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# Currency Mismatches, Debt Intolerance, and Original Sin

## Why They Are Not the Same and Why It Matters

Barry Eichengreen, Ricardo Hausmann, and Ugo Panizza

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### 3.1 Introduction

Recent years have seen the development of a large literature on balance sheet factors in financial crises.<sup>1</sup> The balance sheet approach focuses on the impact of disturbances on the assets, liabilities, and net worth of households, firms, government, and the economy as a whole and on the implications for growth and stability. Some studies focus on the net worth effects of shocks to the exchange rate in the presence of foreign currency-denominated liabilities. Others look at liquidity or interest rate shocks when the tenor of a bank, firm, or country's liabilities is shorter than the tenor of its assets. In some studies the propagation mechanism is the impact on consumption and investment of the change in net worth of households and nonfinancial firms. In others it is the impact on the liquidity and solvency of financial institutions and markets and hence on confidence in the financial system. In still others it is the impact on the sustainability of the public debt.

Recent contributions also differ in their assumptions about the distortion giving rise to these fragilities. Our own work focuses on problems with the structure of global financial markets that result in the inability of econ-

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1. See, for example, Krugman (1999), Razin and Sadka (1999), Aghion, Bacchetta, and Banerjee (2000), Céspedes, Chang, and Velasco (2002), and Jeanne (2002).

omies to borrow abroad in their own currencies.<sup>2</sup> Others focus on policy failures as a result of which governments fail to limit foreign currency and short-maturity borrowing to socially desirable levels and/or fail to insure adequately against its potentially destabilizing consequences.<sup>3</sup>

Hence, while all of these studies are concerned in a broad sense with open-economy balance sheet effects, the issues on which they focus are not the same. These different emphases lead to different perspectives on research and policy.

In section 3.2 we introduce several concepts that are widely used in the literature, describe how they differ, and explain why these differences matter. We distinguish between currency mismatches (differences in the currencies in which assets and liabilities are denominated), debt intolerance (the inability of emerging markets to manage levels of debt that are manageable for advanced industrial countries), and original sin (the difficulty emerging markets face when attempting to borrow abroad in their own currencies). We emphasize that the phenomena denoted by these terms are analytically distinct.

In section 3.3 we show that these distinctions matter empirically as well as conceptually. We analyze the impact of balance sheet variables on the volatility of output, the volatility of capital flows, the management of exchange rates, and creditworthiness of countries. We show that it is important when considering the behavior of such variables to clearly distinguish original sin, debt intolerance, and currency mismatches. Section 3.4 addresses a number of additional debates that have arisen in this context, after which section 3.5 summarizes our conclusions.

## **3.2 Currency Mismatches, Debt Intolerance, and Original Sin Are Not the Same**

Three terms that are prevalent in this literature—currency mismatches, debt intolerance, and original sin—in fact refer to quite different phenomena.

### **3.2.1 Original Sin**

Eichengreen, Hausmann, and Panizza (2005b) define original sin as *the inability of a country to borrow abroad in its own currency*.<sup>4</sup> This focus on ex-

2. See Eichengreen and Hausmann (1999) and Eichengreen, Hausmann, and Panizza (2005b).

3. See, for example, Goldstein and Turner (2004) and Reinhart, Rogoff, and Savastano (2003).

4. In earlier work, Eichengreen and Hausmann (1999) used the term to refer to both the difficulty that countries experience when attempting to borrow abroad in their own currencies and the difficulty they face when attempting to borrow at home at long maturities. In subsequent work we came to conclude that the first of these two problems is particularly difficult. While it is not easy to develop domestic bond markets—something that is the *sine qua non* of

ternal borrowing is motivated by the observation that, in the absence of other distortions, world welfare would be enhanced if capital flowed from capital-rich advanced countries to their more capital-poor emerging market counterparts. It would be further enhanced if countries could use the current account and the capital flows needed to finance it to stabilize the domestic economy when faced with shocks.<sup>5</sup>

One possible explanation for the failure of more capital to flow from rich to poor countries and the difficulty experienced by the latter in using the capital account to smooth consumption is their inability to borrow abroad in their own currencies. If a country's external debt is denominated in foreign currency, then real exchange rate depreciation, by reducing the purchasing power of domestic output over foreign claims, will make it more difficult to service that debt. Knowing that shocks affecting the real exchange rate can disrupt the country's ability to service its debt, foreigners may be rendered less willing to lend. And since the real exchange rate tends to strengthen in good times and weaken in bad times, foreign currency debt will be harder to service in bad times, reducing willingness to lend and thereby accentuating the procyclical nature of capital flows.

Aware of these dangers, a government may use macroeconomic and regulatory policies to limit foreign borrowing. But then capital still will not flow from capital-rich to capital-poor countries, nor will countries be able to cushion the effect of shocks through international borrowing. The government may accumulate foreign reserves to be used to intervene in the foreign exchange market in order to prevent the currency from moving and/or to enable it to act as debt servicer of last resort. But in this case, the country's gross foreign currency liabilities, accumulated by borrowing abroad, are matched by gross foreign currency assets that the government holds in the form of international reserves. If reserves equal gross foreign borrowing, then there will again be no capital transfer from capital-rich to capital-poor economies.

In part, debate on these questions revolves around the validity of the premise that other distortions are absent or at least that they are not the

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facilitating the efforts of firms and governments to borrow at home at long maturities—a growing number of countries are showing an ability to do so. Chile, Hungary, India, and Thailand, among other countries, are able to borrow on domestic markets at fixed rates without indexing their bonds to the exchange rate, as documented in section 3.4. But these same countries are making less progress in developing the ability to borrow abroad in their own currencies. In Eichengreen, Hausmann, and Panizza (2005b) we have also devoted some attention to “the domestic aspect” of original sin. But because the constraints on borrowing abroad in one's own currency seem particularly intractable, we have made this the focus of our recent work and adopted a correspondingly narrower definition of original sin. We return to these issues in section 3.4.

5. That net capital flows from relatively capital-rich to relatively capital-poor countries are not larger is referred to as the “Lucas paradox” (after Lucas 1990). That capital flows are procyclical, exacerbating booms and recessions, has also been widely commented upon (see, e.g., Gavin, Hausmann, and Leiderman 1995).

main thing going on. A contrary view is that the inability of emerging markets to borrow abroad in their own currencies is simply a corollary of other distortions to their economies that remove the incentive for lending and borrowing. Weak policies and institutions in emerging markets so depress the marginal productivity of capital, in this view, that neither the welfare of these countries, nor that of the world as a whole, is enhanced by capital transfer. Foreigners are not inclined to invest in emerging markets, in this view, because productivity there is so low.

The intermediate position is that domestic policies and institutions are important for the ability of countries to borrow abroad in their own currencies, but so are factors largely beyond the control of the individual country.<sup>6</sup> Foreign investors may be reluctant to lend to a country in its own currency if the authorities are prone to manipulating the value of that currency. Institutional and policy reforms giving investors confidence that the value of the currency will be maintained may thus be necessary for a country to be able to borrow abroad in its own currency. But the evidence does not suggest that they are sufficient; too many countries with strong policies and institutions also suffer from original sin. Moreover, if the problem was fear of inflation, we should observe inflation-indexed local currency debts or contracts in the currencies of a variety of well-behaved countries. Instead, we observe a large concentration of debt denominated in a few major currencies.<sup>7</sup>

Chile is a favorite example of a country with increasingly strong institutions and policies. In terms of rule of law, the International Country Risk Guide (ICRG) gave Chile 5 of 6 possible points in 2001, compared to a Latin American average of 2.9 and a world average of 3.8. Chile has also done a good job of managing the risks associated with foreign borrowing, using capital account regulation, prudential supervision, transparency requirements for banks and firms, and flexible exchange rates to encourage prudent management of foreign currency exposures.<sup>8</sup>

One thing that these strengthened policies and institutions have not done, however, is to enable Chile to borrow abroad in its own currency. The consequences have been significant. In 1998 Chile was hit by an adverse

6. This is a fair summary of our view.

7. Of the nearly \$5.8 trillion in outstanding securities placed in international markets in the period 1999–2001, \$5.6 trillion was issued in five major currencies: the U.S. dollar, the euro, the yen, the pound sterling, and the Swiss franc. See Eichengreen, Hausmann, and Panizza (2005b). To be sure, the residents of the countries issuing these currencies (or, in the case of Euroland, the group of countries) constitute a significant portion of the world economy and hence form a significant part of global debt issuance. But while residents of these countries issued \$4.5 trillion of debt over this period, the remaining \$1.1 trillion of debt denominated in their currencies was issued by residents of other countries and by international organizations (which issued a total of \$1.3 trillion of debt). The causes and consequences of this concentration of debt denomination in few currencies are the focus of the literature on original sin.

8. These policies are a reasonable approximation of the emerging consensus on how a prudent emerging market should manage the risks of external borrowing.

terms-of-trade shock. A country able to borrow abroad in its own currency, when hit by this temporary shock, would have eased monetary and fiscal policies, loosened the exchange rate, and financed its growing external deficit by borrowing abroad in order to smooth consumption and stabilize production. This is what Australia did, for example, when hit by the same global shock.<sup>9</sup> But Chile, rather than seeing capital inflows buffer its export shock, suffered a sudden stop in such flows, forcing it to cut its imports by fully 22 percent (nearly 6 percent of gross domestic product [GDP]) between 1997 and 1999. This entailed a collapse in GDP growth from 6.8 percent in 1997 to -0.8 percent in 1999.<sup>10</sup> These are large swings by the standards of the advanced industrial economies.

Why did Chile's performance resemble that of Latin American countries plagued by weak institutions rather than that of advanced countries with comparable institutional-quality ratings, like Australia? Original sin may be part of the answer. If Chile had pursued accommodative policies and allowed the real exchange rate to adjust, adverse balance sheet effects would have created doubts about its ability to service its debt, limiting the willingness of the foreign investors to fund the ensuing deficit. By opting for restrictive policies, the authorities curtailed the demand for foreign finance so as to limit the increase in country risk, but at the cost of a major recession.<sup>11</sup>

The Chilean authorities were not unaware of these dangers, but the *ex ante* policies available to limit the country's vulnerability to sudden stops had costs as well. Gallego and Hernandez (2003) show that the non-interest-bearing deposit requirement imposed on foreign borrowing in the 1990s increased the cost of external finance for Chilean firms. This does not mean that these policies were inadvisable; we have argued elsewhere that such costs were worth paying.<sup>12</sup> In effect they were optimal second-best policies—they were a sensible way of insuring against the risk of sudden stops given that external debt was denominated in foreign currency. But the distance to the first best was substantial because the policies in question entailed a trade-off between access to external finance on the one hand and financial stability on the other. Chile was able to attain a reasonable position on this frontier owing to the strength of its policies and institutions. Even better, of course, would have been the ability to push that frontier outward by acquiring the ability to borrow abroad in local currency.

9. This is the counterexample considered in Eichengreen and Hausmann (1999). This comparison is pursued by Caballero, Cowan, and Kearns (2003), whose interpretation differs.

10. Calculations based on data for imports and GDP from the Central Bank of Chile. For a discussion of the costs of sudden stop in capital flows see Calvo, Izquierdo, and Talvi (2002).

11. After 2000 and especially after 2002, policies became more accommodative and the real exchange rate was allowed to depreciate by 38.6 percent from its peak in 1997. However, capital inflows have yet to resume and growth has remained lackluster, as would be expected given the less expansionary effect of depreciations in countries that suffer from original sin.

12. See Hausmann and Gavin (1996) and Eichengreen (2002).

It is striking in this context that Chile, despite the strength of its institutions, has been unable to escape the problem of original sin that was a constraint on shifting that frontier. This is a specific example of the general point that the standard institution-strengthening measures appear to have relatively little ability over policy-relevant horizons to enable developing countries to acquire the capacity to borrow abroad in their own currencies.<sup>13</sup> The label “original sin” is designed to convey the possibility that the problem may not result only from the actions of the affected country but in addition may have something to do with factors largely beyond its immediate determination and control.<sup>14</sup>

### 3.2.2 Debt Intolerance

Reinhart, Rogoff, and Savastano (2003) define debt intolerance as *the inability of emerging markets to manage levels of external debt that are manageable for advanced countries*. They operationalize the concept as the relationship between a country’s credit rating (also referred to as country risk) and its external debt. They report that ratings fall more rapidly with debt in emerging markets than advanced countries, as if the former have less debt management capacity.

Debt intolerance and original sin are not the same. The inability of a country to borrow abroad in its own currency is one potential explanation for why it may have trouble managing levels of debt that would be manageable for other countries. But no one to our knowledge has claimed that original sin is the only determinant of debt problems.<sup>15</sup>

Reinhart, Rogoff, and Savastano (2003) write that “a country’s external debt intolerance can be explained by a very small number of variables related to its repayment history.” They show that countries that defaulted in the past and have histories of inflation have lower credit ratings in the present. We endorse the insight that history can play an important role in shaping current outcomes. But a minimal condition for a theory of the historical determinants of current events is a transmission mechanism through which events in the past can influence outcomes in the present.<sup>16</sup> One

13. See section 3.3 for additional evidence.

14. We will have more to say about the specific nature of these factors below.

15. This point would not be worth making except that some contributors to the literature have referred interchangeably to countries’ external debt problems in general (their “country risk” or “debt intolerance”) and their inability to borrow abroad in their own currencies in particular (“original sin”). In our previous work and again below, we analyze the determinants of a country’s debt problems, as measured by their credit ratings. We study the impact of original sin on credit ratings, controlling for several other potential determinants of ratings such as a country’s per capita income and its overall indebtedness. This makes clear that we do not see original sin as the only determinant of country risk, although we do find that it is an important determinant.

16. There is now a large literature on this subject. See the discussion in David (2001). We endorse Joshua Aizenman’s conjecture, in his comment on the present paper, that a history of macroeconomic and financial instability may weaken the social contract and impact in-

would also want evidence that this mechanism is at work, for otherwise one could not rule out that omitted factors associated with external debt-servicing difficulties in both the past and present explain the observed correlation, where in fact there is no causal mechanism linking past events to current outcomes.

Reinhart, Rogoff, and Savastano (2003) conjecture that default on external debt may weaken a country's financial system and that a weaker financial system increases the likelihood of subsequent default because countries with weaker financial systems suffer larger output losses when access to external finance is interrupted. They suggest that default on external debt may weaken a country's tax system by encouraging capital flight and tax avoidance, in turn making it harder to raise the revenues needed to service public debts. But they report no regressions relating the size of the financial system and the tax base to countries' histories of default, and no regressions relating current default to the size of the financial system and the tax base. They present no evidence of these or other mechanisms causally linking past defaults to current debt-servicing difficulties.<sup>17</sup>

That the same countries have defaulted in both the distant and the more recent past may in fact reflect other characteristics of those countries that are slow to change but that are omitted from this analysis of debt intolerance. Original sin may be one such characteristic. Elsewhere we have shown that the inability of countries to borrow abroad in their own currencies is persistent.<sup>18</sup> Similarly, that the commodity composition of exports renders some countries' terms of trade persistently more volatile than others may explain why some countries have more difficulty than others in coping with external debt.<sup>19</sup>

Reinhart, Rogoff, and Savastano (2003) regress credit ratings as a measure of debt-servicing prospects on the history of debt and inflation, using data for fifty-three advanced and developing countries. To determine whether developing countries are less able to manage debts that are manageable for advanced economies, they enter the ratio of debt to gross national product (GNP) separately for countries with high credit ratings (67.7 and above on the *Institutional Investor* 100-point scale) and low credit ratings (below 67.7).<sup>20</sup> In support of their hypothesis, they point to the fact

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vestors' attitudes regarding a country's ability to service debts. But these ideas are not made explicit in the literature on debt intolerance.

17. In principle, empirical work along these lines should be feasible. We return to this in the concluding section of our paper.

18. Eichengreen, Hausmann, and Panizza (2005a) use the measures of original sin circa 1850 constructed by Flandreau and Sussman (2005) to document the correlation between original sin then and now.

19. Blattman, Hwang, and Williamson (2003) suggest that the commodity composition of exports and the resulting behavior of the real exchange rate have persistent implications for volatility and growth.

20. Some of their regressions also include the percentage of sample years in which the debt was in default or restructuring.



that the coefficient on the debt-GNP ratio is negative for countries with low ratings and positive for countries with high ratings and to the high  $R^2$  of the regression.

We see three problems with this analysis. First is the omitted-variables problem described above.<sup>21</sup> Second, credit ratings appear on both sides of this equation, as a continuous variable on the left and a dummy for above or below 67.7 on the right (interacted with the debt ratio). This makes it hard to draw much comfort from the high  $R^2$ . Third, there is no separate intercept for countries with credit ratings below 67.7. Hence, all respects in which countries with low credit ratings differ from countries with high credit ratings are loaded into the interaction term between credit ratings and the debt-GNP ratio.

In table 3.1 we show the difference that this makes. The first regression relates credit ratings to debt-GDP separately for advanced and developing countries but does not include a separate intercept for the latter. Here we use Standard & Poor's (S&P) rating data instead of those from *Institutional Investor* in order to preserve comparability with our previous work and further results reported below.<sup>22</sup> Despite using slightly different country samples and data, we obtain the same result as Reinhart, Rogoff, and Savastano (2003)—namely, that the coefficient on the debt ratio is significantly larger for developing countries.<sup>23</sup> The second regression then shows that this result evaporates when a separate intercept is included.

In equation (3), we split the sample not into advanced and developing countries but into countries with high and low credit ratings, following Reinhart, Rogoff, and Savastano (2003). We generate a dummy variable

21. To put the same point another way, the authors put a structural interpretation on an extremely reduced-form relationship.

22. Our rating variable is from S&P and ranges between 0 and 19. (We converted the S&P rating into a numerical variable by adopting the following criteria: selective default = 0, C = 2, CC = 2.5, CCC = 3, B- = 4, and each extra upgrade = one point. A value of 19 corresponds to AAA.) We also adjust our classification for the outlook assigned by S&P to each country, and we increase the rating by 0.33 when the country has a positive outlook and decrease the rating by 0.33 when the country has a negative outlook. The rating variable used by Reinhart, Rogoff, and Savastano is from *Institutional Investor* and ranges from 0 to 100. We report regressions using this alternative measure below.

23. There are two additional differences between these regressions and the ones in Reinhart, Rogoff, and Savastano (2003). First, since our rating variable is censored at 19 (and more than 10 percent of observations are at the upper bound), we use a Tobit model instead of ordinary least squares (OLS). The results are robust to estimating these equations by OLS instead of Tobit. Second, we use averages over the 1993–99 period, while Reinhart et al. use averages for the 1979–2002 period. Finally, while the two samples have similar size (sixty-two countries in our sample, fifty-three in Reinhart et al.), they do not overlap perfectly. We do not know exactly which countries are included in the Reinhart et al. regressions. However, in appendix B1 of their paper, they list sixty-three countries for which they have information on credit rating. Presumably the fifty-three countries included in the regressions are a subset of this sample. There are twenty-three countries that are included in our sample but not in table B1 of Reinhart, Rogoff, and Savastano, and twenty-four countries included in their table B1 that are not in our sample (these countries are listed in the appendix).

**Table 3.1** Credit rating in developing and advanced countries

	RATING I			RATING II			RATING II excluding South Korea
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Debt/GDP advanced	4.814 (2.30)**	-2.659 (1.24)					
Debt/GDP developing	-8.627 (4.96)**	(2.34)**					
Developing	-9.027 (5.78)**						
Debt/GDP high rating			5.783 (3.10)**	-1.511 (0.83)	25.295 (2.46)**	1.597 (0.46)	1.597 (0.46)
Debt/GDP low rating			-9.207 (5.85)**	-4.438 (3.36)**	-32.386 (3.75)**	-12.266 (1.62)	-8.527 (1.18)
High rating				8.917 (6.60)**		33.811 (6.22)**	36.444 (6.98)**
Constant	13.999 (15.60)**	19.757 (15.27)**	14.138 (17.51)**	11.028 (15.03)**	58.449 (10.69)**	44.988 (9.03)**	42.355 (8.92)**
No. of observations	61	61	61	61	45	45	44
R-squared					0.53	0.73	0.76
DEG_DEV = DEG_ADV	$F(1,59) = 41.31$	$F(1,58) = 0.14$	$F(1,59) = 62.7$	$F(1,58) = 1.69$	$F(1,42) = 72.9$	$F(1,41) = 2.77$	$F(1,40) = 1.69$
DEG_HR = DEG_LR							
$p$	0.000	0.705	0.000	0.199	0.000	0.104	0.214

*Notes:* Tobit regressions shown in columns (1)–(4), and ordinary least squares (OLS) with robust standard errors in columns (5)–(7). Absolute value of  $t$ -statistics in parentheses.

\*\*\*Significant at the 1 percent level.

\*\*Significant at the 5 percent level.

that takes value 1 if a given country has a rating above the mean plus 1 standard deviation of our cross-country sample.<sup>24</sup> Column (3) reproduces their result: the coefficients on the debt ratios for high- and low-rated countries are significantly different from one another at standard confidence levels.<sup>25</sup> But when in column (4) we allow the two groups of countries to have a different intercept, the point estimate and the statistical significance of the difference in slope coefficients again collapse.

In the last three columns of the table we replace the Standard & Poor's rating variable used in the first four columns with the *Institutional Investor* rating (which varies from 0 to 100) used by Reinhart, Rogoff, and Savastano (2003). When we intersect the *Institutional Investor* rating with the sample of countries for which we have information on debt relative to GDP we are left with a sample of forty-five countries. We separate the sample into countries with high and low credit ratings using the same threshold used by Reinhart, Rogoff, and Savastano (67.7). Column (5) reproduces their result: the effect of debt-GDP is positive and significant in countries with high credit ratings and negative and significant in countries with low credit ratings. The difference between the two groups is also statistically significant. In column (6), we allow the two groups of countries to have different intercepts and find that the coefficients of debt over GDP are no longer significant in either group of countries.<sup>26</sup> Furthermore, the difference between the two coefficients is no longer significant at conventional confidence levels. The results are also sensitive to the inclusion of an outlier, South Korea, which has relatively low levels of debt and a high credit rating. If Korea is dropped (column [7]), the difference between the coefficients of high- and low-rated countries declines still further.<sup>27</sup>

### 3.2.3 Currency Mismatch

Original sin also differs from currency mismatches, defined as *differences in the values of the foreign currency-denominated assets and liabilities on the balance sheets of households, firms, the government, and the economy as a whole*. In the case of a bank, the concept of a currency mismatch is familiar: it is the difference between the value of the foreign currency-denomi-

24. Reinhart, Rogoff, and Savastano also separate their sample at the mean plus 1 standard deviation. On our numerical scale, this corresponds to a cutoff of 16.

25. That the results are very similar to the preceding set of regressions is not surprising. Only two countries that we classify as advanced have low ratings (Greece and Iceland), while just one country that we classify as developing has a high rating (Singapore).

26. The point estimates are also very different from those in the regressions omitting the additional intercept term.

27. If panel data methods are used instead of simple cross-country comparisons, the difference between the coefficients of high-rating and low-rating countries also remains statistically significant after controlling for country fixed effects. Fixed effect estimates may however be problematic (they amplify the ratio of noise to signal) in a setting where the fixed effects explain 90 percent of the variance of the dependent variable and 80 percent of the variance of the explanatory variable.

nated liabilities and assets (typically normalized by total assets, total domestic currency assets, or another appropriate scale variable). For a firm, the currency mismatch derives from the relationship between net foreign currency-denominated liabilities and the net present value of domestic currency-denominated cash flow. A firm with a currency mismatch will experience an adverse balance sheet effect if exchange rate depreciation raises the value of its net foreign currency-denominated liabilities relative to the net present value of its cash flow.<sup>28</sup>

When we aggregate this up to the national level, consolidating the foreign currency assets and liabilities of residents, we are left with the aggregate currency mismatch. This means that there will be an aggregate currency mismatch when there is a net debt to foreigners denominated in foreign currency. The implications for the country then parallel those for the firm: real exchange rate depreciation that raises the value of a country's external net debt in terms of the value of its national output will create adverse balance sheet effects.

However, the aggregate mismatch that exists when there is a net debt to foreigners denominated in foreign currency is different from original sin, defined as the inability of a country to borrow abroad in its own currency and measured as the ratio of foreign currency-denominated gross debt to foreigners as a share of total gross debt to foreigners. By definition, when banks, firms, or public agencies of a country suffering from original sin borrow abroad, they incur a gross foreign debt denominated in foreign currency. But the country may or may not also incur a currency mismatch, depending on how the authorities respond to that act of borrowing. One consequence of original sin is the tendency for countries afflicted by this problem to accumulate international reserves as a way of protecting themselves from potentially destabilizing financial consequences. We show in section 3.3 that countries with high levels of original sin do in fact hold significantly larger international reserves, other things being equal.

But where reserve accumulation is large, currency mismatches will be small. Thus, where an aggregate mismatch is one possible consequence of original sin, it is not a necessary one. While one possible consequence of original sin is a currency mismatch, another possible consequence is a large reserve accumulation. Either, or to some extent both, may occur.

Currency mismatches may have costs. But large reserve holdings may also have costs, since the yield on reserves is typically less than the cost of funds. If governments settle on an interior solution to their optimization problem, they are likely to accumulate reserves that offset some fraction less than one of gross foreign debt denominated in foreign currency. The re-

28. If depreciation is fully translated into higher prices for firms' output, as would happen with a small exporting firm or when there is a full pass-through of exchange rates into prices, there will be no change in the net worth of a company. But this is not the general case.

sulting currency mismatch will be smaller than the gross debt denominated in foreign currency, while reserve holdings will be larger than in a country that can borrow in domestic currency terms.

It thus makes no sense to criticize measures of original sin as poor measures of aggregate currency mismatches. Authors concerned with the two concepts are attempting to measure different things.

Currency mismatches may have other causes besides original sin. If banks are undercapitalized, with weak risk management and inadequate prudential supervision, moral hazard may tempt banks to fund themselves in foreign currency at low interest rates and on-lend in domestic currency at high rates, ignoring the fact that they incur a currency mismatch that leaves them vulnerable to exchange rate fluctuations.<sup>29</sup> Or a government may neglect the need to accumulate reserves as insurance against exchange rate shocks when foreign debt is denominated in foreign currency terms. Or the authorities may mislead banks and firms into believing that the exchange rate will remain pegged forever, encouraging them to underestimate exchange risk and hence the danger of open positions in foreign currency. Original sin may result in mismatches, depending on how the authorities manage its consequences. But we have never suggested that only original sin matters for currency mismatches, as is asserted in some discussions of our work.

Nor have we asserted that the strength of a country's institutions and policies is irrelevant for managing the consequences of original sin. In particular, countries with strong institutions, capable of running strong policies, are in the best position to cope with the potential mismatch problem. They can accumulate reserves. They can limit foreign borrowing. They can operate more flexible exchange rates. All of these steps may help to limit currency mismatches and financial fragility.<sup>30</sup> But these measures are second best. The first best would involve having the capacity to borrow from foreigners without incurring a currency mismatch.

This is just another way of saying that the measures that countries use to insure against mismatches are not without cost. Limiting access to foreign borrowing may limit investment. Reserve accumulation is costly. Flexible exchange rates are more problematic in countries with large shares of foreign currency-denominated debt. Thus, measures to limit the consequences of original sin taken by countries with the institutional capacity to implement them may come at a cost, as discussed above. This is the sense in which such measures may be incompletely successful at reconciling growth and stability.

29. This is an element of Goldstein's (1998) analysis of the Asian crisis.

30. Thus, where previous authors have said that in empirical work like that presented below we minimize the importance of macroeconomic and prudential policies for currency mismatches, they are confusing currency mismatches with original sin.

### 3.3 How These Differences Matter in Practice

We now show that these distinctions matter in practice. We start by constructing measures of original sin and presenting evidence of its consequences for policy, the volatility of growth and capital flows, and country creditworthiness.<sup>31</sup> We then repeat the exercise adding measures of aggregate currency mismatches and debt intolerance. The results suggest that the effects of original sin are the more statistically robust than those of these alternative concepts.

#### 3.3.1 Original Sin

Our index of original sin is<sup>32</sup>

$$(1) \quad \text{OSIN}_i = \max\left(1 - \frac{\text{Securities in currency } i}{\text{Securities issued by country } i}, 0\right)$$

The numerator includes all securities issued in currency  $i$  regardless of the nationality of the issuer. We adopt this formulation because if residents of countries different from  $i$  issue bonds in currency  $i$ , these bonds can then be used by residents of country  $i$  to swap their foreign currency obligations into domestic currency obligations. This opportunity to hedge would not be captured by an index that only includes local currency debt issued by residents. Although (Securities in currency  $i$ /Securities issued by country  $i$ ) can be greater than 1 (for countries that issue currencies that are widely used by nonresidents), we bound OSIN at zero because countries cannot hedge more debt than they have.

This index includes bonded international debt but does not include cross-border bank loans, since the Bank for International Settlements (BIS) does not provide detailed currency breakdowns of international loans.<sup>33</sup> We therefore weight each observation in the regression analysis below by the share of securities in total foreign debt.<sup>34</sup>

Table 3.2 presents simple averages of OSIN for several groups of countries. The financial centers (United States, United Kingdom, Switzerland, and Japan) have the lowest levels of original sin (in an obvious sense since this is what defines them as financial centers). They are followed by the Euroland countries. Evidently, the advent of the euro (whose introduction provides the dividing point between the two periods in the table) led to a

31. This material is drawn from Eichengreen, Hausmann, and Panizza (2005b).

32. In Eichengreen, Hausmann, and Panizza (2005b), we develop some additional measures of original sin and discuss their strengths and weaknesses.

33. In Eichengreen, Hausmann, and Panizza (2005b) we construct an alternative measure that takes into account bank loans. However, in order to construct this index it is necessary to make assumptions about the currency composition of these loans.

34. The weight is equal to (total securities issued by country  $i$ )/(total bank loans + total securities issued by country  $i$ ).

**Table 3.2** Measures of original sin (OSIN) by country groupings (simple average)

	1993–1998	1999–2001
Financial centers	0.07	0.08
Euroland	0.53	0.09 <sup>a</sup>
Other developed	0.78	0.72
Offshore	0.96	0.87
Developing	0.96	0.93
Latin America	0.98	1.00
Middle East and Africa	0.95	0.90
Asia and Pacific	0.99	0.94
Eastern Europe	0.91	0.84

*Source:* Authors' calculations.

<sup>a</sup>In the 1999–2001 period it is impossible to allocate the debt issued by nonresidents in euros to any of the individual member countries of the currency union. Hence, the number here is not the simple average, but is calculated taking Euroland as a whole.

drop in original sin in Euroland countries.<sup>35</sup> Developing countries have comparatively high levels of original sin, with Latin America having the most and Eastern Europe the least.

As argued above, we expect countries with original sin to be more inclined to accumulate international reserves and to use them to stabilize the exchange rate. Table 3.3 tests these hypotheses. All regressions in this table control for the level of development (proxied by the log of GDP per capita), openness, and foreign debt (total debt securities plus international loans) as a share of GDP. All variables are averages for the period 1993–98.<sup>36</sup>

Column (1) considers the choice of exchange rate regime. The dependent variable LYS is the de facto classification of Levy Yeyati and Sturzenegger (2000), which equals 1 for countries with floating exchange rates, 2 for countries with intermediate regimes, and 3 for countries with fixed rates. Since this measure increases with exchange rate inflexibility, we expect a positive relationship with original sin. The coefficient in question is positive and significant, indicating that countries with original sin float less freely.<sup>37</sup> The coefficient is also economically important. It suggests that moving OSIN from 1 to 0 is associated with a jump of one and a half points on the Levy Yeyati and Sturzenegger (2000) three-point scale. Countries previously inclined to peg will move to limited flexibility, while countries previously following policies of limited flexibility will be inclined to float. Original sin is one explanation, then, for the fear-of-floating phenomenon.

35. This is to be expected, since all of them, including a number of small ones that had not previously enjoyed the privilege, immediately became issuers of a major currency.

36. Since table 3.2 suggests a structural shift in 1999.

37. Since LYS is bounded at 1 and 3, we estimate the equation using double-censored Tobit. In Eichengreen, Hausmann, and Panizza (2005b) we explore whether this result could be due to reverse causality. We refer the reader to that paper for further discussion.

**Table 3.3** Original sin and exchange rate volatility

	LYS (1)	RESM2 (2)	RVER (3)	LYS (4)	RESM2 (5)	RVER (6)
Original sin	1.503 (3.56)***	0.248 (3.74)***	-0.801 (2.02)**	2.285 (3.43)***	0.357 (4.01)***	-1.034 (2.12)**
GDP per capita	0.302 (2.89)***	-0.053 (1.84)*	0.027 (0.61)	0.321 (2.53)**	-0.047 (1.74)*	0.014 (0.31)
Openness	0.198 (0.92)	-0.014 (0.41)	1.018 (2.88)***	0.129 (0.60)	-0.030 (0.89)	1.046 (2.99)***
External debt/GDP	0.290 (0.96)	-0.036 (0.66)	-0.570 (2.36)**	0.622 (1.13)	0.005 (0.09)	-0.664 (2.55)**
Mismatch				-0.037 (0.35)	-0.037 (2.09)**	0.084 (1.22)
Constant	-2.187 (1.94)*	0.531 (1.73)*	0.101 (0.17)	-3.094 (2.14)**	0.399 (1.37)	0.394 (0.56)
No. of observations	75	65	65	59	64	64
R-squared		0.37	0.62		0.42	0.63

Notes: Equations (1) and (4) are estimated by weighted Tobit. All the other equations are estimated with weighted OLS with robust standard errors. Absolute value of *t*-statistics in parentheses.

\*\*\*Significant at the 1 percent level.

\*\*Significant at the 5 percent level.

\*Significant at the 10 percent level.

Next we explore whether countries with high levels of original sin hold more reserves. As noted in section 3.2, this relationship sheds light on the connections between original sin and currency mismatches. Since reserves are often used to intervene in the foreign exchange market, their level may also shed light on the freedom of the float. The dependent variable here is international reserves normalized by M2 (denoted RESM2). Column (2) shows that the coefficient on OSIN is positive, as expected, and significant, as before. The estimated coefficient implies that the increase in reserves in a country where OSIN equals 1 instead of 0 is 25 percent of M2.

Following Bayoumi and Eichengreen (1998a, 1998b), we also define the freedom of the float as the volatility of exchange rates relative to the volatility of reserves (we denote the ratio as RVER). If countries with original sin are less inclined to float, we would expect a negative coefficient. Column (3) supports this hypothesis.

Next we consider the relationship between original sin and volatility of growth and capital flows.<sup>38</sup> There are at least three reasons why original sin may be positively correlated with volatility. First, it limits the authorities' capacity to undertake countercyclical policies. Second, dollar liabilities

38. Besides the independent variables included in table 3.3, we also control for the volatility of terms of trade. All equations are estimated by weighed OLS using robust standard errors.



**Table 3.4** Original sin and GDP and capital flow volatility

	Growth (1)	Flows (2)	Growth (3)	Flows (4)
Original sin	0.011 (1.87)*	7.069 (3.54)***	0.016 (1.49)	9.139 (1.53)
GDP per capita	-0.012 (2.19)**	-3.242 (2.56)**	-0.012 (2.03)**	-3.265 (2.00)*
Openness	-0.001 (0.14)	-4.250 (1.21)	-0.002 (0.29)	-5.136 (0.90)
Terms-of-trade volatility	-0.000 (0.90)	0.221 (1.08)	-0.000 (0.82)	0.201 (0.73)
External debt/GDP	-0.014 (1.67)*	0.212 (0.06)	-0.025 (1.64)	-2.747 (0.29)
Mismatch			-0.002 (1.18)	-0.655 (1.29)
Constant	0.128 (2.30)**	33.134 (2.40)**	0.133 (2.17)**	33.181 (1.91)*
No. of observations	77	33	63	23
R-squared	0.41	0.63	0.38	0.59

*Note:* Robust *t*-statistics in parentheses.

\*\*\*Significant at the 1 percent level.

\*\*Significant at the 5 percent level.

\*Significant at the 10 percent level.

limit the central bank's ability to act as a lender of last resort. Third, dollar-denominated debt increases the costs of currency depreciations that, in the event of a currency crisis, may lead to large falls in output.

Table 3.4 confirms the existence of a positive and statistically significant relationship between original sin and macroeconomic volatility. The estimated coefficient implies that going from an OSIN of 0 to an OSIN of 1 raises the volatility of GDP growth by 1.1 percentage points. Given that the average volatility of GDP growth is 1.5 percent in industrial countries and 3.5 percent in developing countries, original sin may account for a significant part of the difference.

A final set of equations further explores the relationship between original sin and credit ratings (introduced in table 3.1 above). We expect original sin to be negatively related to ratings because it makes the cost of servicing debt dependent on a real exchange rate that is procyclical, increasing the states of the world in which payment is difficult.<sup>39</sup> We regress credit ratings on OSIN, several standard fiscal indicators (public debt over GDP,

39. Hausmann (2003) provides a value-at-risk model of credit ratings and shows that original sin makes debt service depend differently on the variances and covariances of output, the real exchange rate, and the real interest rate. Moreover, the arguments already presented explain why these variances and covariances are themselves different in countries with original sin.

**Table 3.5** Original sin and credit ratings

	RATING					
	(1)	(2)	(3)	(4)	(5)	(6)
Original sin	-5.844 (4.07)***	-5.642 (4.00)***	-5.346 (4.08)***	-7.202 (5.20)***	-7.195 (5.05)***	-4.949 (2.90)***
Debt/GDP	-2.426 (2.51)**		-2.376 (2.71)***	-3.721 (3.79)***	-3.695 (3.66)***	-2.358 (2.31)**
Debt/revenues		-1.000 (2.49)**				
GDP per capita	2.917 (8.47)***	2.670 (6.15)***	2.758 (8.65)***	1.618 (4.25)***	1.636 (4.12)***	2.992 (9.09)***
External debt ratio	2.184 (1.43)	2.784 (1.52)	1.390 (0.99)	3.546 (2.11)**	3.617 (2.00)*	5.309 (2.85)***
Terms-of-trade volatility			-0.092 (2.49)**		0.015 (0.29)	
Real exchange rate volatility				-4.187 (5.49)***	-4.229 (4.50)***	
Mismatch						-2.928 (3.65)***
Constant	-8.062 (2.12)**	-5.962 (1.28)	-5.931 (1.66)	8.394 (1.83)*	8.114 (1.69)*	-9.000 (2.39)**
No. of observations	56	49	54	41	40	45

\*\*\*Significant at the 1 percent level.

\*\*Significant at the 5 percent level.

\*Significant at the 10 percent level.

public debt over government revenues), the country’s level of economic development (as proxied by per capita income), and the share of external debt in GDP. S&P rating data, adjusted as above, are used in what follows.

We find a strong negative correlation between original sin and credit ratings. Columns (1)–(5) of table 3.5 confirm that original sin is correlated with creditworthiness even after controlling for the level of development, total external debt, public debt relative to GDP or revenues, terms-of-trade volatility, and the real exchange rate volatility.<sup>40</sup> A drop in OSIN from 1 to 0 is associated with a five-notch improvement in credit ratings. This would push most countries in the sample above investment grade.

### 3.3.2 Currency Mismatches

Goldstein and Turner (2004) suggest that original sin has been improperly used as a proxy for aggregate currency mismatches. To this we would

40. The volatility of the real exchange rate may be persistent (depending on openness of the economy and the commodity composition of exports), and it is likely to be correlated with the probability of payment difficulties.

only say “not by us.” They suggest that a measure of aggregate mismatches should take into account the currency composition of domestic debt. This is incorrect, since if that debt is domestically held, the assets and liabilities of residents cancel out in the aggregate. To the extent that domestically issued, foreign currency–denominated or linked debt is held by foreigners, that is another issue. Such debt falls conceptually under the heading of foreign currency–denominated external debt.

In practice, holdings of domestically issued, foreign currency debt owned by foreigners are not easy to track. Some information can be obtained by a report on the currency composition of all holdings by U.S. residents of foreign securities for 2001 issued by the U.S. Department of the Treasury. This report has the advantage that it includes holdings of locally issued instruments; its disadvantage is that it covers only the holdings of U.S. residents. These data, summarized in table 3.6, corroborate the idea that the global portfolio is concentrated in very few currencies and that, by implication, the issuers of other currencies suffer from original sin (in other words, that the claims they sell to foreigners are predominantly denominated in foreign currencies, whether these are issued on foreign markets or not). Of the \$648 billion of financial claims on foreigners held by U.S. residents in 2001, \$456 billion (fully 70 percent) were denominated in U.S. dollars. U.S. residents hold 50.9 percent of their claims on Euroland countries in euros and 22.5 percent of their claims on other advanced countries in the currencies of those countries but only 3.1 percent of their claims on developing countries in the currencies of those developing countries.<sup>41</sup>

Goldstein and Turner (2003) define their measure of aggregate effective currency mismatches (AECM) as

$$(2) \quad \text{AECM} = \frac{\text{NFCA}}{\text{EXP}} \cdot \text{FCSHARE},$$

where NFCA is net foreign currency assets, EXP is exports, and FC-SHARE is the foreign currency share of total debt (both domestic and in-

41. Burger and Warnock (2003) look at these data from a different point of view, one that is entirely orthogonal to our point. They compare U.S. holdings of European bonds as a share of the total European market with U.S. holdings of Canadian (or emerging market) bonds expressed as a share of the Canadian (or emerging market) bond market. In Europe, where the overall bond market is much larger, they obtain a relatively small fraction. But this is due to the larger denominator. Consider a world in which the European economy and European bond market are many times larger than those of the United States. We would then see U.S. investors holding only a small fraction of total European bond issuance. But this would tell us nothing about Europe’s susceptibility to original sin; it would only confirm that the European economy and bond market are very much larger than those of the United States. In addition, Burger and Warnock look at asset allocation by region of issuer rather than by currency composition, which is our concern. Thus, table 2 in their paper, cited by Goldstein and Turner (2004) as a criticism of the original-sin view, has no bearing on the question.

**Table 3.6** Composition outstanding of international securities issued by non-U.S. residents and held by U.S. investors (2001)

	USD	EUR	JPY	GBP	OWN	Other	Total	Share of total	Share of international securities	Securities by currency	Currency share
Financial centers	137.4	5.1	32.5	16.1	0.1	0.3	191.6	29.57	19.45	511.8	79.00
Euroland	81.8	87.9	1.9	1.0	0.0	0.3	172.8	26.68	6.74	97.3	15.02
Other developed	115.3	1.0	0.7	0.5	34.1	0.3	151.8	23.44	29.91	34.1	5.26
Offshore	32.7	1.8	0.5	0.5	0.5	0.0	36.1	5.57	69.73	0.5	0.08
Developing	80.0	0.9	0.2	0.1	2.6	0.1	84.0	12.96	17.09	2.6	0.41
International organizations	9.0	0.6	0.8	0.6	0.0	0.6	11.5	1.78	3.05	0.0	0.00
Other and unallocated										1.5	0.23
Total	456.0	97.3	36.7	18.9	37.4	1.5	647.8	100	13.01	647.8	100

*Source:* Authors' calculations based on tables 16 and 17 in U.S. Treasury (2003).

*Notes:* USD = U.S. Dollar; EUR = euro; JPY = yen; GBP = British pound. The OWN currency column is set equal to zero for Euroland (everything is reported under the euro column) and, in the case of financial centers, for Japan and the United Kingdom. The value reported under OWN for financial centers corresponds to issues in Swiss francs. The "Share of International Securities" column shows the share held by U.S. investors over total international bonds issued in 2001 by non-U.S. residents. The "Securities by Currency" and "Currency Share" columns show international securities (and their share) held by U.S. investors in each of the currency groups. For instance, at the end of 2001 U.S. investors held US\$97.3 billion worth of international securities denominated in euro; this corresponds to 15 percent of the total international securities held by U.S. investors.

ternational).<sup>42</sup> Unfortunately, the data do not exist to compute AECM for a substantial number of countries. In particular, information on net foreign currency assets beyond international reserves and on the currency composition of total debt (international and domestic) are available for a limited number of countries. For this reason, Goldstein and Turner restrict their sample to twenty-two countries.

It is possible to build a measure similar to AECM for a larger sample. Consider the following index:

$$(3) \quad \text{MISMATCH} = \frac{\text{RES} - \text{DEBT}}{\text{EXP}} \cdot \text{OSIN},$$

where RES is international reserves, DEBT is international debt, and other variables are defined as above.<sup>43</sup> MISMATCH is not identical to AECM, but for the countries for which we have data on both the correlation of the two measures is 0.82 ( $p$ -value = 0.000).<sup>44</sup>

We now augment the preceding regressions with this measure.<sup>45</sup> To facilitate comparison we multiply MISMATCH by  $-1$  so that a higher value indicates a higher mismatch.

Columns (4)–(6) of table 3.3 show that controlling for MISMATCH does not eliminate the correlation between original sin and our three measures of exchange rate flexibility. If anything, the effect of OSIN becomes stronger. MISMATCH has a significant effect on RESM2 (the ratio of reserves to M2), but this is to be expected because reserves are used in the construction of MISMATCH. There is no significant correlation between MISMATCH and either LYS or RVER, our two measures of exchange rate policy. Columns (3) and (4) of table 3.4 similarly show that MISMATCH is not significantly correlated with the volatility of growth or capital flows.<sup>46</sup>

The last column of table 3.5 checks whether controlling for MIS-

42. Goldstein and Turner suggest that this is a good measure of overall mismatches because, besides capturing both sides of the balance sheet and considering the currency denomination of total debt, it also has substantial volatility over time and hence the potential of being a useful leading indicator of currency crises. Note that since higher levels of AECM indicate lower mismatches, when NFCA is positive they replace exports with imports.

43. We could also measure mismatches as  $[\text{RES} - (\text{DEBT} \cdot \text{OSIN})]/\text{EXP}$ . This alternative definition makes more sense to us, but the one in the text is closer to that used by Goldstein and Turner. In practice, the two measures are highly correlated. The results discussed below do not change if we use one measure instead of the other.

44. In particular, MISMATCH does not capture net international assets or measure the currency composition of total debt.

45. The present expanded sample includes twenty of Goldstein and Turner's twenty-two countries. (Some of the data needed to construct the mismatch proxy for China and Taiwan are not available.)

46. Including this variable in the regressions also reduces the explanatory power of original sin; with a  $p$  value of 0.14, OSIN is no longer statistically significant at conventional levels. At the same time, controlling for MISMATCH substantially raises the point estimate of OSIN. This suggests that the drop in statistical significance is due to the fact we are now forced to use a smaller sample. If we estimate equations (1) and (2) on the same sample as equations (3) and (4) we find results similar to those of columns (3) and (4): the point estimates of original sin increase, but the coefficients are not statistically significant.

MATCH affects the relationship between original sin and credit ratings. The significance of MISMATCH indicates that countries with large stocks of international reserves and small international debts have better ratings, other things being equal, these variables providing widely utilized rules of thumb for the rating agencies. But controlling for MISMATCH leaves the point estimate and significance of the coefficient on OSIN unchanged. An interpretation is that credit ratings are sensitive to both whether a country can borrow abroad in its own currency and how effectively it manages any currency mismatches that result from its inability to do so.

### 3.3.3 Debt Intolerance

Recall that Reinhart, Rogoff, and Savastano (2003) define debt intolerance as the inability of emerging markets to manage external debts that are manageable for advanced countries. They operationalize it as the relationship of external debt (scaled by GDP or exports) to a measure of country risk (credit ratings).

We already included the debt-GDP and debt-revenue ratios in the credit rating regressions reported earlier in this section, along with OSIN. There we found that both original sin and debt ratios matter for credit ratings.<sup>47</sup> We can generalize this analysis by allowing the debt ratio to have a different impact on credit ratings in advanced and developing countries. Let  $DE\_GDP \cdot IND$  and  $DE\_RE \cdot IND$  denote the effect of the debt-GDP and debt-tax revenue ratios in the advanced economies and  $DE\_GDP \cdot DEV$  and  $DE\_RE \cdot DEV$  the effect of these same ratios in developing countries. Table 3.7 shows that the impact of original sin on credit ratings is robust to this extension. When we add a separate intercept for developing countries to avoid loading all other respects in which advanced and developing countries differ into the  $DE\_GDP \cdot DEV$  and  $DE\_REV \cdot DEV$  terms, original sin remains significant and important, while there is again no difference in the elasticity of credit ratings with respect to the external debt ratio in developing versus advanced economies.

We constructed two alternative measures of debt intolerance and checked whether adding them to our regressions for exchange rate flexibility diminishes the impact of original sin. The first measure, DI1, is nonofficial external debt (scaled by GDP) relative to RATING.<sup>48</sup> The second one, DI2, is the domestic and external public debt (again scaled by GDP) relative to RATING. Table 3.8 asks whether controlling for debt intolerance, so measured, affects the correlation between original sin and exchange rate flexibility.<sup>49</sup> It turns out that these proxies for debt intolerance have little

47. As does MISMATCH—again, see table 3.5.

48. Our measure differs from that of Reinhart, Rogoff, and Savastano in that we include both public and private debt while excluding official instead of concessional debt.

49. When we use DI1, we run regressions both including and excluding external debt over GDP from some specifications on the grounds that this variable is in the numerator of DI1.

**Table 3.7** Original sin and credit rating in developing and industrial countries

	RATING			
	(1)	(2)	(3)	(4)
Original sin	-5.100 (3.38)***	-5.385 (3.46)***	-4.751 (3.32)***	-5.101 (3.53)***
DE_GDP · IND	-1.553 (1.31)		-2.451 (2.05)**	
DE_GDP · DEV	-3.557 (2.66)**		-2.475 (1.84)*	
DE_RE · IND		-0.860 (1.57)		-1.354 (2.45)**
DE_RE · DEV		-1.113 (2.22)**		-0.847 (1.79)*
GDP per capita	2.663 (6.71)***	2.575 (5.12)***	1.936 (4.00)***	1.729 (3.01)***
External debt/GDP	2.252 (1.50)	2.799 (1.54)	1.751 (1.22)	2.015 (1.17)
Developing			-3.004 (2.38)**	-3.226 (2.52)**
Constant	-6.314 (1.58)	-5.288 (1.06)	1.606 (0.32)	4.085 (0.69)
No. of observations	56	49	56	49

*Notes:* Table shows weighted Tobit estimations. Absolute value of *t*-statistics in parentheses.

\*\*\*Significant at the 1 percent level.

\*\*Significant at the 5 percent level.

\*Significant at the 10 percent level.

additional impact on exchange rate flexibility, while the results for original sin are basically unchanged.<sup>50</sup>

Table 3.9 examines the implications of adding these alternative measures of debt intolerance to our analysis of the volatility of growth and capital flows. Their addition does not diminish the impact of original sin on the volatility of either GDP growth or capital flows. In contrast, neither measure of debt intolerance has a significant impact on the volatility of GDP growth.

There is some evidence that debt intolerance is significantly correlated with the volatility of capital flows. But when we separate the variable into its two components (debt ratio and credit rating), we find that most of the explanatory power resides with the denominator (see columns [9]–[11] of table 3.9). Total external debt over GDP and government debt over GDP are never statistically significant (total debt also has the wrong sign). This

50. The debt intolerance measure has additional impact on exchange rate flexibility only in two specifications.

**Table 3.8** Original sin, debt intolerance, and exchange rate volatility

	LYS			RESM2			RVER		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Original sin	1.737 (3.74)***	1.886 (3.89)***	1.738 (3.85)***	0.271 (4.09)***	0.247 (3.61)***	0.271 (4.11)***	-0.843 (2.18)**	-0.136 (0.76)	-0.809 (2.02)**
GDP per capita	0.259 (1.94)*	0.220 (1.69)*	0.259 (2.39)**	-0.034 (1.12)	-0.044 (1.72)*	-0.034 (1.57)	0.124 (1.78)*	0.033 (1.66)	-0.001 (0.03)
Openness	0.208 (0.84)	0.391 (0.86)	0.208 (0.85)	0.007 (0.22)	0.079 (1.20)	0.007 (0.22)	0.990 (4.37)***	-0.057 (0.68)	1.052 (3.70)***
External debt/GDP	-0.004 (0.01)	0.069 (0.20)		0.001 (0.00)	-0.050 (0.62)		-1.603 (2.85)***	0.072 (0.80)	
D11	2.435 (0.19)		2.377 (0.43)	-1.012 (0.43)		-1.006 (0.83)	17.456 (2.52)**		2.368 (0.83)
D12		-1.849 (0.74)			-0.766 (1.70)*			0.299 (1.26)	
Constant	-2.033 (1.48)	-1.817 (1.26)	-2.030 (1.66)	0.338 (1.12)	0.415 (1.47)	0.337 (1.41)	-0.825 (1.07)	0.002 (0.01)	0.151 (0.24)
No. of observations	59	51	59	53	46	53	52	45	52
R-squared				0.34	0.40	0.34	0.73	0.25	0.69

*Notes:* Equations (1)–(3) are estimated with weighted Tobit model. All the other equations are estimated with weighted OLS with robust standard errors.

\*\*\*Significant at the 1 percent level.

\*\*Significant at the 5 percent level.

\*Significant at the 10 percent level.



**Table 3.9 Original sin, debt intolerance, and GDP and capital flow volatility**

	Growth (1)	Flows (2)	Growth (3)	Growth (4)	Flows (5)	Flows (6)	Flows (7)	Flows (8)	Flows (9)	Flows (10)	Flows (11)
Original sin	0.013 (2.45)**	0.015 (2.84)***	0.013 (2.46)**	0.015 (2.77)**	5.271 (2.77)**	9.163 (4.48)***	6.693 (3.15)***	8.959 (4.19)***	3.155 (1.82)*	5.630 (2.35)**	5.547 (2.15)**
GDP per capita	-0.007 (2.04)**	-0.008 (2.65)**	-0.007 (2.98)***	-0.009 (2.85)***	-1.234 (1.13)	-2.173 (2.43)**	-3.041 (2.58)**	-2.340 (2.48)**	2.012 (1.16)	1.469 (0.99)	1.240 (0.87)
Openness	0.002 (0.41)	-0.005 (0.50)	0.002 (0.50)	-0.006 (0.65)	-1.606 (0.35)	-1.918 (0.44)	-6.413 (1.67)	-3.357 (0.91)	3.139 (1.10)	3.948 (1.22)	2.243 (0.79)
Terms-of-trade volatility	0.000 (0.23)	0.000 (0.13)	0.000 (0.37)	0.000 (0.24)	0.145 (0.59)	-0.159 (1.65)	0.217 (1.03)	-0.137 (1.55)	0.100 (0.49)	-0.224 (1.86)*	-0.197 (1.59)
External debt/GDP	-0.008 (0.42)	-0.005 (0.65)			-20.531 (1.83)*	-2.797 (1.14)			-0.616 (0.23)	-3.093 (1.10)	
D11	-0.026 (0.09)		-0.109 (0.81)		355.751 (1.76)*		57.418 (0.75)				
D12		-0.075 (1.19)		-0.078 (1.21)		52.839 (4.85)***		52.850 (4.87)***			
Rating									-1.494 (2.54)**	-1.337 (2.51)**	-1.316 (2.44)**
Public debt/GDP										1.686 (0.60)	1.839 (0.66)
Constant	0.078 (2.35)**	0.093 (2.80)***	0.082 (3.01)***	0.097 (2.94)***	13.241 (1.03)	22.635 (2.36)**	31.258 (2.37)**	23.906 (2.39)**	5.858 (0.58)	9.169 (0.91)	10.562 (1.08)
No. of observations	62	54	62	54	29	26	29	26	29	26	26
R-squared	0.38	0.35	0.38	0.35	0.64	0.75	0.60	0.74	0.68	0.73	0.73
Sum of coefficients evaluated at the mean									DEBT + RATING	DEBT + RATING + DE_GDP	RATING + DE_GDP
Test									-20.58 $F(1,22) = 6.1$	-18.84 $F(1,18) = 6.0$	-17.16 $F(1,19) = 6.5$
p									0.022	0.025	0.020

Note: Robust t-statistics in parentheses.

\*\*\*Significant at the 1 percent level.

\*\*Significant at the 5 percent level.

\*Significant at the 10 percent level.

is telling us that countries with low credit ratings have relatively volatile capital flows, which is not surprising given the bidirectional causality between the variables.<sup>51</sup>

### 3.4 Additional Issues

In this section we consider a number of additional issues arising from the recent literature related to this paper.

#### 3.4.1 Hedging

Efforts to measure an economy's vulnerability to balance sheet effects using the value of securities issued abroad that are denominated in foreign currencies can mislead if swaps and other derivative transactions are used to hedge currency exposures.<sup>52</sup> The limited availability of information on derivative transactions is thus an impediment to empirical work in this area.<sup>53</sup>

Of course, if foreigners hold no financial claims on a country that are denominated in its own currency (the extreme form of original sin that appears to afflict fully half of the countries considered in the appendix to Eichengreen, Hausmann, and Panizza 2005b), then its *aggregate* foreign currency exposure cannot be hedged as a matter of definition.<sup>54</sup> For residents of the country to swap out of their aggregate currency mismatch, there must be someone on the other side of the swap. If foreigners are unwilling to hold local currency exposure, they will be unwilling to purchase swaps, and the issuing country will be unable to hedge its aggregate foreign currency exposure. Firms can use hedges to pass around foreign currency exposure like a hot potato, but as a group they cannot shed it if foreign investors are unwilling to hold it.<sup>55</sup> If that exposure is reallocated domesti-

51. In addition, we reject the null that the two coefficients enter with equal and opposite signs, as suggested by the debt intolerance hypothesis. This is shown in the last two rows, which check whether the sum of the rating and debt coefficients (evaluated at the mean of the respective variables) is equal to zero and strongly reject the hypothesis.

52. Simply tabulating the value of foreign currency-denominated securities sold to foreigners will not produce a measure of gross foreign currency exposure, for example, if domestic issuers use derivative transactions to swap out of the foreign currency.

53. To put the point another way, the difficulty of tracking off-balance-sheet transactions creates problems for the balance sheet approach.

54. Goldstein and Turner (2004) state that the "original sin hypothesis" assumes that all emerging markets are alike in terms of their ability to hedge foreign exposures. If they are alluding to our work, then this description is erroneous. To the contrary, we emphasize that those countries with the most severe cases of original sin (i.e., when all of the country's debt to foreigners is denominated in foreign currency) are by definition unable to hedge their exposures in the aggregate, while others may be able to do so to some extent.

55. Alternatively, the government can assume the risk. Bonomo, Martins, and Pinto (2003) suggest that after the Brazilian devaluation of 1998 the government became the ultimate source of hedging. In this case, then, the mismatch was transferred from the private to the public sector.

cally in efficient ways—if it is transferred at a price to firms in the strongest position to manage the associated risks (from firms producing nontradables to firms producing tradable goods, for example)—then the effects of original sin may be mitigated.<sup>56</sup> But the effects are analytically distinct from the phenomenon itself.<sup>57</sup>

### 3.4.2 Measuring Currency Mismatch

In the case of aggregate currency mismatches, it is important to net a country's international reserves and other foreign currency-denominated financial assets from gross external liabilities denominated in foreign currency. It may or may not be important to also include domestic debts denominated in foreign currency. If there is no foreign participation in domestic debt markets, then the currency denomination of domestic debts has no bearing on calculations of the aggregate currency mismatch, insofar as one resident's domestic dollar (peso) liability is another resident's domestic dollar (peso) asset.<sup>58</sup>

With the growing participation of foreign investors in local emerging bond markets, it becomes increasingly problematic to neglect the currency denomination of issues on the latter. But it cannot simply be assumed that all local currency issues are local currency denominated. Burger and Warnock (2003, n. 9) observe that “BIS data on domestic bonds is not collected at the security level but *should* contain only local-currency denominated bonds placed locally; for Argentina and Peru, however, it contains some foreign currency issues” (emphasis added). Burger and Warnock re-categorize the relevant bonds for these two countries. Unfortunately, it is probable that there also exist other foreign currency issues in the BIS data. There is also the fact that some fraction of emerging market debt securities placed locally is indexed to the exchange rate rather than denominated in foreign currency, creating the same problems as foreign currency-denominated debt from the point of view of the balance sheet literature.

Concentrating solely on the currency composition of financial assets

56. Goldstein and Turner (2004) criticize our OSIN measure for failing to distinguish the allocation of currency risk between traded and nontraded goods-producing sectors. This confuses the effects of OSIN with its magnitude (in effect, it fails to distinguish between the left- and right-hand-side variables in our regression equations). We return to this point below. It also confuses their concern, currency mismatches, with ours, the currency composition of the gross external debt. This criticism is also disingenuous because Goldstein and Turner themselves have no information on the distribution of aggregate currency exposures between the traded and nontraded goods-producing sectors for the sample of twenty-two countries.

57. If hedging had been important in the sample period for mitigating the *effects* of original sin, we of course would not find the strong correlation between original sin, fear of floating, capital flow and output volatility, and credit ratings that we document in the previous section.

58. The currency denomination of domestic debts may still have important implications for the financial vulnerability of individual firms and banks, as noted above (if, for example, foreign currency net liabilities are concentrated among producers of nontradables). But this vulnerability will not be picked up by aggregate measures of the currency mismatch.

and liabilities also ignores natural hedges. The same exchange rate change that increases the cost of servicing foreign currency–denominated external obligations may increase the demand abroad for the exports of the indebted country and hence its capacity to meet its debt service obligations. This observation has encouraged some students of currency mismatches to normalize net foreign currency–denominated financial debt by exports, as we saw in equation (2) above.

But normalizing by exports, whether gross or net, confuses stocks with flows.<sup>59</sup> What is relevant when the exchange rate changes is the (increase in the) flow of export revenues relative to the (increase in the flow of) debt service costs, not a comparison of stocks of financial assets with flows of export receipts. Comparing the flow of export receipts with the flow of interest payments on foreign currency–denominated financial assets would be more appropriate in this context.<sup>60</sup>

Normalizing the stock of net external debt denominated in foreign currency by exports also conflates the extent of the mismatch with its effects. A country that exports less will almost certainly find it harder to undertake the macroeconomic adjustment needed to contend with the adverse balance sheet effects of exchange rate depreciation. But the impact of an exchange rate change when there is a currency mismatch is different from the size of the mismatch.<sup>61</sup> A measure like equation (2) might be defended as a leading indicator of the potential severity of potential mismatch problems, but this would be quite different from saying that it is an adequate measure of the extent of mismatches.

### 3.4.3 The Domestic Dimension

Eichengreen and Hausmann (1999) used original sin to refer to both the difficulty emerging markets have in borrowing abroad in their own currencies and the difficulty that many of them also experience in borrowing at home, in local currency terms, at long maturities and fixed rates. Countries suffering from both problems will find it particularly difficult to cope with adverse shocks. If they allow the currency to depreciate in response, they will be hammered by the balance sheet effects of the aggregate currency mismatch. But if they attempt to support the currency by raising interest

59. At the level of abstraction, Goldstein and Turner (2004) distinguish a flow measure of mismatches from a stock measure of mismatches, but this distinction is not maintained when they turn to empirics and develop the measure reproduced in equation (2) above.

60. In addition, the same distinction between gross and net foreign currency–denominated financial obligations emphasized elsewhere applies to exports as well; the (increase in) export revenues should presumably be net (of the increase in import spending) rather than gross.

61. In a regression framework, an appropriate way of controlling for the fact that the same currency mismatch may have larger effects on macroeconomic variables in less open economies is to interact the mismatch variable with a measure of openness (also controlling separately for openness, since openness may also affect those macroeconomic variables through non–balance sheet channels), not to construct a variable that conflates the extent of the mismatch with the likely magnitude of its effects.

rates, firms and banks will have their financial situation destabilized by the rise in the short-term interest rate, given the absence of long-term fixed-rate debt.<sup>62</sup>

In subsequent work we narrowed our definition, focusing on the difficulty that emerging markets experience in borrowing abroad in their own currencies, reflecting evidence that, with sufficient time and effort, it has become possible for some of them to develop the capacity to place longer-term domestic currency issues with local residents. The International Monetary Fund (IMF; 2003) reports that local corporate bond issues in emerging markets grew by a factor of 10 between 1997–99 and 2000–2001 and that local bond markets have been the dominant source of funding for the public sector in emerging markets as a class. The role of domestic bond issues in corporate funding has been particularly important in Latin America, where local bond issues nearly equaled the sum of international issues of bonds, equities, and syndicated lending in the period 1997–2001.

At the same time, a substantial number of domestic bond placements are indexed to the exchange rate, as noted above, rendering them indistinguishable from a currency-risk point of view from foreign currency-denominated issues. A substantial share of the remainder is indexed to the short-term interest rate, thereby providing no protection from interest rate hikes. Still, emerging markets, especially in Asia, have made some progress in issuing long-dated bonds that, when indexed at all, are indexed to slowly moving variables like inflation rather than to financial variables like exchange rates and short-term interest rates that respond instantaneously to shocks.<sup>63</sup>

Figure 3.1 shows a scatter plot of our original sin measure (OSIN) versus a measure of the ability to issue domestic currency long-term fixed-rate debt, or “domestic original sin” (DSIN), for all countries for which we have been able to construct both measures. Our main source of information on domestic original sin is JPMorgan’s (1998, 2000, 2002) *Guide to Local Markets*, which reports detailed information on domestically traded public debt for twenty-four emerging market countries. We divide outstanding government bonds into five categories: (a) long-term domestic currency fixed rate (DLTF); (b) short-term domestic currency fixed rate (DSTF); (c) long-term (or short-term) domestic currency debt indexed to interest rate (DLTII); (d) long-term domestic currency debt indexed to prices (DLTIP); and (e) foreign currency debt (FC). We define domestic original sin as

62. This was the situation in which Asian banks that had funded themselves by incurring short-term obligations found themselves in 1997; it is also the reason the dilemma of whether to let the exchange rate go or to defend it with interest rate hikes was a no-win situation.

63. Thus, in our empirical work we classify countries as not suffering from the domestic aspect of original sin only when they have issued significant amounts of domestic currency debt that is not floating rate, short term, or dollar indexed. In one of our measures, we include debt that is indexed to the consumer price index, a more slowly moving nonfinancial variable.

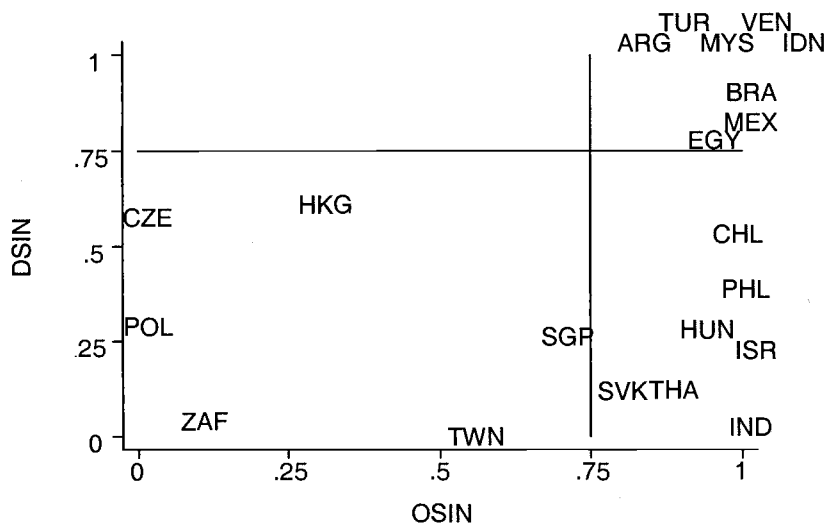


Fig. 3.1 Domestic versus international original sin (2001)

$$DSIN = \frac{FC + DSTF + DLTI}{FC + DLTF + DSTF + DLTI + DLTIIP}$$

This definition focuses on both foreign currency debt and domestic currency short-term debt (or long-term but indexed to the interest rate).<sup>64</sup>

Note that there are a number of countries with low levels of DSIN but high levels of OSIN, such as Chile, Israel, India, Hungary, and Thailand. Contrary to the conjecture of Reinhart, Rogoff, and Savastano (2003), it is not obvious that the domestic and international aspects of original sin are determined by identical sets of factors.<sup>65</sup>

There is now a substantial literature on the development of domestic bond markets and on the relevant policy initiatives (see Harwood 2000; Herring and Chatusripitak 2000). Steps for developing domestic bond markets include running stable macroeconomic policies, strengthening

64. We only have information on traded debt (and mostly public debt). Hence, if a country has a market for long-term fixed-rate bank loans but no market for long-term fixed-rate debt instruments, our indexes may overestimate original sin. If, on the other hand, a country has a market for long-term fixed-rate debt instruments but no market for long-term fixed-rate bank loans, our indexes will provide a lower bound for original sin. The data in figure 3.1 are for December 2001, with the exception of Argentina (where the data refer to 1998) and Egypt (where the data refer to 2000).

65. On the other hand, there are no countries with high levels of DSIN and low values of OSIN. This supports the idea that resolving the domestic aspects of original sin is a necessary condition for addressing the international aspect. Hausmann and Panizza (2003) show that the determinants of DSIN and OSIN are empirically quite different, with inflation history and institutions playing a larger role in the former and country size playing an important and robust role in the latter.

payment and settlement systems, and using regulation to encourage transparency on the part of market participants. But what is striking is that the same emerging markets that have made progress in these areas and thus have been rewarded with faster domestic bond market development have made less progress in acquiring the capacity to borrow abroad in their own currencies. This is the observation that led us to more narrowly focus our definition of original sin. It is what has led us to conjecture that something about the structure of foreign demand for claims denominated in the local currency is contributing to the problem of original sin.<sup>66</sup>

Even if domestic reforms that help to promote the development of local markets do not eliminate original sin, might they not eliminate the main reason for worrying about it by eliminating the need for countries to borrow abroad? With well-developed domestic financial markets, the argument might run, it will become possible to finance domestic investment out of domestic savings, with no need for recourse to foreign finance. However, such a conclusion would minimize the benefits of international borrowing (and lending) for smoothing consumption, diversifying risk, and augmenting investment where appropriate. Countries like the United States with well-developed domestic financial markets still make use of the capital account for these purposes. It is not obviously the case, in other words, that well-developed domestic financial markets render the foreign finance superfluous.<sup>67</sup> To the contrary, the case for having safe access to international finance remains compelling.

The question is what safety requires. Potential borrowers must pursue macroeconomic, financial, and institutional reforms in order to be able to deploy foreign funding productively and become attractive destinations for international capital flows. But potential borrowers and lenders must also be able to address the sources of the reluctance of foreign investors to hold claims denominated in the currencies of emerging markets in order to create an attractive balance between the risks and returns of borrowing abroad. It is to this problem that we now turn.

#### 3.4.4 Reflections on Causes

In Eichengreen, Hausmann, and Panizza (2005a) we examine several potential explanations for original sin. Although level of development, monetary credibility, and quality of institutions may play a role, the evidence there suggests that these variables by themselves cannot account for the

66. We consider this possibility more systematically below.

67. Goldstein and Turner (2004, p. 21) write that they find unpersuasive “the view (implicit in the OSH [original sin hypothesis]) that any analysis of the path to reduced financial fragility and higher economic growth in emerging markets should concentrate exclusively on external sources of finance.” This position is certainly not implicit in our work. Rather, our position is that domestic bond market development does not eliminate the argument for international finance. If we have focused on measures to enhance access to international finance, this is because this aspect of the problem is particularly difficult to solve (as is explained in the text).

widespread nature of the phenomenon. Country size is the only variable analyzed that is both statistically and economically significant as a determinant of original sin. It is this finding that leads us to formulate an explanation for original sin based on the costs and returns to portfolio diversification at the global level.

Here we summarize our previous empirical analysis and consider some additional wrinkles.<sup>68</sup> Country size is measured as the principal component of the log of total GDP, log of total trade and the log of total domestic credit. Column (1) of table 3.10 shows that country size is negatively related to original sin. A variety of sensitivity analyses support the conclusion that size is important in regressions seeking to explain original sin. We therefore control for country size in all of the empirical analysis that follows.

Table 3.2 above suggested that original sin varies between financial centers, the Euroland countries, other advanced economies, and developing countries. In the analysis that follows we therefore control for membership in these country groups by including a vector of country-group variables (where developing country is the omitted alternative). Table 3.2 shows that these fixed effects are quite important.<sup>69</sup>

In column (2) of table 3.10 we add per capita GDP as a measure of economic development. Both this variable and country size are negatively correlated with original sin, although only size is significantly different from zero at standard confidence levels.

In column (3) we consider inflationary history as a measure of monetary credibility. Our variable is constructed as the average of log inflation over the last twenty years in an effort to capture any lingering effects of policies long past. While countries with histories of more inflation appear to have more original sin, the effect does not approach statistical significance at standard confidence levels.<sup>70</sup>

68. Since our dependent variable ranges between 0 and 1, all the regressions are estimated by weighted Tobit. In Eichengreen, Hausmann, and Panizza (2005a) we show that the results are robust to alternative estimation techniques. As before, all variables are measured as 1993–98 averages (except where explicitly noted to the contrary).

69. Not including these fixed effects, which subsequent analysis shows to be important, may therefore bias our results. Doing so may attribute to a country's policies the effects of its status as a financial center. Or it may attribute to, say, inflation the effect of all the characteristics of a country that are associated with its industrial-country status. In the interest of completeness, we show below how the results change when we omit these country-group fixed effects and provide an interpretation of the differences. It turns out that they do not change very much.

70. Shorter lags of inflation only strengthen this result. This finding is also robust to a variety of sensitivity analyses. When we replace average inflation with the log of maximum inflation over the period, we again find no significant relationship with original sin. To test potential nonlinearities in the relationship between inflation and original sin, we also experimented with both the average log of inflation and its square. In this case, neither of the coefficients on inflation is significant. Alternatively, we use the principal component of average inflation and maximum inflation and again find no significant correlation with original sin (results are reported in the appendix of Eichengreen, Hausmann, and Panizza 2005a).



**Table 3.10** The causes of original sin

	OSIN (1)	OSIN (2)	OSIN (3)	OSIN (4)	OSIN (5)	OSIN (6)	OSIN (IV) (7)	OSIN (IV) (8)	OSIN (9)	OSIN (10)	OSIN (IV) (11)
Size	-0.562 (6.16)***	-0.310 (3.37)***	-0.318 (3.57)***	-0.350 (3.71)***	-0.330 (3.60)***	-0.323 (3.53)***	-0.318 (3.54)***	-0.345 (2.07)**	-0.365 (2.13)**	-0.290 (3.22)***	-0.270 (2.64)***
GDP per capita		-0.142 (1.59)									
AV_INF			0.307 (1.19)								
DE_GDP				-0.073 (0.50)							
DE_GDP · DEV					0.247 (0.88)						
DE_GDP · IND					-0.186 (1.13)						
Institutions							0.158 (0.50)	-0.226 (0.68)	-0.041 (0.36)		
DC_GDP						-0.050 (0.46)				-0.332 (1.49)	-1.568 (0.95)
FIN_CENTER		-0.679 (1.99)*	-0.866 (2.88)***	-0.825 (2.72)***	-0.645 (2.01)**	-0.883 (2.65)**	-1.179 (2.16)**			-0.753 (2.40)***	0.239 (0.19)
EUROLAND		-0.125 (0.61)	-0.304 (2.11)**	-0.344 (2.61)**	-0.155 (0.84)	-0.326 (1.80)*	-0.553 (1.50)			-0.226 (1.37)	0.488 (0.53)
OTH_DEVEL		0.007 (0.03)	-0.200 (1.47)	-0.275 (2.18)**	-0.094 (0.53)	-0.203 (1.03)	-0.501 (1.05)			-0.224 (1.75)*	-0.016 (0.05)
DEVELOPING								0.049 (0.09)	0.409 (1.38)		
Constant	1.388 (13.14)	2.526 (3.40)***	1.277 (10.87)***	1.426 (11.99)***	1.260 (8.00)***	1.388 (13.18)***	1.343 (11.64)***	1.224 (2.29)**	0.931 (2.64)**	1.521 (10.13)***	2.119 (2.65)***
No. of observations	75	75	74	64	64	75	75	29	29	74	74

*Notes:* Table shows weighted Tobit estimations. Absolute value of *t*-statistics in parentheses.

\*\*\*Significant at the 1 percent level.

\*\*Significant at the 5 percent level.

\*Significant at the 10 percent level.

Columns (4) and (5) test the hypothesis that original sin is the consequence of debt-intolerant countries borrowing too much.<sup>71</sup> Regressing original sin on the public debt–GDP ratio, we find that the coefficient on the latter is insignificantly different from zero. To capture the possibility that the impact of the same debt–GDP ratio is greater in developing countries, column (5) allows the impact of debt to differ between them (where  $DE\_GDP \cdot DEV$  is the debt–GDP ratio interacted with a developing-country dummy and  $DE\_GDP \cdot IND$  is the same ratio interacted with an industrial-country dummy, as before). While we obtain a positive coefficient on debt–GDP for developing countries and a negative coefficient for the advanced countries, neither coefficient differs significantly from zero at standard confidence levels.

Columns (6)–(9) consider institutional quality (using the index of rule of law developed by Kaufmann, Kraay, and Zoido-Lobaton 1999). The Tobit regression in column (6) produces a negative effect of institutions on original sin, but one that is again statistically insignificant at standard confidence levels. Recent papers (e.g., Sachs 2001; Hall and Jones 1999; Acemoglu, Johnson, and Robinson 2001) suggest focusing on geography and colonial settlement patterns as ways of identifying the exogenous component of institutions. When we instrument institutions with distance from the equator (column [7]), we find that the former is still not statistically significant. When we instrument institutions with the log of settler mortality (column [8]), there again appears to be no effect. Column (9), where we estimate this equation by OLS but use the same sample as in column (8), suggests that this is not due to the limited number of countries for which we have data on settler mortality.

In column (10) we consider the role of financial development.<sup>72</sup> We find a negative but not statistically significant relationship between original sin and financial development as measured by the ratio of domestic credit to GDP. To control for the endogeneity of financial development, we next instrument the domestic credit–GDP ratio with the origin of the legal system. We follow La Porta et al. (1998), using a dummy variable that takes a value of 1 in countries that follow the French civil law tradition. Column (11) shows that controlling for endogeneity does not affect the result.

Column (1) of table 3.11 includes all of these variables in the same equation. We consider these to be the definitive hypothesis tests. Again, we find that the coefficient on *SIZE* is negative and significantly different from zero at conventional confidence levels. In addition, GDP per capita and institutions are also statistically significant. But while GDP per capita has the expected negative sign, institutions have a positive coefficient, as if coun-

71. This would make debt intolerance the fundamental cause of the financial fragility problem and original sin one of its symptoms.

72. Tirole (2002) provides a political economy explanation for a possible relationship between original sin and the development of the domestic financial system.

**Table 3.11** The causes of original sin: Encompassing tests

	OSIN			OSIN (IV)
	(1)	(2)	(3)	(4)
Size	-0.302 (3.32)***	-0.325 (3.48)***	-0.326 (3.50)***	-0.333 (3.52)***
GDP per capita	-0.262 (2.08)**	-0.127 (1.31)		
AV_INF	0.288 (0.89)	0.150 (0.49)	0.070 (0.29)	-0.060 (0.14)
DE_GDP	-0.003 (0.02)	-0.102 (0.60)	0.044 (0.26)	-0.059 (0.28)
Institutions	0.305 (1.88)*		0.091 (0.70)	-0.120 (0.33)
DC_GDP	-0.313 (1.05)	-0.173 (0.59)	-0.403 (1.38)	-0.319 (1.19)
FIN_CENTER	-0.492 (1.45)	-0.453 (1.31)	-0.680 (2.06)**	-0.479 (0.91)
EUROLAND	0.032 (0.15)	0.010 (0.04)	-0.220 (1.18)	-0.074 (0.22)
OTH_DEVEL	-0.053 (0.24)	0.030 (0.14)	-0.299 (1.55)	-0.072 (0.17)
DEVELOPING				
Constant	3.506 (3.54)***	2.505 (3.22)***	1.516 (7.66)***	1.618 (4.89)***
No. of observations	63	63	63	63

*Notes:* Table shows weighted Tobit estimations. Absolute value of *t*-statistics in parentheses.

\*\*\*Significant at the 1 percent level.

\*\*Significant at the 5 percent level.

\*Significant at the 10 percent level.

tries with worse institutions suffer less from original sin. This appears to be due to the high correlation between GDP per capita and rule of law (0.83). A Wald test suggests that the two variables are not jointly significant (*p*-value = 0.14), and when they are entered one at a time (in columns [2] and [3]) neither of them is statistically significant. The last column shows that the results do not change if we instrument institutions with latitude.<sup>73</sup>

Tables 3.10 and 3.11 thus suggest that original sin is robustly related to country size and to countries' status as financial centers, advanced economies, or emerging markets but that it is only weakly related to institutional variables like rule of law and measures of policy like inflation and fiscal history.

When we eliminate the country-group dummies, in table 3.12, inflation

73. When we instrument institutions with settler mortality, none of the explanatory variables matters (which presumably reflects the limited sample size).

**Table 3.12** The causes of original sin omitting country-group fixed effects

	OSIN (1)	OSIN (2)	OSIN (3)	OSIN (4)	OSIN (5)	OSIN (IV) (6)	OSIN (IV) (7)	OSIN (8)	OSIN (9)	OSIN (IV) (10)
SIZE	-0.415 (4.51)***	-0.495 (5.71)***	-0.555 (5.92)***	-0.414 (4.54)***	-0.480 (5.32)***	-0.487 (4.58)***	-0.358 (2.17)**	-0.435 (2.97)***	-0.399 (4.47)***	-0.84 (0.38)
GDP per capita	-0.170 (3.00)***									
AV_INF		0.610 (2.20)**								
DE_GDP			0.050 (0.31)							
DE_GDP · DEV				0.421 (2.04)**						
DE_GDP · IND				-0.210 (1.24)						
INSTITUTIONS										
DC_GDP					-0.182 (2.33)**	-0.196 (1.19)	-0.309 (1.92)*	-0.202 (1.96)**	-0.554 (2.99)***	-3.22 (1.52)
Constant	2.835 (5.47)***	1.226 (11.08)***	1.374 (11.66)***	1.224 (11.01)***	1.486 (12.33)***	1.483 (10.62)***	1.382 (7.66)***	1.429 (7.82)***	1.636 (11.32)***	3.046 (2.74)***
No. of observations	75	74	64	64	75	75	29	29	74	74

*Notes:* Table shows weighted Tobit estimations. Absolute value of *t*-statistics in parentheses.

\*\*\*Significant at the 1 percent level.

\*\*Significant at the 5 percent level.

\*Significant at the 10 percent level.

**Table 3.13** The causes of original sin: Encompassing tests omitting fixed effects

	OSIN (1)	OSIN (IV)	
		(2)	(3)
SIZE	-0.352 (3.88)***	-0.366 (3.43)***	-0.700 (2.10)**
GDP per capita	-0.248 (2.30)**	-0.156 (0.52)	-0.269 (0.71)
AV_INF	0.274 (0.88)	0.164 (0.32)	0.775 (0.84)
DE_GDP	-0.002 (0.01)	-0.050 (0.26)	-0.893 (1.09)
DC_GDP	-0.291 (1.25)	-0.286 (1.08)	2.897 (0.91)
INSTITUTIONS	0.255 (1.61)	0.092 (0.15)	-0.546 (0.83)
Constant	3.437 (4.03)***	2.785 (1.31)	2.546 (1.22)
No. of observations	63	63	63

*Notes:* Table shows weighted Tobit estimations. Absolute value of *t*-statistics in parentheses.

\*\*\*Significant at the 1 percent level.

\*\*Significant at the 5 percent level.

\*Significant at the 10 percent level.

history matters when entered by itself, as in column (2). There is also some evidence of an effect of institutions (whether modeled as exogenous or instrumented using settler mortality) in columns (5) and (7). There is more evidence of the importance of financial development (see column [9]), although the correlation between financial development and original sin is not robust to instrumenting financial development with the origin of the legal code (see in column [10]).

But when we include proxies for the competing hypotheses simultaneously, in table 3.13, the results are essentially identical to before. Column (1) shows that SIZE and GDP per capita are statistically significant. Column (2) allows institutions to be endogenous (we use latitude as an instrument) and shows that only size remains statistically significant. Column (3) treats both rule of law and domestic credit over GDP as endogenous (again we instrument domestic credit over GDP with the origin of the legal code). Once more, only SIZE enters with a coefficient that is statistically distinguishable from zero at standard confidence levels.<sup>74</sup>

74. If one ignores the fact that the coefficients on the policy and institutional variables go to zero when they are included in the equation simultaneously (which will be comfortable only for readers with strong priors), then the contrast between tables 3.11 and 3.12 would suggest an interpretation like the following. When the fixed effects for financial centers, advanced economies, and emerging markets are included in the equation, they absorb the cross-group

What might account for the fact that it is mainly large countries that seem to be able to issue foreign debt in their own currencies and for the concentration of the world's portfolio in a few currencies? While each additional currency adds opportunities for diversification, it does so with decreasing marginal benefits. In a world with transaction costs (which increase with the number of currencies in which investors take positions), the optimal portfolio will therefore have a finite number of currencies.

Imagine the following situation.<sup>75</sup> There are two countries: one has  $N$  trees while the other has one tree. All trees are identical in their expected income and its variance; the large country just has more of them. Shocks to each tree are uncorrelated. Assume that the exchange rate moves with the realization of relative output. If there were no transaction costs of investing abroad, then it would be optimal to hold a globally diversified portfolio: the large country would invest  $1/(N + 1)$  of its wealth in the small country, while the latter would invest  $N/(N + 1)$  in the large country. Now introduce costs to international transactions. If all countries were of size 1, then the presence of transaction costs would not affect the composition of the world portfolio. But if country size differs, then the benefits of international diversification will be greater for the small country than for the large one. There will be less appetite in the large country to hold the currency of the small country, while there will still be a large appetite for the small country to hold the assets of the large one. This is to say, large countries offer significant diversification possibilities, while small countries do not. If the transaction costs associated with international diversification are the same for investors in both countries, then the world will choose to invest in a few large currencies. Notice that this is through no fault of the small country, but a consequence of the existence of cross-border costs and asymmetries in size and diversification.

An implication of this view is that even if we identify characteristics that have allowed a few small countries to issue external debt in their own currencies—like, say, South Africa, New Zealand, or Poland—it would be a fallacy of composition to assume that if other small countries acquired those same characteristics then they too would make it into the world port-

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variation in the data. The coefficient on a variable like, say, inflation or rule of law then picks up only the within-group variation. This is telling us that if we could transform Colombia into Canada and give the former the more favorable policy history and institutions of the latter overnight (along with its greater proximity to large markets, etc.), then we would also give it a greater ability to borrow abroad in its own currency. On the other hand, transforming Colombia into Chile (in terms of the quality of policies and institutions) would do little to enhance its ability to borrow abroad in its own currency. This is not to reject the importance of sound policies and institutional development. But it does suggest that the standard advice to this effect is not going to solve the problem of original sin that plagues emerging markets any time soon.

75. We are indebted to Roberto Rigobon for yet unpublished joint work on this idea.

folio. Each successful country may limit the chances of the others, given declining marginal benefits of diversification.

A further implication of this approach is that country size matters for original sin. Some countries have an advantage in shedding original sin because the large size of their economies and currency issue makes them attractive as components of the world portfolio. In contrast, the currencies of small countries add few diversification benefits relative to the additional costs they imply.

Country size can explain why large countries like the United States and Japan do not suffer from original sin. But what about Switzerland and, for that matter, the United Kingdom? Note that the financial-center dummy remains large and significant even after controlling for country size. This is another way of saying that the United Kingdom and Switzerland have become immune to the problem. But if becoming a financial center is evidently another way of shedding original sin, this is easier said than done. Clearly, countries that either are or were major commercial powers (e.g., the United States, Britain in the past) have a leg up. In addition, some countries have been able to gain the status of financial centers as a quirk of history or geography.<sup>76</sup> Network externalities giving rise to historical path dependence have worked to lock in their currencies' international status: once the Swiss franc was held in some international portfolios and used in some international transactions, it became advantageous for additional investors and traders to do likewise. And because Britain was the world's leading industrial, trading, and lending nation once upon a time, the pound sterling acquired its position as a prominent currency for the denomination of international claims—a luxury that the country enjoys to this day, albeit to a lesser and declining extent. These observations are related to the literature on the determinants of key currency status (Kiyotaki, Matsuyama, and Matsui 1992), which explains the dominance of a small number of currencies in international markets as a function of network externalities and transaction costs. This literature does not deny that additional countries can gain admission to this exclusive club, but it suggests that they face an uphill battle.

All this suggests that the global portfolio may be concentrated in a very few currencies for reasons beyond control—at least, beyond that of the excluded countries.

#### 3.4.5 Borio and Packer

Since the first draft of this paper was circulated as an NBER working paper, Borio and Packer (2004) have sought to replicate and extend its regressions for credit ratings and the causes of original sin. Their tests differ

76. For example, Switzerland, a mountainous country at the center of Europe that was hard to take over and also small enough to retain its neutrality, became a convenient destination for foreign deposits.

slightly from ours in their particulars. Thus, they use a slightly different measure of original sin (also drawn from the appendix in Eichengreen, Hausmann, and Panizza 2005b). They attempt to adjust for hedging by interacting our measures of original sin and currency mismatches with the BIS's data on total foreign exchange spot and derivatives transactions. They use a different measure of credit ratings (an average of Moody's and S&P ratings, in contrast to the S&P measure utilized here). In some of their work they add measures of corruption and country risk constructed from indexes provided by Transparency International and the ICRG, respectively. They measure debt intolerance in the same manner as Reinhart, Rogoff, and Savastano (2003; in addition to including the external debt ratio as a regressor, interacting this with a dummy variable for emerging markets), and also model it as the interaction of the debt-GDP ratio with measures of recent default history and inflation history. And their analysis of the causes of original sin pools the data for different years rather than using cross-section averages as in subsection 3.4.4 above.

Despite these changes, their results for credit ratings are similar to our own. Original sin continues to affect credit ratings at the 99 percent level despite the use of a longer list of controls, although their point estimate is somewhat smaller than our own. They also find a significant effect for currency mismatches, as do we in table 3.5 above. Their debt intolerance proxies are significant about half the time.

Some of their findings regarding the causes of original sin are also consistent with ours. They too report a significant positive coefficient on country size. Our measure of the importance of inflation (average inflation over the last twenty years) and their measure of strength of institutions (the Kaufmann, Kraay, and Zoido-Lobaton 1999 measure of rule of law) never approach statistical significance at standard confidence levels.<sup>77</sup> Where their results appear to differ is where they obtain a positive coefficient on an alternative measure of inflation (share of the last forty years when inflation exceeded 40 percent) and on the ICRG measure of political risk, suggesting that past policies and current institutions do in fact affect the incidence of original sin.

There is some evidence that these findings are sensitive to the particulars of specification and estimation. Borio and Packer's (2004) regressions appear to be estimated on pooled data, but the measure of inflation (the share of the last forty years when inflation exceeded 40 percent) does not have any within-country variation. In pure cross-section estimates (which seem more appropriate given the lack of time variation in the key independent variable) the significance of this variable declines significantly (as it does when we adjust the standard errors for clustering). In addition, their re-

77. They also obtain, counterintuitively, a negative coefficient on corruption, suggesting that more corrupt countries find it easier to borrow abroad in their own currency.



gressions do not include the dummy variables for country groups; adding them, as in our table 3.12, causes the significance of this variable to disappear. We also worry about their use of data for the years 2000–2003 for the Euroland countries, when the advent of the euro made the concept of original sin much less relevant for them. Recall that we limit our own analysis to data through 1998, with precisely this problem in mind. And when we instrument the ICRG index of institutions (as in subsection 3.4.4), the significance of this variable also evaporates.

### 3.5 Conclusion

In this paper we have contrasted three concepts widely utilized in the recent literature on emerging market debt. Two of the terms—original sin and debt intolerance—attempt to explain the same phenomenon, namely the volatility of emerging market economies and the difficulty that these countries have in servicing and repaying their external debts. The debt intolerance school traces the problem to institutional weaknesses of emerging market economies that in turn lead to weak and unreliable policies. It suggests that these countries' histories have bequeathed a situation where they find it difficult to run strong policies.

The original-sin school traces the problem instead to the structure of global portfolios and international financial markets. It suggests that emerging market economies are volatile because they find it difficult to denominate their obligations in units that better track their capacity to pay, such as the domestic currency or the domestic consumption basket. It suggests that this constraint derives in part from the structure of international portfolios and the operation of international financial markets. It points to forces that concentrate international portfolios and markets in a few major currencies—the dollar, euro, yen, pound, and Swiss franc—and to the evidently limited appetite of international investors for adding additional currencies to their portfolios.

In contrast, the literature on currency mismatches, as we read it, is concerned with the consequences of these problems. It emphasizes balance sheet mismatches that may arise either from the weak policies pointed to by the debt intolerance literature or from the difficulty emerging markets experience when attempting to place domestic currency-denominated debt with foreign investors pointed to by work on original sin. It is concerned with how these consequences are managed by the macroeconomic and financial authorities.

Thus, these terms should not be used interchangeably. The hypotheses and problems to which they refer are distinct. Using them synonymously is an unnecessary source of confusion.

We close with suggestions for investigators concerned with currency

mismatches, debt intolerance, or original sin. For those concerned with currency mismatches, the challenge is to show that mismatches can be measured with the precision needed to systematically test hypotheses regarding their causes and consequences. Absent comprehensive information on the currency denomination of assets, liabilities, swaps, and other derivatives, it is difficult to reliably measure the currency composition of a country's external assets and liabilities. The same problem follows from the absence of information on foreign holdings of domestic placements and on the presence or absence of exchange rate indexation clauses in those holdings. Once the concept is adequately operationalized, the challenge will be to model its determinants as well as its consequences—since the extent of the mismatch is a choice variable of, among others, the government, which chooses whether to restrict foreign borrowing and to insure against the consequences by accumulating reserves—and to analyze the two aspects in a consistent way.

For those concerned with debt intolerance, the challenge is to establish the existence of links between past policies and current outcomes and to document the mechanisms through which they act. Reinhart, Rogoff, and Savastano (2003) suggest that the fact that the same countries have defaulted repeatedly over a period of centuries reflects the corrosive impact of past policies on their financial markets and tax systems today and, through that channel, on their current management of external obligations. A correlation between past defaults and current defaults is insufficient to establish this case. That correlation could reflect any omitted variable that matters persistently for debt-servicing difficulties and is slow to change over time.<sup>78</sup> The challenge is thus to show that past default plays a causal role in the development of financial markets and tax systems, after controlling adequately for other determinants of their development, and that the structure of fiscal and financial systems in turn matters for current debt-servicing outcomes, after similarly controlling for their other determinants.

For those concerned with original sin, the challenge is to document the distortions in global financial markets that make it difficult to get international investors to add more currencies to their portfolios. In previous work we speculated that most of the benefits of international portfolio diversification can be obtained by building portfolios limited to a handful of currencies. If there are fixed transaction and management costs associated with including additional currencies, then the diversification benefits of adding more may be dominated by these costs. Here, shedding light on the

78. As we noted above, two candidates are the commodity composition of exports, which affects the volatility of the terms of trade, and the persistent difficulty that the same relatively small, less developed countries have had in getting their currencies added to the global portfolio.

obstacles to getting international investors to hold additional currencies in their portfolios is the principal challenge to research.

## Appendix

Countries included in table 3.1 of this paper but not included in table B1 of Reinhart, Rogoff, and Savastano (2003): Austria, Barbados, Belgium, Belize, China, Cyprus, Estonia, Germany, Iceland, Kazakhstan, Latvia, Lebanon, Luxembourg, Malta, Mongolia, Oman, Russian Federation, Slovak Republic, Slovenia, Switzerland, Tunisia, and the United Kingdom.

Countries included in table B1 of Reinhart, Rogoff, and Savastano (2003) but not included in table 3.1 of this paper: Algeria, Ecuador, Egypt, Ethiopia, Ghana, Hong Kong, Ireland, Japan, Kenya, Mali, Malaysia, Nepal, New Zealand, Nigeria, Portugal, Romania, Saudi Arabia, Sri Lanka, Swaziland, Tanzania, Uruguay, Venezuela, and Zimbabwe.

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## Comment Joshua Aizenman

This is a comprehensive paper, which provides an overview of a large body of research. The purpose of the paper is to compare and contrast three approaches dealing with balance sheet factors in emerging markets: original sin (OS), debt intolerance (DI), and currency mismatches (CM).

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## Synopsis of the Paper

As the paper's title highlights, it shows that the OS, DI, and CM hypotheses, and problems with which these three approaches deal, are analytically distinct. Both OS and DI seek to explain the volatility of emerging markets (EM) and their difficulty in servicing debts. The DI school argues that institutional weaknesses of EM economies lead to weak and unreliable policies. In contrast, the OS school focuses on the structure of global portfolios and international financial markets. The CM concept deals with the consequences of these problems. The authors point out that OS differs from CM. By definition, OS implies a gross foreign debt denominated in foreign currency. But the country may or may not also incur CM, depending on how the authorities respond to the act of borrowing.

Debt intolerance is reflected in the EMs' inability to manage levels of external debt that are manageable for OECD countries. As was shown by Reinhart, Rogoff, and Savastano (2003), credit ratings fall more rapidly with debt in EMs than in advanced countries, indicating that the former have less debt management capacity. Possible interpretations of DI include institutional weaknesses of EM economies which lead to weak and unreliable policies. Countries' histories have bequeathed a situation where they find it difficult to run strong policies. The Eichengreen, Hausmann, and Panizza paper questions the validity of the debt intolerance tests implemented by Reinhart, Rogoff, and Savastano, raising several robustness concerns.

The authors illustrate the issues at hand by asking in section 3.2 why Chile's performance resembled that of Latin America and not Australia. Original sin is part of the answer. Chile is a favorite example for economists of a country with increasingly strong institutions and policies. Standard institution strengthening measures have not impacted the capacity to borrow abroad in an EM's own currency, over policy-relevant horizons. The OS approach views this inability as a key shortcoming, explaining the problems facing EMs.

A key part of the paper is section 3.3, where the authors run an implicit horse race, contrasting OS versus CM and DI. They start by showing that countries with high levels of OS hold more reserves, are less inclined to float, and are characterized by higher macro volatility and lower credit ratings. The authors repeat the exercise adding measures of aggregate CM and DI. The results suggest to the authors that the effects of OS are more statistically robust than those of these alternative concepts.

### Comment 1: The Costs and Benefits of External Borrowing

Original sin presumes that external borrowing is beneficial. This presumption is not supported by the data of recent years.

The authors state early in section 3.2 that OS is defined as "the inability

of a country to borrow abroad in its own currency.” They add that the “focus on external borrowing is motivated by the observation that, in the absence of other distortions, world welfare would be enhanced if capital flowed from capital-rich advanced countries to their more capital-poor emerging market counterparts.”

Had OS been the only distortion, then removing it would have been welfare improving. Yet, in practice, developing countries are struggling with a large number of distortions. Hence, the welfare effect of removing one distortion is ambiguous. Specifically, if removing the OS would increase the volume of other distortion activities, it may be welfare reducing.

Unlike the authors, I argue that external borrowing, as a source of financing growth, is overrated. To illustrate this, I rely on results reported in Aizenman, Pinto, and Radziwill (2004). Using the World Development Indicators data, we construct there a self-finance measure, indicating the stock of tangible capital supported by actual national past saving, relative to the actual stock of capital.<sup>1</sup> We found that, in the 1990s, 90 percent of the stock of tangible capital of a typical developing country was self-financed, and that higher self-financing ratios were associated with higher growth. Alternatively, in recent years, countries that relied more on external finance, including external borrowing, grew at a slower rate. The data are also consistent with the notion that the surge in capital inflows in the aftermath of financial liberalization funds capital outflows, with little impact on self-financing ratios.

These findings are consistent with several interpretations.

- *Habit formation*: A takeoff triggered by relaxing a state’s attitude toward private saving and investment increases both saving and investment. If saving and investment increased at the same rate, we would observe a self-financed higher growth rate, as has been the case in

1. The ideal self-financing would be obtained by unbounded backward discounting, had we all the past information:

$$\hat{f} = \frac{\sum_{i=1}^{\infty} S_{t-i}(1-d)^{i-1}}{\sum_{i=1}^{\infty} I_{t-i}(1-d)^{i-1}},$$

where  $d$  is the depreciation rate of tangible capital,  $I_t$  and  $S_t$  are gross investment and national saving at time  $t$ , in constant purchasing power parity, respectively. A value of 1 of the self-financing measure would correspond to an economy where the entire stock of domestic capital is self-financed. A self-financing ratio below 1 indicates reliance on foreign saving;  $1 - \hat{f}_t$  is the foreign-financing ratio, measuring the fraction of domestic capital that was financed by foreign saving. In practice, the unbounded backward discounting is not feasible due to scarcity of data. This limitation induces us to rely on approximated measures of self-financing. As is illustrated in Aizenman, Pinto, and Radziwill (2004), the approximated self-financing measure deviates from the ideal financing measure by second-order magnitude. An alternative strategy is to construct self-financing ratios using gross domestic saving instead of national saving (the gap between the two is the net current transfers from abroad). This does not affect the main results inferred by relying on the self-financing ratio.

China, India, and other countries in recent years (see Carroll, Overland, and Weil 2000 for further discussion).

- *Collateral to induce FDI* (Dooley, Folkerts-Landau, and Garber 2004): Countries may accumulate foreign assets to signal their soundness, in order to attract FDI.
- Most capital flows are *gross, with little net effect* (Dooley 1988). This is consistent with response to differences in risk perceived by residents and nonresidents.

### **Comment 2: Limited Ability to Test Which Approach—OS, DI, or CM—Is Most Important**

Some of the methodological concerns are generic and may apply equally well to all tests of balance sheet problems; short of conducting controlled experiments, available empirical procedures have limited power in identifying the independent roles of OS, DI, and CM. More specific concerns:

- Original sin measures of most developing countries are practically the same (one for most external OS measures, as can be seen in figure 3.1 in the paper). This suggests a censoring problem.
- Theory predicts a nonlinear interaction between OS, DI, and CM. It may be hard to pick up such nonlinearity in a log linear model, especially if one is not testing a tightly specified model.
- The background literature suggests several variables that are omitted in the present study, like polarization, political instability, and distribution of income.

All the above suggest that more insight can be gained by looking at case studies.

### **Comment 3: Is OS the Key for Explaining Problematic Performance? Not Necessarily**

A possible clue to the issues at hand is that there is very little variation in the OS measures across countries, yet there is large variation in performance. This observation suggests that countries may take off without solving OS and without solving “institutional weaknesses.” Such a takeoff may be accomplished by relaxing the grip of the state on the private sector, encouraging, instead of penalizing, entrepreneurship (as has apparently been the case of China, India, etc.). Hence, prolonged growth acceleration may happen without dealing with constraints imposed by OS, or the constraints imposed by existing institutions.

### **Comment 4: Are Institutional Weaknesses the Key to DI?**

An alternative interpretation is that the key to DI is deeper structural factors, including polarization, distribution of income, and political instability. More generally, DI may be related to the ability of the social contract



to deal with shocks. History impacts investors' priors about these concerns. All the above may explain the root sources of EM vulnerability, as has been articulated in past contributions (see Alesina and Tabellini 1989; Cukierman, Edwards, and Tabellini 1992; Rodrik 1999).

#### **Comment 5: Second-Best Effects of Relaxing OS Constraints**

For countries characterized by overborrowing, relaxing the OS constraints without dealing with the overborrowing bias would increase excessive borrowing by weak regimes, reducing welfare. This is another example of the second-best situation confronting most developing countries.

#### **Comment 6: Chile versus Australia Is a Prime Example of OS**

The latest World Development Indicators reveals that the real GDP per capita growth rate of Chile was double that of Australia during 1986–2003 (0.04 versus 0.02). This may suggest that OS is not the major obstacle to growth. It is also consistent with the findings of Caballero, Cowan, and Kearns (2005), who contrasted country trust versus currency trust, arguing that the lack of country trust is a more fundamental and serious problem behind sudden stops. They point out that Chile needs external insurance more than Australia does, precisely because its terms-of-trade shocks are amplified by the resulting contraction in the supply of external funds. So OS is a greater problem for Chile than for Australia. “But importantly,” Caballero et al. add, “OS is not the primitive problem behind the need for substantial insurance; the problem is a lack of country-trust.” This is vividly illustrated by the observation that Australia’s inflation was 4 percent since federation (about 102 years ago), exceeding 20 percent in only one year. In contrast, Chile’s inflation exceeded 20 percent in approximately half the years during that period. Australia has a long history with no default by the federal or state governments. Australia’s trust was generated by experiencing several substantial negative external shocks without defaulting, unlike most Latin American countries.

To conclude: the authors are making a strong case that OS, CM, and DI are distinct hypotheses, dealing with related but different issues. The empirical evaluation of the relative merits of OS, CM, and DI remains debatable—there is no clean test that can do the job. The authors’ presumption underlying the focus on OS—that foreign borrowing is welfare enhancing—is debatable. Original sin is only one of the distortions EMs grapple with, and potentially not the most important one. Removing OS, without dealing with the other distortions, may be welfare reducing.

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