemala	1	H_o	H_1	LRS	5%CV	LGDP= 1.71+0.74 LVOLX
		r=0	r=1	62.5	15.9	(0.57) (0.10)
		r=1	r=2	2.5	9.2	
Honduras	1	H_o	H_1	LRS	5%CV	LGDP= 0.94+1.09LVOLX
		r=0	r=1	52.8	15.9	(1.52) (0.29)
		r=1	r=2	3.1	9.2	
Nicaragua	1	H_o	H_1	LRS	5%CV	LGDP= 2.25+0.52LVOLX
		r=0	r=1	17.1	15.9	(0.44) (0.091)
		r=1	r=2	5.1	9.2	
Panama	1	H_o	H_1	LRS	5%CV	LGDP= 1.00+1.15LVOLX
		r=0	r=1	58.5	15.9	(0.28) (0.11)
		r<=1	r=2	3.6	9.2	
Dominican Republic	2	H_o	H_1	LRS	5%CV	LGDP = -4.03+2.07LVOLX
		r=0	r=1	22.8	15.9	(2.17) (0.52)
		r=1	r=2	2.9	9.2	
Haiti	1	H_o	H_1	LRS	5%CV	LGDP = 0.14+1.12LVOLX
		r=0	r=1	25.1	15.9	(0.81) (0.20)
		r=1	r=2	3.3	9.2	

Note: The values in parentheses in the fourth column correspond to the asymptotic standard errors.

Table 7 shows the corresponding estimated elasticities of imports and the equilibrium rates of economic growth derived with the trivariate cointegrating vectors (including GDP, exports and terms of trade) for El Salvador and the bivariate cointegrating ones (excluding the terms of trade) for the remaining seven economies examined.

As expected, all income-elasticities of imports here estimated were positive and the price elasticity (for El Salvador) was negative.[11] Only for Dominican Republic and Haiti did the difference between the estimated and the actual rates of growth exceeded one percentage point. In the former case the actual long-term expansion of the econ-

[11] These estimates of long-term economic growth for Central American countries constitute an improvement from our previous findings (Moreno-Brid and Pérez 1999). In particular, for Honduras and El Salvador our *ex post* forecast errors are now substantially lower. However, in the latter case the estimated rate of growth now exceeds the rate actually observed, thus contradicting our earlier findings. Such result may be due to the use of a dummy variable to account for the period of armed struggle. Other differences may arise from our reliance in the present paper on the results of the ALR method.

TABLE 7

INCOME ELASTICITIES OF IMPORTS AND ACTUAL (y_A*) AND BALANCE-OF-PAYMENTS CONSTRAINED (y_E**) GROWTH RATES OF GDP DERIVED FROM THE ESTIMATED COINTEGRATING VECTORS FOR 1950-97

Country	Income elasticity ξ	Price elasticity ϕ	y_a*	y_e**
Costa Rica	1.69	-	4.7	3.7
El Salvador	0.95	-0.32	3.4	4.0
Guatemala	1.35	-	3.8	3.3
Honduras	0.92	-	3.8	3.5
Nicaragua	1.92	-	2.5	2.1
Panama	0.87	-	4.2	4.8
Dominican Republic	0.48	-	4.8	3.7
Haiti	0.89	-	1.1	2.7

TABLE 8

THE DOMINICAN REPUBLIC. AVERAGE TRADE, SERVICE, CURRENT ACCOUNT GAPS AND UNILATERAL TRANSFERS AS PERCENTAGE OF GDP, 1950-92

Years	Foreign trade gap	Service gap	Net unilateral transfers	Current account gap
1950-60	5.6	-3.4	-0.3	1.9
1961-70	-0.2	-5.2	1.8	-3.6
1971-80	-2.5	-6.7	2.2	-7.0
1981-92	-12.1	6.7	5.3	-4.6

Note: The difference between the sum of the external and service gaps, net unilateral transfers and the current account gap equals the rent gap (-4.5% of GDP).

Sources: Martí-Gutierrez (1997); ECLAC (1997).

omy surpassed the limits imposed by its foreign trade performance. This may be due to certain economic or political factors that opened additional sources of foreign exchange - over and above its exports - that allowed an expansion of domestic activity at high rates. In fact, in the Dominican case, private international remittances and other income from abroad have gradually become important sources of foreign exchange. As shown in Table 8, the Dominican Republic's trade balance was in surplus during the 1950s - coinciding with the economic boom experienced under the dictatorship of Leonidas Trujillo[12] - but turned rapidly into a widened deficit. However, foreign remit-

[12] Trujillo ruled the Dominican Republic in 1930-61 and promoted a strategy of import substitution that brought about secular economic growth. However, by 1959 it had lost steam and led to a balance of payments crisis (see Pons 1995).

tances from the United States – and an important inflow of service sector income – somewhat loosened the grip of the foreign exchange constraint on economic growth in the 70s and especially in the 80s. Such flows, however, may not necessarily be sustainable in the future.

For Haiti, our results indicate that there are important constraints on its long-term economic growth that weigh more heavily than the availability of foreign exchange. The widespread incidence and degree of poverty among its population, the relative lack of human and physical capital, the acute decay of its infrastructure, the erroneous economic policies followed by the Duvalier regimes, and the political instability since the mid-Eighties are in our view key elements that must have hindered Haiti's long-term economic expansion.

4. Conclusions

The findings of the present paper indicate that the balance-of-payments-constrained growth model provides a useful tool to understand the long-term growth of the eight Latin American economies here examined for the 1950-97 period. Its empirical adequacy may be grounded on these developing countries' key dependence on imported machinery, equipment and other inputs from abroad so that their availability of foreign exchange puts a ceiling to the rate of expansion of their domestic production.

The results of the Johansen cointegration techniques strongly supported the BPC-model in its simple version given by Thirlwall's Law for most of the Central American and Caribbean countries. Indeed, with the exception of El Salvador, the results identified a long-run relationship between real GDP growth and exports, with no evidence of any significant influence of the terms of trade on it. These findings shed important light on the issue regarding the determinants of long-term economic growth in small open developing countries. Indeed, with the exception of El Salvador, our results question the Structuralist School's key claim that places the secular decline in the terms of trade as the main culprit for the slow economic expansion of developing countries. Our findings indicate that the terms of trade may not necessarily constitute a good starting point to explain the long-term growth of these Central American and Caribbean econo-

mies. On these matters, it may be important to emphasize that the terms of trade have been rather stable for most countries in the sample selected. However, to provide a full explanation of whether the terms of trade do or do not exert a significant influence on the long-term economic growth of most LDCs is clearly beyond the objectives of the present paper.

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