HOW SUSTAINABLE ARE 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, Argentina, Chile, Colombia, Ecuador, Panama, Peru, Paraguay and Uruguay, during the period 1960 - 2009. 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 also appropriated 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, namely, how solvent a Government is over time, has been the focus of many surveys during the last decades. This is a very relevant topic, since the control of fiscal deficit involves sustainable development and economic growth. In addition, political decisions regarding the control of fiscal deficit do not only influence government expenditures and revenues, but also have large effects on macroeconomic variables such as national saving and investment, and therefore, on the current account.

A good example of the relevance of fiscal deficit is the Maastricht treaty. In 1991, European Union countries (EU) signed the treaty in order to unify their economic policies. The basic convergence criteria were inflation, exchange rate, nominal interest, debt and fiscal deficit. The treaty stated that government deficit and public debt should not be over 3% and 60% of GDP, respectively. By the end of 1999, European Monetary Union (EMU) countries had already accomplished what was

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agreed on the treaty. From the empirical point of view, the recent world crisis has pointed out the importance of using econometric methodologies that consider structural breaks.

On the other hand, most of Latin American governments have endeavored to keep up consumer confidence of the economy, for which they have sought to guarantee fiscal sustainability. This requires governments to take up responsible fiscal policies to assure macroeconomic stability. Furthermore, fiscal sustainability has become the focus of even more interest because of the adoption of fiscal rules by some Latin American governments.

Fiscal sustainability hypothesis plays an important role, since it implies that government revenues and expenditures must share a long-run trend. Although there is numerous evidence that seems to support this hypothesis, there is also evidence of the non-existence of fiscal sustainability. The latter is mainly due to the importance of government expenditures as a political instrument and is also related to the difficulties that some countries experience when trying to fund it with their current revenues.

Regarding the empirical literature on this topic, works such as Hakkio and Rush [1991] and Haug [1991] used non-panel methodologies to prove 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 appropriated in this context. Prohl and Schneider [2006], Afonso [2007] and Afonso and Rault [2010], among others, used macroeconomic panel methodologies.

The contribution of this paper is two-fold. In the first place, it applies recent econometric methodologies related to unit root (Hadri and Rao [2008]) and cointegration tests (Westerlund [2006]). They are second generation macroeconomic panel data tests, which correct by cross-sectional dependence among individuals and additionally are also appropriated under the existence of structural breaks. In the second place, it contributes to empirical literature on fiscal sustainability for Latin America, a topic that has attracted the attention of several researchers since the mid 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 showed in the third section. Finally, some concluding remarks are presented in the section four.

2. Sustainability Hypothesis

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

2.1. **Theoretical Model.**

Hakkio and Rush [1991] use a dynamic model where the Government faces a budget constraint in period t 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, without including debt interest debts. Dividing (1) by 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 growing rate. Rewriting (2)

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

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 growing rate (ω_{it}). Rewriting equation (3)

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

Equation (4) represents the global balance. On the other hand, $e_{it} - r_{it}$ 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 prove fiscal sustainability of the countries. The first right-hand side term of equation (5) implies fiscal or monetary dominance, since it lays out monetary and fiscal policies targets of the central Government. The right-hand side of the equation is fundamental in this survey, since it is associated with the transversality condition, which determines whether the hypothesis of sustainability holds or not.

The transversality condition (or solvency condition) states that the public debt can not increase faster than the economy, and thus, it avoids Central Government to face a *Ponzi* problem. As a result, in order to accomplish the transversality condition, the public debt must increase slower 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, then we can rewrite equation (5) as

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

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

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

2.2. **Empirical Methodology.** In general, there are three methodologies to test the sustainability hypothesis in the empirical literature. The first one, consists in 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 in testing 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, then the sustainability hypothesis holds. The final one also test cointegration but using public debt and primary budget deficit, 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] unit root test is applied to revenues and primary expenditures. Second, if these series turn out to be integrated of order 1, Westerlund [2006] methodology is applied to test for cointegration and estimate log-run relationship between them. This relationship can be described as

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

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

2.2.1. *Hadry and Rao unit root in a heterogeneous panel with structural break and cross-sectional dependence.* Hadri and Rao [2008] consider the following four models in order 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, since it only includes a structural break in levels and has no deterministic trend. On the other hand, Model 1 includes a structural break in levels and has deterministic trend, but it does not present a trend with breaks; whereas Model 2 allows for breaks in the trend to exist, but not a break in the level of the series. 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 is given 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 parcial 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

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

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 the autoregressive coefficients estimated in equation (18), $\widehat{\sigma}^2_{\upsilon_i}$ is the LRV estimate of $\widehat{\upsilon}_i$, which can be estimated using quadratic spectral window heteroscedastic and autocorrelation consistent estimator. The number of optimal lags, p, may be determined by 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 in a heterogenous panel with multiple structural breaks and cross-sectional dependence.* 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, z_{it} is a vector of deterministic components[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 vectors of parameters. The structural breaks are denoted with the subscript $j = 1,2,...,M_i+1$. Those breaks are located at $T_{i,1},...,T_{i,M}$, where $T_{i,0} = 1$ and $T_{i,M_i+1} = T$. It is assumed cross-sectional independence 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

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

where $S_{iT} = \sum_{t=1}^{T} w_{it}$. The long-run variance of the vector u_{it} conditional to v_{it} is $\omega^2_{i,12} \equiv \omega^2_{i,11} -$

[2]Westerlund [2006] considers five cases of deterministic componentes: 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 is assumption is relaxed later on.

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

$\omega'_{i,21}\Omega_{i,21}^{-1}$.

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

$$H_0 : \phi_i = 0 \quad \text{for} \quad i = 1, 2, ..., N$$
$$H_A : \phi_i \neq 0 \quad \text{for} \quad i = 1, 2, ..., N_1 \quad \text{and} \quad \phi_i = 0 \quad \text{for} \quad i = N_1 + 1, N_1 + 2, ..., N$$

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

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

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 by using the Fully Modified OLS methodology (FMOLS) of Phillips and Hansen [1990]. The structural breaks are determined endogenously by Bai and Perron [2003] 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 comes 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, both as a share of GDP, for 8 Latin American countries, Argentina, Chile, Colombia, Ecuador, Panama, Paraguay, Peru and Uruguay, during 1960-2009.[6]

3.1. **Estimation results.** Below, the results of Hadri and Rao [2008] panel unit root and Westerlund [2006] cointegration tests are presented.

3.1.1. *Panel unit root test results.* In this subsection, 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 showed, respectively.[7] 5000

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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] Brasil, Bolivia and Venezuela were excluded due to inconsistencies when compared to other data sources.

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

replications were used for the bootstrap methodology.[8]

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

TABLE 1. Unit root test for Government 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 Government 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

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

[9] The results of the panel unit root test in first differences confirm that the series in levels are $I(1)$. They are not showed but they 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 one presents the estimated structural breaks and the second one shows the result of the cointegration test. The estimated long-run coefficients are presented in the third one. In addition, Figure1 and 2 show Government revenues and primary expenditures for the 8 Latin American countries that were considered, along with the estimated breaks. In order to take into account cross-sectional dependence, a block bootstrap method with geometrical distribution was used with block size 5 and 5000 simulations. Given the sample size, the cointegration methodology considers at most 3 breaks per country. Furthermore, the residuals of (20) are estimated by FMOLS.

As can be seen in Table 3, Argentina is the country that exhibits most breaks in the cointegration relationship, whereas Peru does not report any. On the other hand, Chile, Panama and Paraguay present two breaks each and Colombia, Ecuador and Uruguay only have 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 reflect partially the history of the second part of the XX century, characterized by two large stages of hyperinflation, monetary crises and dependent central banks. These situations made countries focus their economic policies on stabilizing prices and the exchange rate, apart from controlling public expenditures. Argentinean 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

[10]The authors acknowledge professor Joakim Westerlund for providing kindly his programm of the test in GAUSS, which was written out later on in R.

the national reorganization process started after the central Government was overthrown, situation that was propitiated by General Jorge Rafael Videla. The 2002 break represents the Default that Argentina experienced, known as “El Corralito”, after the massive leak of capitals that forced the Government of president de la Rúa to freeze banking deposits (Cortes [2003]).

On the one hand, Chile was the first Latin American country that entered the OECD (since 2010). It has a large military expenditures as share of GDP in comparison to other countries of the region (roughly 4%). In 2000, it implemented a fiscal rule in order to decrease fiscal deficit and keep it around the 1% of GDP. Furthermore, it is rich in copper (only for 1970, copper exportations made up the 60% of Chilean total exportations). On the other hand, as can be seen in Figure 1, public expenditures increased almost 36% in 1971, which was mainly due to public sector 48% wages increment. After the financial crisis of 1981 and the elimination of the fixed exchange rate, Chile experienced a 11% recession, from which got out immediately, as is showed by the average growing rate of 7.5% between 1984 and 1989 (Meller [1996]). From another point of view, the estimated breaks for Chile trace the Chilean military regime during 1973-1989.

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

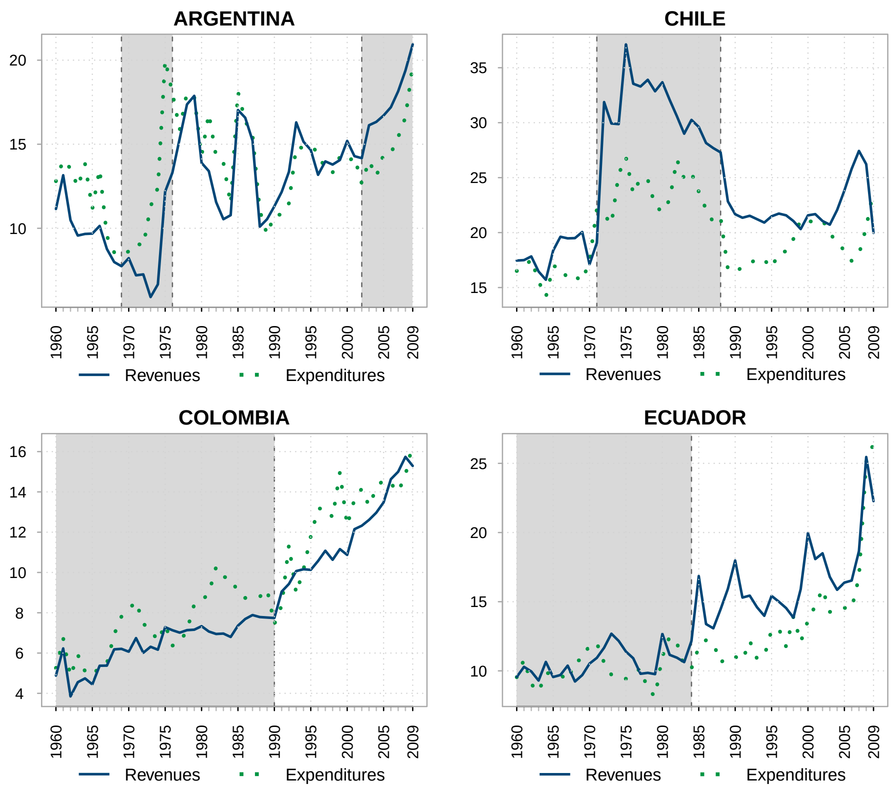
At the beginning of the 70s, Ecuador was under civil dictatorship. In 1972 PetroEcuador was created and the country entered the Organization of Petroleum Exporting Countries (OPEC). By the 80s, the crisis deepened to the point of increasing its fiscal deficit around the 2.3% in 1982. This was triggered by commercial deficit and falling oil prices. Nonetheless, in 1984 the fuel prices increased dramatically, which in turn incremented Ecuadorian oil revenues as it is showed in Figure 1 (Spurrier [1986]).

Currently, Panama is one of the most globalized economies in Latin America. It has 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. Then, in 1972, the new constitution made expenditures in health increase over the 10% of total national budget (first break, see Figure 2), which brought about an increase of Government total expenditures. During 1988 and 1989 Panama experienced its social and economical hardest crisis ever.

Moreover, Paraguay is a country characterized by military dictatorships. Stroessner was president for thirty five years, between 1954 and 1989. In 1980, the treaty on Asociación Latinoamericana de Integración (ALADI) was signed and in 1984, the largest hydroelectric of the world, named Usina Hidroeléctrica de Itaipú started operations. During 2001 and 2002, public expenditures registered negative growing rates, mainly due to the reduction in social expenditures (roughly 50%). Finally, Peru does not register any statistically significant break according to the estimations.

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 Government revenues and primary expenditures for Argentina, Chile, Colombia and Ecuador (1960-2009)



Source: OXLAD and CEPAL.

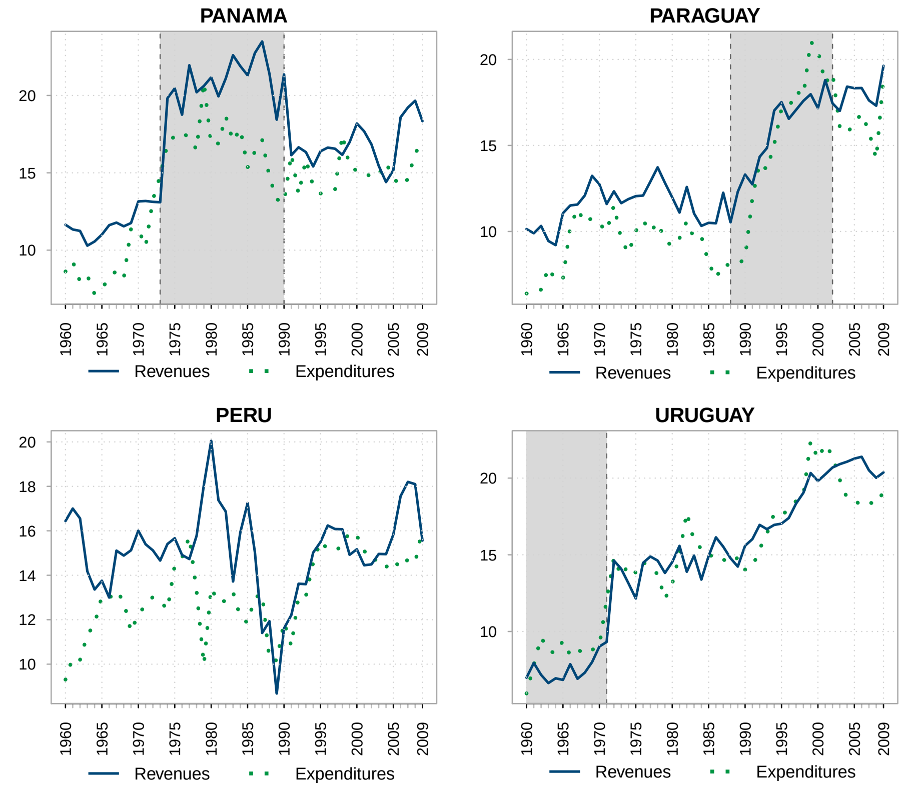
hypothesis of cointegration at usual significance levels.

TABLE 4. Results of the cointegration test

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

In Table 5 the estimations of the log-run coefficients are reported along with its standard deviation. Given that these coefficients are significantly lower than 1 for the 8 countries that were studied,

FIGURE 2. Structural breaks in the relationship between Government 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, but there is in the weak sense according to Quintos [1995]. In this case, Chile, Panama and Paraguay exhibit the largest estimated coefficients: 0.79, 0.72 and 0.66, respectively. On the other hand, Colombia and Uruguay have the lowest coefficients, 0.22 and 0.48.[11] The estimated coefficients are statistically significant at 5% level, excepting Peru.

[11]Lozano and Cabrera [2009] also found out that there is fiscal sustainability in the weak sense for 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 enough empirical evidence that has already studied the relationship between Government expenditures and revenues through diverse methodologies that aim at determining whether the Government intertemporal budget constraint holds and hence, whether its debt is sustainable in the long-run. However, since the last decade, several surveys that were attempting to demonstrate the former at regional level have appeared. These surveys arose from the need to incorporate two characteristics which may be determinant when addressing this problem in 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 into account the former characteristic.

This document investigates the existence of long-run relationship between Government primary expenditures and revenues in order to prove whether 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. The coefficients of the log-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 means that, although there is a long-run relationship, the cointegration coefficient is lower than 1. According to Quintos [1995], this implies that there is fiscal sustainability but in the weak sense. Therefore, if expenditures increases in 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, the results obtained imply that the public finance 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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