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Abstract

The debt crisis in Latin America is associated with the large fiscal imbalances of the 1980s; therefore public finance sustainability occupies the center of stabilization efforts in these economies. The literature examining this question in emerging economies is surprisingly scant and this paper aims at filling this gap. We analyze sustainability for a sample of Latin American countries, employing unit root tests that incorporate nonlinear alternative hypotheses. These tests capture the thresholds or corridor regimes that international agreements or markets impose on emerging economies' public finances. We show that support for sustainability substantially improves when such nonlinearities are taken into account.

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1. Introduction

During the 1980s and 1990s many developing and transition economies went through major economic disturbances. The 1980s debt crises in Latin America (LA) and the change in the political regime in the Eastern European countries in the 1990s have been accompanied by macroeconomic imbalances that led to restructuring of the whole economy.

In particular, the crisis in the LA had stemmed from severe problems in public sector finances.[1] Their correction has been at the center of the subsequent stabilization policies. By the end of the 1980s, most of these countries had made substantial progress in the fiscal front by reducing their public sector deficits and reversing debt accumulation. Chart 1 shows that countries in our sample such as Guatemala, El Salvador and Mexico exhibit a clear reversal and settling of the debt/GDP ratio at the pre-crisis range. Costa Rica, Panama and Guyana reduced their debt/GDP ratios by the end of the 1980s. By the second half of the 1990ies, however, debt ratios in the first two countries were back to their crisis levels again.

The health of the public sector finances in LA is a concern for international investors and institutions for two reasons. First, government saving is an important component of national saving the size of which relative to investment determines the state of the external balances. Second, since a large percentage of private debt is backed by government, an increase in public debt is often associated with the worsening of foreign indebtedness of the country. Indeed, about a decade after the 1980s debt crisis, in 1994 when Mexico faced the "tequila" problem, the international community's attention turned to government's finances again.

Despite a large body of literature focusing on the stabilization programs in LA, and the more recent strand that explores institutional and political factors affecting these countries' fiscal performance, surprisingly little or no work exists in the literature on the sustainability of the government fiscal policies in the region.[2] In this paper, we analyze the state of the fiscal imbalances in selected Latin American countries for which time series data were available and evaluate the sustainability of their fiscal stance.

[1] Agenor and Montiel (1999) note that the origins of the debt crises for a large number of the highly indebted countries are to be found in the public sector.

[2] See Alesina, Hausmann, Hommes and Stein (1996), Stein, Talvi and Grisanti (1998).

The traditional approach to this question consists in looking at the stationarity of the government debt or deficit. This methodology, however, is inadequate for countries when frequent regime shifts occur or when the variables in question exhibit a threshold behavior, which bias results to rejecting unit roots. Paradoxically, the regime switch is a desirable outcome when it characterizes countries that embark on a stabilization program. Moreover, a country may follow a rule whereby the debt/GDP ratio is kept below an implicit or explicit threshold (imposed by markets or international institutions).[3] These tests assume a continuous and constant-speed adjustment process, however, and they often fail to capture the virtuous nature of such fiscal discipline.

In this paper we explore a different explanation for the seemingly unsustainable nature of fiscal policies. We use newly developed stationarity tests that allow the alternative hypothesis to incorporate nonlinearities. In particular, we employ two different sets of nonlinear stationarity tests that complement each other in demonstrating that series initially found to have unit-roots with traditional tests may, in fact, be stationary.

Our major contribution to the literature is thus two folds. First, we focus on a region whose public policy has been at the heart of international investors' concerns and stabilization programs but whose public debt sustainability has remained largely unexplored. Second, we use a methodology that accounts for the possibility that the behavior of fiscal authorities may be nonlinear. That is, their reaction to debt accumulation may be different when debt is high or low thus, affecting the time series properties of the fiscal policy variables. We show that these new tests overturn most of the nonstationarity results obtained from the traditional tests. Depending on the specification of the debt measure and the model used, we are able to find mean reversion in up to four out of seven countries where the standard tests showed none.

Our methodology turns out to be promising for not only the countries in our sample but it can also be used fruitfully in most developing and transition countries that went successfully through fiscal retrenchment. Our finding indicates that for the purposes of policy evaluation it would be misleading to solely rely on the traditional tests since they may frequently fail to reject the unit-root null, wrongly suggesting that policies

[3] Bertola and Drazen (1993) provide a relevant theoretical model.

adopted by these countries are unsustainable. By contrast, the new tests can successfully capture nonlinearities, providing a richer and possibly more reliable framework for the evaluation of fiscal policy sustainability.

2. A review of the literature

The literature on the government intertemporal budget constraint (IBC) is vast. The main approach to analyzing the sustainability of a government's fiscal policy is to examine if the government budget constraint holds in present value terms. More precisely, the current debt should be offset by the sum of expected future discounted primary budget surpluses (exclusive of interest payments). Sustainability tests, however, do not provide a consensus because results vary with the approach adopted, the sample period, the specification of the transversality condition, and the econometric methodology used.

One approach to analyzing sustainability consists of testing the stationarity of the debt and/or deficit. In a pioneering paper, Hamilton and Flavin (1986) reject the nonstationarity of constant-dollar undiscounted U.S. debt under the assumption of constant real interest rates. Smith and Zin (1988) obtain the same result with a similar specification for Canadian data. Wilcox (1989) extends the Hamilton and Flavin model by allowing for stochastic real interest rates and finds that discounted real U.S. debt is nonstationary. Corsetti and Roubini (1991) obtain mixed results for debt stationarity among the OECD countries. Using variable discount rates Uctum and Wickens (2000) find support for mean reversion in smaller European countries.

Other studies look for a cointegrating relationship linking the primary deficit, the stock of outstanding debt and interest payments for the United States. The results of Trehan and Walsh (1988) using longer-term data, find support for the sustainability of U.S. fiscal policy by showing that the deficit inclusive of interest payments is stationary. In contrast, Kremers (1989) finds that, even though during most of the inter-and post-war period US fiscal stance was sustainable, evidence suggests violation of the intertemporal budget constraint more recently. Hakkio and Rush (1991) look at whether government revenue and spending inclusive of interest payments are cointegrated and conclude that sustainability does not hold. In a later study, however, Trehan and Walsh (1991) find that

using constant discount rates may give conflicting results between the cointegration tests and the stationarity tests based on the first-differenced debt.

Most of this literature is nonstochastic and implicitly assumes that dynamic efficiency holds (Abel *et al*., 1989). Though Bohn (1995) casts doubt on both assumptions and in particular on the IBC tests that rely on constant discount rates, Ahmed and Rogers (1995) show that, under certain conditions tests of cointegration are still appropriate. Using historical data that go back to 1700s and cointegration analysis, they find strong evidence favoring sustainability of the U.S. fiscal policy and some support for sustainability of the U.K. fiscal policy.

A third approach to sustainability consists in examining the existence of a feedback from debt to deficit, which avoids pitfalls associated with the debt-stationarity analysis. If such a negative relation exists, debt is considered to be mean reverting. Wickens and Uctum (1993) and Bohn (1998) show that this condition is satisfied for the US national and public debt, respectively. Using such a feedback-augmented test, Feve and Henin (2000) find more support for stationarity among the G7 countries and Uctum and Thurston (2002) among emerging economies than the traditional tests do.

The empirical literature that tests for public finances sustainability by focusing on debt and/or deficit stationarity has typically relied on the standard Dickey Fuller (DF) and Augmented Dickey Fuller (ADF) tests (e.g., Trehan and Walsh 1991). When structural breaks exist in the intercept or the trend, however, the above tests may misleadingly show that the series in question is nonstationary. Uctum and Thurston (2001) use the Perron (1990) approach and find indeed that the nonstationarity result may be reversed when structural breaks are appropriately taken into account. The Zivot and Andrews (1992) tests provide a further refinement by allowing the breakpoint to be unknown. Papadopoulos and Sidiropoulos (1999), for example, use such tests to consider fiscal policy sustainability in the EU countries and find that three out of five economies have sustainable deficits.

The recent developments in nonstationary panel econometrics gave rise to an additional set of tests with higher power, potentially making the rejection of the unit-root hypothesis easier. The panel unit root approach, however, is not useful when the objective is to evaluate the stance of a single country. The rejection of the unit-root null

in a panel does not imply that all series in the panel are stationary, and does not provide information about specific countries.[4]

The choice of a particular alternative hypothesis in unit-root tests affects their ability to reject the null hypothesis. Thus, using an alternative hypothesis that corresponds to the real process increases the power of the tests. All the stationarity tests mentioned above incorporate alternative hypotheses that involve linear models. In this paper we explore a different possibility, namely a nonlinear alternative. If the nonlinear model incorporated in the alternative hypothesis adequately approximates the true model, then the nonlinear versions of the ADF tests proposed below will be better equipped to reject the unit-root null as compared to the standard ADF tests or other variants of them. Thus not only we achieve a higher power for the stationarity tests but we also obtain more transparent, country-specific results.

The critical question that emerges then is why should one expect the true model to be non-linear. The class of non-linear models we consider implies the presence of "corridor regimes" where the series may behave differently within and outside a given band. The seemingly erratic behavior within a given set of values may not preclude mean-reversion once the series approach some threshold limits. A stationarity test that does not account for such a non-linear process will interpret the meandering of the series within the band as evidence of nonstationarity.

The presence of a corridor regime is particularly relevant when the series considered reflect a policy/choice variable, possibly bounded by explicit or implicit thresholds. The policy maker can take immediate corrective action when the policy variable that is under its direct control approaches or exceeds the threshold. Government debt and deficit series, in general, fit this description. This possibility is potentially more pronounced in many Latin American countries whose public finances are subject to many policy constraints implying threshold limits. Such constraints may reflect international agreements and domestic stabilization programs. Recent changes in the fiscal policy frameworks of many emerging market economies prescribe explicit ceilings for the government budget deficit. For example the 1999 Fiscal Responsibility Law in Argentina and the 1999 Fiscal Transparency Law in Peru impose ceilings on the government budget

[4] See Mark (2001) for further details and technical difficulties entailed with this approach.

deficit. Similar legislation is adopted or being drafted in Brazil, Colombia and other countries (IMF, 2001). Moreover, during periods of crises fiscal adjustment can be postponed until a class of creditor willing to provide funding can be found (Agenor and Montiel, 1999).

Another channel is provided by Bertola and Drazen (1993) who examine the signaling effects of fiscal policy when agents smooth consumption intertemporally. In particular, they consider a model of fiscal adjustment where government spending as a percentage of GDP is cut drastically, once government consumption hits a critical/threshold level. When government spending becomes sufficiently high the private sector anticipates a discrete cut and permanent income (as well as consumption) rise. They also show that the experiences of fiscal consolidation efforts in a number of European countries is consistent with such behavior.

An additional source of fiscal tightening may be due to the exchange rate regime and /or shifts in the regime. A characteristic of emerging economies is their vulnerability to massive capital flows swings, which often requires the country to put a cap on its fiscal spending. For example, a typical macroeconomic policy recipe in the presence of a capital inflow surge is to offset the aggregate demand effects of the capital inflow-induced monetary expansion with a tighter fiscal policy.[5]

Indeed, visual inspection of the debt ratio may suggest the presence of such thresholds as in the case of Mexico and Costa Rica (Figure 1). The tests that we employ incorporate non-linear alternative hypotheses that capture the potential "corridor regime" behavior and thus, circumvent the limitation of the standard stationarity tests that perceive this behavior as nonstationarity.

The argument for threshold effects in public debt is supported by the evidence presented in other recent work using smooth transition autoregressive (STAR) models. These studies point to the presence of nonlinearities in fiscal policy in the United States (Sarno, 2001) and the United Kingdom (Cipollini, 2001).[6] Our approach, however, is

[5] This has been the case in Costa Rica as suggested by Montiel (1996). Identifying the precise sources of a fiscal tightening when stabilization programs are in place, however, is not always a straightforward exercise.

[6] In addition, Giavazzi et al. (2000) find that the private sector's response to fiscal policy is likely to be nonlinear when the fiscal impulses are sizeable and persistent.

fundamentally different from such studies. In particular, the previous studies fit a STAR model assuming that the debt process itself is stationary, while our approach directly tests for the stationarity of the debt series.

3. Model, Methodology and Data

The intertemporal budget constraint

The starting point of the analysis is the government budget constraint, which can be written as

$$\Delta b_t = -s_t + \rho_t b_{t-1} \tag{1}$$

where b is a measure of government debt, *s* is the seignorage inclusive primary surplus, and ρ is the ex-post interest rate on the outstanding stock of government debt. Earlier literature uses various measures of government debt. In this study we consider real debt, and debt normalized by GDP. Each of these debt measures has a corresponding interest rate. For example, if b is real debt, then ρ is the real interest rate, and if b is defined as debt/GDP ratio then ρ is the real interest rate adjusted for the growth rate of real GDP.

Solving (1) forward assuming perfect foresight and successively substituting out the future discounted debt measure, gives the n-period intertemporal budget constraint:

$$b_t = \delta_{t,n} b_{t+n} + \sum_{i=1}^{n} \delta_{t,i} s_{t+i} \tag{2}$$

where $\delta_{t,n} = \prod_{s=1}^{n} (1+\rho_{t+s})^{-1}$ is the time-varying discount factor n-periods ahead.

A necessary and sufficient condition for sustainability is that as *n* goes to infinity, the discounted value of the debt measure converges to zero. This is also known as the transversality condition, and implies that no Ponzi games are allowed, meaning no new debt is issued to meet interest payments. This condition can be expressed as:

$$\lim_{n\to\infty} \delta_{t+n} b_{t+n} = 0 \tag{3}$$

It then follows that current debt is offset by the sum of current and future discounted surpluses, implying that the government budget constraint holds in present value terms. The traditional sustainability approach consists in applying the ADF test on b_t or on its discounted version and test if it is stationary.

Methodology

We use two unit-root tests that incorporate a nonlinear alternative hypothesis. The first test, due to Kapetanios, Shin, and Snell (2002), considers the null hypothesis of a unit root against the alternative of a STAR model in a context similar to DF test. In particular, we test for the null hypothesis of $\gamma = 0$ in the following model:

$$\Delta b_t = \beta b_{t-1}(1 - e^{-\gamma b_{t-1}^2}) + \varepsilon_t . \quad (4)$$

The test is carried out by a *t*-test of the coefficient of b^3_{t-1} being zero in the auxiliary regression

$$\Delta b_t = \alpha + \phi b_{t-1}^3 + \varepsilon_t . \quad (5)$$

In the presence of constants and trends, the data are first detrended/demeaned. The 1%, 5%, and 10% critical values for the detrended and demeaned data are –3.93, -3.40, and -3.13, respectively. We refer to this test as the non-linear augmented Dickey-Fuller (NLADF) test.

The second test uses an alternative detrending strategy. Chortareas, Kapetanios, and Shin (2002) combine the analysis of Kapetanios, Shin and Snell (KSS) and Schmidt and Phillips (1992) to derive a test of the unit root hypothesis against a smooth transition autoregressive alternative when the unit root appears in a model of the form envisaged by Schmidt and Phillips. To be more specific, let the model be given by

$$b_t = \psi + \xi t + x_t \quad (6)$$

$$\Delta x_t = \beta x_{t-1}(1 - e^{-\gamma x_{t-1}^2}) + \varepsilon_t \quad (7)$$

where $\beta < 0$, and ε_t is an *i.i.d.* error with finite variance σ^2. We are interested in testing the null hypothesis $\gamma = 0$. Under this hypothesis, the model is a unit root model whereas under the alternative it is a stationary nonlinear model. To test this hypothesis one needs to construct an LM test along the lines discussed in Schmidt and Phillips. This is given by a *t*-test of $\phi = 0$ in the regression

$$\Delta b_t = \alpha + \phi s_{t-1}^3 + \varepsilon_t \quad (8)$$

where $s_{t-1} = b_t - \tilde{\psi} - \xi(t-1)$ and $\tilde{\xi} = (b_T - b_1)/(T-1)$, $\tilde{\psi} = b_1 - \tilde{\xi}$, as CKS show. Under the null hypothesis, the asymptotic distribution of

$$\tau = \frac{\sum_{t=1}^{T}(s_{t-1}^3 - \bar{s^3})\varepsilon_t}{\hat{\sigma}\left[\sum_{t=1}^{T}(s_{t-1}^3 - \bar{s^3})\right]^{1/2}} \tag{9}$$

is given by

$$\tau \Rightarrow \frac{\int \mathcal{V}(r)dW(r)}{\int \mathcal{V}^2(r)dr} \tag{9´}$$

where $\hat{\sigma}$ is the estimated standard error of the regression, $\bar{s^3}$ is the mean of s_t, *W(r)* is a standard Brownian motion, *V(r)* is a standard Brownian bridge and $\mathcal{V}(r) = V(r)^3 - \int V(r)^3 dr$. To deal with the issue of possible weak dependence in ε_t regression (8) is augmented with lags of Δb_t following the approach of DF and the results of Ng and Perron (1995). Standard analysis along the lines of, say, KSS shows that the asymptotic distribution of the test does not change. The results of Ng and Perron (1995) concerning data dependent selection of the lag order for the lag polynomial in Δb_t carry over to this case as argued by KSS. We refer to this test as the nonlinear Schmidt-Phillips (NLSP) test. The 1%, 2.5%, 5%, 10% critical values of the test are -3.52, -3.23, -3.00, -2.73, respectively.[7]

Data

The countries in the sample are Mexico, Costa Rica, El Salvador, Guatemala, Panama, Honduras, and their choice has been dictated by the availability of data. We analyze three different debt measures used in the literature: real debt, debt/GDP ratio, discounted real debt and discounted debt/GDP ratio. The last two debt measures are compound discounted with the corresponding discount rate (adjusted for inflation or/and growth rate). However, as is explained below, the discount rate is an approximation of the real

[7] The critical values for this test and the NLADF test have been obtained by simulation. Further may be found in Kapetanios, Shin and Snell (2002) and Chortareas, Kapetanios and Shin (2002).

cost of debt. In high inflation/growth economies, adjusting the real rate for real GDP growth (required to discount the debt/GDP) sometimes gives a negative discount rate that gets compounded in the measurement. Since the resulting debt measure is meaningless, we only report results from the first three measures.

We used the following series to construct our debt measures: nominal government debt, the GDP deflator, nominal GDP (GNP when the GDP not available), and interest rate. All series come from the *International Financial Statistics* and the *Government Financial Statistics* of the IMF. The debt data are annual and the starting date varies from 1970 to 1986 and ends at 2000. To ensure efficient use of the statistical tests carried in the analysis, however, we need a sufficient number of observations. Long and detailed series of debt/deficit are available for few LA countries. Considering only the countries for which sufficient annual data exist would further restrict our sample. To avoid this problem we converted the annual data to quarterly using a cubic transformation (further details available from the authors). This transformation affects all tests symmetrically, therefore we expect that it should not introduce any measurement bias that would change our interpretation of the results.

The interest rate series are notoriously poor in Latin American countries. For an interest rate series that roughly reflects borrowing conditions in the economy and matches the sample length of government debt series, we computed the geometric average of the existing interest rates at a particular date, except the discount rate that tends not to fluctuate. We could not find any reliable interest rate series for Honduras, so we calculated the interest rate as the US Treasury-Bill rate plus changes in the bilateral exchange rate, which amounts to assuming that the uncovered interest rate parity holds[8]. For compounding, the interest rate is adjusted for the inflation rate calculated as a centered moving average with four lags and four leads.

[8] In most of these countries, until recently policy makers kept interest rates intentionally low to encourage growth. The available average interest rate would therefore be lower than the market rate if financial markets were free. A low discount rate biases results toward rejecting stationarity too often, so to find stationarity despite this drawback only reinforces our results. In general, these approximations could introduce measurement problems that would affect test results. Whether the bias is upward or downward, however, it would affect all tests in the same direction and the comparison would still remain valid.

4. Results

We present the results for the three different measures of debt in Tables 4.1, 4.2, and 4.3. All tables have the same structure. In particular, the first three columns provide the results of the standard DF and ADF tests. We consider two versions of the ADF test corresponding to different optimal lag-length selection procedures. The first, ADF(4), assumes four lags while the second, ADF(A), employs an automated process for selecting the optimal number of lags. The next three columns provide the results of the unit-root tests that incorporate a nonlinear alternative in the form of an Exponential Smooth Transition Autoregressive (ESTAR) process. The three specifications correspond to those of the first three (standard) stationarity tests DF, ADF(4), and ADF(A) and are labeled NLDF, NLADF(4), and NLDF(A), respectively. The last three columns provide the results of the nonlinear tests where the alternative hypothesis represents a geometrically ergodic process defined by a self-exciting threshold autoregressive (SETAR) model with three regimes. Those three tests are labeled NLSP, NLASP(4), and NLASP(A) respectively.

<Insert Table 4.1 about here>

Compared to the gloomy picture of the traditional unit-root tests, the nonlinear tests generally present a more optimistic view of the sustainability of fiscal policies in South America. The typical DF and ADF tests point unequivocally to the presence of unit roots in the undiscounted real debt processes in all sample countries (Table 4.1). The results of the nonlinear unit-root tests, however, dispute this picture. All six nonlinear tests (with the exception of NLSP) indicate stationarity in two out of the seven countries we consider, namely Honduras and Mexico.

Although the literature commonly analyzes government debt in real terms, this is not a concept that is frequently used in practice. Financial analysts often refer to a compound present-value concept of real debt, while the popular press reports government debt as a ratio to GDP. The contradicting results provided by alternative methodologies in Table 4.1, motivate our further inquiry using additional debt measures.

<Insert Table 4.2 about here>

We first consider the debt-to-GDP ratio and the results from the three types of tests (Table 4.2). As with the real debt measures, all three DF and ADF specifications

show complete lack of evidence for stationarity. In contrast, both versions of nonlinear unit-root tests show a completely different landscape. In particular, the NLADF(4) tests that incorporate the ESTAR process alternative show mean reversion in up to three out of seven countries (Costa Rica, Guatemala, and Honduras). The NLASP(4) tests that incorporate the SETAR alternative hypothesis show mean reversion in up to four out of seven countries (El Salvador, Guatemala, Honduras, and Panama).

<Insert Table 4.3 about here>

Finally, Table 4.3 shows the results from applying the same set of tests to compound discounted real debt measures. Unlike the previous cases, now the typical DF and ADF tests provide limited evidence of mean-reversion. More specifically, the DF and ADF(4) tests show evidence of stationarity for up to one country each, while the ADF(A) test suggests stationarity for two countries. In contrast, the non-linear tests provide again much stronger evidence of stationarity in the compound discounted real debt measures. In particular, the NLADF(4) test results support stationarity in the debt measures of two countries (Honduras and Mexico), and the NLASP(4) in four countries (Costa Rica, El Salvador, Honduras, and Mexico). Both the NLADF(A), and NLASP(A) test results support stationarity for the same three countries (Costa Rica, Honduras, and Mexico).

We have conducted further tests using alternative debt measures point to the same direction. When we use a simple (not compound) discounted debt-to-GDP ratio measure, the results of the DF and ADF tests indicate complete lack of stationarity while each of the nonlinear stationarity test results support stationarity in two countries. The results are available from the authors upon request.

To sum up, the use of nonlinear unit root tests allows us to uncover substantial evidence of stationarity in the debt/deficit series of the countries in question. The importance of this finding is important by itself since it questions the broad picture of non-stationarity –thus unsustainability- of government debts portrayed by conventional tests.

The nonlinear tests reverse the traditional test results for sustainability in Mexico and Honduras when we use the real debt measures either undiscounted or compound discounted. In Costa Rica, the new tests reverse the nonstationarity result for most debt measures, but in particular the debt/GDP ratio. The NLASP(4) test provides strong

support for stationarity in El Salvador using both the simple and compound discounted real debt measures, while the standard ADF tests weakly reject the unit root with both measures. The evidence for debt stationarity provided by the nonlinear tests is weaker for countries like Guatemala and Panama. Nevertheless, the ability of the new tests to uncover even limited stationarity provides potentially eye-opening evidence and a contrast to standard stationarity tests.

5. Conclusion

Both the global macroeconomic environment and the domestic imbalances have confronted the Latin American emerging markets with continual challenges. Authorities repeatedly implemented stabilization policies that were either self-imposed or encouraged by the international financial community. A typical component of such efforts is curbing the accumulation of national and, in particular, public debt. Surprisingly, however, one can hardly find evidence/research addressing the sustainability of public finances in those countries.

This paper responds to this challenge by providing evidence on debt stationarity or public finances sustainability for a set of Latin American countries. In addition to providing evidence for a relatively unexplored geographical area, we offer a new perspective on testing for public debt stationarity. In particular, we use unit root tests that allow the alternative hypothesis to incorporate nonlinear processes. Fiscal authorities in those countries often take corrective actions and thus, fiscal policy may respond differently to different levels of public debt. In such a context, the traditional stationarity tests (ADF) may fail to capture adequately the adjustment-to-equilibrium process and paradoxically interpret such policies as unsustainable.

The methodology we adopt in this paper is not constrained by a continuous and constant-speed adjustment process and, therefore, is better suited for addressing public debt stationarity issues. Moreover, it can successfully account for the presence of "corridor" regimes. Our results significantly enhance the evidence supporting fiscal sustainability in Latin American countries, and confirm the appropriateness of the new tests, which allow for non-linear adjustments.

Chart 1: Debt/GDP ratios

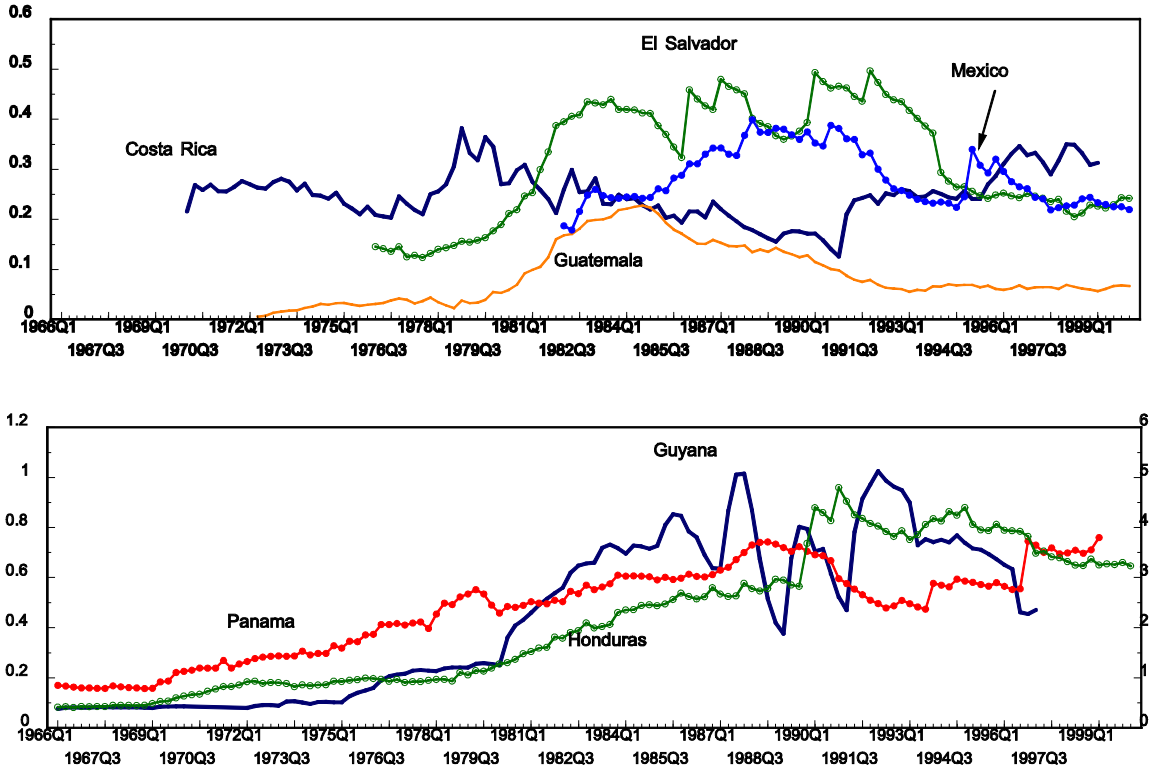

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Table 4.1: Stationarity of real debt[+]

	DF	ADF(4)	ADF(A)	NLDF	NLADF(4)	NLADF(A)	NLSP	NLASP(4)	NLASP(A)
Costa Rica	-0.099	-1.769	-1.547	-0.585	-2.752	-3.629*	-1.430	-3.535*	-4.444**
El Salvador	-1.736	-3.501*	-3.660*	-1.476	-3.278	-1.860	-1.324	-3.706**	-1.953
Guatemala	-0.804	-2.095	-1.449	-1.250	-3.134	-3.050	-1.260	-2.892	-2.832
Honduras	-1.012	-3.199	-2.811	-1.380	-7.505**	-6.850**	-1.105	-6.617**	-6.506**
Mexico	-1.367	-2.543	-2.868	-1.441	-3.469*	-3.806*	-1.451	-3.231*	-3.628**
Panama	-37.092**	-3.017	-8.684**	-9.821**	-2.055	-1.296	-0.333	-0.072	0.625

[+] DF (ADF) is the Dickey-Fuller (augmented DF) test, NLDF and NLADF are the nonlinear DF and ADF tests, NLSP and NLASP are the nonlinear Schmidt-Phillips test and its augmented version. X(4) assumes four lags, X(A) selects an optimal number of lags. The 1%, 5% and 10% critical values are –3.93, -3.40, -3.13 for the NLADF tests, and the 1%, 2.5%, 5% and 10% critical values are –3.52, -3.23, -3.00, -2.73 for the NLSP tests.

Table 4.2: Stationarity of Debt/GDP[+]

	DF	ADF	ADF(A)	NLDF	NLADF(4)	NLADF(A)	NLSP	NLASP(4)	NLASP(A)
Costa Rica	-2.443	-2.950	-2.662	-4.733**	-5.882**	-6.804**	-4.186**	-4.423**	-5.352**
El Salvador	-1.484	-2.203	-2.292	-1.411	-1.940	-1.877	-1.334	-1.981	-1.942
Guatemala	-1.578	-2.390	-1.482	-1.874	-2.671	-1.898	-1.457	-1.774	-1.025
Honduras	-1.652	-2.255	-1.820	-2.019	-3.067	-2.441	-0.817	-1.712	-1.003
Mexico	-2.029	-1.561	-2.062	-3.587*	-3.815*	-3.636*	-0.813	-0.578	-0.640
Panama	-1.467	-2.675	-3.503*	-0.610	-1.855	-1.814	-3.175	-3.074*	-3.010*

[+] See footnote Table 4.1.

Table 4.3: Stationarity of compound discounted real debt[+]

	DF	ADF	ADF(A)	NLDF	NLADF(4)	NLADF(A)	NLSP	NLASP(4)	NLASP(A)
Costa Rica	-0.099	-1.769	-1.547	-0.585	-2.752	-3.629*	-1.430	-3.535*	-4.44**
El Salvador	-1.736	-3.501*	-3.660*	-1.476	-3.278	-1.860	-1.324	-3.706**	-1.953
Guatemala	-0.804	-2.095	-1.449	-1.250	-3.134	-3.050	-1.260	-2.892	-2.832
Honduras	-1.012	-3.199	-2.811	-1.380	-7.505**	-6.850**	-1.105	-6.617**	-6.506**
Mexico	-1.367	-2.543	-2.868	-1.441	-3.469*	-3.806*	-1.451	-3.231*	-3.628**
Panama	-37.092**	-3.017	-8.684**	-9.821**	-2.055	-1.296	-0.333	-0.072	0.625

[+] See footnote Table 4.1.

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