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IDA in UF:

On the benefits of changing the currency denomination of concessional lending to low-income countries[1]

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Executive summary

Developing countries tend to overwhelmingly denominate their external debt in a few major foreign currencies. This makes the domestic cost of debt service dependent on the real exchange rate, which is a price that tends to strengthen in good times and weaken in bad times, thus making debt service anti-cyclical, rising just when it is most difficult to pay. Countries have a good reason to borrow in foreign currency: domestic currency markets abroad are essentially non-existent. Even the IBRD window of the World Bank lends in dollars because it must fund itself in the same capital markets that do not accept local currency denominations.

The IDA window also lends in dollars but does not have this excuse. It is funded with fiscal resources and could be lent, in principle, in any unit it wished. We argue that it should lend in inflation-indexed domestic currency, or UFs, following Chile's *Unidades de Fomento*.

We base our argument on the following criteria. First, we review the general literature on the negative consequences of foreign-currency debt for domestic stability, fiscal solvency and the effectiveness of monetary policy. We then show that these effects are present in the universe of IDA countries and in the characteristics of debt service to IDA. We find that real depreciations have a significant and persistent impact on the IDA-debt to GDP ratio and the IDA-interest payments to GDP ratio. We show that while the volatility in the dollar value of the typical UF of an IDA country is about 15.6 percent per year, an IDA debt-weighted basket of UFs has had since 1980 a volatility of about 3.5 percent per year. Moreover, the volatility of a random sample of the UFs of half the IDA members would have a volatility of 4.3 percent. This indicates that there are ample opportunities

for risk sharing among IDA countries. In fact, we find that a random sample of 50 percent of IDA members would achieve almost the same We further show that denominating the IDA portfolio in UFs in 1985 would have achieved the same NPV of reflows over the last 15 years, had the interest rate been only 9 basis points higher. We argue that this is so because in the post-1985 IDA countries performed very poorly. In the coming years, we believe that a UF denominated portfolio would generate a higher NPV than a dollar denominated portfolio. We base our view on the fact that this actually holds true provided that the sum of the real appreciation of the IDA basket and US inflation exceed 1.37 percent per year. With US inflation running at about 2 percent and since the real exchange rate tends to appreciate in a recovery, this threshold does not appear high. Moreover, we argue that even if the dollar value of the NPV of IDA reflows were to decline, it would still be preferable to denominate the loans in UFs. At present, IDA reflows and hence IDA's lending capacity declines in terms of consumption units if countries do well. By contrast, if countries do poorly, the value of reflows in terms of GDP increases, making the debt service burden higher. Denominating the debt in UFs keeps the value of the reflows and the lending capacity of IDA constant in units of consumption, which is a more meaningful economic metric.

We propose that IDA offer countries the right to convert all existing IDA loans to inflation-indexed local currency debt through a once-and-for-all balance-sheet operation. We suggest that this offer should be made contingent on a critical number of countries participating in the process in order to assure that there is enough risk-sharing to assure that the IDA portfolio has limited exchange rate volatility. We suggest that the participation of half of the countries would be more than is required.

Disbursements, interest and amortization payments would be made in dollars but the amounts would be indexed to the country's UF. We propose to maintain unchanged the other financial conditions of loans such as interest rates and amortization schedules.

I. Introduction

The recent literature on economic crises has identified balance sheet effects as a major source of problems. If a country's external obligations are overwhelmingly denominated in foreign currency – if it suffers from the problem that Eichengreen and Hausmann (1999) refer to as "original sin" – then when it accumulates a net debt, as developing countries are expected to do, it will have an aggregate currency mismatch on its balance sheet in the sense that movements of the exchange rate will induce aggregate wealth effects. To some, this might seem like an inconsequential financial detail. The currency denomination of the entries on different sides of the national balance sheet has not, until recently, figured prominently in theories of economic growth and cyclical fluctuations. Macroeconomic stability, according to the conventional wisdom, reflects the stability and prudence of a country's monetary and fiscal policies. The rate of growth of per capita incomes depends on rates of human and physical capital accumulation and on the adequacy of the institutional arrangements determining how that capital is deployed. Fine points like the currency in which a country's foreign debt is denominated, by comparison, are regarded as specialized concerns of interest primarily to financial engineers.

Recent research has shown that the neglect of mismatch problems constitutes an important oversight. In particular, the composition of external debt – and specifically the extent to which that debt is denominated in foreign currency – is a key determinant of the stability of output, the volatility of capital flows, the management of exchange rates, and

the fiscal and external solvency of a country as measured, inter alia, by its credit rating (Eichengreen, Hausmann and Panizza 2003).

A. A review of Original Sin

The fact is that we do not understand why so many international obligations are denominated in the currencies of a small handful of advanced economies. To put the point another way, we do not adequately understand why developing countries find it so difficult to borrow in their own currencies.

Superficially, the answer may appear as self-evident. Foreign investors are reluctant to hold claims on countries with poor policies and weak market-supporting institutions: you would not expect foreigners to do things that even residents are unwilling to do. There is something to this view. But, as soon as one begins to probe deeper, one discovers that the nature of the problem is not so evident. The weakness of institutions of contract enforcement and the instability of macroeconomic and financial policies may help to explain why some countries cannot borrow at all, but this is not the same as explaining why many of those countries that can in fact borrow find it so hard to borrow in their own currencies. And while histories of high inflation and fiscal profligacy can explain the reluctance of international investors to hold claims denominated in the currencies of some developing countries, investors seem equally reluctant to hold claims denominated in the currencies of emerging markets with track records of fiscal and monetary prudence. Moreover, if the issue is fear that a borrower may be tempted to inflate away the debt denominated in his own currency, then we should observe inflation-indexed debt or

short-term debt (which is harder to inflate away), not necessarily dollar-denominated debt. In fact, all countries that are able to borrow abroad in their own currencies are also able to borrow at long maturities and at fixed rates in their domestic markets. The converse, however, is not true: more than a few countries that are able to convince local savers to buy long-term obligations in nominal or inflation indexed terms – consider for example India, Israel and Chile – but are unable to get foreigners to hold these claims. This suggests that there may be something about the currency denomination of debt that is not just associated with fear of inflation and expropriation.

To put the point another way, while the quality of policies and strength of institutions vary enormously across countries, virtually all emerging markets must borrow in foreign currency. At end of 2001, according to the US Treasury, Americans held $84 billion of developing country debt, but only $2.6 billion was denominated in the currencies of those countries. Of the $648 billion in overseas debt held by Americans at the end of 2001, 97 percent was denominated in 5 currencies: the US dollar, the euro, the British pound, the Japanese Yen and the Canadian dollar. Of the $434 billion of developing country debt securities that were outstanding on average between 1999 and 2001, less than 12 billion was denominated in the currency of these countries[2]. Clearly, the problem is too widespread to be easily explicable in terms of the weakness of policies and institutions, whose prevalence is less. It is as if emerging markets suffer from an inherited burden, almost irrespective of the policies of their governments. This is why the difficulty they face in borrowing abroad in their own currencies is sometimes referred to as "original sin" (Eichengreen and Hausmann 1999).

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[2] These numbers are from Tables 1 and 3 in Chapter 1 below.

The discussion on the reasons for this phenomenon is usually based in some form of market distortion, whether on incentives or on externalities. For some, (Dooley, 1999, Burnside, Eichenbaum and Rebelo, 2000) countries borrow in foreign currency because they want to. They face a moral hazard problem that distorts their incentives. They believe that in case of a devaluation, they will be bailed out. We find this explanation unconvincing and have argued instead for an explanation based on missing markets: they do not borrow in local currency because they cannot.

B. Lending by the World Bank

To bring the point home, we should ask: why does the IBRD window of the World Bank lend in foreign currency, exposing the member countries to an inconvenient currency mismatch? The answer in this case is clear. It is because that is the denomination of the debt it is able to place in international capital markets and thus lending in local currency would expose the bank to an inconvenient currency mismatch problem. Hence, missing markets on its liability side prevent the IBRD from lending in more appropriate forms.

Eichengreen and Hausmann (2003) proposed that the IBRD window attempt to develop a debt market denominated in a basket of inflation-indexed emerging market currencies. They show that such a basket would exhibit trend appreciation, relatively low volatility and a negative covariance with consumption growth in G-10 countries, thus representing a good diversification vehicle for developed-country investors. Such a debt market would allow the World Bank to lend to each of the members of the index in their own inflation-

indexed currency, thus making the World Bank a solution for, rather than a source of, original sin.

However, it is harder to justify why IDA – the concessional window of the World Bank – also denominates its claims in foreign currency. After all, IDA is funded with fiscal resources and the only reason for requiring repayment is to permit the institution to maintain a certain lending capacity over the long run through the use of the reflows from borrowers. In this paper, we study ways to achieve this without creating the unnecessary risk of exposing borrowing members to a currency mismatch. As we will show, there are ample opportunities for risk-sharing among the borrowing members of IDA, making it feasible to *lend in inflation-indexed local currency at current interest rates while achieving the same level of IDA reflows*.

The paper is structured as follows. Section 3 discusses the importance of the currency denomination of debt for the macro stability of developing countries in general. Section 4 analyzes these issues for the debt service to IDA of member countries and finds similar characteristics. Section 5 simulates and analyzes its impact on the total IDA portfolio as well as on member countries. Section 6 presents our proposal and the policy issues it raises. Section 7 presents some concluding remarks.

II. Implications of foreign currency debt in developing countries

Countries with original sin that accumulate a net foreign debt – as developing countries are expected to do – will have a currency mismatch on their national balance sheets in the sense that movements in the real exchange rate will have aggregate wealth effects. This makes the real exchange rate a relevant price in determining the capacity to pay. Since the real exchange rate is quite volatile and it tends to depreciate in bad times, original sin significantly lowers the creditworthiness of a country. Moreover, the wealth effects limit the effectiveness of monetary policy, as expansionary policies may weaken the exchange rate, cause a reduction in net worth and will thus be either less expansionary or even contractionary (Aghion, Bacchetta and Banerjee 2001, Céspedes, Chang and Velasco (2003). This renders central banks less willing to let the exchange rate move, and they respond by holding more reserves and aggressively intervening in the foreign exchange market or adjusting short-term interest rates pro-cyclically (Hausmann, Panizza and Stein, 2001, Calvo and Reinhart, 2002). The existence of dollar liabilities also limits the ability of central banks to avert liquidity crises in their role as lenders of last resort (Chang and Velasco, 2000). And, dollar-denominated debts and the associated volatility of domestic interest rates heighten the uncertainty associated with public debt service, thus lowering credit ratings (Hausmann, 2003).

Given these facts, it is no surprise that countries afflicted by original sin have a hard time achieving domestic economic stability. Their incomes and their capital flows are more volatile than those of countries free of the phenomenon (Eichengreen, Hausmann and Panizza, 2003). Since financial markets know that mismatches are a

source of financial fragility, developing countries burdened with them are charged an additional risk premium when they borrow, forcing them to skate closer to the edge of solvency. A shock to the exchange rate can then cause asset prices to move adversely, tipping them over the precipice. But if countries attempt instead 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.

It has been amply recognized that developing countries tend to be more volatile than industrial countries in the sense that they have a more unstable rate of GDP growth (IDB, 1995, Hausmann and Gavin 1996). Table 1 shows that their GDP growth is more than twice as volatile as that of industrial countries: 5.8 percent per annum instead of 2.7. However, if a country's debt is denominated in foreign currency – say US dollars – its capacity to pay will be related, not to the value of its GDP in constant local currency units (LCU), but in US dollar terms. Table 1 shows that the volatility of changes in real US$ GDP is almost 3 times higher than in LCU for developing countries. Hence, the typical industrial country without original sin would face a relevant volatility of 2.7 percent per annum, while the typical developing country with original sin would face a relevant volatility of 13 percent.

Table 1: Volatility of GDP Growth (1980-1999)

	All Countries	Industrial Countries	Developing countries
Real GDP Growth	5.0%	2.7%	5.8%
Real Dollar GDP Growth	12.3%	10.3%	13.0%
GAP in RER 5-yr MA	49.7%	18.1%	61.2%
N. Countries	43	11	32

The greater relevant volatility in the capacity to pay comes from the fact that original sin makes the real exchange rate matter for debt service and this variable is very volatile in developing countries. Table 2 presents the volatility of the real exchange rate for a sample of developed and developing countries. The volatilities are normalized to be equal to 1 for the sample as a whole. The table clearly shows that the volatility of the real exchange rate is between 2 and 3 times higher in developing countries. Hence, not only does the real exchange rate matter for debt service in countries with original sin, but in addition, the real exchange rate in these countries tends to be significantly more volatile.

Analysts often argue that a volatile real exchange rate does not matter if the debt is sufficiently long term. If purchasing power parity holds in the long run, then deviations of the real exchange rate should not be very long-lived and a country's solvency should not be much affected by relatively temporary movements in the real exchange rate. Markets will not change their minds about the solvency of a country based on short term movements of the real exchange rate. However, this view is not compatible with the facts at hand. Table 1 shows that the volatility of movements in the five-year moving average

of the real multilateral exchange rate is very high. The table calculates the average percentage gap between the maximum and the minimum value of a 5 year moving average of the real exchange rate for a sample of developed and developing countries for the period between 1980 and 2000. The table indicates that the 5-year moving average moved by more than 60 percent in the average developing country, more than three times the magnitude of industrial countries[3]. Said differently, the 5-year average value of the debt to GDP ratio would have moved by more than 60 percent in the typical developing country through real exchange rate valuation changes alone! Table 2 shows that the greater volatility of the real exchange rate in developing countries is as much of a feature at 5 years than at 1 year and that it has remain the same in the 1980s and 1990s.

Table 2: Volatility of the Real Exchange rate

	1 YR Volatility	**5YR Volatility**	**1 YR Volatility 1980s**	**5YR Volatility 1980s**	**1 YR Volatility 1990s**	**5YR Volatility 1990s**
Developing Countries	1.292	1.283	1.327	1.321	1.234	1.249
Industrial Countries	0.506	0.513	0.471	0.473	0.565	0.545
Difference	0.786	0.770	0.855	0.848	0.669	0.703
t-statistics	4.262	4.818	3.769	3.689	3.176	4.130
P (Dev>Ind)	1.000	1.000	1.000	1.000	0.999	1.000

Another way to look at this data is by studying the events in which there has been a large decline in the capacity to pay foreign debt. Table 3 shows the occasions in which the dollar value of GDP over a two-year period fell by more than 30 percent[4]. Two facts clearly emerge from the table: the events identified tend to capture many of the recent

[3] The multilateral exchange rate tends to be smaller than their bilateral real exchange rate vis a vis the US dollar, especially for industrial countries.

[4] We use a two-year period in order to take account of the fact that a large depreciation will have a different impact on the one-year decline in GDP depending on the month in which it takes place. A two-year period helps smooth out this effect.

debt crises. More importantly, while the average decline in dollar GDP for this sample of countries was 46 percent, the decline in GDP in local currency units was less than a twentieth of that. In other words, the collapse in the capacity to pay is more related to real exchange rate movements than to output declines.

Table 3: Large Drops in Dollar GDP

Country	Year	Change in Dollar GDP	Change in Real GDP	Country	Year	Change in Dollar GDP	Change in Real GDP
Nigeria	1999	-74%	-2%	Syrian Arab Republic	1988	-40%	-13%
Nigeria	1987	-68%	28%	Trinidad and Tobago	1987	-38%	-20%
Uruguay	1984	-67%	-8%	Togo	1982	-38%	-15%
Egypt, Arab Rep.	1991	-63%	4%	Mexico	1982	-38%	8%
Indonesia	1998	-60%	7%	South Africa	1985	-38%	4%
Sierra Leone	1986	-57%	-10%	Ecuador	1987	-38%	1%
Mexico	1983	-56%	-9%	Egypt, Arab Rep.	1992	-37%	6%
Uruguay	1983	-55%	-17%	Indonesia	1999	-37%	-7%
Costa Rica	1982	-54%	-10%	Egypt, Arab Rep.	1990	-36%	10%
Nigeria	1986	-52%	1%	Trinidad and Tobago	1986	-36%	-13%
Syrian Arab Republic	1989	-48%	9%	Swaziland	1985	-36%	2%
Jamaica	1985	-46%	4%	Namibia	1985	-35%	15%
Honduras	1991	-46%	-4%	Paraguay	1985	-35%	13%
Dominican Republic	1985	-46%	4%	Ecuador	1999	-33%	-2%
Togo	1994	-45%	-12%	Jamaica	1984	-33%	12%
Chile	1983	-45%	-13%	Papua New Guinea	1999	-33%	-5%
Sierra Leone	1990	-44%	-15%	Mexico	1995	-33%	1%
Dominican Republic	1986	-44%	10%	Sierra Leone	1998	-31%	-22%
Senegal	1994	-43%	-4%	Sweden	1982	-31%	-1%
Korea, Rep.	1998	-41%	-5%	Papua New Guinea	1998	-31%	-4%
Jordan	1989	-41%	-20%	Madagascar	1988	-31%	7%
Thailand	1998	-41%	-12%	Jamaica	1992	-30%	-10%
Honduras	1990	-40%	0%	Morocco	1982	-30%	1%
Jordan	1990	-40%	-19%	Venezuela	1984	-30%	4%
Guatemala	1987	-40%	3%	AVERAGE	-46%	-2%	

One implication of this analysis is that countries suffering from original sin should be significantly riskier than countries without this burden, after controlling for other determinants of creditworthiness such as debt ratios. This may help explain the poor predictive capacity of fiscal fundamentals such as the debt to tax revenue ratio as a

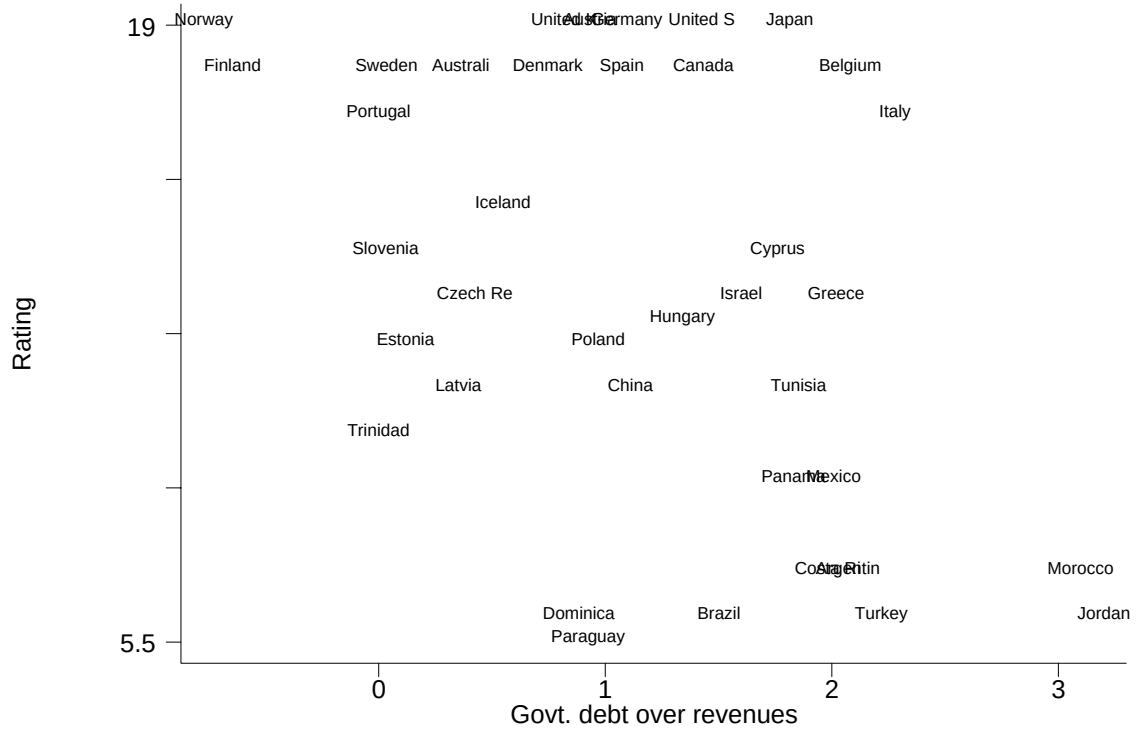
determinant of credit rating, as is clear from Figure 1.[5] Countries like Brazil, Argentina, Turkey and Mexico had a debt to tax revenue ratio that was broadly similar or in fact lower than those of the Italy, Belgium, the US, Canada or Spain while their credit rating could not be more different.[6] As argued in Hausmann (2003), original sin lowers evaluations of solvency because it heightens the dependence of debt service on the evolution of the exchange rate, which is more volatile, has the wrong correlation with the capacity to pay and may be subject to crises and crashes.

[5] The debt to GDP ratio is an even worse predictor. However, it can be argued that public debt is serviced out of the portion GDP that the government can tax. Since tax revenue to GDP ratios are lower in developing countries they should therefore have a lower debt to GDP ratio for the same rating.

[6] We use the ratings from Standard and Poor's. We converted the S&P rating into a numerical variable by adopting the following criterion. Selective default = 0, C=2, CC=2.5, CCC= 3, B-=4, and each extra upgrade one point. The maximum is 19 that corresponds to AAA.

[6] We test whether the effect of credit rating was due to non-linearities around the investment grade threshold but find no evidence for this hypothesis.

Figure 1: Credit Rating and Debt to Revenue Ratios



To test this hypothesis, we regress foreign-currency credit rating of countries on two standard measures of fiscal fundamentals -- public debt as a share of GDP and public debt as a share of tax revenues-- on the level of development, on the magnitude of the foreign debt (SHARE) and on original sin. The equations are estimated by weighted double-censored Tobit. The results, in Table 4, show a large and statistically significant effect of original sin on credit ratings.[7] Redemption (the total elimination of original sin) is associated with an improvement of ratings by about five notches. This effect is strong and present even though we control for the level of economic development, as captured by the real GDP per capita and for the magnitude of the public debt measured either as a share of GDP or as a share of tax revenues.

[7] These results are robust to alternative definitions of original sin and estimation techniques. See Hausmann (2003), Eichengreen, Hausmann and Panizza (2003).

Table 4: Original Sin and credit ratings

	(1)	(2)	(3)	(4)
	RATING1	RATING1	RATING1	RATING1
			Dropping Financial Centers	
OSIN3	-5.845	-5.644	-5.214	-4.955
	(4.08)***	(4.01)***	(3.31)***	(3.21)***
DE_GDP	-2.421		-2.285	
	(2.50)**		(2.32)**	
DE_RE		-0.999		-0.975
		(2.49)**		(2.39)**
LGDP_PC	2.916	2.670	2.976	2.729
	(8.48)***	(6.16)***	(8.36)***	(5.97)***
SHARE2	2.187	2.787	1.810	2.405
	(1.43)	(1.52)	(1.09)	(1.18)
Constant	-8.058	-5.962	-9.119	-7.037
	(2.12)**	(1.28)	(2.29)**	(1.44)
Observations	56	49	53	46

t statistics in parentheses (weighted Tobit estimations)

*** significant at 10%; ** significant at 5%; *** significant at 1%**

Hence, original sin helps explain why countries suffer from creditworthiness problems: it is not due only to their incapacity to limit debt accumulation; it is due to a large extent to the fact that the structure of the debt they issue makes them risky at levels of debt that are consistent with a AAA rating in other countries.

III.Original sin and the capacity to pay IDA obligations

a) Short run effects

In this section we study the characteristics of debt service to IDA in the countries that borrow through this World Bank window. We evaluate the impact that different types of shocks have on interest payments, debt outstanding and net amortizations, all measured as a percentage of GDP (see Appendix for the list of member countries). We show that a depreciation of the exchange rate is associated with a significant (and economically meaningful) increase in all three variables. These findings are robust to different specifications and the inclusion of other controls.

The benchmark regression is the following:

$$d_{i,t} = \alpha_i + \beta_e e_{i,t} + \beta_\pi \pi_{i,t} + \beta_y y_{i,t} + \varepsilon_{i,t}$$

where all variables are measured in log differences; $d_{i,t}$ represents either the log differences on interest payments on IDA debt measured as a proportion of GDP, the debt to GDP ratio, or debt amortizations for country *i* and year *t*; $e_{i,t}$ is the exchange rate; $\pi_{i,t}$ is the domestic inflation rate; $y_{i,t}$ is the GDP measured in domestic currency. We estimate the model both in random and fixed effects.

Our preferred specification involves normalizing each variable country by country by its respective standard deviation. This methodology produces in general better results than running the level regression because countries that exhibit excessive variance are overweight in the standard ordinary least squares (OLS). This is exactly the problem that appears when there is heteroskedasticity in the data, and requires generalized least squares GLS to obtain consistent standard deviations. We adopted the weighted least square (WLS) which is a feasible alternative to deal with the problem. See Green (1994) for a detail treatment. The results after normalizing are the following:[8]

[8] The results for the data without normalization are similar but the standard deviations are much larger – as should be expected.

TABLE 5: Estimates of the exchange rate effects on selected debt measures.

	Interest Payments/GDP		Debt/GDP	
	OLS	FF	OLS	FF
Exchange Rate	0.33842	0.41917	0.51755	0.55506
	0.03733	0.04147	0.03459	0.03822
	9.1	10.1	15.0	14.5
Domestic Inflation	0.09242	0.20929	0.11479	0.28540
	0.06092	0.08054	0.05644	0.07422
	1.5	2.6	2.0	3.8
GDP in Local Currency	-0.24048	-0.39652	-0.33376	-0.52211
	0.05132	0.07768	0.04755	0.07158
	-4.7	-5.1	-7.0	-7.3

Let us concentrate, first, on the coefficient on the exchange rate. As can be seen, it enters significantly in both variables and in both specifications. Furthermore, the coefficients are extremely close across specifications suggesting (as indeed occurs) that the Hausman specification test is passed. The interpretation of the coefficient is as follows, a one percent exchange rate depreciation increases the interest payments measured as a percentage of GDP by 0.34 percent and increases the debt to GDP ratio by 0.51. The fixed effects results are very similar. These elasticities suggest a tremendous sensitivity of debt burden measures to exchange rate movements.

Domestic inflation on average worsens debt service capacity, although the effect is only statistically significant for the debt to GDP ratio. These results should have been expected considering that in most of these countries the debt is in foreign currency, so that inflation does not erode it away. Notice that the point estimates are statistically smaller than the ones from the nominal exchange rate.

Finally, notice that GDP in local currency has a negative and significant impact on the interest payments and the debt to GDP ratio. The idea is that an increase in domestic

GDP (other things equal) will reduce the burden of the debt and the interest payments. These results are robust to different specifications, countries, and time periods. It is always the case that exchange rate depreciations roughly increase the debt to GDP ratios in about a half and the interest payments in about a third.

b) Long run effect: impulse responses.

Let us now evaluate the long run implications and the dynamics of the exchange rate depreciation on the debt and its components. The results from the previous section concentrate on the contemporaneous effect of a depreciation. In this section, by including lags in the regression we study the debt dynamics and its long run effect.

We estimated the same model as before but including three lags on all variables. In the next figures we show the impulse responses of the three variables of the debt to a 1 percent permanent exchange rate depreciation.

FIGURE 2.1: Interest rate payments to GDP impulse response

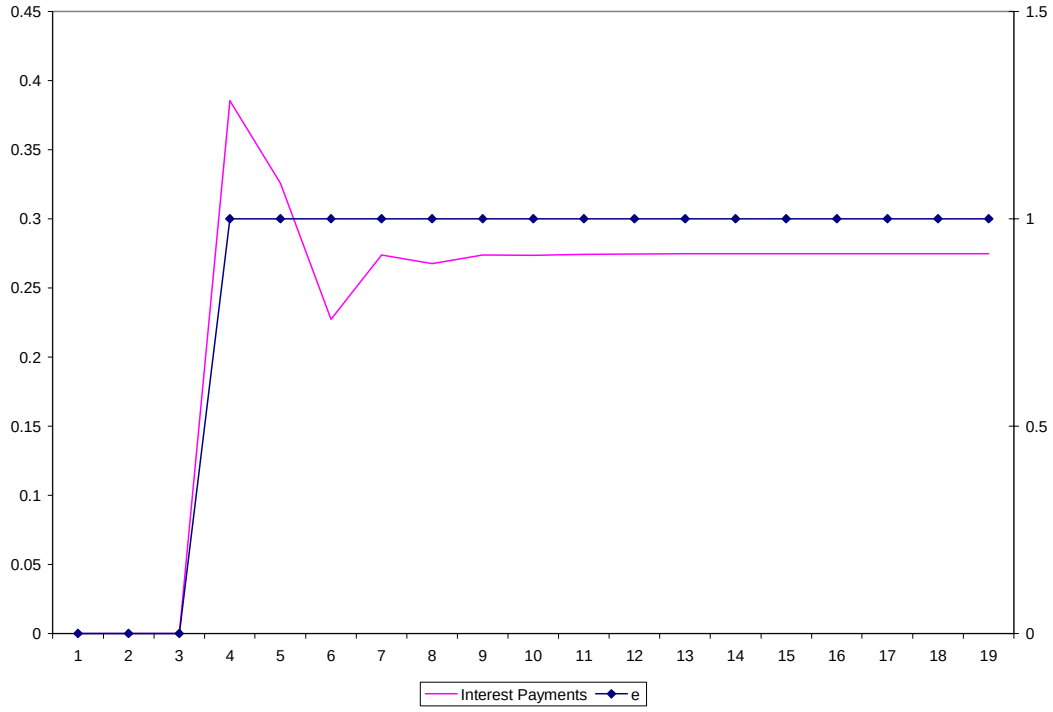
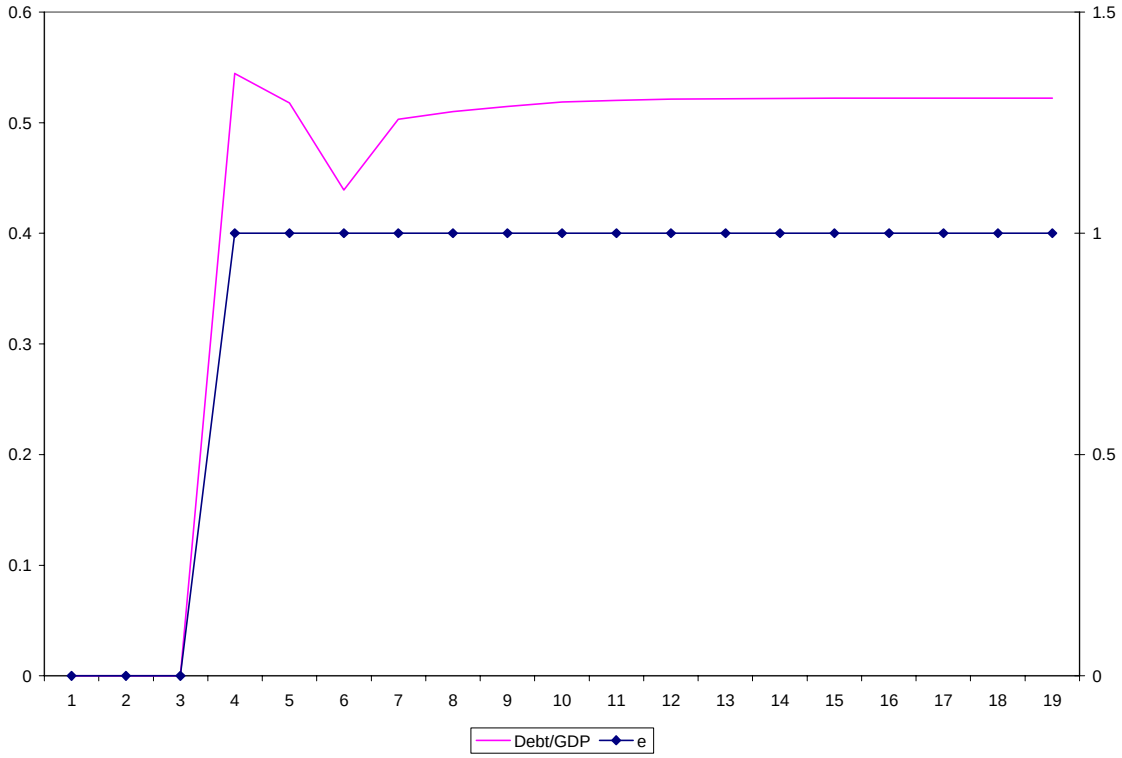


FIGURE 2.2: Debt to GDP ratio: impulse response



As is clear from the pictures there is a slight overshooting of the exchange rate effect on the debt dynamics, but the long run impact continues to be economically significant and similar to the one estimated for the contemporaneous effect. The interest payments react immediately to the exchange rate depreciation, increasing in about 0.4 percent of GDP – which is in line with the OLS results. Five years later the exchange rate adjustment has an effect on the interest burden of about 0.27 percent.

Interestingly, the short and long run impact on the debt to GDP ratio are almost identical. The debt to GDP ratio increases 0.54 percent, which 5 years later stabilizes to 0.52 percent. As can be seen there is some dynamics estimated by the model, but it matters little to the final behavior. This result is consistent with the idea that real exchange rate innovations tend to behave in a manner close to a random walk, in the sense that there is little mean reversion in the stochastic process of the real exchange rate.

In summary, this section has shown that important aspects of the debt dynamics are significantly affected by exchange rate movement. These effects are economically meaningful. The short run effects are in general larger than the long run elasticities, but not by much. Finally, the exchange rate is the larger and most meaningful variables affecting changes in the capacity to pay.

IV. Changing the way IDA lends

With 83 member countries, IDA should be able to achieve a significant amount of risk diversification among its members. One way this diversification could occur is by lending to each country in terms of inflation-indexed local currency. To facilitate the exposition, we will refer to this unit as UF – as the Chilean *Unidades de Fomento* are usually called. We ask, what would be the characteristics of the portfolio of IDA loans if these were denominated in the UF of each member country. This would mean that the debt would have a constant value in terms of real domestic consumption, instead of volatile and counter-cyclical foreign currency.

In this section we study the feasibility of this approach by studying first how much risk would the IDA portfolio have if it were denominated in the UF of each member country. We first analyze the volatility in the value of a portfolio of a basket of UFs of IDA countries where country weights would be based on their current debt weights in the IDA portfolio. We compare this volatility to that of each country UF. Second, we construct a simulation of all IDA flows from 1980 to 2000 assuming that the loans would have been denominated in the UF of each member country. We study the implication for IDA and for the member country capacity to pay in the face of shocks.

A. The volatility of an IDA basket of inflation-indexed local currencies

How volatile would the IDA portfolio be if it was denominated in the UF of each country? We will show first that changing the currency denomination from dollars to

domestic indexed debt has important risk diversification characteristics that have not been exploited.

The exercise we perform in this section is the following: First, we compute the standard deviation of the dollar value of the UF of each IDA country, as well as the average standard deviation in the sample. Second, we compute the average exposure of IDA to these countries. This is calculated as the average outstanding debt to each country divided by the IDA total debt. These shares are adjusted yearly to reflect the availability of the data. With the proper shares in place we compute a basket real exchange rate, where the weights in the basket are the exposures. This produces a new series (which is the real exchange rate depreciation of the basket currency). The results are shown in Figure 3.

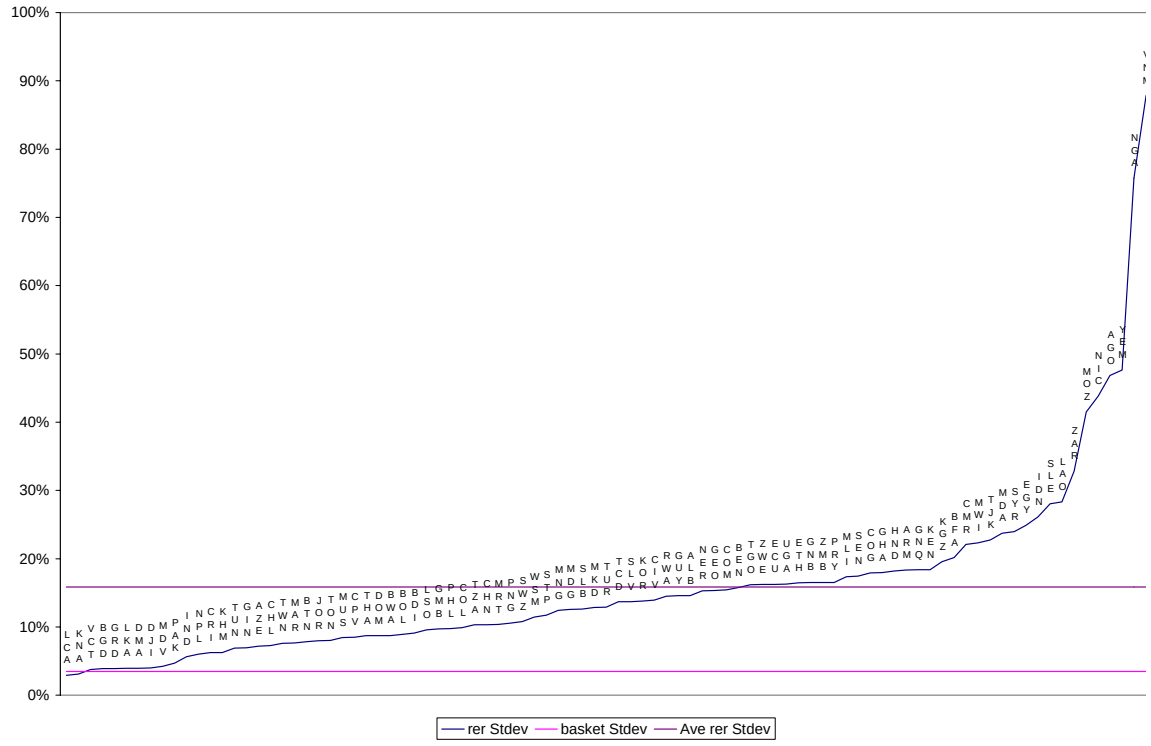


Figure 3. :Volatility of the inflation-indexed local currency values

The average standard deviation of real exchange rate depreciations is 15.88 percent, with a maximum of 87.87 percent and a minimum of 2.92 percent. However, notice that the standard deviation of the basket is only 3.49 percent! Indeed, there are only two countries that individually have smaller standard deviations than the basket. By comparison, the standard deviation of the US$ - Deutsch Mark and US$ - Yen rate averaged over 12 percent in the 1980-2000 period.

This exercise implies that there is a tremendous amount of risk diversification by lending to the countries in UFs. The risk of the overall portfolio is only about a fifth of the average currency volatility of each of its members.

B. Simulating the change in currency denomination

In this section we study the implications of changing the debt denomination – from US dollars to a debt in inflation-adjusted local currency – on the dynamics of the debt both from the point of view of IDA and of the borrowing members.

1. Nature of the simulation

The procedure to simulate the change in debt denomination is the following:

1. For country *i*, we convert the initial debt in the data base into local currency at the prevailing exchange rate.

2. We leave unaffected the dollar value of IDA disbursements, but we convert them into local currency at the prevailing exchange rate in each period.
3. We augment the nominal value of the debt by the domestic inflation rate in each period. We then calculate the amortizations due as the same *proportion* of the debt that is amortized in the original data. This is equivalent to computing an amortization rate in the original data and maintaining it for the domestic currency denominated debt.
4. From the original data, we compute the implied interest rate by dividing the interest payments by the outstanding debt. We assume that this interest rate (which reflects the average lending conditions for each year-country pair) remains the same, except for the fact that it will be increased by a constant premium.
5. We compute a new interest rate on UFs by increasing the implied dollar interest rate by a premium. This premium will be used to make sure that the NPV of IDA reflows in dollars remains the same. We assume the premium to be the same for all countries.
6. Using the new UF interest rate, we calculate the interest payment and the debt dynamics.
7. We iterate the calculation until we find a premium that achieves the same net present value of IDA reflows from ALL countries as in the original data.

It is important to notice that under this assumption the net present dollar value of IDA reflows over the 20 year period is identical to that in the historical data. To compute this

NPV we assumed that the World Bank has a discount rate of one percent[9]. Moreover, the actual value of IDA disbursements year by year is the same as in the historical data. This however allows us to exploit not only the benefits of international diversification, but also of some inter-temporal smoothing as well, as now the path of the interest rate payments and amortizations will differ year by year.

2. Effects on the total IDA portfolio

After cleaning the data[10], we computed the premium required by the WB to keep the net present value of the reflows constant. The required premium was 0.089 percent. This means that the average interest rate would need to increase from 0.724 percent to 0.812 percent.

What happens to the yearly flows of interest and total debt service (interest plus amortizations)? To answer these questions, we look at the total interest payments (Figure 4) and the total debt service (Figure 5) of IDA in the historical and simulated data.

As can be seen, there are moderate differences in the payment schedule. Regarding interest rates, there are years in which the WB would received up to 18 percent more than in the original data, and there are years in which it receives 10 percent less.

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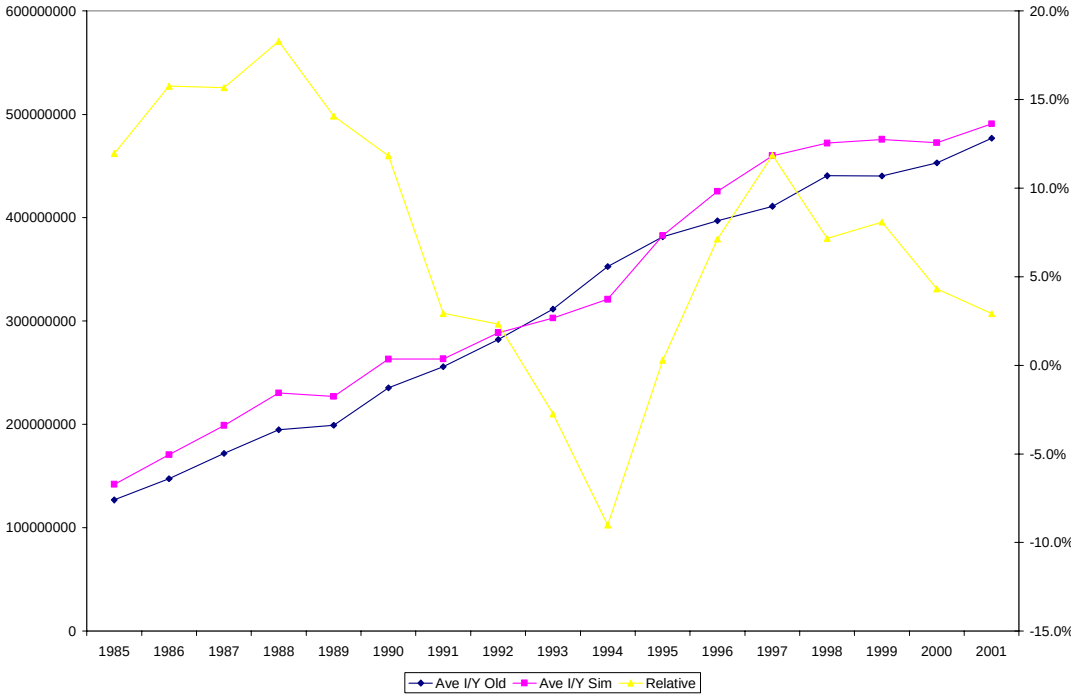
[9] In our simulations we tried with discount rates between zero and five and found almost no difference in the results. Hence, the relative impatience of the WB makes almost no difference to our results.

[10] We had to clean the data for errors in the amortization figures. There were 7 observations that had amortizations (much) larger than the outstanding debt. We maintained the value of total debt exposure, and calculated reasonable values of amortizations and disbursements.

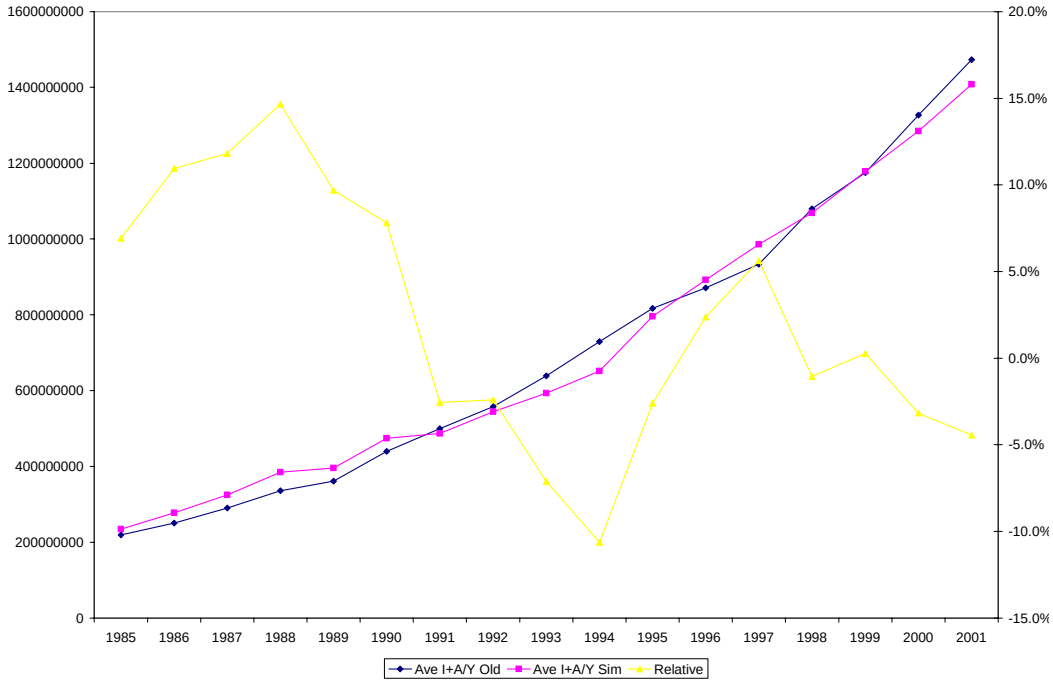
A similar result is obtained regarding the total flows. In this case, the maximum difference is 15 percent, as opposed to more than 18 percent. Still, however, there are sizeable, but not major, differences in the time profile of the flows. Nevertheless, these differences tend to shift the debt burden away from years in which the average real exchange rate of IDA member is weak to years in which it is strong, thus making the debt service better track the capacity to pay.

Figure 4.



Actual and simulated total interest payments: levels and percentage difference

Figure 5.
Actual and simulated total debt service: levels and percentage difference



3. Impact on debtor countries.

The next question is, obviously, what are the implications to the debtors countries of changing the currency denomination. The previous exercise has assured the World Bank that the net present value of the debt repayments remains exactly the same. Now we turn to see the benefits that such change may produce to each country and the transfers it might convey.

We know that on average the ratios of debt to GDP, interest payments or total debt service cannot change much, given that we have not changed the NPV of total IDA reflows or the GDP of the countries. However, there may be a significant change in

behavior through the reallocation of the debt burden across country and over time in a way that may achieve a lower volatility and better cyclical properties of these flows.

We expect the benefit of the change in currency denomination to come in the time-profile of payments and not in the average payments. In other words, when the debt is in foreign currency we know that countries in bad states of the world face a more than proportional increase in their debt burdens, making a bad situation even worse. This is indeed in line with the results obtained in the general literature reviewed in section III and in the regression analysis of IDA countries in section IV. Our goal here is to show that the change in the currency denomination will modify this pattern of correlations.

To show the change in the stochastic properties of the debt to GDP ratios and the interest rate to GDP payments we regressed them in the real and simulated data these variables with respect to output and the real exchange rate. The regression includes country fixed effects and the results presented are from the level regression with normalized variables. However, we also ran equations that included trends, we ran them in first differences, with and without the normalization. The qualitative results of all these exercises remain the same. Nevertheless, we concentrate on the normalized regression in levels.

The results of such an exercise are presented in the table 6.

Table 6. Real and simulated debt.

	D/Y		I/Y		(I+A)/Y	
	Old	New	Old	New	Old	New
Growth	-0.1298	-0.0063	-0.1635	-0.0368	-0.0591	0.0174
	0.0411	0.0464	0.0437	0.0486	0.0373	0.0399
	3.16	0.13	3.74	0.76	1.59	0.29
Real Depreciation	0.3513	0.1361	0.3202	0.0890	0.3004	0.0231
	0.0270	0.0305	0.0287	0.0319	0.0245	0.0262
	13.02	4.47	11.16	2.79	12.28	0.88

As can be seen, in the real data there is a close relationship between debt to GDP ratios and output and the real exchange rate – both coefficients are statistically significant. We find that a shock to the real exchange rate of one standard deviation increases the debt to GDP ratio in 0.35 standard deviations. Notice that when the same regression is run with the simulated data, this elasticity becomes much smaller: only 0.13, suggesting that the debt to GDP ratios of the UF-denominated debt will be less procyclical than the dollar debt. We discuss the interpretation of these coefficients below.

Even more important is the findings on the direct impact of the change in denomination on the flow of payments by the country. The second pair of columns show the results for the ratio of interest payments to GDP[11] - a one standard depreciation of the real exchange rate increases the interest payments burden in 0.32 standard deviations. Similarly, a one standard deviation increase in output decreases the interest payments in 0.16 percent. As before, these are sizeable and economically important effects. However, when the same

[11] The results for the interest plus the amortization are slightly less strong, but qualitatively the same.

regression is run on the simulated data, both coefficients move toward zero – the interest to GDP ratio becomes much less sensitive to both output and the real exchange rate.

The interpretation of these results is clear. In the real data, when output increases the actual interest payments do not increase in the same proportion, meaning that the ratio falls. In good times – when GDP grows – the interest burden falls. However, the counterpart is that a recession would imply a sizeable increase in the debt burden. In the simulated (UF-denominated) data we find that the debt burden variables are less correlated with output. Indeed, in both cases the coefficient becomes smaller and insignificant. This implies that the UF denominated debt is implicitly offering an insurance to the country. The coefficient on the real exchange rate conveys a very similar effect. In the real data, real exchange depreciations increase the debt burden significantly. However, we find that this elasticity becomes less than a third of the original when in the simulated data.

As a final point, it is important to remember that in emerging markets recessions and depreciations usually come hand in hand. Therefore, the excess pro-cyclicality of dollar-denominated debt service should be very significantly reduced through redenomination of the debt.

4. Implications of changing the denomination of the debt

What are the implications of this change in the pattern of correlations? First, presumably, the fact that the debt burden becomes larger in good times and smaller in bad times

makes the probability of debt repayment larger. Moreover, welfare will be larger given that the new debt service will allow consumption paths to be more stable and government expenditures smoother. Furthermore, this increased stability should reduce the ex-ante risk premia that these countries face. This means that the probability of repayment of contractual obligations to IDA would be larger for a UF denominated debt, a fact that we are not taking into account when comparing the two reflows[12].

Second, in the actual state of affairs we have assumed that output is independent of the country risk premium. But this is unwarranted as the data clearly shows a correlation between the two. If we were to relax this assumption, i.e. if we were to incorporate an endogenous reaction of the country risk to the improved risk profile provided by the new debt denomination, we would obtain even more stability in the new regime. Moreover, in the dollar regime, a recession increases the debt burden and debt repayments in terms of GDP, which amplifies the recession. This effect would be smaller with UF debt, further reducing output volatility, a fact that we are not taking into account in our simulation. Again, this should be reflected in further reductions of country premiums and more stability. Hence this implies that our simulation by not incorporating these two effects, underestimates the potential stabilizing properties achieved by changing the denomination of the debt to UFs.

There are some aspects that we want to clarify to make sure that it is clear what the simulation on the new debt is NOT doing. For example, the fact that the debt burdens

[12] In practice, this means that since the IDA debt is dollar denominated, the probability of distressed lending or debt reductions is larger than it would be under a UF denominated debt.

have a better time profile does not mean that the average debt per country will go down. We have made the transformation to assure that the NPV of reflows remains the same. Furthermore, the average interest and amortization payment are also unaffected. Finally, it is not the case that the volatilities of the debt to GDP ratios, or any other measure of debt burden are smaller. In our simulations we found they were smaller for 2/3 of the countries, but this is not a generalized pattern. In sum, the change in the debt denomination just modifies the pattern of correlations between the debt burden and important macro variables. There are no rebates, nor free lunches in this transaction.

We find that modifying the debt denomination has small effects on the WB annual reflows (and exactly zero on its NPV), while it will be able to change the time series pattern and the distribution across countries of the debt burden. The new profile becomes less procyclical and therefore provides insurance to countries that are so desperate in need of some. The stability provided by the new pattern of payments should produce other benefits such as reductions in country risk premium, less volatile output, and in the end, more prosperity.

C. What are the implications of the new correlations?

To study the implications of the new set of correlations we do a Monte Carlo simulation. The idea is to compare the debt path of two economies subject to the same shocks to the exchange rate, but that differ in their correlation structure. In one economy, the real exchange rate has implications on the interest payments and debt to GDP ratios equal to those reported on the first columns of Table 6, using historical data, while the other

economy has the elasticities computed in the second columns of the same table using the simulated data.

We assume an initial debt to GDP ratio is 50 percent, an interest rate on IDA loans of 1 percent, a 1 percent GDP growth rate, and a primary surplus equal to 0.5 percent of GDP. Under these assumptions, if there were no shocks, the path of the debt to GDP ratio would be constant at 50 percent.

We assume that the standard deviation of the real exchange rate is 15 percent which is the average standard deviation in the sample. We look at 10 years horizon and compute the distribution of the debt to GDP ratio.

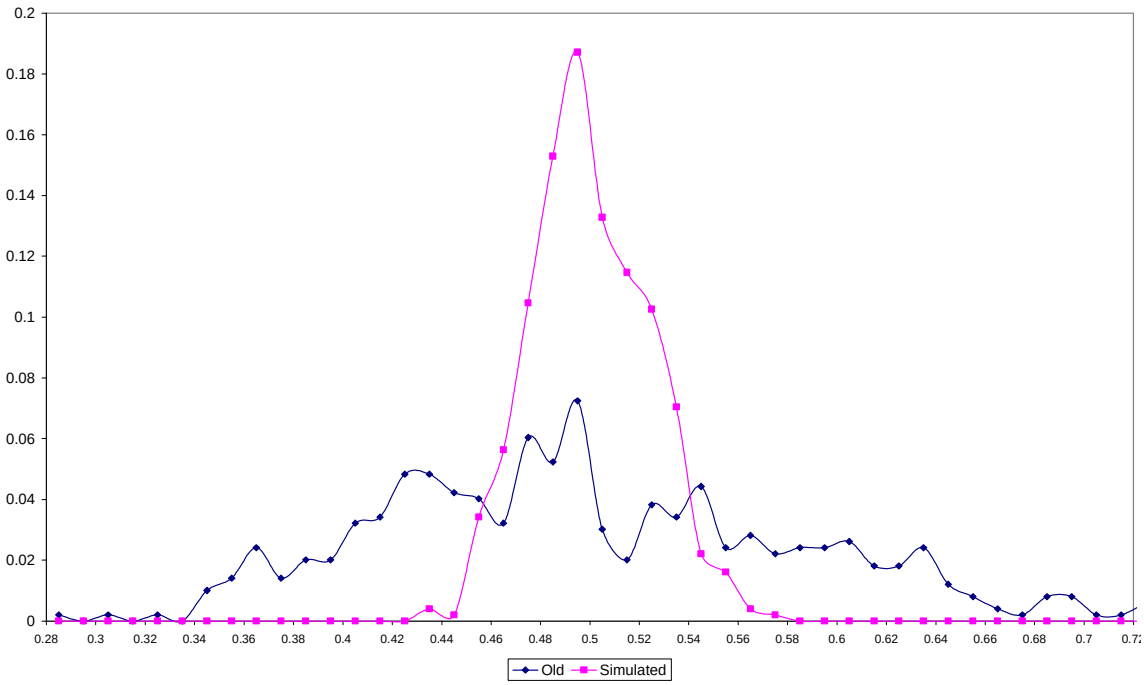
The Monte-Carlo is performed by drawing 500 replications of 10 years of exchange rate shocks. We assume that the exchange rate follows a random walk with one period ahead standard deviation equal to the average standard deviation in the data. Using those shocks and the regressions in Table 6, we compute the new path of interest rate payments and debt. Finally, we concentrate our analysis on the distribution of the debt to GDP ratio at the end of the horizon.

Using the correlation structure based on historic data we find that the average debt (10 years later) is 50.05 percent; with a standard deviation of 8.6 percent. So, the expected debt remains almost constant and the risk of the debt entails a coefficient of variation of more than 17 percent. On the other hand, when we used the pattern of correlations

implied by the simulated data (which assumes that debt is denominated in UFs), the average debt is 50 percent – so on average there is no significant difference – but the standard deviation of the debt is 2.4 percent – which reflects a sizeable reduction of the coefficient of variation to 4.7 percent. Figure 6 shows the histogram of debt to GDP ratio. The change in the volatility can be easily appreciated.

In other words, moving from dollar denominated debt to domestic indexed bonds does not change the expected value of the debt to GDP ratio, but makes it more predictable. Indeed, this implies a reduction of the variance of the debt to GDP ratio by a factor of 13!

Figure 6: debt to GDP ratio



Another dimension in which there is an important improvement is in the realization of "bad" events. Regarding sovereign debt, the important question is not the volatility itself but how the debt burden is distributed, i.e. how large is the debt burden in bad realizations. It is only in these states of the world that we care about debt sustainability.

As can be seen from the figure, the two distributions are quite symmetric indicating that the high variance in the "old" case is not driven by very small realizations. In fact, the debt using the current covariance structure fluctuates from 28 to 72 percent of GDP, while using the simulated debt it ranges from 42 to 58 percent. In fact, computing the ratio of the distance between the maximum and minimum between the old and new debts shows a reduction of 3.7 times. In other words, the span of all values where the debt is distributed comes down to a fourth when the debt is changed to domestic currency.

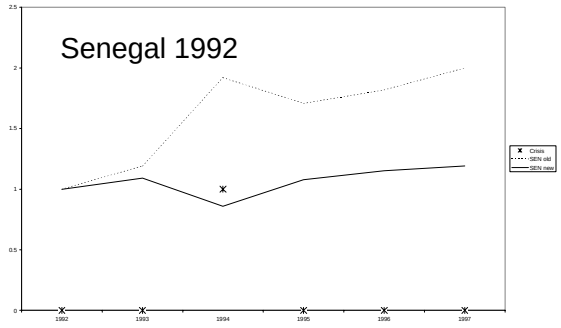
Furthermore, we computed the probability that the debt to GDP ratio will reach more than 60 percent at any time before 25 years. Using the old correlation structure we found that in 26.5 percent of the simulations the debt reached that point, while with the new correlation structure it was only on 0.5 percent of the simulations. In other words, even for very long horizons, the debt to GDP ratio becomes much more predictable under the new denomination.

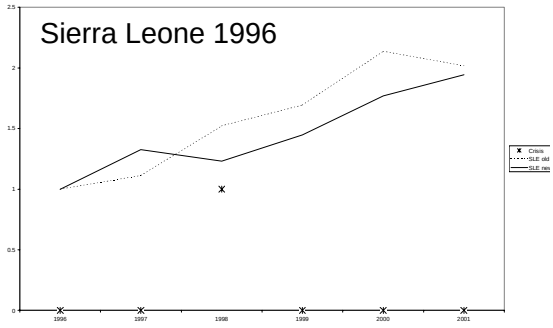
Therefore, an important effect of the change in denomination on the debt is that it eliminates the extreme realizations and makes the debt more dependent on fundamentals than on shocks. In this simulation, we have not modeled the interaction between the interest rate charged to the country and the level of the debt; mainly because in IDA lending this relationship is not there. However, it should be obvious, that if the interest goes up when the debt increases both output and the debt burden should become even more anti-cyclical, causing a further deterioration of the path of the debt in bad realizations. Hence, the simulations here shown are a lower bound to the benefits that would be created if the currency denomination were changed.

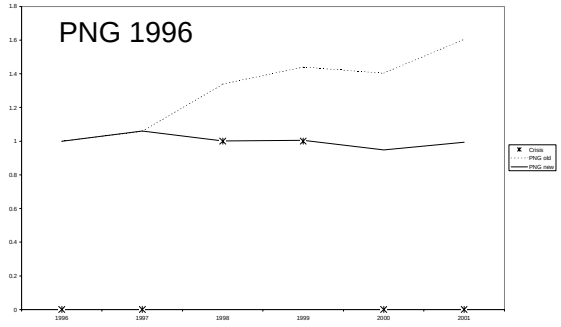
To highlight how different the debt path is under the indexed debt we studied the set of events in which countries suffered a large drop in the dollar value of their GDP (i.e. country/events in Table 3) and that are also in our dataset of IDA borrowers. The following 16 figures we present the actual path and the simulated path of the debt to GDP ratio.

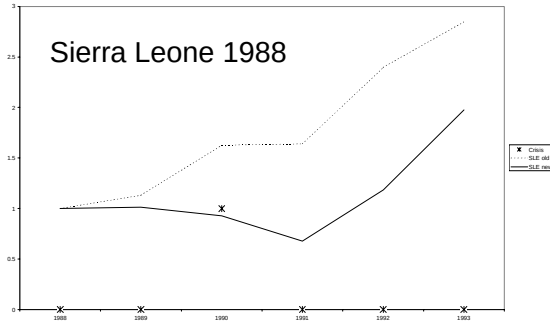
In the figures the continuous line represents the path of the indexed debt, the broken line is the original dollar-denominated debt, and the stars indicate the years in which there is a large fall in the dollar GDP. There are 16 events that are included in Table 3 and have enough data to compute the debt path before and after the output collapse.

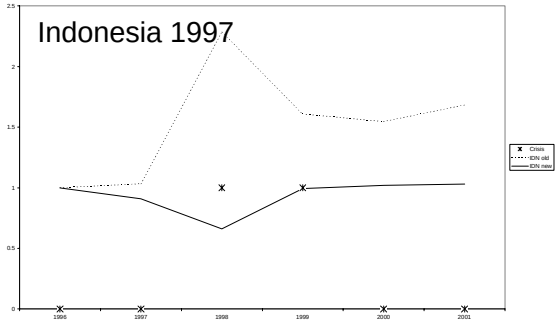
As can be seen, the new debt path prevents the currency crisis from being further aggravated by the debt burden. The debt to GDP ratio becomes smoother around crisis times and provides an automatic relief in bad times vis a vis the dollar-denominated debt.

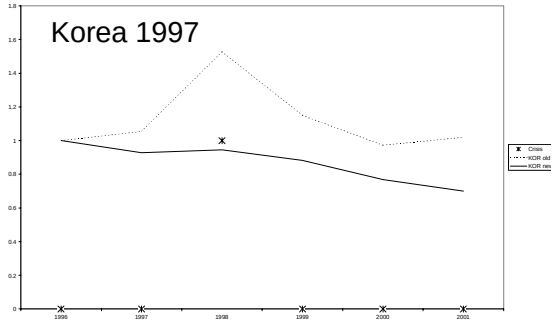


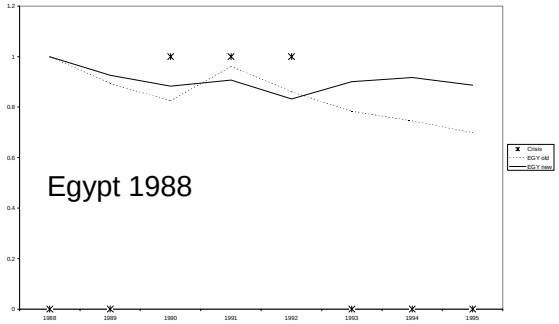


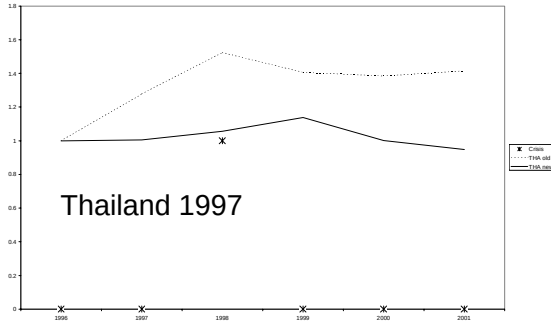


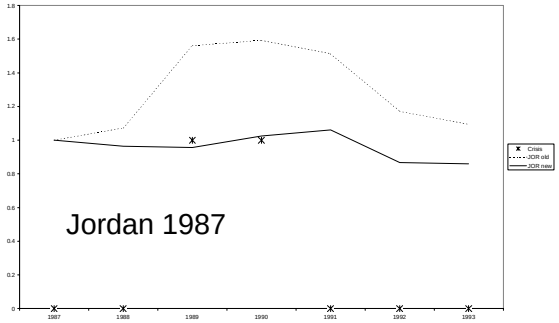


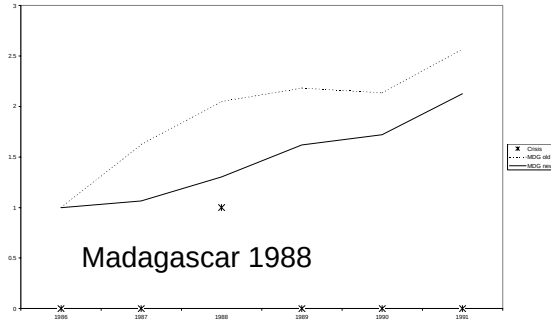

Indonesia 1997
Crisis
IDN old
IDN new

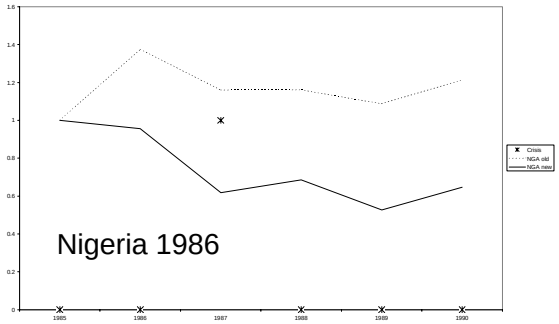

Korea 1997
Crisis
KOR old
KOR new

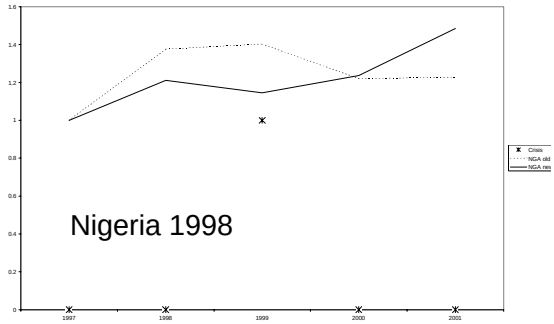

Egypt 1988
Crisis
EGY old
EGY new


Thailand 1997
Crisis
THA old
THA new


Jordan 1987
Crisis
JOR old
JOR new


Madagascar 1988
Crisis
MDG old
MDG new


Nigeria 1986
Crisis
NGA old
NGA new


Nigeria 1998
Crisis
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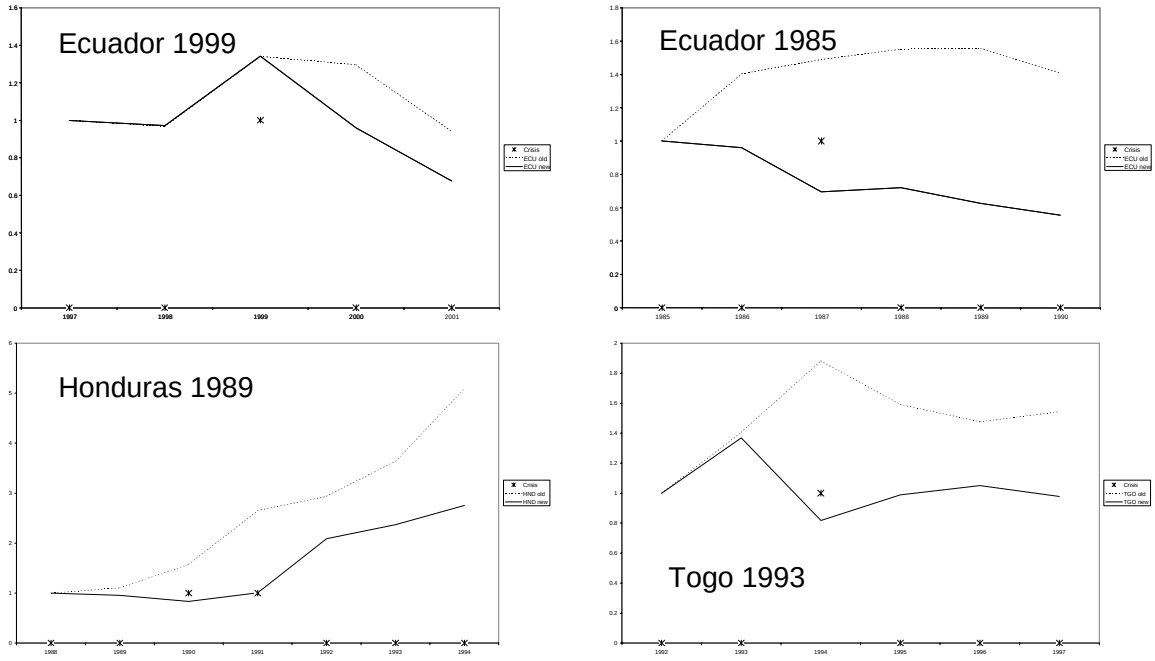
NGA new



D. Looking Ahead

In this section we study two aspects that we consider critical for policy formulation. First, we have the issue of the expected trend value of the UF-denominated IDA portfolio vis a vis the current arrangement. This is important to know if changing the denomination warrants an increase in the interest rate charged to the new UF-denominated debt. The second issue is whether the US dollar constitutes a relevant benchmark for IDA from the point of view of its own developmental goals. This is important to determine how we should view changes in the projected dollar value of IDA reflows.

E. The expected trend value of the weighted UF portfolio

The simulation we performed used mainly data of the last 15 years (i.e. since 1985). This was a period in which many IDA countries suffered severe currency crises. For example,

during this period, the debt weighted UF basket of IDA countries experienced a small depreciation vis a vis the dollar, requiring a .08 basis point increase in the interest rate to maintain the same NPV. Given that the UF does not subtract the inflation rate in the US, this implies that the real exchange rate depreciated even more, by an additional amount equivalent to the US inflation rate.

This cannot be a situation of equilibrium. In a steady state, one would expect a stable real exchange rate and hence a rising value of the UF vis a vis the dollar, by the amount of the US inflation. But IDA countries are not supposed to be in steady state. They are supposed to converge to the incomes of richer countries, especially if their policies, supported by the World Bank, are successful. Such a growth process should unleash a Balassa-Samuelson effect, which appreciates the real exchange rate, causing an appreciation of the UF basket in dollar terms.

To study the impact of trend real exchange rate movements on the dollar value of the NPV of IDA, we modify the stochastic properties of the real exchange rate processes. In particular, we maintain the second moments and change the drift. In other words, we keep the structure of variances and covariances intact, but change the average depreciation or appreciation of the real exchange rate. The question we pursue is the following. Assume we change the denomination to domestic currency indexed debt (the UF basket) maintaining exactly the same interest rate the countries have been paying. What is the projected dollar value of the UF basket that maintains the NPV of the dollar reflows constant?

The UF basket increases in value with real appreciation and with the US inflation. A real exchange rate depreciation lowers the dollar value of the UF basket while a real appreciation increases its value. Larger dollar inflation – at a constant real exchange rate – implies an appreciation of the UF basket vis a vis the dollar. Our interest is to understand what is the trend in the value of the UF basket (i.e. the sum of the real exchange rate depreciation/appreciation and dollar inflation) that makes the two reflows equal?

Very interestingly, we find that a trend in the UF basket equal to 1.37 percent a year makes the NPV of the UF basket equal to that of the US$. Any combination of real exchange rate appreciation and US inflation that exceeds 1.37 will make the dollar value of the NPV of the UF weighted IDA basket larger than the current US$ denominated basket.

This is a very low threshold. The US inflation has averaged more than this – 2 percent for the last decade. In addition, IDA countries should improve their performance in the future – which by definition is the goal of institutions such as the WB – and this should cause a real exchange rate appreciation. Therefore, changing the denomination from dollars to domestically indexed debt at the same interest rate and maturity will produce a higher NPV of flows to the WB if the sum of US inflation plus real exchange rate appreciation is larger than 1.37 percent. Unless the dismal performance of the last two decades is repeated, this should be the most likely scenario.

F. Is the US dollar an appropriate benchmark for IDA?

Beyond what may happen to the dollar value of the NPV of IDA reflows once the denomination is changed to UFs, the question is should we care about it? The point is that the currency denomination maintains the value of the loan portfolio in the unit of account. Maintaining the value in dollars may not be a relevant metric from the point of view of developing countries. Denominating the debt in UFs maintains the lending capacity of IDA in terms of units of consumption. If the countries do well and their real exchange rate appreciates, IDA's lending capacity measured in units of consumption will shrink. The debt burden will also decline concomitantly. By contrast, if countries do poorly, IDA's lending capacity will increase, but this comes as the result of a rising debt service burden. We argue that keeping the lending capacity and the debt burden constant in units of consumption makes more developmental sense than keeping constant in dollars: it avoids making the debt burden and the lending capacity anti-cyclical.

V. Policy implications and implementation

We have argued that a debt denominated in local currency indexed to the local inflation rate (UFs) would have significantly better risk management characteristics from the point of view of countries while generating minor increases in the variance of the dollar value of the IDA portfolio. This is the consequence of major reductions in currency risk through diversification and to some inter-temporal smoothing given that debt service is moved to years in which the economies perform better. In addition, we have argued that

if the IDA portfolio were to be converted into UFs at the current interest rate and amortization schedule, the dollar value of the NPV of IDA reflows will increase if the sum of the average real exchange rate appreciation and US inflation exceeds 1.37 percent. This is clearly the more likely scenario, which would only fail to happen in the economic environment becomes quite negative for IDA countries[13]. We argue further that even if this were to happen, IDA would maintain its lending capacity in terms of local consumption units while lowering the debt service burden on existing debtors in an economically adverse situation. This seems like a better alternative than what would happen in an adverse scenario under the current regime: it would generate an (unsustainable) increase in the debt burden aggravating an already bad situation.

A. Proposal

Based on these results, the ideal solution would be the following:

1. The IDA portfolio should be transformed from its current US dollar denomination into inflation-indexed local currency units.
2. Under the new regime, both disbursements and repayments would be made in US dollars but the amounts to be paid would be based on the value of the UF.
3. In order to achieve the diversification benefits at minimal additional risk to IDA, the change should be done to the outstanding debt, as a balance sheet operation.
4. All other conditions of the loans, i.e. interest rate, maturity, grace period, amortization schedule, etc., would be maintained.

[13] In fact, over the last 15 years, the difference between the dollar portfolio and the UF portfolio would have required only adjustment of only 8 basis points to equate the two NPVs, in spite of the unusually negative performance of so many IDA countries.

5. The indexation clause would need to be based on a price index that the World Bank or the IMF consider adequate and whose calculation can be monitored.

It is clear that in a world in which the real exchange rate is a random walk with no drift, all countries would buy into this scheme, as it would lower the debt service risk at no expected extra cost.

B. Further Considerations

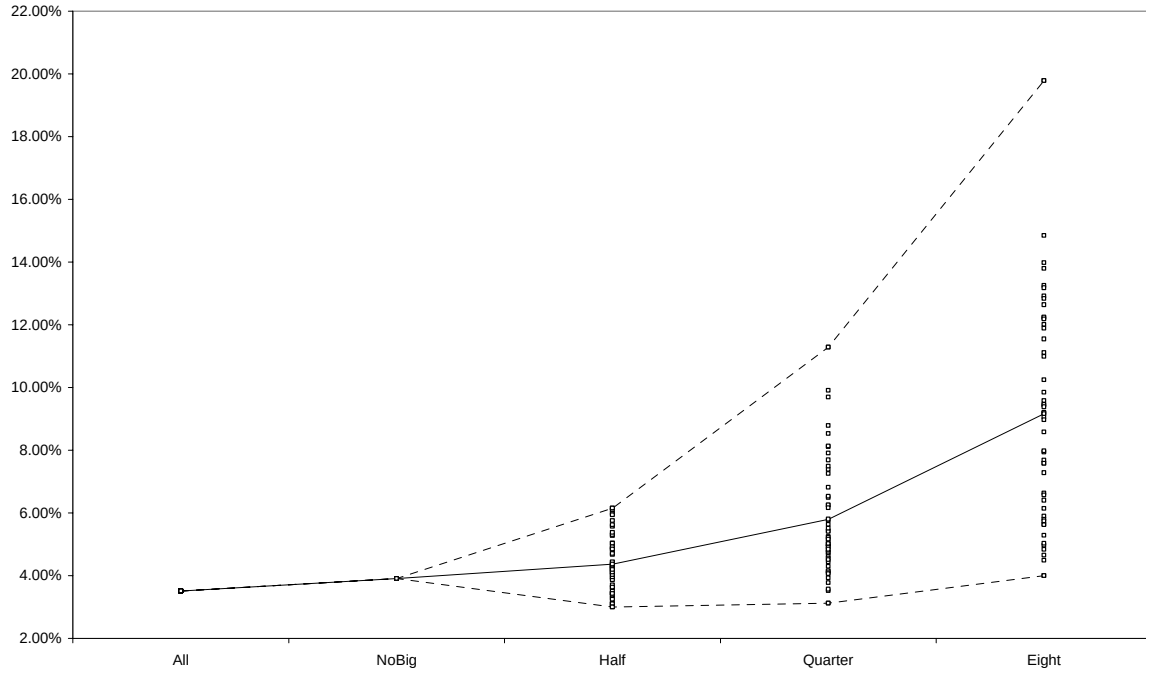
Although, we believe that this initiative would be the best we understand that it might confront several limitations in practice. For example, not all countries might buy into the currency exchange. Countries that expect a real appreciation will be less willing to accept the change in denomination, as this would increase the expected cost of debt service by the amount of the expected appreciation. One important question is how the political systems of those countries would value the reduction in risk relative to the expected increase in debt service. However, from a prudential point of view, The World Bank should value the reduction in risk and may consider making the conversion to local currency less than an option and more of a mandatory proposition. This can be done, for example, by conditioning access to additional resources to the acceptance of the debt conversion.

In this regard, we study the stochastic properties of IDA portfolio's for random sub-sets of the countries involved. We evaluate the ex-post risk of a portfolio containing (i) the whole sample, (ii) the whole sample excluding 7 big IDA borrowers (China, Egypt,

Korea, Philippines, India, Indonesia, and Thailand), (iii) taking random samples of half the countries (45), (iv) random samples of a quarter of the countries (22), (v) and random samples of one eighth of the countries. We produce 100 replications of the random sub-samples.

The objective is to compare the real exchange rate risk of the portfolio for all the different samples. This provides a benchmark to which we can compare the diversification benefits. The results are presented in Figure 8.

Figure 8: IDA's portfolio risk for several sub-samples of countries



Notice that if only half the countries are included in the sample, the risk of the portfolio does not increases as much. Indeed, as can be seen in the following table, the summary statistics indicate that with half the countries of the sample, the risk of the portfolio

increases from 3.51 percent to an average of 4.36 percent with a maximum of 6.15 percent. This is still implies a very sizable amount of risk diversification.

	All	NoBig	Half	Quarter	Eight
Average	3.51%	3.91%	4.36%	5.80%	9.16%
Stdev	0.00%	0.00%	0.87%	1.82%	3.38%
Max	3.51%	3.91%	6.15%	11.28%	19.78%
Min	3.51%	3.91%	3.00%	3.12%	4.00%

Furthermore, even if only 22 countries enter (a quarter) the total (average) risk is 5.80 percent.

We would therefore suggest that the World Bank offer to do the currency conversion provided a critical number of countries participate, sway more than 30.

Finally, the last consideration is the issue of Moral Hazard. The argument goes as follows: Lending in UFs implies lending in a unit that borrowers could potentially manipulate and this would lead to opportunistic depreciations.

Although this argument is important, there are some considerations that mitigate its relevance. First, it is important to remember that the problem of Original sin is associated with the fear of floating. And because countries fear the balance-sheet effects of depreciations they adopt excessively rigid and unsustainable exchange rate policies. Hence, we should expect that shifting the currency denomination will allow countries to have a more flexible exchange rate – i.e. lending in UFs reduces fear of floating and the bias towards excessive and unsustainable rigidity should be eliminated. This may affect

short-term volatility in RER, but it is unlikely to do anything to long term RER. Indeed, there is no evidence that the degree of short term exchange rate flexibility (LYS index) is correlated with 5-year RER volatility (Hausmann, Rigobon and Panizza, 2003).

Second, to avoid gaming with the exchange rate the debt could be denominated in the average UF value of the previous quarter/semester. This will reduce the incentives for strategic devaluations. Finally, we must remember that countries cannot erode the value of the debt through inflation, as the debt is adjusted for this factor. They need to effectively change relative prices. A real depreciation implies a reduction in the dollar value of wages and hence in the value of wages measured in tradable food items. There is a large domestic constituency that would oppose such an opportunistic behavior.

VI. Concluding remarks

It is difficult for developing countries to denominate their external debt obligations in a unit that tracks adequately their capacity to pay. Foreign debt is highly concentrated in a few major currencies. This difficulty also affects the capacity of the World Bank's IBRD window to lend in anything other than foreign currency loans, as it must fund itself in international capital markets that do not accept debt denominated in developing-country currencies.

This form of borrowing increases significantly the risk associated with external debt. The real exchange rate tends to depreciate (appreciate) in bad (good) times, increasing (lowering) the domestic cost of external debt service in those occasions. This creates a set

of macroeconomic headaches that would be best avoided: higher fiscal and external risks, ineffective monetary policy, inadequate exchange rate flexibility, and self-fulfilling crises.

The IDA window of the World Bank is funded through fiscal resources and hence does not have the restrictions in its lending imposed by the structure of international capital markets. It could lend in whatever unit it saw fit. If it were to lend in inflation-indexed domestic-currency units or UFs it would want to make sure that the reflows it received from its borrowers were comparable, if not identical as if it had lent in US dollars. This can be easily achieved because the volatility of a debt weighted basket of UFs is barely 3.4 percent per year, just one fifth the volatility of this variable in the typical IDA country ($1/25^{th}$ of the variance) and significantly lower than the US$-Deutsch Mark (now Euro) or US$-Yen rate. In addition, there is some degree of inter-temporal smoothing of aggregate IDA reflows that is achieved through this mechanism.

If IDA had lent in inflation-indexed local currency terms since 1985, it could achieve the same NPV reflows with a minor adjustment to the interest rate it charges (8 basis points in our calculation). However, the emerging debt structure would have tracked much better the capacity of its member countries to pay. Going forward, we anticipate that a change to UFs would increase the dollar value of the NPV of IDA reflows, as conditions are unlikely to be as adverse as in the past two decades.

UFs are a good basis to lend because they are closely related to the real exchange rate which is a synthesis variable that captures many shocks to the economy: not only terms of trade, but also output shocks (e.g. natural disasters) and capital market developments. A UF based IDA debt would be good for the macro stability of these countries. It would also reduce credit risk in IDA. After all, low-income countries that get into payment problems (e.g. in the context of large de facto real depreciations) get their debt implicitly rescheduled either through debt reductions or new distressed lending. Denominating debts in UFs would automatically adjust the dollar value of debt service to better track the country's capacity to pay, without these contraptions.

Most importantly, all these benefits are generated by the fact that the current arrangement does not fully exploit the opportunities for inter-national and inter-temporal risk sharing among borrowing members of IDA.

VII. Appendix

Countries in our IDA data base:

ALBANIA
ANGOLA
ARMENIA
AZERBAIJAN
BANGLADESH
BENIN
BHUTAN
BOLIVIA
BOSNIA-HERZEGOVINA
BOTSWANA
BURKINA FASO
BURUNDI
CAMBODIA
CAMEROON
CAPE VERDE
CHAD
CHILE
CHINA
COLOMBIA
COMOROS
CONGO, DR
CONGO, REPUBLIC OF
COSTA RICA
COTE D'IVOIRE
DJIBOUTI
DOMINICA
DOMINICAN REPUBLIC
ECUADOR
EGYPT
EL SALVADOR
EQUATORIAL GUINEA
ERITREA
ETHIOPIA
GAMBIA, THE
GEORGIA
GHANA
GRENADA
GUINEA
GUINEA-BISSAU
GUYANA
HONDURAS
INDIA
INDONESIA
JORDAN
KENYA
KOREA, REPUBLIC OF
KYRGYZ REPUBLIC
LAO PEOPLE'S DEM. REP.
LESOTHO
MACEDONIA
MADAGASCAR
MALAWI
MALDIVES
MALI
MAURITANIA
MAURITIUS
MOLDOVA
MONGOLIA
MOROCCO
MOZAMBIQUE
NEPAL
NICARAGUA
NIGER
NIGERIA
PAKISTAN
PAPUA NEW GUINEA
PARAGUAY
PHILIPPINES
RWANDA
SAMOA
SAO TOME AND PRINCIPE
SENEGAL
SIERRA LEONE
SOLOMON ISLANDS
SRI LANKA
ST. KITTS AND NEVIS
ST. LUCIA
ST. VINCENT AND THE GRENADINES
SWAZILAND
SYRIAN ARAB REPUBLIC
TAIWAN, PROVINCE OF CHINA
TAJIKISTAN
TANZANIA
THAILAND
TOGO
TONGA
TUNISIA
TURKEY
UGANDA
VIETNAM
YEMEN, REPUBLIC OF
ZAMBIA
ZIMBABWE

REFERENCES

Aghion, Philippe, Philippe Bacchetta, and Abhijit Banerjee (2000), "Currency Crises and Monetary Policy in an Economy with Credit Constraints," mimeo UCL.

Calvo, Guillermo and Carmen Reinhart (2002), "Fear of Floating," *Quarterly Journal of Economics* 117, pp.379-408.

Céspedes Luis Felipe Roberto Chang and Andrés Velasco (2002) "IS-LM-BP in the Pampas," unpublished manuscript, Harvard University

Eichengreen, Barry and Hausmann, Ricardo, 2003, "Editors' Introduction" in *Other people's money: debt denomination and financial instability in Developing Countries*, University of Chicago Press, forthcoming. "Debt Denomination and Financial Instability in Emerging Market Economies:"

Hausmann, Ricardo (2003) "Good Credit Ratios, Bad Credit Ratings: The Role of Debt Denomination," in *Rules-Based Fiscal Policy in Emerging Markets: Background, Analysis and Prospects*, G. Kopits (editor), London: Macmillan (forthcoming).

Hausmann, Ricardo, and Ugo Panizza (2003) "The Determinants of "Original Sin": An Empirical Investigation" *Journal of International Money and Finance*, forthcoming.

Hausmann, Ricardo, Ugo Panizza and Roberto Rigobon (2003) "The real exchange rate volatility puzzle", mimeo.