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SUSTAINABILITY OF LATIN AMERICAN FISCAL DEFICITS: A PANEL DATA APPROACH♣

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ABSTRACT. This paper evaluates the fiscal sustainability hypothesis for eight Latin American countries for the period 1960 - 2009: Argentina, Chile, Colombia, Ecuador, Panama, Peru, Paraguay and Uruguay. Using second generation cointegration panel data models, we test whether government revenues and primary expenditures are sustainable in the long run. This methodology allows for cross-sectional dependence among countries and is appropriate under the existence of potential structural breaks. We found empirical evidence of sustainability of the primary deficit for these Latin American countries but only in a weak sense.

Keywords: *Fiscal Sustainability, Panel Unit Root tests, Panel Cointegration tests, Structural Change.*

JEL Classification: *C22, C23, H62.*

1. INTRODUCTION

Fiscal sustainability or how solvent a government is over time, has been the focus of many surveys during the last decades. This is a highly relevant topic because the control of fiscal deficits involves sustainable development and economic growth. In addition, political decisions regarding the control of fiscal deficits influence government expenditures and revenues, and have large effects on macroeconomic variables such as national savings and investments, and therefore, on the current account.

One good example of the relevance of the fiscal deficit is the Maastricht treaty. In 1991, European Union countries (EU) signed this treaty to unify their economic policies. The basic convergence criteria were inflation, exchange rate, nominal interest, debt and fiscal deficit. The treaty stated that a government's deficit and public debt should not be higher than 3% and 60% of the country's GDP, respectively. By the end of 1999, European Monetary Union (EMU) countries had already

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accomplished the treaty's agreed-upon goals. From the empirical point of view, the recent world crisis has pointed out the importance of using econometric methodologies that consider structural breaks.

However, most Latin American governments have endeavored to maintain consumers' confidence in the economy. For this purpose, they have attempted to guarantee fiscal sustainability. This requires governments to adopt responsible fiscal policies to assure macroeconomic stability. Furthermore, fiscal sustainability has become a focus of increasing interest because of the adoption of fiscal rules by some Latin American governments.

The fiscal sustainability hypothesis implies that government revenues and expenditures must share a long run trend. Although there is plentiful evidence that supports this hypothesis, there is also evidence of the non-existence of fiscal sustainability. The latter is primarily due to the importance of government expenditures as political instruments; it is also related to the difficulties that some countries experience when trying to fund government expenditures with their current revenues.

In the empirical literature on this topic, Hakkio and Rush [1991] and Haug [1991] used non-panel methodologies to demonstrate fiscal sustainability. These surveys used the cointegration test developed by Engle and Granger [1987]. Given the strong links among the economies of a region, a panel approach is more appropriate in this context. Prohl and Schneider [2006], Afonso [2007] and Afonso and Rault [2010], among others, have used macroeconomic panel methodologies.

This paper's contribution is two-fold. First, it applies recent econometric methodologies related to unit root (Hadri and Rao [2008]) and cointegration tests (Westerlund [2006]). These are second-generation macroeconomic panel data tests, which correct with the cross-sectional dependence among individuals and are additionally appropriate under the existence of structural breaks. Second, it contributes to the empirical literature on fiscal sustainability for Latin America, a topic that has attracted the attention of several researchers since the middle of the last decade.

The outline of this article is as follows: the second section describes the economic and econometric background associated with the sustainability hypothesis. The empirical results are shown in the third section. Finally, concluding remarks are presented in the fourth section.

2. Sustainability Hypothesis

In this section, the model proposed by Hakkio and Rush [1991] is described. This model focuses on the government's Intertemporal Budget Constraint (IBC).

2.1. **Theoretical Model.**

Hakkio and Rush [1991] use a dynamic model in which the government faces a budget constraint in period t, which is expressed in nominal terms as follows:

$$E_{it} + (1 + n_{it})B_{i,t-1} = R_{it} + B_{it}, \tag{1}$$

where B_{it} is the public debt for country i in period t; R_{it} represents the central government revenues, including those from seigniorage; n_{it} is the nominal interest rate and E_{it} represents central

government expenditures, not including debt interest debts. Dividing (1) by the nominal GDP of each country, y_{it}, the equation is normalized in terms of the real size of the economy:

$$\frac{E_{it}}{y_{it}} + \frac{(1+n_{it})}{(1+\omega_{it})}\frac{B_{i,t-1}}{y_{i,t-1}} = \frac{R_{it}}{y_{it}} + \frac{B_{it}}{y_{it}}, \tag{2}$$

where ω_{it} is the nominal GDP growth rate. Equation (2) can be written as follows:

$$e_{it} + (1+\rho_{it})b_{it-1} = r_{it} + b_{it}. \tag{3}$$

Lowercase letters represent real terms variables in equation (1), r_{it} corresponds to central government revenues, b_{it} is public debt, e_{it} is central government expenditures and ρ_{it} is the interest rate adjusted by the GDP growth rate (ω_{it}). Equation (3) is, therefore, rewritten as follows:

$$b_{it} - b_{it-1} = e_{it} - r_{it} + \rho_{it}b_{it-1} = \Delta b_{it}. \tag{4}$$

Equation (4) represents the global balance, whereas $e_{it} - r_{it}$ is the primary balance.

Assuming that the expected value of ρ_{it} is time invariant,[1] equation (3) is solved to obtain

$$b_{it} = \sum_{j=0}^{\infty} E_t \delta^{j+1}(r_{i,t+j} - e_{i,t+j}) + E_t \delta^{j+1} b_{i,t+j}, \tag{5}$$

where $\delta^{j+1} = \left(\frac{1}{1+\rho_i}\right)$. Equation (5) shows a relevant condition to achieve fiscal sustainability of the countries. The first term of the right-hand side of equation (5) implies fiscal or monetary dominance because it represents the monetary and fiscal policy targets of the central government. The right-hand side of the equation is fundamental to this survey because it is associated with the transversality condition, which determines whether the hypothesis of sustainability holds.

The transversality condition (or solvency condition) states that the public debt can not increase faster than the economy, and therefore, avoids forcing the central government to face a Ponzi problem. As a result, to achieve the transversality condition, the public debt must increase more slowly than the mean of the interest rate

$$\lim_{j\to\infty} E_t \delta^{j+1} b_{i,t+j} = 0. \tag{6}$$

If the transversality condition holds, we can rewrite equation (5) as follows:

$$b_{it} = \sum_{j=0}^{\infty} E_t \delta^{j+1}(r_{i,t+j} - e_{i,t+j}). \tag{7}$$

Equation (7) implies that policies are only sustainable if the sum the of the discounted primary fiscal surplus (present value) equals the gross debt. Given that these series are $I(1)$, Hakkio and Rush [1991] showed that for IBC to hold, the central government's revenues and expenditures

[1] A discussion of this assumption can be found in Hakkio and Rush [1991] and Quintos [1995].

need to be cointegrated.

2.2. **Empirical Methodology.** In general, there are three methodologies used to test the sustainability hypothesis in the empirical literature. The first consists of determining the stationarity of the budget deficit by applying unit root tests (Hamilton and Flavin [1986], Wilcox [1989], Holmes, Otero, and Panagiotidis [2010]). A stationarity result entails that the sustainability hypothesis holds, whereas a non-stationarity result implies the opposite. Given that revenues and expenditures are non-stationary, the second methodology consists of testing the cointegration between these variables (Hakkio and Rush [1991], Quintos [1995], Bravo and Carrion-i Silvestre [2002], Ehrhart and Llorca [2008], Afonso and Rault [2010], Westerlund and Prohl [2010]). If the series are cointegrated, the sustainability hypothesis holds. The final method also tests cointegration, but it uses the public debt and primary budget deficits when both series are non-stationary (Haug [1991], MacDonald [1992], Prohl and Schneider [2006]).

The empirical strategy of this survey is as follows: first, Hadri and Rao [2008]'s unit root test is applied to revenues and primary expenditures. Second, if these series turn out to be integrated of order 1, Westerlund [2006]'s methodology is applied to test for cointegration and estimate the long run relationship between them. This relationship can be described as follows:

$$r_{it} = \alpha_i + \beta_i e_{it} + \varepsilon_{it}. \tag{8}$$

Hakkio and Rush [1991] showed that if the variables are cointegrated, the government budget constraint holds. Quintos [1995] not only considers whether the series are cointegrated, but also considers the magnitude of the long run coefficient. Quintos claims that $\beta_i = 1$ is a sufficient condition for fiscal sustainability to hold in the strong sense. Furthermore, she argues that $0 < \beta < 1$ implies sustainability in the weak sense and that, therefore, the government is spending more than it is collecting.

2.2.1. *Hadry and Rao's unit root test in a heterogeneous panel with a structural break and cross-sectional dependence.* Hadri and Rao [2008] consider the following four models to test for a unit root on the series y_{it}:

$$\text{Model 0: } y_{it} = \alpha_i + r_{it} + \delta_i D_{it} + \varepsilon_{it}, \tag{9}$$

$$\text{Model 1: } y_{it} = \alpha_i + r_{it} + \delta_i D_{it} + \beta_i t + \varepsilon_{it}, \tag{10}$$

$$\text{Model 2: } y_{it} = \alpha_i + r_{it} + \beta_i t + \gamma_i \delta_i DT_{it} + \varepsilon_{it}, \tag{11}$$

$$\text{Model 3: } y_{it} = \alpha_i + r_{it} + \delta_i D_{it} + \beta_i t + \gamma_i \delta_i DT_{it} + \varepsilon_{it}, \tag{12}$$

where r_{it} is a random walk process without drift, $r_{it} = r_{it-1} + u_{it}$, $i = 1, ..., N$ and $t = 1, ..., T$. The error terms u_{it} and ε_{it} are $i.i.d.$ and mutually independent. D_{it} and DT_{it} are dummies associated with the structural breaks. Model 0 is the most restrictive because it only includes a structural break in levels and has no deterministic trend. In contrast, Model 1 includes a structural break in levels and has a deterministic trend but does not present a trend with breaks. Model 2 allows for

breaks in the trend, but not at the level of the series, to exist. Finally, Model 3, the least restrictive, includes level, trend and break in both deterministic components.

The dummy variables D_{it} and DT_{it} are defined as follows:

$$D_{it} = \begin{cases} 1 & \text{if } t > T_{B,i} \\ 0 & \text{otherwise} \end{cases} \tag{13}$$

$$DT_{it} = \begin{cases} t - T_{B,i} & \text{if } t > T_{B,i} \\ 0 & \text{otherwise,} \end{cases} \tag{14}$$

where $T_{B,i} = \omega_i T$ denotes the break point for the i-th individual and $\omega_i \in (0,1)$.

The panel statistics for testing the unit root are provided by:

$$\widehat{LM}_{T,N,k}(\widehat{\omega}) = \frac{1}{N}\sum_{i=1}^{N} \eta_{i,T,k}(\widehat{\omega}_i), \tag{15}$$

where $\eta_{i,T,k}(\omega_i)$ is the KPSS statistic for the *i-th* individual given the break ω_i as follows:

$$\eta_{i,T,k}(\widehat{\omega}_i) = \frac{\sum_{t=1}^{T} S_{it}^2}{T^2 \widehat{\sigma}_{\varepsilon,i}^2}. \tag{16}$$

In the previous equations, the subscript k denotes the four models considered by Hadri and Rao [2008] ($k = 0,1,2,3$), $\widehat{\omega}_i = \text{argmin}_{\omega_i \in (0,1)} SSR(\omega_i)$, S_{it} is the partial sum of residuals $\hat{\varepsilon}_{it}$ and $\hat{\sigma}_{\varepsilon,i}^2$ is the long run variance (LRV) estimator of ε_{it}, where

$$\widehat{\sigma}_{\varepsilon,i}^2 = \lim_{T\to\infty} \tfrac{1}{T} E\left(S_{iT}^2\right).$$

Under some assumptions, the limit distribution of (15) is as follows:

$$Z_k(\widehat{\omega}) = \frac{\sqrt{N}\left(\widehat{LM}_{T,N,k}(\widehat{\omega}) - \overline{\xi}_k\right)}{\overline{\zeta}_k} \xrightarrow{d} N(0,1), \tag{17}$$

where $\overline{\xi}_k = \frac{1}{N}\sum_{i=1}^{N} \xi_{i,k}$ and $\overline{\zeta}_k = \frac{1}{N}\sum_{i=1}^{N} \zeta_{i,k}^2$ are the mean and variance estimators, respectively. To correct for serial correlation, Hadri and Rao [2008] assume that $\widehat{\varepsilon}_{it}$ follows an $AR(p)$ model as follows:

$$\widehat{\varepsilon}_{i,t} = \rho_{i,1}\widehat{\varepsilon}_{i,t-1} + \rho_{i,2}\widehat{\varepsilon}_{i,t-2} + \cdots + \rho_{i,p_i}\widehat{\varepsilon}_{i,t-p_i} + \upsilon_{i,t}. \tag{18}$$

The LRV estimate of $\sigma_{\varepsilon_i}^2$ is obtained as:

$$\widehat{\sigma}_{\varepsilon_i}^2 = \min\left\{ T\widehat{\sigma}_{\upsilon_i}^2, \frac{\widehat{\sigma}_{\upsilon_i}^2}{\left(1 - \widehat{\rho}_i(1)\right)^2} \right\},$$

where $\widehat{\rho}_i(1)$ is the sum of all of the autoregressive coefficients estimated in equation (18) and $\widehat{\sigma}_{\upsilon_i}^2$ is the LRV estimate of $\widehat{\upsilon}_i$, which can be estimated using a quadratic spectral window heteroscedastic

and an autocorrelation consistent estimator. The number of optimal lags, p, may be determined using the Bayesian Schwarz selection criteria (SBIC).

Additionally, to correct for cross-sectional dependence among individuals, Hadri and Rao [2008] follow the bootstrap methodology proposed by Maddala and Wu [1999]. They generate the errors, $\widehat{\varepsilon}^*_{i,t}$, recursively from bootstrap innovations $\widehat{\upsilon}^*_{i,t}$, as:

$$\widehat{\varepsilon}^*_{i,t} = \rho_{i,1}\widehat{\varepsilon}^*_{i,t-1} + \rho_{i,2}\widehat{\varepsilon}^*_{i,t-2} + \cdots + \rho_{i,p}\widehat{\varepsilon}^*_{i,t-p} + \widehat{\upsilon}^*_{i,t}. \tag{19}$$

Finally, y^*_{it} is obtained by adding $\widehat{\varepsilon}^*_{i,t}$ to the deterministic component of the corresponding selected model ((9), (10), (11) or (12)). The bootstrap procedure is repeated several times to derive the empirical distribution of the LM statistic (17).

2.2.2. *Westerlund cointegration test in a heterogeneous panel with multiple structural breaks and cross-sectional dependence.* The Westerlund [2006] cointegration test is an extension of the McCoskey and Kao [1998] test that allows for the presence of multiple structural breaks at both level and trend. This methodology also accounts for cross-sectional dependence.

It is assumed that the data-generating process of the $I(1)$ series y_{it} is as follows:

$$y_{it} = z'_{it}\gamma_{ij} + x'_{it}\beta_i + e_{it}, \tag{20}$$

where $x_{it} = x_{i,t-1} + v_{it}$ is a $k-$dimensional $I(1)$ vector that contains the regressors and z_{it} is the vector of the deterministic component[2] and $e_{it} = r_{it} + u_{it}$ with $r_{it} = r_{i,t-1} + \phi_i u_{it}$. β_i and γ_{ij} are the vectors of the parameters. The structural breaks are denoted with the subscript $j = 1,2,...,M_i+1$. These breaks are located at $T_{i,1},...,T_{i,M}$, where $T_{i,0} = 1$ and $T_{i,M_i+1} = T$. Cross-sectional independence is assumed in the vector $w_{it} = (u_{it}, v'_{it})'$, [3] where w_{ij} and w_{kt} are independent for all j, t and $i \neq k$. Additionally, it is assumed that $w_{ij} = C_i(L)\varepsilon_{it}$ [4] and the matrix $\Omega_i \equiv C_i(1)C_i(1)'$ is positive definite [see Assumption 1 in Westerlund [2006]].

Furthermore, the long run variance matrix of the vector $w_{i,t}$ is defined as follows:

$$\Omega_i \equiv \lim_{T\to\infty} \tfrac{1}{T} E\left(S_{i,T}S'_{i,T}\right) = \begin{pmatrix} \omega^2_{i,11} & \omega'_{i,21} \\ \omega_{i,21} & \Omega_{i,22} \end{pmatrix},$$

where $S_{iT} = \sum_{t=1}^{T} w_{it}$. The long run variance of the vector u_{it} conditional to v_{it} is $\omega^2_{i,12} \equiv \omega^2_{i,11} - \omega'_{i,21}\Omega^{-1}_{i,21}$.

If $\phi_i = 0$, then x_{it} and y_{it} are cointegrated. In this test, the null and alternative hypotheses can be written as follows:

[2] Westerlund [2006] considers five cases of deterministic components: 1) $z_{it} = \{\oslash\}$, 2) $z_{it} = \{1\}$, 3) $z_{it} = \{1,t\}'$, 4) and 5) correspond to cases 2) and 3) with structural breaks.

[3] This assumption is later relaxed.

[4] L is the lag operator, $C_i(L) < \infty$ and $\varepsilon_{it} \sim i.i.d.(0, I_{K+1})$.

$$H_0 : \phi_i = 0 \quad \text{for} \quad i = 1,2,...,N$$

$$H_A : \phi_i \neq 0 \quad \text{for} \quad i = 1,2,...,N_1 \quad \text{and} \quad \phi_i = 0 \quad \text{for} \quad i = N_1+1, N_1+2, ..., N$$

Westerlund [2006] proposes the following LM panel statistic to prove the null hypothesis of cointegration:

$$Z(M) = \frac{1}{N} \sum_{i=1}^{N} \sum_{j=1}^{M_i+1} \sum_{t=T_{i,j-1}+1}^{T_{ij}} \frac{S_{it}^2}{\left(T_{ij} - T_{i,j-1}\right)^2 \widehat{\omega}_{i,12}^2}, \tag{21}$$

where $S_{it} = \sum_{s=T_{ij}+1}^{t} \widehat{\varepsilon}_{is}$ and $\widehat{\varepsilon}_{it}$ is an efficient estimate of e_{it} in (20). This can be obtained with the Fully Modified OLS methodology (FMOLS) of Phillips and Hansen [1990]. The structural breaks are determined endogenously by Bai and Perron [2003]'s procedure.[5] The limiting distribution of this test is normal. However, Westerlund [2006] uses a bootstrap methodology to incorporate the effect of cross-sectional dependence among countries.

3. Empirical Results

The data used in this paper come from the Oxford Latin American economic history database (OxLAD) and the Economic Commission for Latin America and the Caribbean (ECLAC). It contains annual information on revenues and primary expenditures as a share of the GDP for 8 Latin American countries: Argentina, Chile, Colombia, Ecuador, Panama, Paraguay, Peru and Uruguay, during the period of 1960-2009.[6]

3.1. **Estimation results.**

The results of the Hadri and Rao [2008] panel unit root and the Westerlund [2006] cointegration tests are presented below.

3.1.1. *Panel unit root test results.* In this subsection, the Hadri and Rao [2008] stationarity test is implemented. Tables 1 and 2 contain the results of the unit root tests for revenues and primary expenditures as a share of GDP. In column 2 of each table, the selected model ((9), (10), (11) or (12)) is presented; in columns 3 and 4, the optimal lag number of the autoregressive process in equation (18) and the estimated LM individual statistic (KPSS) are shown, respectively.[7] Five thousand replications were used for the bootstrap methodology.[8]

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[5] $\widehat{T}_i = \underset{T_i}{\operatorname{argmin}} \sum_{j=1}^{M_i+1} \sum_{t=T_{ij-1}+1}^{T_{ij}} \left(y_{it} - z_{it}' \widehat{\gamma}_{ij} - x_{ij}' \widehat{\beta}_i\right)^2$.

[6] Brazil, Bolivia and Venezuela were excluded due to inconsistencies when compared with other data sources.

[7] The number of lags and the deterministic component of the models were selected using the Bayesian Information Criteria (SBIC).

[8] The authors acknowledge Professor Yao Rao for kindly providing his GAUSS code, which was later written in R.

The results showed that the null hypothesis of stationarity for both series is rejected at a 5% significance level, which means that revenues and primary expenditures have a unit root.[9]

TABLE 1. Unit root test for governmental revenues

LM statistic		2.7788	
Asymptotic p-value		0.0027	
Bootstrap p-value		0.0460	
Country	Model	AR lag	LM statistic
Argentina	3	3	0.1479
Chile	3	1	0.0548
Colombia	2	3	0.0811
Ecuador	3	1	0.0517
Panama	3	1	0.0421
Paraguay	3	1	0.0584
Peru	3	1	0.0256
Uruguay	1	1	0.0742

TABLE 2. Unit root test for governmental primary expenditures

LM statistic		2.2981	
Asymptotic p-value		0.0110	
Bootstrap p-value		0.0280	
Country	Model	AR lag	LM statistic
Argentina	3	1	0.0846
Chile	3	1	0.0278
Colombia	1	0	0.0742
Ecuador	2	1	0.1338
Panama	3	0	0.1491
Paraguay	0	1	0.0572
Peru	1	1	0.0379
Uruguay	3	2	0.0694

[9]The results of the panel unit root test in first differences confirm that the series in levels are $I(1)$. These results are not shown but are available on request.

Given that both series are non-stationary, the next step of the methodology is to check whether there is a long run relationship between them.

3.1.2. *Panel cointegration results.* Tables 3, 4 and 5 show the results of the cointegration test proposed by Westerlund [2006].[10] The first column of each table presents the estimated structural breaks and the second shows the result of the cointegration test. The estimated long run coefficients are presented in the third column. In addition, Figures1 and 2 show government revenues and primary expenditures for the 8 Latin American countries that were considered along with the estimated breaks. To take cross-sectional dependence into account, a block bootstrap method with geometrical distribution was used with a block size of 5 and 5000 simulations. Given the sample size, the cointegration methodology considers 3 breaks per country at most. Furthermore, the residuals of (20) are estimated by FMOLS.

As shown in Table 3, Argentina exhibits the most breaks in the cointegration relationship, whereas Peru reports none. In contrast, Chile, Panama and Paraguay present two breaks each and Colombia, Ecuador and Uruguay each have only one.

TABLE 3. Structural breaks estimated by the cointegration test

Country	Number of Breaks	Break 1	Break 2	Break 3
Argentina	3	1969	1976	2002
Chile	2	1971	1988	-
Colombia	1	1990	-	-
Ecuador	1	1984	-	-
Panama	2	1973	1990	-
Paraguay	2	1988	2002	-
Peru	0	-	-	-
Uruguay	1	1971	-	-

The estimated breaks partially reflect the history of the second part of the 20th century, which was characterized by two stages of hyperinflation, monetary crises and dependent central banks. These situations forced countries to focus their economic policies on stabilizing prices and the exchange rate, apart from controlling public expenditures. Argentina's case was characterized by several military takeovers and dictatorial regimes. The 1969 break represents the disproportionate rise of military expenditures due to the increasing political violence between 1965-1973. In 1976, a national reorganization process began after the central government was overthrown, a situation

[10]The authors acknowledge Professor Joakim Westerlund for kindly providing his program of this test in GAUSS, which was later written in R.

propitiated by General Jorge Rafael Videla. The 2002 break represents the default known as "El Corralito", which Argentina experienced after the massive leak of capitals that forced the government of President Fernando de la Rúa to freeze banking deposits (Cortes [2003]).

On the one hand, Chile was the first Latin American country to enter the OECD (since 2010). Military expenditures are a large share of its GDP in comparison with other countries in the region (roughly 4%). In 2000, Chile implemented a fiscal rule to decrease the fiscal deficit and keep it at approximately 1% of GDP. Furthermore, the country is rich in copper (in 1970, copper made up 60% of total Chilean exports). On the other hand, as shown in Figure 1, public expenditures increased almost 36% in 1971 mainly due to a 48% increase in wages in the public sector. After the financial crisis of 1981 and the elimination of the fixed exchange rate, Chile experienced an 11% recession from which it immediately recovered, as demonstrated by the average growth rate of 7.5% between 1984 and 1989 (Meller [1996]). From another point of view, the estimated breaks for Chile follow the Chilean military regime between 1973 and 1989.

Colombia exhibited a long period of moderate inflation, almost 45 years after the Second World War. In 1989, its opening began after the Washington Consensus was signed. Likewise, in 1991 a new Political Constitution was adopted that guaranteed the Central Bank its independence. These two events may be related to the estimated break in 1990.

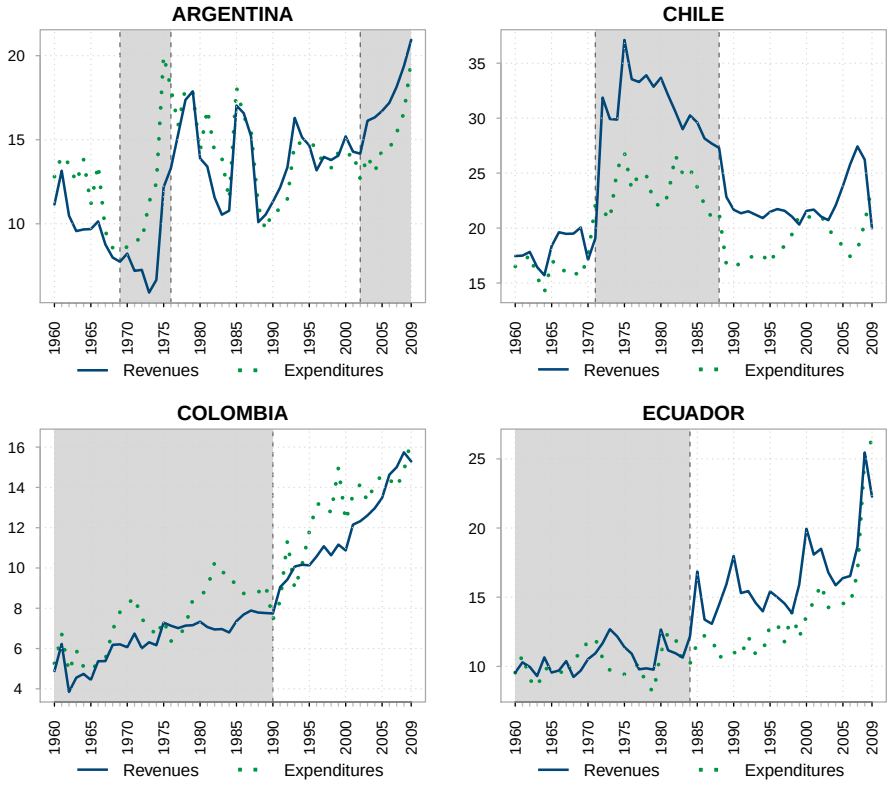
At the beginning of the 1970s, Ecuador was under civil dictatorship. In 1972, PetroEcuador was created and the country entered the Organization of Petroleum Exporting Countries (OPEC). By the 1980s, the crisis had deepened to the point of increasing Ecuador's fiscal deficit to approximately 2.3% in 1982. This was triggered by the commercial deficit and falling oil prices. Nonetheless, in 1984, fuel prices increased dramatically, which in turn increased Ecuadorian oil revenues as shown in Figure 1 (Spurrier [1986]).

Currently, Panama is one of the most globalized economies in Latin America. It has an investment rating, is completely dollarized and the service sector is growing stronger. In 1968, it experienced a military takeover, which gave way to General Torrijos' dictatorship. In 1972, the new constitution increased health expenditures to more than 10% of the total national budget (first break, see Figure 2), which brought about an increase in total governmental expenditures. During 1988 and 1989, Panama experienced its most difficult social and economic crisis ever.

Paraguay is a country characterized by military dictatorships. Alfredo Stroessner was president for 35 years, between 1954 and 1989. In 1980, the treaty on Asociación Latinoamericana de Integración (ALADI) was signed; in 1984, the largest hydroelectric power plant in the world, Usina Hidroeléctrica de Itaipú, began operations. During 2001 and 2002, public expenditures registered negative growth rates, mainly due to the reduction in social expenditures (roughly 50%). According to these estimations, Peru does not register any statistically significant break.

Table 4 presents the results of the cointegration test for government revenues and primary expenditures. Both the asymptotic and bootstrap $p-values$ are large enough not to reject the null

FIGURE 1. Structural breaks in the relationship between governmental revenues and primary expenditures for Argentina, Chile, Colombia and Ecuador (1960-2009)



Source: OXLAD and CEPAL.

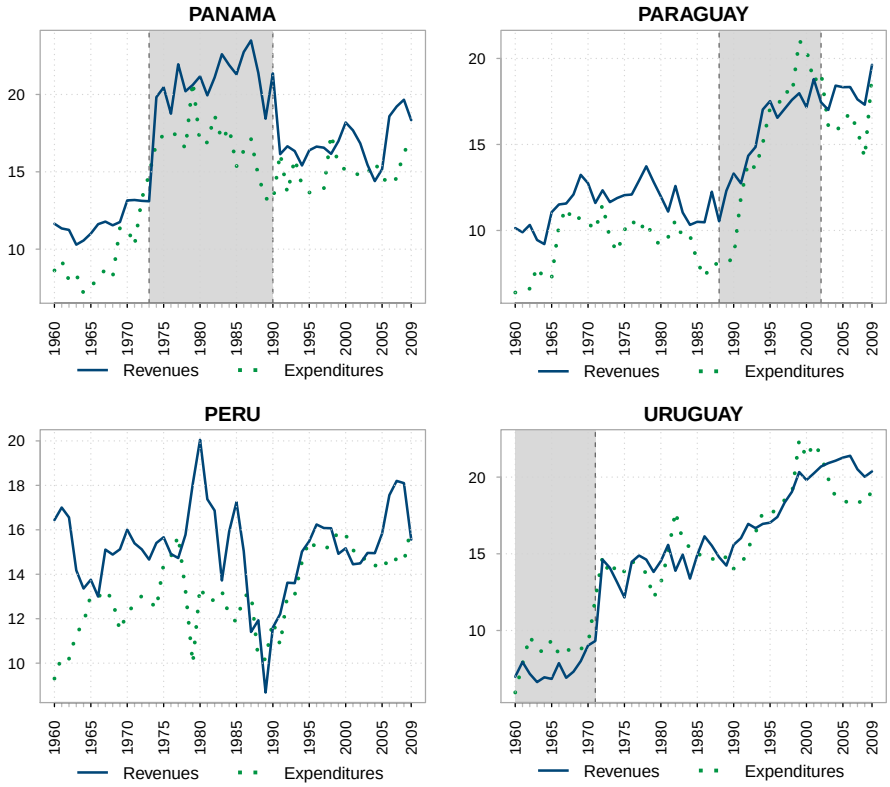
hypothesis of cointegration at the 5 significance level.

TABLE 4. Results of the cointegration test

LM statistic	0.874
Asymptotic p-value	0.191
Bootstrap p-value	0.243

Table 5 reports the estimates of the long run coefficients along with their standard deviations. Given that these coefficients are significantly lower than 1 for the 8 countries that were studied,

FIGURE 2. Structural breaks in the relationship between governmental revenues and primary expenditures for Panama, Paraguay, Peru and Uruguay (1960-2009)



Source: OXLAD and CEPAL.

there is no fiscal sustainability in the strong sense, although according to Quintos [1995] it exists in the weak sense. In this case, Chile, Panama and Paraguay exhibit the largest estimated coefficients: 0.79, 0.72 and 0.66, respectively. In contrast, Colombia and Uruguay have the lowest coefficients, 0.22 and 0.48[11]. The estimated coefficients are statistically significant at the 5% level, except in the case of Peru.

[11]Lozano and Cabrera [2009] also found out that there is fiscal sustainability in the weak sense in the Colombian case.

TABLE 5. Cointegration coefficients

Country	Coefficients	Standard Deviation
Argentina	0.596	0.079
Chile	0.786	0.086
Colombia	0.224	0.092
Ecuador	0.612	0.087
Panama	0.722	0.107
Paraguay	0.664	0.061
Peru	0.593	0.304
Uruguay	0.485	0.087

4. CONCLUDING REMARKS

There is sufficient empirical evidence obtained through diverse methodologies of the relationship between government expenditures and revenues to determine whether the government intertemporal budget constraint holds and, hence, whether its debt is sustainable in the long run. However, over the last decade, several surveys that have attempted to demonstrate the former condition at the regional level have appeared. These surveys arose from the need to incorporate two characteristics that may be determinant when addressing this problem in the panel context: possible structural breaks and cross-sectional dependence across individuals. The recent world crisis has pointed out the importance of applying methodologies that take the former characteristic into account.

This document investigates the existence of the long run relationship between government primary expenditures and revenues to prove whether a fiscal sustainability condition holds for Latin American countries. Annual series from Argentina, Chile, Colombia, Ecuador, Panama, Peru, Paraguay and Uruguay during 1960-2009 are used for data. The coefficients of the long run relationship are estimated by applying the second-generation cointegration panel test proposed by Westerlund [2006], which incorporates cross-sectional dependence and multiple structural breaks.

The results suggest that primary expenditures and revenues exhibit common movements in the long run. Nevertheless, the relationship between these variables is not 1 to 1. This condition means that, although there is a long run relationship, the cointegration coefficient is lower than 1. According to Quintos [1995], this implies that fiscal sustainability only exists in the weak sense. Therefore, if expenditures increase by 1%, revenues will increase less than 1% in the long term, which means that the governments are spending more than they are collecting. Chile, Panama and Uruguay exhibit the largest estimated coefficients, whereas Colombia displays the lowest one. In general, these results imply that the public finances of the 8 Latin American countries were weakly sustainable between 1960 and 2009. They also suggest that these governments must be cautious with their public finances.

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