PUBLIC DEBT INDICATORS IN LATIN AMERICAN COUNTRIES: SNOWBALL EFFECT, CURRENCY MISMATCH AND THE ORIGINAL SIN

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Introduction

In economic models, government's behavior is often analyzed under an opportunistic perspective; indeed, some countries or geographic regions are viewed as "serial defaulters".[1] "Debt-intolerant" countries have weak fiscal structures and fragile financial systems. Thus, as a policy prescription, as the enhancement of institutions is a long term process, the safe thresholds of public debt should be set at a much lower level than in developed countries, perhaps 20 or 30 per cent of GDP.[2]

On the other hand international investors still lend to countries that have a background of defaulting their debt. A recent study demonstrates that international investors did not loose in those countries, considering the very high returns generally obtained in periods preceding the failure to pay.[3] Governments sometimes default debt not because they want to, but because they do not have alternatives.[4]

In this paper we argue that, in Latin American countries that have access to international capital markets, debt sustainability stands for a combination of endogenous factors, essentially the pro-cyclical bias of fiscal policies, and exogenous factors, like the sudden stop of capital flows which followed the Russian crisis.[5]

As the pro-cyclical bias (or fiscal sin) is an important explanation of debt accumulation during the Nineties,[6] there are other salient issues: the snowball effect, which quantifies the combined impact of the lack of growth and interest rates, and the original sin, which emphasizes the role of highly volatile exchange rates. Hence,

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[1] The expression, referring to "serial killers", belongs to Reinhart, Rogoff and Savastano (RRS, 2003).

[2] This is the recomendation of RRS; IMF outlines similar conclusions (see for example World Economic Outlook, 2003).

[3] Klinden, Weder and Zettemeyer (2002) calculate that the long-term return rate in emerging countries is quite similar to the U.S. Treasury bonds.

[4] See Neut and Velasco (2003).

[5] See Calvo (2003).

[6] In an earlier study (Martner and Tromben, 2003), we have found evidence of the fiscal sin, showing that during the early Nineties, retrospectively viewed as "good years", there were diverse behaviors, with some countries that reduced their debt burden considerably, while others were very pro-cyclical. These initial conditions influenced heavily in the debt dynamics in the "lost half-decade".

it seems very difficult and quite arbitrary to fix low thresholds in terms of GDP, as long as the exogenous component of public debt dynamics remains significant.

In the first section we expose some accounting difficulties concerning the proper definition of public debt in Latin American countries. In section 2 we quantify the snowball effect during the "lost half decade"[7] period (1998-2002), which in a number of countries represented more than five points of GDP. In other words, the exogenous component of public debt accumulation was significant, depicting an explosive situation in which debt servicing absorbs an increasing proportion of fiscal revenues. In general terms, the reaction function of fiscal policy (e.g., the possibility to generate in the short term debt-stabilizing fiscal primary surpluses) was not sufficient to avoid a growing snowball.

In section 3 we intend to combine traditional indicators of debt sustainability with a measure of currency mismatch. As other authors do, we compare the foreign currency liabilities of public sector with exports, a rough measure of external assets. Despite the crudeness of the exercise, it highlights the significance of currency mismatch in the explanation of recent crisis, and the importance of including the external balance of liabilities and assets of countries when assessing sustainability.

Using a *logit* model, in section 4 we explore the variables that can explain the entry into a debt crisis, constructing thereby an early-warning model for Latin American Countries. The significant variables are the level of debt in terms of GDP, interest debt payments, growth and openness, among others. Story also matters; debt sustainability hence depends on a combination of exogenous and structural factors that cannot be synthesized in a "one size fits all" safe threshold.

The concluding remarks address the problem of original sin,[8] which is defined as country's inability to borrow abroad in its own currency or to borrow long term, even domestically. This incompleteness in financial markets creates fragility inside the country, suffering from "currency mismatch" (when projects generating local currency are financed with foreign currency) and "maturity mismatch" (when long-term projects are financed with short-term loans). With original sin, movements in exchange rates have wealth effects that limit the effectiveness of monetary policy (Aghion, Bacchetta and Banerjee 2001, Céspedes, Chang and Velasco 2002).[9] Although it is argued that the original sin cannot be redeemed, some roads to deliverance are explored.

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7 See ECLAC (2003).

8 The expression was used for the first time by Eichengreen and Haussman (1999).

9 The fear of float depicts the usual situation in which authorities fear the wealth effects of devaluations when there is a substantial portion of dollar-denominated liabilities, both public and private; see Calvo, Reinhart (2002).

1. Salient features of public debt in Latin America

Since the crises of the Eighties, public debt management has been a constant preoccupation of fiscal authorities. At the Central Government level,[10] debt showed a clear decline, measured in percent of GDP, from the end of the Eighties until 1996. Coinciding with the business cycle reversion, from 1997 this indicator began to increase again. Sudden stops must be a true damnation in Latin America: when capital flows decrease significantly, public sector borrowing requirements increase, as the economic activity diminish and the cost of public debt measured in local currency begins to climb in flexible exchange rate regimes.

There are considerable difficulties in collecting the existing data on public debt, in terms of availability, coverage and definition issues. The Government Finance Statistics Manual (2001) defines public debt stock as following: "Debt consists of all liabilities that require payment or payments of interest and/or principal by the debtor to the creditor at a date or dates in the future. Thus, all the liabilities in the Government Finance Statistics system are debt except for shares and other equity and financial derivatives" (p. 129). It recommends also treating obligations for social security benefits in the future and contingents contracts as a memorandum item and not as public debt.

Despite this clear definition, the public debt data is still quite heterogeneous in Latin America. The major issues that arise building a data set in Latin America are:

- The consolidation of liabilities and assets between institutions (for example between social security funds and the Central government). Doubts still exist concerning the correct methodology at the central government level, which is the coverage used by the majority of Latin American countries; many countries publish both the consolidated and the non-consolidated data. To increase the confusion, these are often called gross and net debt. Which is the correct number? Some say that the important point is the debt record, whoever is the debt holder, because there is an obligation to repay. Others say that by doing a consolidation we recognize that the financial flows inside the public sector have not the same macroeconomic effects than debt with the private sector.
- In some cases, countries include Central bank liabilities but do not incorporate the corresponding assets, such as international reserves.
- Some countries include indirect debts; these should be treated as contingent liabilities. It is the case in Bolivia, Ecuador, El Salvador, Nicaragua, and Paraguay.
- Some countries do not disseminate official data of domestic public debt, like Paraguay and Dominican Republic.

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[10] A complete description of public debt data available for Latin American countries can be found in www.eclac.cl/ilpes

Concerning the first point, the methodology of the European Union is clear: "Government debt means the total gross debt at nominal value outstanding at the end of the year of the sector of "general government", with the exception of those liabilities, the corresponding financial assets of which are held by the sector of "general government (Council Regulation (EC) N. 475/2000)".

Of course, credit rating agencies always focus on the highest data when they make their evaluations. This situation produces a huge damage on countries' public finances (for example in the case of Brazil, non consolidated debt of the public sector represented more than 70 per cent of GDP at the end of 2002, while the consolidated public debt represented 50 per cent of GDP for the same period (see Box 1).

Without a homogenous methodology that allows a complete coverage of liabilities and assets, the norm should be to record consolidated gross public debt of General Government, excluding Central Bank and public enterprises. If there are relevant quasi-fiscal operations or contingent liabilities with a high probability of occurrence, which incorporates also public guaranteed debt, the most appropriate is to record these operations separately.

Table 1 shows the evolution of public debt at the Central Government level in Latin American Countries, as well as the percentage of external debt. Two tendencies emerge; for eleven countries, public debt measured in percent of GDP has decreased during the Nineties (for several in a significant way: Chile, Dominican Republic, El Salvador, Honduras, Mexico, Nicaragua, Venezuela). Seven other countries heavily increased their public debt stock: Argentina, Brazil, Colombia, Costa Rica, Ecuador, Paraguay and Uruguay, rising by the same way interest payments. Three countries of the region have defaulted (Ecuador in 1999 and Argentina in 2001) or restructured (Uruguay in 2003) their public debt in recent years.

The 2002 jump of public debt stock in Argentina and Uruguay, resulting from huge devaluations of local currencies, illustrate in a dramatic way the so-called original sin. In the case of Argentina, the currency board in place until the end of 2001 diminished somewhat artificially the burden of public debt as a proportion to GDP. With devaluation and recession, the indicator almost tripled its value; the equilibrium exchange rate should be lower in the long term than the one recorded since 2002. The opposite situation happens in Ecuador where the persistence of a domestic inflation in spite of dollarization appreciated the real exchange rate, reducing public debt in terms of GDP.

In macroeconomic models with a representative agent with an infinite horizon and perfect markets, there is neutrality of government debt both in level (Ricardian equivalence) and in composition. But there is a gap between theory and practice: on one hand theory argue for neutrality of public debt management; on the other, a growing number of countries adopt explicitly for their public debt management practices of the private sector.

Box 1. Public debt accounting methodology in Brazil

The Federal government (defined as direct and indirect administration, public social security system, and non financial federal public funds) gross debt is composed by national government liabilities held by sub-national governments, public and private financial system, non financial private sector and the rest of the world. Obligations linked to the external sector are converted to *reales* with the exchange rate at the end of the period. Values of Federal government gross debt are recorded considering portfolio positions without taking into account operations of the Central bank. The items of the Federal government net debt (37.6 per cent of GDP) in 2003 are:

- Securities issued by the National Treasury – Federal domestic public debt constituted by public bonds issued by the National Treasury recorded in the Electronic Settlement and Custody System (SELIC) and those under the custody of the Central Office for Private Securities (CETIP) placed and redeemed in Brazilian currency, including securities at the Central Bank's portfolio (+43.3);
- Bank debt - Loans and financing granted by financial institutions to the non-financial public sector;
- Bank debt of decentralized agencies – Loans and financing granted by financial institutions to entities of indirect administration (governmental agencies, universities, foundations, etc);
- Social Securities deposits and investments – Corresponds to the public securities investment portfolio of the Social Security;
- Certificates of privatization (CP) – Securities issued by the National Treasury and usable in the purchase of shares of state-owned enterprises within the framework of the National Privatization Program;
- Debts of the Union and of state-owned enterprises assumed and renegotiated by the federal government and securitized through the issuance of securities registered with the CETIP;
- Agricultural debt securities (TDA) on the market – Securities backed by the INCRA/MA issued by the National Treasury in land expropriation procedures for agrarian reform;
- FAT investments in public securities -Worker Protection Fund investments in National Treasury securities;
- Investments of various funds – Refers to investments of public funds other than financial intermediaries in federal securities;
- Law 8727/93 – Debt of states, municipalities, and public enterprises at 6/30/93, refinanced by the Union under Law 8727/93;
- External debt – Short-, medium- and long-term external public debt (+13.9).

Federal government debt is disseminated as net and gross with a monthly periodicity, and the difference between them was 15 points of GDP in 2003 for Federal government. The net consolidated public sector debt (which is composed by General government, Central bank and public non financial enterprises) corresponds to net debt of National government (Federal government and Central bank) plus net debt of local and intermediate government with national government, public and private financial system, non financial private sector and the rest of the world. Social security public system and public funds are also included. The resulting stock is adjusted in order to obtain the concept of net fiscal debt: privatization adjustments, patrimonial adjustments, external debt adjustments (for exchange rate fluctuations) and domestic debt adjustments (also for exchange rate fluctuations when domestic debt is indexed to the US dollar). Net debt of the so-called harmonized public sector does not include the monetary basis as the Macroeconomic Monitoring Group of MERCOSUR (GMM) recommends. Finally, the question surges: which is the appropriate data?

Brazilian Public Debt

	1998	1999	2000	2001	2002	2003
Net Debt – National Government	25.0	29.8	30.6	32.8	35.3	37.2
Federal Government	25.6	29.6	29.8	33.4	35.7	37.6
Central Bank	–0.6	0.2	0.8	–0.6	–0.4	–0.4
Gross Debt – General Government	54.8	58.5	64.5	70.6	71.4	79.0
Net Debt – General Government	39.8	45.7	45.9	51.7	54.2	58.0
Federal Government	25.6	29.6	29.8	33.4	35.7	37.6
States and Municipalities	14.2	16.1	16.1	18.3	18.5	20.4
Net Debt – Consolidated Public sector (A)	41.7	48.7	48.8	52.6	55.5	58.7
General Government	39.8	45.7	45.9	51.7	54.2	58.0
Central Bank	–0.6	0.2	0.8	–0.6	–0.4	–0.4
Non Financial Public Enterprises	2.6	2.8	2.2	1.6	1.7	1.1
Net Debt – Harmonized Public sector					51.8	
Privatization Adjustment (B)	–3.2	–3.7	–5.1	–4.8	–4.0	–4.1
Patrimonial Adjustment (C)	3.3	4.2	4.6	6.2	5.8	6.0
Adjustment for external debt (D)	0.6	3.3	3.8	4.4	8.0	6.5
Adjustment for domestic debt (E)	0.7	4.4	4.9	6.0	9.6	8.3
Fiscal net Debt (A-B-C-D-E)	40.3	40.5	40.6	40.8	36.1	42.0

Source: Central Bank of Brazil.

Table 1

Central Government Consolidated Debt Stock and Its External Component
(percent of GDP and percent of total debt)

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Argentina	…	…	…	29.4	31.3	33.8	35.7	34.5	37.6	43.0	45.0	53.7	145.9	138.1
	…	…	…	…	…	…	…	*74.1*	*74.0*	*69.5*	*66.3*	*61.2*	*62.8*	*56.6*
Bolivia [1]	65.1	52.9	51.5	63.5	64.3	61.8	54.9	57.9	57.4	61.1	62.6	71.7	74.9	92.4
	…	…	…	*77.3*	*78.1*	*77.7*	*74.7*	*76.7*	*76.2*	*72.7*	*69.0*	*63.2*	*62.5*	*71.1*
Brazil [2]	…	12.8	12.1	9.5	12.9	13.3	15.9	18.7	25.0	30.1	31.0	32.8	35.6	36.9
	…	…	*93.2*	*81.0*	*49.3*	*26.3*	*9.9*	*10.4*	*16.8*	*26.3*	*24.2*	*25.1*	*35.2*	*27.7*
Chile	45.4	38.8	31.7	29.2	23.5	17.9	15.1	13.2	12.5	13.8	13.7	15.0	15.7	13.3
	42.0	*43.2*	*42.6*	*40.0*	*39.8*	*32.1*	*28.1*	*24.2*	*25.5*	*28.9*	*26.6*	*30.3*	*36.5*	*42.4*
Colombia	14.8	14.0	15.0	14.5	12.7	13.9	14.4	17.8	22.1	29.5	36.9	44.3	50.5	53.2
	87.2	*89.0*	*80.5*	*69.3*	*63.8*	*58.6*	*54.1*	*50.2*	*52.0*	*51.1*	*49.5*	*50.1*	*50.4*	*49.5*
Costa Rica	...	28.5	23.3	24.3	26.8	28.7	33.2	30.0	39.5	35.2	36.6	38.6	40.8	38.2
	…	*65.4*	*61.2*	*52.7*	*44.0*	*40.3*	*27.7*	*26.1*	*20.5*	*24.4*	*27.7*	*28.3*	*29.9*	*32.7*
Ecuador	70.0	67.2	73.8	85.1	71.1	59.1	58.7	51.7	56.3	83.6	71.8	58.0	51.1	47.7
	97.1	*96.8*	*97.9*	*96.8*	*89.1*	*87.6*	*85.1*	*86.4*	*81.4*	*78.4*	*75.2*	*77.0*	*77.7*	*76.9*
El Salvador	45.7	41.7	43.1	44.3	41.7	37.3	37.8	36.2	33.3	26.0	27.4	31.1	36.0	38.0
	…	…	…	*64.0*	*60.9*	*61.2*	*64.5*	*66.8*	*66.2*	*69.5*	*64.4*	*61.6*	*67.5*	*69.7*
Guatemala	23.1	17.5	16.5	15.5	15.4	14.0	13.5	14.0	14.6	17.5	16.9	18.0	16.4	18.4
	55.9	*55.2*	*56.2*	*55.2*	*57.7*	*62.4*	*60.5*	*61.1*	*65.5*	*67.1*	*66.0*	*68.7*	*72.6*	*69.6*
Haiti	...	...	...	...	...	...	37.9	40.0	36.6	38.6	43.8	46.2	60.3	55.9
	…	…	…	…	…	…	*66.7*	*70.1*	*69.7*	*68.6*	*68.9*	*68.1*	*71.0*	*71.5*
Honduras [1]	84.4	81.0	76.8	85.9	94.6	87.0	82.2	80.3	72.7	77.2	69.7	68.7	71.0	71.8
	…	…	…	…	…	…	…	…	…	…	…	*94.8*	*94.5*	*94.6*
Mexico	46.5	38.1	28.1	25.3	35.3	40.8	31.1	25.8	27.8	25.6	23.2	22.5	24.0	24.7
	51.7	*56.0*	*57.8*	*57.6*	*64.3*	*79.3*	*75.6*	*66.6*	*64.6*	*56.9*	*47.1*	*41.6*	*39.6*	*39.2*
Nicaragua [1]	…	…	…	…	304.5	252.4	141.1	206.9	197.0	183.8	175.9	179.0	194.4	193.8
	…	…	…	…	*95.1*	*95.7*	*89.3*	*58.7*	*63.0*	*63.3*	*64.0*	*62.7*	*58.0*	*59.0*
Panama [1]	123.4	114.2	89.9	97.8	94.5	95.8	84.0	78.2	75.8	79.8	77.2	83.3	76.0	74.8
	85.6	*87.1*	*83.2*	*74.3*	*75.3*	*77.8*	*74.0*	*74.6*	*75.5*	*72.4*	*72.5*	*74.6*	*74.5*	*75.1*
Paraguay [3]	12.8	11.5	8.2	9.4	7.2	10.0	9.7	10.3	12.8	20.9	25.9	29.2	39.3	…
Peru	52.4	60.9	59.6	63.6	53.4	47.8	45.1	31.8	40.3	47.1	45.3	45.1	47.3	48.4
	…	…	…	…	…	…	…	…	*85.5*	*80.2*	*79.2*	*78.9*	*78.2*	*78.6*
Dominican R. [1][3]	84.7	60.6	49.2	47.8	37.5	33.2	29.2	23.9	23.1	20.9	19.0	19.6	24.0	40.2
Uruguay	…	…	23.3	21.5	21.0	19.9	20.2	21.3	23.2	25.6	30.9	37.8	76.8	95.9
Venezuela [1]	…	…	…	…	…	…	45.2	30.9	28.4	28.2	26.2	29.9	41.0	42.9
	…	…	…	…	…	…	*91.4*	*90.1*	*88.7*	*83.8*	*70.6*	*63.0*	*69.5*	*65.5*

Notes: In italics, we show the external component of public debt (as percent of total debt). – (1) Public sector debt stock. – (2) Net debt of federal government and central bank. – (3) It only includes external public debt.
Source: ECLAC, United Nations.

Referring to public debt composition, data shows a clear tendency to use in a more intensive way domestic debt instruments. This situation should reduce the exposition of countries to exchange rate fluctuations (at least in the case of those domestic instruments which are not indexed to foreign currency). The increase of the share of domestic public debt is outstanding in Brazil, Colombia, Costa Rica, Mexico and Peru. This is in part a result of the difficulties to borrow abroad, and also the outcome of the dissemination of international guidelines for debt management of IMF and World Bank (see Box 2).

Box 2. Public debt management strategies

Public debt strategies in which countries appeal to excessive external debt in foreign currencies and short-term debt (including also floating interest rates) are very risky. For example, debt expressed in foreign currencies may appear, *ex ante*, less expensive than debt expressed in local currency with the same maturity, but may result more expensive in instable capital market or in the case of a depreciation of the local currency. Furthermore, public debt management authorities must take into account that the exchange regime can affect linkages between debt management and monetary policy. For example, debt expressed in foreign currency may appear less expensive in a fixed exchange regime where exchange instability is limited, but may result very risky if the exchange regime turn to be unsustainable.

A framework should be elaborated that allow public debt management authorities to identify and find an arbitrary solution between anticipated cost and risk of the public debt instruments portfolio. Generally public debt management authorities deal with different type of risk; the major role of the unit in charge of the public debt management is to identify those risks, evaluate if possible their magnitude and elaborate the best feasible strategy in order to find an arbitrary solution between cost and risk. To accomplish this task, they must have access to financial and macroeconomic projections. To assess risk, debt managers should regularly conduct stress tests of the debt portfolio on the basis of the economic and financial shocks to which the government – and the country more generally – are potentially exposed. When constructing such assessments, debt managers needs to factor in the risk that the government will not be able to roll over its debt and be forced to default, which has costs that are broader than just government's budget. Moreover, debt managers should consider the interactions between the government's financial situation and those of the financial and non-financial sectors in time of stress in order to ensure that government's debt management activities do not exacerbate risks in the private sector. In general, models used should enable government debt managers to undertake the following types of risk analysis:

- Project expected future debt servicing costs over a medium-to long-term horizon based on assumptions regarding factors affecting debt-servicing capability, such as: new financing requirements; the maturity profile of debt stock; interest rate and currency statistics of new debt; assumptions for future interest rates and exchange rates and the behavior of relevant non-financial variables (e.g., commodity prices for some countries);
- Generate a debt-profile, consisting of key risk indicators of the existing and projected debt portfolio over the projected horizon;
- Calculate the risk of future debt servicing costs in both financial and real terms by summarizing the results of stress tests that are formulated on the basis of the economic and financial shocks to which the government and the country more generally are potentially exposed. Risks are typically measured as the potential increase in debt servicing costs under risk scenarios relative to the expected cost; and
- Summarize the costs and risks of alternative strategies for managing the government's debt portfolio as a basis for making informed decisions on future financing alternatives.

The theoretical framework of assets and liabilities administration for public debt management is a useful method, because cost and risk analyses of portfolio's instruments of public debt is directly linked to fiscal resources. In this framework, characteristics and risks of the assets cash flow are examined, and if it is possible liabilities with the same characteristics are selected in order to minimize probabilities of a liquidity shortage caused by a currency or maturity mismatch. The IMF and the World Bank establish that "the main objective of public debt management is to ensure that the government's financing needs and its payment obligations are met at the lowest possible cost over the medium to long run, consistent with a prudent degree of risk".

2. Public debt dynamics: the snowball effect

Even if many countries did significant efforts to reduce their public debt stock, the combination of high interest rates, sharp devaluations and recessive episodes had devastating consequences on public finance. An explosive debt dynamics – a snowball effect – can result, in which debt servicing absorbs an increasing proportion of fiscal revenues.

In order to calculate the snowball effect, public debt dynamics can be expressed by the following equation:

$$B_t = B_{t-1} - GB_t + SF_t \tag{1}$$

where Bt is public debt stock, *GBt* the global government balance, *SFt* the stock-flow adjustment that ensures the consistency between government balance and the variation in the stock of debt; *t* denotes the year. The stock-flow adjustment includes the accumulation of financial assets, the change in the value of debt stock denominated in foreign currency and remaining statistical adjustments. The equation can be presented emphasizing the role of the primary balance:

$$B_t = B_{t-1}(1+i) - PB_t + SF_t \tag{2}$$

where *PBt* is the primary balance, and *i* is the implicit interest rate. The implicit interest rate is calculated as the interest paid as a percentage of debt stock at the end of the year (*t–1*). Rewriting the equation in terms of GDP (*Yt*):

$$\frac{B_t}{Y_t} = \frac{B_{t-1}}{Y_{t-1}} \cdot \frac{1+i}{1+n} - \frac{PB_t}{Y_t} + \frac{SF_t}{Y_t} \tag{3}$$

where n is the rate of growth of GDP. Rearranging:

$$\frac{B_t}{Y_t} - \frac{B_{t-1}}{Y_{t-1}} = -\frac{PB_t}{Y_t} + \frac{B_{t-1}}{Y_{t-1}} \cdot \frac{i-n}{1+n} + \frac{SF_t}{Y_t} \tag{4}$$

If lower case letters represent ratios in terms of GDP:

$$\Delta b_t = -pb_t + b_{t-1} \cdot \frac{i-n}{1+n} + sf_t \tag{5}$$

The debt dynamics (Δb) can be separated in three components, the primary balance (*pb*), the contribution of interest and real growth rates or snowball effect, and the stock-flow adjustment[11] (*sf*). The data used for calculations are available on demand. Table 2 shows the importance of the snowball effect for several episodes and countries, and a comparison with the European Union countries.

In the period 1990-2002, the maximum snowball effect reached on average 4.1 points of GDP – associated with a public debt of 54.6 – in Latin American countries, with peaks of 12.2 in Ecuador, 8.8 in Argentina, 7.9 in Venezuela, and more than 5 points of GDP in Brazil, Honduras and Mexico. By contrast, in the early Nineties the maximum in European countries averaged 3.8 points of GDP – with an associated debt of 72.8 – with peaks of 9.9 in Italy and 7.2 In Belgium. The problem is more acute in Latin American countries in 1998-2002, and will continue to damper severely if the financial conditions remain unchanged.

Figure 1 shows debt dynamics for the period 1998-2002, separating 18 countries into three groups: in group A, countries that have access to the international capital markets to issue public debt (market access countries)[12] and public debt increased; in group B, countries that have access to international markets, and public debt has decreased or has been constant; and in group C, countries that cannot issue sovereign bonds in the international capital markets.

In the first group, the main reason of the rising of the debt is currency devaluation in 2002, as it can be seen in the magnitude of the stock-flow adjustment in Argentina and Uruguay. In Brazil, the positive primary balance was not sufficient to impede the increase of debt, due to exogenous factors. In Colombia the negative impact of these factors came together with a persistent primary deficit. In Venezuela the increase was quite small.

In Brazil fiscal authorities began to generate systematic primary surpluses since 1999 with the Fiscal Responsibility Law, approved in 2000 which defines annual fiscal targets for the next three exercises. The aim is to achieve primary surpluses allowing the public debt-to-GDP ratio stabilization. But the effort was not sufficient to impede public debt growth, because of the deterioration of economic growth rate and of financing conditions. In the case of Brazil, fixing primary surplus targets (instead of global balance) was *per se* a success, because it permitted the separation of fiscal goals from interest and exchange rates fluctuations. Thus, if during the period 1999-2002 global deficits were bigger than expected, the year

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[11] The devaluation of the local currency hits directly in two of the components of debt dynamics: on the snowball effect through the increase of the flow of interests paid measured in terms of GDP, and on the stock-flow adjustment through the increase of the stock of debt.

[12] We define as "market access countries" the twelve Latin-American countries belonging to JPMorgan's EMBI Global Index.

Table 2

The Magnitude of the Snowball Effect
(percent of GDP)

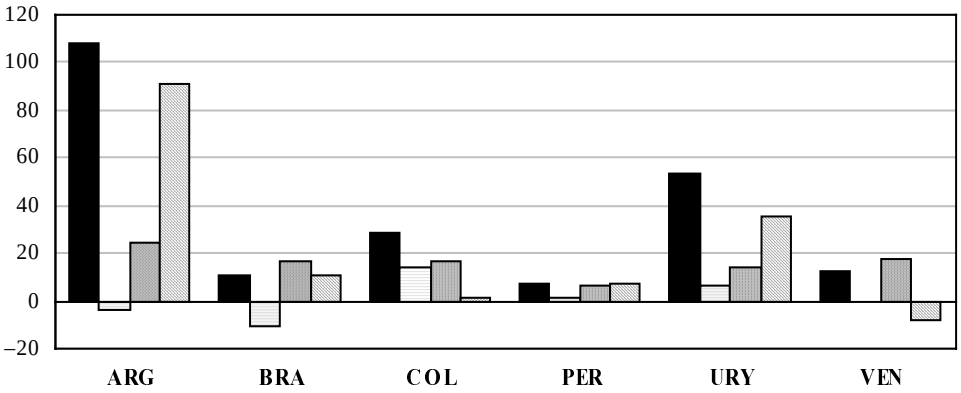
	Maximum of the snowball effect	Public debt associated with maximum of the snowball effect	Accumulated snowball effect	Accumulated public debt stock
	1990-2002		**1998-2002**	
Latin American countries	**4.1**	**54.6**	**9.1**	**16.0**
Argentina	8.8 (2002)	145.9	24.0	108.3
Bolivia	1.4 (2001)	71.7	2.6	17.5
Brazil	5.2 (1999)	30.1	16.7	10.6
Chile	0.5 (1999)	13.8	0.5	3.2
Colombia	4.3 (1999)	29.5	16.7	28.4
Costa Rica	4.4 (1996)	33.2	10.5	1.3
Ecuador	12.2 (1999)	83.6	21.5	–5.2
El Salvador	0.9 (1996)	37.8	2.4	2.7
Guatemala	1.0 (2001)	18	3.5	1.8
Haiti	0.8 (2002)	60.3	0.5	23.6
Honduras	5.7 (1994)	94.6	4.5	–1.6
Mexico	6.4 (1995)	40.8	9.8	–3.8
Panama	3.9 (2001)	83.3	10.0	0.2
Paraguay	1.4 (2002)	39.3	5.0	26.5
Peru	4.7 (1992)	59.6	6.2	7.0
Dominican Republic	0.4 (2002)	24	–1.9	0.9
Uruguay	4.7 (2002)	76.8	14.0	53.6
Venezuela	7.9 (2002)	41	18.0	12.6
European countries	**3.8**	**72.8**	**3.2**	**–7.2**
Belgium	7.2 (1993)	138.2	13.5	–13.5
Denmark	6.4 (1993)	78	11.6	–10.7
Germany	2.7 (1996)	59.8	9.7	–0.1
Greece	2.8 (1993)	110.1	0.3	–1.1
Spain	1.7 (1996)	68.1	–3.6	–10.8
France	3.0 (1993)	45.3	5.4	–0.5
Ireland	1.1 (1992)	100.2	–19.5	–22.5
Italy	9.9 (1993)	118.1	11	–9.6
Luxembourg	0.2 (2002)	5.7	–0.6	–0.6
Netherlands	4.3 (1993)	79.3	2.3	–14.4
Austria	2.5 (1993)	61.8	7.1	3
Portugal	5.1 (1993)	59.1	–1.6	3.1
Finland	3.9 (1993)	55.9	2	–5.9
Sweden	4.7 (1996)	73.5	7.5	–15.3
United Kingdom	1.7 (1992)	39.2	2.4	–9.1

Source: Authors' calculation for Latin American countries and European Commission (2003) for European countries.

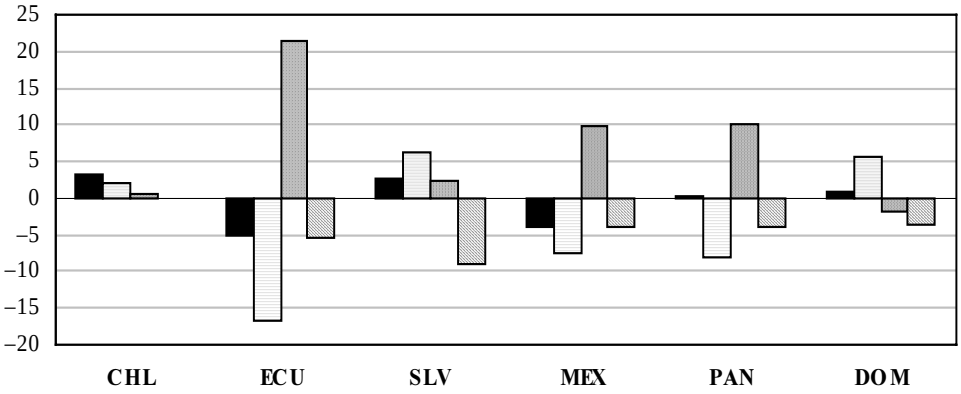
Figure 1

Contribution to the Change of Public Debt Stock in Latin America, 1998-2002

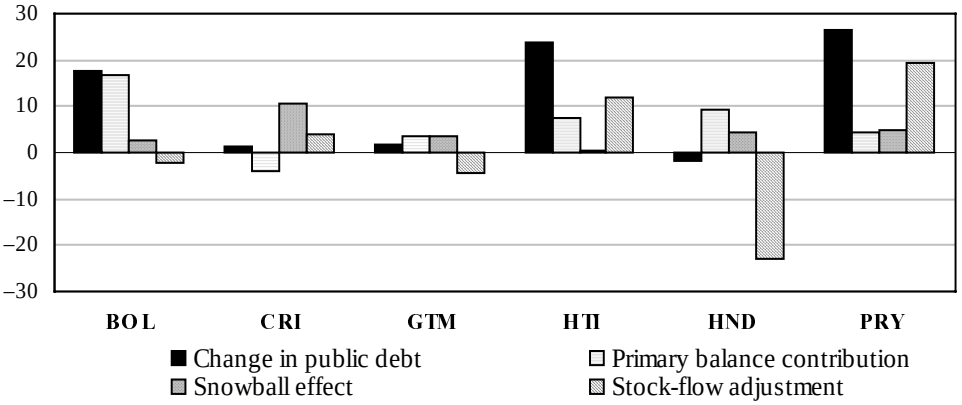
A – Market-Access Countries with Increasing Public Debt



B – Market-Access Countries with Decreasing Public Debt



C – Countries That Cannot Issue Sovereign Bonds



Source: Elaboration of the authors.

2003 should represent the beginning of a virtuous circle, leading to the absorption of the public debt-to-GDP ratio if the exchange rate converges to a lower level.

In group B, there has been a decline of the public debt-to-GDP ratio in Ecuador and Mexico, meanwhile in the other countries this ratio was relatively constant. In El Salvador, there has been a negative stock-flow adjustment, which can be attributed to the recent dollarization process. The particular case of Ecuador is highlighting: this country needed to cumulate eighteen points of GDP of fiscal primary surpluses to reach a decrease of its public debt of five points of GDP from 1998 to 2002. As in El Salvador, there has been also a negative stock flow adjustment attributed to the dollarization process. In Dominican Republic, the decline in the public debt-to-GDP ratio has been completely reversed with the crisis of the financial system of 2003. The consolidated public debt rose from 24 per cent of GDP in 2002 to 40 per cent of GDP in 2003. In the case of Mexico, the fiscal authorities managed to balance the negative impact of the exogenous variables with primary surpluses. The negative stock-flow adjustment also contributed to reduce public debt. It is nonetheless remarkable the complete absence of snowball effects in Chile, a country with very low levels of public debt and interest rates.

In group C, the impact of the snowball effect is much lower, except for Costa Rica. In Honduras, Haiti, Guatemala and Bolivia the implicit interest rate is quite low. In these countries, external financing relies mainly on the "Poverty Reduction and Growth Facilities" programs.

3. Debt sustainability indicators

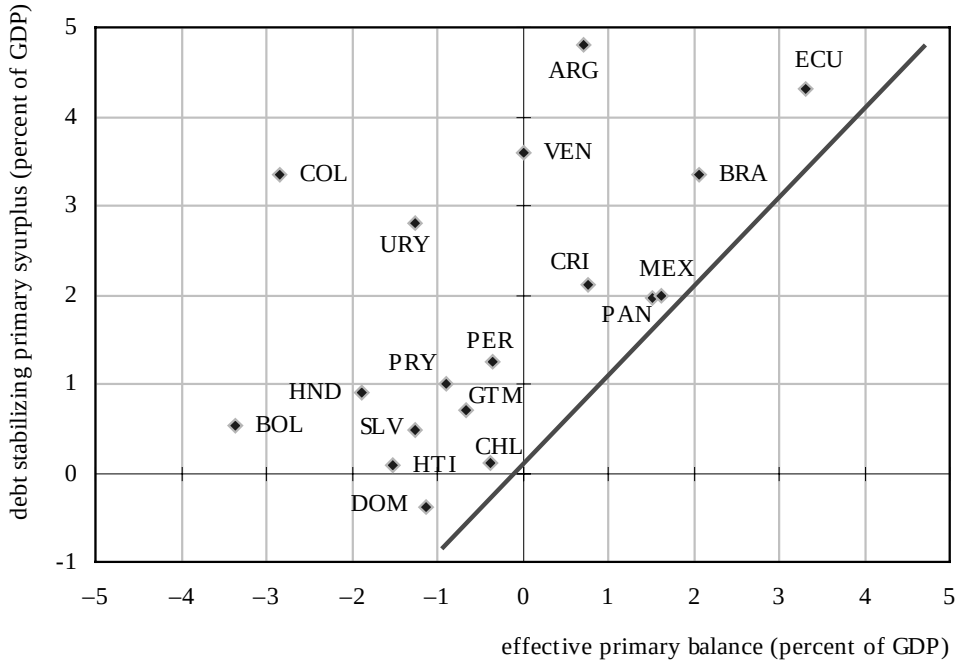
The required debt-stabilizing primary balances are extremely fluctuant, as a consequence of the volatility of interest, exchange and real growth rates. In such a context, it is really a hard task to fix short-term targets in the public debt-to-GDP ratio. Debt sustainability indicators should take into account this exogenous component; analysts that aim to formulate general policy prescriptions should do the same.

During the period 1998-2002, some countries had systematically a negative difference between their effective primary balance and the required one to stabilize debt. A combined process of generation of primary balances and improvement in the financial conditions seem to be the only way to ensure debt sustainability. In figure 2 we represent, as an average for the 1998-2002 period, the effective primary balance and the debt-stabilizing primary balance, calculated as the standard short-term Blanchard's (and others, 1990) indicator. To do so, we assume no stock-flow adjustment and we suppose $\Delta b_t = 0$. From (5), the short-term debt-stabilizing primary balance can be derived as:

$$pb_t = b_{t-1} \cdot \frac{i-n}{1+n} \tag{6}$$

Figure 2

Effective and Debt-stabilizing Primary Surplus, Average for 1998-2002
(percent of GDP)



Source: Authors' calculations.

It clearly appears that there has been a significant negative difference between these two variables, except for Chile, Dominican Republic, Mexico and Panama. The gap represented up to five points of GDP in Colombia, and three points in Argentina, Bolivia, Uruguay and Venezuela. Recent papers develop some refinements to this kind of indicators, introducing a fiscal policy reaction function and taking into account the currency mismatch of debt.

3.1 Introducing government's reaction function

Croce and Hugo (2003) propose a fiscal sustainability indicator, calculated with an operationally simple recursive algorithm that is derived from the debt-to-GDP ratio subject to the government's reaction function. The authors suppose that government has the ability to react when the debt-to-GDP ratio exceeds the target ratio, by generating a primary surplus consistent with the target ratio.

We start from equation (3), assuming there is no stock-flow adjustment. The same equation can be written in lower cases as follows:

$$b_t = \frac{1+i}{1+n} b_{t-1} - ps_t \qquad \text{(6-bis)}$$

We define now as *ps* the primary surplus, instead of the primary balance *pb*. The authors add two additional equations in order to define targets on primary surplus and debt and the government's reaction function:

$$b_t = \beta_t b_{t-1} - ps_t \qquad \text{where } \beta_t = \frac{1+i_t}{1+n_t} \qquad \text{(6-bis)}$$

$$ps^* = (\beta^* - 1) b^* \qquad (7)$$

$$ps_t = ps^* + \lambda_t (b_{t-1} - b^*) \qquad (8)$$

In equation (7), β^* and ps^* are respectively the discount factor and the primary surplus that would prevail once convergence to the target debt b^* is reached. In equation (8), λ_t is a parameter that indicates the intensity of the policy response at time t, namely the deviation of the observed public debt ratio from the target. From equations (6-bis), (7) and (8) we get the budget constraint that include the government reaction ability:

$$b_t = (\beta_t - \lambda_t) b_{t-1} - (\beta^* - \lambda_t - 1) b^* \qquad (9)$$

The authors assume furthermore that $b_{t-1} > b^*$. This implies, following the equation (9), that b_t would converge to b^*, if and only if $|\beta_t - \lambda_t| < 1$. Therefore, they propose to use as an indicator of fiscal sustainability (IFS):

$$IFS_t = (\beta_t - \lambda_t) = \left(\frac{1+i_t}{1+n_t} - \frac{ps_t - ps^*}{b_{t-1} - b^*} \right) \qquad (10)$$

If $IFS_t < 1$ fiscal policy is sustainable; if $IFS_t \geq 1$ then fiscal policy is unsustainable. According to the authors, one advantage of this indicator over Blanchard's is that no estimations of future GDP and interest rates are required: the indicator can generate its results based on current, past, and target values of relevant variables.

Croce and Hugo fix β^* at 1.02 for developed countries and 1.03 for developing countries; this values represent the median of the distribution of the observed values. However, this value is far from being representative; Table 3 shows the calculations for Latin American countries that issue sovereign bonds and whose public debt increased in the period 1997-2002. It can be seen that the value of β is very dissimilar for different years and among countries. On average, the observed spread between interest rates and the rate of growth was very high, except for the case of Peru. If we fix a target value of public debt b* of 25 per cent of GDP

for all countries, we can estimate the target primary surplus, using alternative values for β*.

When we estimate β* as the spread between interest rate and real growth rate in the 1997-2002 period, the indicator is above 1 for all the countries except for Chile. Critical values are reached by Brazil, Colombia and Venezuela where the spread is 12 points percent.

The IFS shows problems of sustainability for most of the countries in the recent years (except for Ecuador), which is still another way to confirm that debt rose. Of course, if the bad financing conditions and the lack of growth of this period

Table 3

Indicator of Fiscal Sustainability with a Government Function Reaction for Selected Countries, 1997-2002

			1997	1998	1999	2000	2001	2002
			β					
Argentina			0.976	1.025	1.114	1.088	1.140	1.163
Brazil			1.061	1.303	1.209	1.063	1.090	1.066
Colombia			1.101	1.177	1.204	1.135	1.097	1.071
Ecuador			1.028	1.067	1.216	1.052	1.002	1.024
Peru			0.973	1.064	1.043	1.015	1.045	0.992
Uruguay			1.014	1.017	1.113	1.101	1.119	1.125
Venezuela			0.993	1.084	1.177	1.068	1.094	1.305
	β^*_1	ps^*	IFS_1					
Argentina	1.084	2.11	1.13	1.20	1.29	1.14	1.24	1.18
Brazil	1.132	3.30	0.73	0.91	…	1.30	1.25	1.14
Colombia	1.131	3.27	0.61	0.61	–0.22	3.28	1.59	1.40
Ecuador	1.065	1.62	0.99	1.13	1.14	0.97	0.96	0.99
Peru	1.022	0.56	0.95	1.04	1.15	1.07	1.11	1.03
Uruguay	1.082	2.04	…	…	…	…	1.79	1.33
Venezuela	1.120	3.01	1.37	0.90	2.17	4.12	–0.08	1.81
	β^*_2	ps^*	IFS_2					
Argentina	1.03	0.75	1.00	1.06	1.18	1.06	1.17	1.13
Brazil	1.03	0.75	1.01	1.31	…	0.80	0.83	0.81
Colombia	1.03	0.75	0.86	0.88	0.40	2.33	1.34	1.27
Ecuador	1.03	0.75	0.97	1.10	1.12	0.95	0.94	0.97
Peru	1.03	0.75	0.96	1.06	1.16	1.08	1.11	1.04
Uruguay	1.03	0.75	…	…	…	…	1.57	1.23
Venezuela	1.03	0.75	1.24	0.57	1.57	3.18	–1.89	1.22

Notes: β_1^* is the average for 1997-2002 for each country; β_2^* is the value suggested by Hugo and Croce (2003). For both indicators the target value of debt is 25 per cent). We omit to show values when $b^* = bt$.

Source: Elaboration of the authors.

are taken into account, the indicator worsens, and the associated "stationary" primary surplus is higher. If on the contrary we assume that these factors are temporary (when $\beta_2^* = 1.03$), the evaluation of sustainability is less severe. For example, in Brazil the effort that has been made to generate high primary surpluses is well captured by the second indicator, delivering the country from the "unsustainable" condition.

As the authors have pointed out, it is very difficult to encapsulate in one number the complex issue of fiscal sustainability. In this particular case, the indicator only applies when the current public debt-to-GDP ratio is higher than the targeted value, loosening then generality. Another deficiency (indeed pointed out by the authors) is that the indicator does not incorporate the effects of real exchange rate misalignment on fiscal sustainability. This caveat applies indeed to all fiscal sustainability indicators.

3.2 A measure of currency mismatch

A currency mismatch is a situation in which the currency denomination of a country's or a sector's assets differs from that of its liabilities such that its net worth is sensitive to changes in the exchange rate. In almost all emerging countries, public debt is labeled in foreign currency, while government revenues relies to a large extent on domestic output. This situation creates a currency mismatch in the public sector balance sheet, making fiscal sustainability very sensitive to exchange rate movements.

Calvo, Izquierdo and Talvi (2002) analyze the specific case of Argentina and propose a fiscal sustainability indicator that compares the composition of debt with the degree of openness, linking in a very aggregate manner the evolution of external debt with the capacity to obtain resources from exports.

In order to obtain a debt-to-GDP ratio constant ($\bar{b}$), from equation (6) we can see that the primary surplus must satisfy:

$$ps_t = \bar{b}\left[\frac{(1+i)}{(1+n)} - 1\right] \tag{11}$$

Debt-to-GDP ratio can be expressed as:

$$\bar{b} = \frac{B}{Y} = \frac{B^{nt} + eB^*}{Y^{nt} + eY^*} \tag{12}$$

where e is real exchange rate (defined as relative price between tradable and non-tradable goods); B^{nt} is debt in terms of non-tradables; B^* is debt in terms of tradables; Y^{nt} is output in terms of non-tradables and Y^* is output in terms of

tradables (proxied by exports). The currency mismatch measure is $(B^{nt} / eB^{*})/(Y^{nt} / eY^{*})$. Consider the limit cases:

- if $b = \frac{eB}{Y^{nt}}$ then all valuation effects take place on debt only. This is the worst scenario in which real exchange rate depreciation hits fully on sustainability,
- if $(B^{nt} / eB^{*})/(Y^{nt} / eY^{*}) = 1$, the composition of debt and output is perfectly matched, and real exchange rate depreciation has no effect on fiscal sustainability.

In Table 4, we calculate for some Latin American countries two public debt mismatch measures (the lower, the worse), only with external debt first and then using also domestic debt denominated in foreign currency to estimate B^{*}.

Table 4

Public Debt Mismatch Measures, 2002

	External debt / Total public debt (%)	Exports / GDP (%)	Currency mismatch measure 1	Currency mismatch measure 2
Argentina	62.8	27.7	0.23	0.12
Brazil	35.2	15.5	0.34	0.08
Chile	36.5	34.5	0.91	0.03
Colombia	50.3	17.5	0.21	0.20
Ecuador	77.7	25.4	0.10	...
El Salvador	66.9	26.7	0.18	...
Mexico	39.7	27.2	0.57	0.57
Peru	78.2	16.4	0.05	...
Uruguay	74.8	21.6	0.09	...
Venezuela	67.1	29.0	0.20	...

Notes: Public sector debt mismatch measure 1 considers only external public debt. Public sector debt mismatch measure 2 includes also domestic debt expressed in foreign currency.

Source: Elaboration of the authors.

The indicator may be inappropriate in dollarized countries like Ecuador and El Salvador, but it clearly shows high degrees of mismatch in Argentina, Brazil, Colombia, Peru, Uruguay and Venezuela. Most of these countries exhibit a relatively low degree of openness (when measured by exports in GDP), when compared to their external public debt level. Of course, the public/private composition of exports should also matter in this evaluation of sustainability.

Nevertheless, in recent years many countries are collecting export taxes in primary sectors and royalties in the mining sector, in order to diminish their own currency mismatch.

Mexico and Chile are in a much better position, when we use the first mismatch indicator. What is the ideal number? If the value is one, countries could pay in a year their external obligations if all the amount of exports were used to this purpose. Obviously, this would be an implausible situation. May be something like 0.5 would be an indicator of currency alignment, from the public finance point of view.

Of course, public debt mismatch measure worsens when we take into account domestic debt denominated in dollars.[13] In Brazil for example, around 30 per cent of domestic public debt was indexed to the dollar, increasing this way their currency mismatch. An exception is Mexico where public internal debt is entirely issued in domestic currency. It appears thus that the traditional indicators of sustainability are not well suited to address the key issue of currency mismatch.

4. An early-warning model

Sustainability has become a central element of the work of IMF. As emphasized by Ter-Minassian (2004), this encompasses both the assessments of external and fiscal sustainability and is probabilistic in nature, as the debt dynamics depend on uncertain macroeconomic and fiscal developments and changes in asset prices. Thus, assessing sustainability is analyzing the probability that debt dynamics become unstable. The template can provide upper-bound estimates of the likely evolution of the debt stock, but does not indicate what level of debt is too high. Thus, this approach is flexible enough to avoid general conclusions concerning debt thresholds.

From a comparative perspective, which is the one adopted here, more flexible ways to address this issue than single-number indicators are to estimate either fiscal policy reaction functions (IMF, 2003) or *logit* models (Manasse, Roubini and Schimmelpfenning, MRS, 2003). In the first case, the primary fiscal balance responds to both the level of public debt and other temporary factors, like the business cycle, inflation and commodity prices. This approach has the merit to estimate for each country a primary balance target, depending on exogenous conditions. A second way to assess fiscal sustainability is to estimate an early warning model. Using a panel data set for 47 market access countries, the authors (MRS) estimate a *logit* model of debt crisis to find critical thresholds that depend on many variables.

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[13] In the case of Chile, this indicator is misleading. The domestic debt of the Treasury is mainly owned by the central bank, issued in dollars with a very long maturity.

A country is defined to be in default if it is classified so by Standard & Poor's or if it receives a disbursement in the first year of a large Fund Arrangement (over 100 per cent of quota). The explanatory variables are divided into six groups: external debt variables, public debt variables, variables from the Fund's currency crisis Early Warning System, other macroeconomic variables, fiscal variables and political variables. Therefore, they proceed along a three-stage strategy: first, they regress each variable against sovereign default indicator; second they pool the best performers within each group of variables and run the *logit* regression; and third they combine the best performers from each group in a general model. In formal terms, the probability of being in debt crises, in year t is given by:

$$P_t = f((1 - SCI_{t-1}) * X_{t-1}; SCI_{t-1} * X_{t-1}) \tag{13}$$

where *SCI* denotes the sovereign debt crisis indicator and *Xt* denotes the vector of explanatory variables. The first argument corresponds to the probability of entering into a crisis in *t* (given that the country was not in crisis in *t–1*), and the second argument corresponds to the probability of being in crisis, or in other words not exiting from crisis in *t* (given that the country was in crisis in *t–1*).

In this section we apply the same methodology for market access Latin American countries. The discussion behind predicting sovereign debt crises is highly important, and it is crucial also to understand the nature of sovereign debt default: is it associated to liquidity problems or to solvency issues? The model proposed here will help to answer this question. Table 5 summarizes the debt crisis episodes for the twelve emerging market access countries in Latin America, their number and their average length for each country. In the database there are 25 crisis episodes during the period 1970-2002. Table 6 shows means of some of the variables that will be used in the regression estimates, during crisis and non-crisis episodes, for the 1980-2002 period, for 12 countries.

As it can be observed, the mean of the external public debt-to-GDP ratio is 42.1 per cent, when countries are in crisis; this ratio is 25.4 per cent in "normal" circumstances. External liquidity variables, like short-term public debt, the current account balance, the financial account balance and the foreign direct investment (inflows), measured as percentage of GDP, are significantly different when countries are in crisis. For instance, the Financial Account balance represents 3.7 per cent of GDP during normal periods and –1.8 per cent of GDP during crisis. These numbers illustrate the episodes of "sudden stop" of capital flows. Referring to fiscal variables, it can be seen that all the relevant variables have the expected differences: debt interest payments and short-term debt are higher in crisis episodes. By contrast, primary balances are higher during crisis, showing the pro-cyclical adjustment efforts of Latin American central governments.

Table 7 shows the results of the regression, using the *logit* approach with a robust variance estimator. The coefficients have the expected signs, and z-values are significant at a 5 per cent level. The liquidity variables, such as the financial account balance, the interest debt payments to GDP ratio and international reserves, have higher marginal effects than solvency variables, such as total external debt to GDP

Table 5

Countries and Debt Crisis Years in the Database (1970-2002)

	Number of crisis	Average length (years)	Years in crisis	Crisis episodes
Argentina	3	5.0	15	1982-94, 1995-96, 2001-
Brazil	3	5.3	16	1983-95, 1998-00, 2001-
Chile	1	8.0	8	1983-91
Colombia	1	3.0	3	2000-
Dominican Republic	2	3.0	6	1983-1986, 1992-1994
Ecuador	2	8.0	16	1982-96, 1999-01
El Salvador	1	16.0	16	1981-97
Mexico	2	5.0	10	1982-91, 1995-96
Panama	1	14.0	14	1983-97
Peru	3	6.3	19	1976-77, 1978-81, 1983-98
Uruguay	3	2.0	6	1983-86, 1987-88, 1990-92
Venezuela	3	3.3	10	1983-89, 1990-91, 1995-98

Source: Authors' calculation.

Table 6

Means of Variables in the Database (1980-2002)

	All	Non-crisis	Crisis	Number of observations
Fiscal variables				
Total Public Debt/GDP (1990-2002)	38.7	30.8	47.5	68
Debt interest payments on total public debt / GDP	2.9	2.1	3.5	245
Short term debt / GDP	9.1	7.6	10.2	264
Short term interest /GDP	0.5	0.5	0.6	264
Primary balance / GDP	1.0	0.6	1.3	183
External variables				
External public debt / GDP	35.1	25.4	42.1	266
Current account balance / GDP	–2.4	–3.2	–1.8	276
Financial account balance / GDP	0.9	3.7	–1.1	275
Foreign Direct Investment (net inflows) / GDP	1.9	2.6	1.3	265
Reserves / GDP	7.7	8.8	7.0	264
Interest on external debt / GDP	3.3	2.9	3.7	264
Interest on external debt / XGS	15.2	13.2	16.6	264
Other variables				
Openness / GDP	52.2	53.9	50.9	276
Real growth GDP (percent)	2.4	2.8	2.1	276
Inflation (percent)	138.0	20.2	226.5	275

Source: Authors' calculation.

Table 7

Regressions Results: Coefficient Estimates
(Dependent Variable: Debt Crisis Indicator)

	Marginal effect	*Logit* coefficient	z-value
External public debt / GDP	0.009	0.09	2.03
Financial account balance / GDP	–0.029	–0.16	–2.71
International Reserves / GDP	–0.023	–0.12	–2.64
Short term debt / GDP _1	0.012	0.07	1.82
Public Debt interest payments / GDP	0.060	0.33	2.01
Openness / GDP	–0.003	–0.02	–2.98
Real growth GDP (percent) _1	–0.024	–0.13	–1.72
Constant		–2.44	–2.60
Lagged crisis indicator	0.762	4.42	7.30

Notes: 1/ *Logit* regression with robust variance estimates, allowing for country-specific variances (Huber White sandwich estimator). 2/ Marginal effects calculated at sample means for each variable. For the crisis indicator (dummy variable), marginal effect has been calculated for the change from 0 to 1.

Source: Authors' calculation.

Table 8

Regressions Results: Model Performance
(Dependent Variable: Debt Crisis Indicator)

	Early Warning Model
Observations	225
Wald-test for joint significance	Chi 2 (8) = 198.98
Debt crisis entries correctly	Argentina 1995 and 2001, Brazil 2001, Chile 1983, Ecuador 1999, Mexico 1982 Peru 1983 and 1998, Uruguay 1983, Venezuela 1983 and 1995.
Debt crisis entries not predicted	Colombia 2000, Ecuador 1982, Dominican R. 1992 and 1995, Uruguay 1990.

Source: Authors' calculation.

ratio. Trade openness and real growth also matters; the former encapsulate the effects of currency mismatch, while the latter reveal the importance of the snowball effect in crisis episodes.

Finally, the model performance is summarized in Table 8. Our logit model predicted the majority of debt crises entries, while sending no false alarm. The performance of the model could be improved significantly if data were in a quarterly frequency, which would allow more debt crisis entries.

5. Concluding remarks: the Original Sin and roads to redemption

This paper has argued that the poisonous cocktail of growth slowdown, currency depreciation and dollarized liabilities played a key role in recent public finance crises in some Latin American countries. Foreign currency-denominated debts intensify the uncertainty of public debt service, thus lowering credit ratings. As stressed by Eichengreen, Haussman and Panizza (EHP, 2003), "if countries attempt to minimize these risks by limiting their recourse to foreign sources of funding, they may then be starved of the finance needed to underwrite their growth. The process of economic and financial development will be slowed. Countries in this situation thus face a Hobson's choice".

These authors construct different indicators of original sin and explore the causes of the phenomenon. A first hypothesis is that original sin is a symptom of inadequate policy credibility, which tends to be a particular problem in developing countries. In this view, original sin is not a problem in itself; it is more of a symptom, signaling the presence of weak institutions or rule of law. Reinhart, Rogoff and Savastano (2003) show that a poor track on debt repayment or inflation lowers the rating of countries and increases risk.

An alternative definition of original sin is the generalized liability dollarization that prevails in Latin American countries. Large RER devaluations take place in the context of sudden stops of capital flows, which in turn can be explained by externalities such as distortionary taxes and low tax bases, weak rule of law and poor creditor's protection (Calvo, 2003). If original sin reflects institutional weaknesses, there are no easy tricks, like compulsory "pesificación" or a quick UF.[14] Calvo emphasizes that if Institutions are slow to change, full dollarization may be a second-best solution. This is by the way the same prescription made by Eichengreen and Haussman (1999) in their seminal paper, and this is why many people associate original sin with dollarization. The argument is that once the dollar is accepted for all domestic payments, currency mismatch dissolves, and maturity mismatches are attenuated, because it becomes easier to issue long term papers in dollars.

If we discard this drastic solution,[15] the other way is to become more like Australia, achieving redemption from original sin and delivering from the fear of float by reducing debts and inflation and developing deep and liquid financial domestic markets. The countries should then accumulate a track record and develop a reputation to maintain price stability. IMF surveillance would have to pay much greater attention than in the past to the build-up of vulnerable external and domestic debt positions in emerging economies. According to Goldstein (2003), the Fund's

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[14] The "pesificación" refers to the process of the compulsory conversion of dollar-denominated debts in Argentina, and the UF is the "Unidad de Fomento", a CPI indexed unit generally used in Chile for medium and long-term contracts.

[15] Dollarization was promoted intensively at the end of the Nineties by some International Finance Institutions. While Ecuador and El Salvador adopted full dollarization, the rest of Latin American countries has rather moved to more flexible exchange rates.

staff now argues that Latin American countries ought to be aiming toward eventual upper limits on government debt-to-GDP ratios of 25-30 per cent and that fiscal policy should be dominated by the debt constraint when debt ratios reach the upper limit of a prudent band.

This standard advice is somewhat contradicted by the fact that, no matter the macroeconomic performance, most development countries and all Latin American countries have an index of original sin of one. In other words, some countries have been unable to borrow abroad in their own currencies even with sound public finances, low inflation and deep financial markets. Consistently, the relationship between institutional quality and original sin is neither statistically nor economically significant, according to EHP.

The proposal of EHP to overcome the original sin is to develop an appropriate currency basket index, a unit of account that would include a well-diversified set of emerging-market and developing-country currencies, weighted by their GDPs at purchasing power parity. This unit will be more stable than the US dollar, since shocks that are positive for some economies will be negative for others. Then the International Financial Institutions should start issuing debt in such an index. The IFI's would thereby eliminate the currency mismatch generated by their own lending, thus becoming a solution instead of a source of original sin. The only practical way for developing countries to escape original sin is to develop an international initiative to build a market for this currency basket index.

Other proposals try to ensure sustainability by diminishing the impact of the snowball effect, or the lack of growth, in public finance. For instance, Borensztein and Mauro (2002), arguing that debt crises are generally triggered by growth slowdown, suggest that countries could protect themselves by issuing bonds indexed to the real growth of rate of their GDP. This mechanism would then help to diminish the pro-cyclical bias of fiscal policy, lowering interest debt payments in bad times and paying more when GDP gap is positive, maintaining therefore the debt/GDP ratio at sustainable levels. Promoting this kind of self-insurance schemes would be another challenge to International Finance Institutions.

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