The Pain of Original Sin

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1. Introduction

If a country is unable to borrow abroad in its own currency – if it suffers from the problem that we refer to as "original sin" – then when it accumulates a net debt, as developing countries are expected to do, it will have an aggregate currency mismatch on its balance sheet. Of course, such a country can take various steps to eliminate that mismatch or prevent it from arising in the first place. Most obviously, it can decide not to borrow. A financially autarchic country will have no currency mismatch because it has no external debt, even though it still suffers from original sin as we define it. But this response clearly has costs; the country in question will forgo all the benefits, in the form of additional investment finance and consumption smoothing, offered by borrowing abroad. Alternatively, the government can accumulate foreign reserves to match its foreign obligations. In this case the country eliminates its currency mismatch by eliminating its net debt (matching its foreign currency borrowing with foreign currency reserves). But this too is costly: the yield on reserves is generally significantly below the opportunity cost of funds.

All of this might seem relatively inconsequential. The currency denomination of the foreign debt has not, until recently, figured prominently in theories of economic growth and cyclical fluctuations. Macroeconomic stability, according to the conventional wisdom, reflects the stability and prudence of a country's monetary and fiscal policies. The rate of growth of per capita incomes depends on rates of human and physical capital accumulation and on the adequacy of the institutional arrangements determining how that capital is deployed. Fine points like the currency in which a country's foreign debt is

denominated, by comparison, are regarded as specialized concerns of interest primarily to financial engineers.

In this chapter we show that neglect of this problem constitutes an important oversight. In particular, we show that the composition of external debt – and specifically the extent to which that debt is denominated in foreign currency – is a key determinant of the stability of output, the volatility of capital flows, the management of exchange rates, and the level of country credit ratings. We present empirical analysis demonstrating that this 'original sin' problem has statistically significant and economically important implications, even after controlling for other conventional determinants of macroeconomic outcomes. We show that the macroeconomic policies on which growth and cyclical stability depend, according to the conventional wisdom, are themselves importantly shaped by the denomination of countries' external debts.

Establishing the importance of original sin for the macroeconomic outcomes of interest requires a precise measure of the phenomenon. Indeed, one reason why the problem of debt denomination has not received the attention it deserves may be that adequate information on its incidence and extent are not readily available. Thus, a contribution of this chapter is to develop a series of numerical indicators of original sin. In addition to demonstrating their importance for the macroeconomic variables relevant to our argument, we present the indicators themselves, country by country, so they can be used by other authors to analyze still other problems.

In Sections 2 and 3 of this chapter, we quantify the problem and characterize its incidence. Section 4 analyzes its effects – what we characterize as the pain of original sin.

This is followed by a brief conclusion and an appendix where we report the results of a battery of sensitivity analyses and present the underlying indicators.

2. Facts about Original Sin

Of the nearly $5.8 trillion in outstanding securities placed in international markets in the period 1999-2001, $5.6 trillion was issued in 5 major currencies: the US dollar, the euro, the yen, the pound sterling and Swiss franc. To be sure, the residents of the countries issuing these currencies (in the case of Euroland, of 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 dollars 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. Since these other countries and international organizations issued a total of $1.3 trillion dollars of debt, it follows that they issued the vast majority of it in foreign currency. The measurement and consequences of this concentration of debt denomination in few currencies is the focus of this paper.

Table 1 presents data on the currency composition of bonded debt issued cross-border between 1993 in 2001. "Cross-border" means that Table 1 excludes local issues. We split the sample into two periods, demarcated by the introduction of the euro. The figures are the average stock of debt outstanding during in each sub-period. The information is organized by country groups and currencies of denomination. The first country group, financial centers, is composed of the US, the UK, Japan, and Switzerland; the second is composed of the Euroland countries; the third contains the remaining

developed countries; and the fourth is made up of the developing countries; we also report data on bond issues by the international financial institutions (since these turn out to be important below).

Column 1 presents the amount of average total stock of debt outstanding issued by residents of these country groups. Column 2 shows the corresponding percentage composition by country group. Columns 3 and 4 do the same for debt issued by residents in their own currency, while columns 5 and 6 look at the total debt issued by currency, independent of the residence of the issuer. Column 7 is the proportion of the debt that the residents of each country group issued in their own currency (the ratio of column 3 to column 1), while column 8 is the proportion of total debt issued in a currency relative to the debt issued by residents of those countries (the ratio of column 5 to column 1).

Notice that while the major financial centers issued only 34 percent of the total debt outstanding in 1993-1998, debt denominated in their currencies amounted to 68 percent of that total. In contrast, while other developed countries ex-Euroland issued fully 14 percent of total world debt, less than 5 percent of debt issued in the world was denominated in their own currencies. Interestingly, in the period 1999-2001 – following the introduction of the euro – the share of debt denominated in the currencies of other developed countries declined to 1.6 percent. Developing countries accounted for 10 percent of the debt but less than one per cent of the currency denomination in the 1993-1998 period. This, in a nutshell, is the problem of original sin.

When we look at the currency denomination of the debt issued by residents, we see that residents of the major financial centers chose to denominate 68.3 percent of it in their own currency in 1999-2001, while the residents of Euroland used the euro in 56.8

percent of their cross-border bond placements. This figure is substantially higher than the 23.2 percent which they chose to denominate in their own currency in 1993-1998, before the introduction of the euro. In that earlier period, the other developed countries issued 17.6 percent of their debt in their own currencies, a number not too different from that for the Euroland countries; in the recent period, however, this number has declined to 9.6 percent. The number for developing countries is an even lower 2.7 percent.

It is sometimes possible for countries to borrow in one currency and swap their obligations into another. Doing so requires, however, that someone actually issue debt in the domestic currency (otherwise there is nothing to swap). Column 8 takes this point on board and is therefore a better measure of a country's ability to borrow abroad in its own currency than column 7, in the sense that when the ratio in column 8 is less than 1, it indicates that there are not enough bonds to do the swaps needed to hedge the foreign currency exposure of residents.

Column 8 reveals that in 1999-2001 the ratio of debt in the currencies of the major financial centers to debt issued by their residents was more than 150 per cent. (This, in a sense, is what qualifies them as financial centers.) This ratio drops to 91.3 percent for the Euroland countries, to 18.8 percent in the other developed countries (down from 32.9 percent in the previous period), and to 10.9 percent for the developing nations. Notice that after the introduction of the euro, Euroland countries narrow their gap with the major financial centers while other developed countries converge towards the ratios exhibited by developing nations.

Figure 1 plots the cumulative share of total debt instruments issued in the main currencies (the solid line) and the cumulative share of debt instruments issued by the

largest issuers (the dotted line). The gap between the two lines is striking. While 87 percent of debt instruments are issued in the 3 main currencies (the US dollar, the euro and the yen), residents of these three countries issue only 71 percent of total debt instruments. The corresponding figures for the top five currencies, 97 and 83 percent, respectively, tell the same story.

Table 2 presents similar information for cross-border claims by international banks reporting to the Bank for International Settlements. These data only distinguish the five major currencies (US dollar, euro, Swiss franc, British pound, and Japanese yen) and an "other currency" category. The table shows that of $7.8 trillion in cross-border bank claims, 81 percent are denominated in the 5 major currencies. While we cannot know how much is actually issued in each borrower's currency, we can safely say that the bulk of the debt in the developing world and in the developed countries outside the issuers of the major currencies is also in foreign currency.

One possible problem with the data of Table 1 is that it only captures cross-border bond issuance and does not capture the nationality of the bond*holder*, only the place of issue. So, it may be the case that countries do their local currency funding in the local market and their foreign currency funding abroad. Foreigners willing to hold domestic currency bonds would just purchase them in the local markets. These domestically issued but foreign owned domestic currency bonds would not be included in Table 1. To address this issue we look at the currency composition of the international securities held by US residents, independently of the place of issue.

According to the US Treasury (Table 3), these securities amounted to USD 647 billion at the end of 2001. However, of these securities USD 456 billion or 70.4 percent

were denominated in US dollars. This indicates that the willingness of US investors to expose themselves to foreign credit risk is significantly higher than their willingness to expose themselves to foreign currency risk: they hold more claims on foreigners than claims in foreign currency. Moreover, if we include the exposure to the euro, the yen and the British pound and the Canadian dollar, the total foreign exposure of US investors denominated in major currencies amounts to 97 percent of the total. In the case of developing countries, while US investors held USD 84 billion in securities issued by developing countries, only 2.6 billion (or 3.1 percent) was denominated in local currency. The message of Table 3 is similar to that of Table 1: global investors denominate their claims predominantly in very few currencies. The willingness to hold foreign securities is significantly larger than the willingness to hold them in foreign currency, except for a few major currencies.

All this points to the fact that original sin is a global phenomenon. It is not limited to a small number of problem countries. It seems to be associated with the fact that the vast majority of the world's financial claims are denominated in a small set of currencies. In turn this suggests that the problem may have something to do with observed patterns of portfolio diversification – or its absence. We develop this point in Chapter 9.

3. Measuring Original Sin

To develop indices of original sin, we use the data on securities and bank claims used to construct Tables 1 and 2. We start with the securities data set, which provides a full currency breakdown.

Our first indicator of original sin (*OSIN*1) is one minus the ratio of the stock of international securities issued by a country in its own currency to the total stock of international securities issued by the country. That is,[1]

$$OSIN1_i = 1 - \frac{\text{Securities issued by country } i \text{ in currency } i}{\text{Securities issued by country } i}$$

Thus, a country that issues all its securities in own currency would get a zero, while a country that issues all of them in foreign currency would get a 1 (the higher the value, the greater the sin). We also compute a variant of OSIN1 by using the data on security holding by US investors (*USSIN1*).

OSIN1 has two drawbacks. First, it only covers securities and not other debts. Second, it does not take account of opportunities for hedging currency exposures through swaps. We deal with these issues next. Consider the following ratio:

$$INDEXA_i = \frac{\text{Securities + Loans issued by country } i \text{ in major currencies}}{\text{Securities + Loans issued by country } i}$$

*INDEX*A has the advantage of increased coverage. (It also has the disadvantage of not accounting for the debt denominated in foreign currencies other than the majors; we address this problem momentarily). To capture the scope for hedging currency exposures via swaps, we also consider a measure of the form:

$$INDEXB_i = 1 - \frac{\text{Securities in currency } i}{\text{Securities issued by country } i}$$

*INDEX*B accounts for the fact, discussed above, that debt issued by other countries in one's currency creates an opportunity for countries to hedge currency

[1] We follow Hausmann et al. (2001) but extend their sample from 30 to 90 countries and update it to the end of 2001.

exposures via the swap market. Notice that this measure can take on negative values, as it in fact does for countries such as the US and Switzerland, since there is more debt issued in their currency than debt issued by nationals. However, these countries cannot hedge more than the debt they have. Hence, they derive scant additional benefits from having excess opportunities to hedge. We therefore substitute zeros for all negative numbers, producing our third index of original sin:

$$OSIN3_i = \max\left(1 - \frac{\text{Securities in currency } i}{\text{Securities issued by country } i}, 0\right)$$

We are now in a position to refine *INDEX*A. Recall that *INDEX*A understates original sin by assuming that all debt that is not in the 5 major currencies is denominated in local currency. This may be a better approximation for countries with some capacity to issue debt in their own currencies. However, if this is so, it should be reflected in *OSIN*3 because it means that someone – either a resident or a foreign entity – might have been able to float a bond denominated in that currency. If this is not the case, this provides information about the likelihood that the bank loans not issued in the 5 major currencies, were denominated in some other foreign currency. We therefore replace the value of *INDEX*A by that of *OSIN*3 in those cases where the latter is greater than the former.[2] Hence we propose to measure *OSIN*2 as:

$$OSIN2_i = \max(INDEXA_i, OSIN3_i)$$

Notice that *OSIN*2 ≥ *OSIN*3 by construction and that, in most cases, *OSIN*1 ≥ *OSIN*2.

[2] If the composition of the bank debt was the same as that of securities then OSIN3 should be smaller than *INDEX*A, since it includes not only debt issued by residents but also that issued by foreigners. When OSIN3 is greater than *INDEX*A, it is informative of a potential underestimate of original sin.

Table 4 presents the average of these four indexes for the different country groupings and different parts of the developing world. (The individual country values can be found in Appendix Table A1.) As before, we observe the lowest numbers for the major financial centers, followed by Euroland countries (which exhibit a major reduction in original sin after the introduction of the euro). Other developed countries exhibit higher values, while the highest values are for the developing world (Figure 2). The lowest values in the developing world are in Eastern Europe, while the highest are in Latin America.

Original sin from the perspective of US investors (USSIN1) is similar to the one we observe with the BIS data. There is a strong positive correlation between USSIN1 and each of OSIN1 (0.64, p-value 0.00) and OSIN3 (0.50, p-value 0.00). As in the case, of OSIN3, the developing countries with the lowest values of USSIN1 (below 0.9) are South Africa, Czech Republic, Poland, and Taiwan (Hungary has a low value in USSIN1 but a higher values in OSIN3).

Table 5 lists countries with measures of *OSIN*3 below 0.8 in 1999-2001, excluding the financial centers. Among the countries with the least original sin are several future Eastern European accession countries and overseas regions of European settlement (Canada, Australia, New Zealand and South Africa). Notice further that both fixed-rate Hong Kong and floating-rate Singapore and Taiwan appear on this list, raising questions about whether any particular exchange rate regime poses a barrier to redemption.[3] In fact, the countries listed in Table 5 are equally distributed among fixers, floaters and countries with an intermediate regime (Figure 3).

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[3] We return to this issue in Chapter 9 below.

Original sin is also persistent, to a surprising extent. Flandreau and Sussman in Chapter 6 below present a three-way classification of original sin circa 1850, based on whether countries placed bonds in local currency, indexed their debt to gold (included gold clauses in their debts), or did some of both. Table 6 shows the mean value of *OSIN*3 in the 1993-1998 period for each of the three groups distinguished by Flandreau and Sussman. *OSIN*3 is highest today in the same countries that had gold clauses in their debt in the 19th century (average 0.86) and lowest for countries that issued domestic debt (average 0.34) and intermediate in countries that issued both gold-indexed and domestic-currency debt (average 0.53); hence, there is a high correlation between original sin then and now. The standard t test suggests that countries that exclusively issued debt with gold clauses in the 1850s suffer from significantly higher levels of original sin today than either countries that issued both gold-indexed and domestic-currency debt (p-value = 0.016) or those that issued exclusively in local currency (p-value = 0.000).

In their original formulation, Eichengreen and Hausmann (1999) defined original sin as "a situation in which the domestic currency cannot be used to borrow abroad, *or to borrow long term, even domestically* [emphasis added]. While the focus of this book and this chapter is the inability to borrow abroad in domestic currency (what we call *international* original sin), we also computed an index for the capacity of a country to borrow at long maturities domestically (which we refer to as domestic original sin). There are two reasons for deriving such an index. First of all, it would be important to know to what extent these two issues are related or are in fact two different types of issues. Second, it has been argued that creating a domestic market in own currency is a necessary

condition for inducing foreigners to use a country's currency (Tirole, 2002). We would like to shed some light on these issues both here and in Chapter 9.

Our main source of information is J.P. Morgan's (2002, 2000, 1998) "Guide to Local Markets" that reports detailed information on domestically traded public debt for 22 emerging market countries. J.P. Morgan also provides information on the presence of domestic private debt instruments and shows that in most countries (the exceptions being Singapore, South Korea, Taiwan, and Thailand) this is a negligible component of traded debt.

J.P. Morgan reports data on total outstanding domestic government bonds and the main characteristics (total amount, maturity, currency, and coupon) of the various government bonds present in each market. We classify the bonds listed by J.P. Morgan according to their maturity, currency, and coupon (fixed and indexed rate). In particular, we divide outstanding government bonds into 5 categories: (i) long-term domestic currency fixed rate (DLTF); (ii) short-term domestic currency fixed rate (DSTF); (iii) long-term (or short-term) domestic currency debt floating rate debt, i.e. indexed to an interest rate (DLTII); (iv) long-term domestic currency debt indexed to the price level (DLTIP); and (v) foreign currency debt (FC). Using the above information, we compute the following indicator of domestic Original Sin:[4]

$$DSIN = \frac{FC + DSTF + DLTII}{FC + DLTF + DSTF + DLTII + DLTIP}$$

[4] Hausmann and Panizza (2003) discuss alternative indicators of domestic original sin.

Our definition of domestic original sin focuses on both foreign currency debt and domestic currency short-term debt (or long-term but floating so that it has very little duration risk). It should be clear that while the definition focuses on total debt, we only have information on traded debt (and mostly public debt). Hence, our index does not include information on bank loans. Table 7 ranks countries according to the domestic original sin index. We find that more than half of the countries in our sample have indexes that are above 50 percent. Only 5 out of the 22 countries of Table 7 have more than three-quarters of their public debt in long-term fixed rate domestic currency bonds. Figure 4 organizes the 21 countries for which we have measures of their ability to borrow internationally in local currency (OSIN3) and domestically at long maturities and fixed rates in local currency (DSIN). At first glance, it is clear that the two concepts are rather poorly correlated, indicating that they are not just two sides of the same coin, as the Eichengreen and Hausmann 1999 definition implied. Looking more in detail at the data, we split the sample according to whether the respective values of these two variables are above or below 0.75. The resulting four quadrants are telling. The first quadrant is empty: there are no countries that can borrow abroad in local currency, but have small long-term fixed-rate domestic markets. This suggests that domestic market development is a necessary condition for redemption from original sin. However, the graph also shows that it is not a sufficient condition: while there are 8 countries that suffers from both types of sin (second quadrant) and 6 countries have achieved redemption in both dimensions (fourth quadrant), 7 countries suffer from international original sin, while having been

redeemed on the domestic front (third quadrant).[5] In Chapter 9 we discuss the causes of this pattern and the unconventional role played by capital controls[6].

4. The Pain

Original sin has important consequences. Countries with original sin that have net foreign debt will have a currency mismatch on their national balance sheets. Movements in the real exchange rate will then have aggregate wealth effects.[7] This makes the real exchange rate a relevant price in determining the capacity to pay. Since the real exchange rate is quite volatile and it tends to depreciate in bad times, original sin significantly lowers the creditworthiness of a country. Moreover, the wealth effects limit the effectiveness of monetary policy, as expansionary policies may weaken the exchange rate, cause a reduction in net worth and will thus be either less expansionary or even contractionary (Aghion, Bacchetta and Banerjee 2001, Céspedes, Chang and Velasco in Chapter 2 of this volume). This renders central banks less willing to let the exchange rate move, and they respond by holding more reserves and aggressively intervening in the foreign exchange market or adjusting short-term interest rates (Hausmann, Panizza and Stein, 2001, Calvo and Reinhart, 2002). The existence of dollar liabilities also limits the ability of central banks to avert liquidity crises in their role as lenders of last resort (Chang and Velasco, 2000). And, dollar-denominated debts and the associated volatility

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[5] In what remains, we will refer to original sin as referring exclusively to its international dimension, i.e. to the ability to borrow abroad in local currency.
[6] A more in depth discussion can be found in Hausmann and Panizza (2003).
[7] Governments can of course close the economy to foreign borrowing or accumulate international reserves sufficient to match the foreign-currency obligation (in which case it will also not have a *net* foreign debt). Our point is that an aggregate mismatch is unavoidable when a country suffers from original sin and there is a *net* foreign debt. Note also that the wealth effect may be smaller in countries with a larger tradable sector, this is why most of our regressions control for openness.

of domestic interest rates heighten the uncertainty associated with public debt service, thus lowering credit ratings.

Given these facts, it is no surprise that countries afflicted by original sin have a hard time achieving domestic economic stability. Their incomes are more variable and their capital flows more volatile than those of countries free of the phenomenon. Since financial markets know that inability to borrow abroad in the domestic currency is a source of financial fragility, developing countries burdened with original sin are charged an additional risk premium when they borrow, forcing them to skate closer to the edge of solvency. A shock to the exchange rate can then cause asset prices to move adversely, tipping them over the precipice. But if countries attempt instead to minimize these risks by limiting their recourse to foreign sources of funding, they may then be starved of the finance needed to underwrite their growth. The process of economic and financial development will be slowed. Countries in this situation thus face a Hobson's choice.

Original sin and fiscal solvency

It has been amply recognized that developing countries tend to be more volatile than industrial countries in the sense that they have a more unstable rate of GDP growth (IDB, 1995, Hausmann and Gavin 1996). Table 8 shows that their GDP growth is more than twice as volatile as that of industrial countries: 5.8 percent per annum instead of 2.7. However, if a country's debt is denominated in foreign currency – say US dollars – its capacity to pay will be related, not to the value of its GDP in constant local currency units (LCU), but in US dollar terms. Table 8 shows that the volatility of changes in real US$ GDP is almost 3 times higher than in LCU for developing countries. Hence, the typical industrial country without original sin would face a relevant volatility of 2.7 percent per

annum, while the typical developing country with original sin would face a relevant volatility of 13 percent.

The greater relevant volatility in the capacity to pay comes from the fact that original sin makes the real exchange rate matter for debt service and this variable is very volatile in developing countries. Table 9 presents the volatility of the real exchange rate for a sample of developed and developing countries. The volatilities are normalized to be equal to 1 for the sample as a whole. The table clearly shows that the volatility of the real exchange rate is between 2 and 3 times higher in developing countries. Hence, not only does the real exchange rate matter for debt service in countries with original sin, but in addition, the real exchange rate in these countries tends to be significantly more volatile.

Analysts often argue that a volatile real exchange rate does not matter if the debt is sufficiently long term. If purchasing power parity holds in the long run, then deviations of the real exchange rate should not be very long-lived and a country's solvency should not be much affected by relatively temporary movements in the real exchange rate. Markets will not change their minds about the solvency of a country based on short term movements of the real exchange rate. However, Table 8 shows that the volatility of movements in the five-year moving average of the real multilateral exchange rate is very high. The table calculates the percentage gap between the maximum and the minimum value of a 5 year moving average of the real exchange rate for a sample of developed and developing countries for the period between 1980 and 2000. The table indicates that the 5-year moving average moved by more than 60 percent in the average developing

country, more than three times the magnitude of industrial countries[8]. Said differently, the 5-year average value of the debt to GDP ratio would have moved by more than 50 percent in the typical developing countries through real exchange rate valuation changes alone! Table 9 shows that the greater volatility of the real exchange rate in developing countries is as much of a feature at 5 years than at 1 year and that it has remain the same in the 1980s and 1990s.

Another way to look at this data is by studying the events in which there has been a large decline in the capacity to pay foreign debt. Table 10 shows the occasions in which the dollar value of GDP over a two-year period fell by more than 30 percent[9]. Two facts clearly emerge from the table: the events identified tend to capture many of the recent debt crises. More importantly, while the average decline in dollar GDP for this sample of countries was 46 percent, the decline in GDP in local currency units was less than a twentieth of that. The collapse in the capacity to pay is more related to real exchange rate movements than to output declines.

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

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

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

determinant of credit rating, as is clear from Figure 5.[10] Countries like Brazil, Argentina, Turkey and Mexico had a debt to tax ratio that was broadly similar or in fact lower than those of the Italy, Belgium, the US, Canada or Spain while their credit rating could not be more different.[11] As argued in Hausmann (2003), original sin lowers evaluations of solvency because it heightens the dependence of debt service on the evolution of the exchange rate, which is more volatile and may be subject to crises and crashes.

To test this hypothesis, we regress foreign-currency credit rating of countries on two standard measures of fiscal fundamentals -- public debt as a share of GDP and public debt as a share of tax revenues-- on the level of development, on the magnitude of the foreign debt (SHARE) and on original sin. The equations are estimated by weighted double-censored Tobit. The results, in Table 11, show a large and statistically significant effect of original sin on credit ratings.[12] Redemption (the total elimination of original sin) is associated with an improvement of ratings by about five notches. This effect is strong and present even though we control for the level of economic development, as captured by the real GDP per capita and for the magnitude of the public debt measured either as a share of GDP or as a share of tax revenues.

Hence, original sin helps explain why countries suffer from creditworthiness problems: it is not due to their incapacity to limit debt accumulation; it is that the

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

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

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

[12] These results are robust to alternative definitions of original sin, also as shown in Appendix Table A4.

structure of that debt makes them risky at low levels of debt that are consistent with a AAA rating in other countries.

Original sin and nominal exchange rate volatility

We will now explore the relationship between the management of monetary and exchange rate policy and the presence of original sin. We posit that countries that suffer from this phenomenon will be less willing to allow their exchange rate to fluctuate. There are no widely accepted indicators of exchange rate flexibility. We will therefore employ three alternative measures to make sure that any results are not excessively dependent on particular definitions. First, we use the de facto classification of Levy-Yeyati and Sturzenegger (2000) (*LYS*). This is a discrete variable that equals one for countries with a flexible exchange rate regime, 2 for countries with intermediate regimes, and 3 for countries with a fixed exchange rate regime; we therefore expect original sin to be positively correlated with *LYS*. Our second measure of exchange rate flexibility (following Hausmann, Panizza and Stein, 2001) is international reserves over M2 (*RESM2*), the motivation being that countries that float without regard to the level of the exchange rate should require relatively low levels of reserves, while countries that want to intervene in the exchange rate market need large war chests. Again, we expect a positive correlation. Finally, following Bayoumi and Eichengreen (1998a,b) we examine the extent to which countries actually use their reserves to intervene in the foreign exchange market, comparing the relative volatility of exchange rate and reserves

(*RVER*).[13] *RVER* will be high in countries that let their currencies float and low in countries with fixed exchange rates; thus, we anticipate negative correlation with original sin.

In all regressions original sin is measured as the average value for 1993-1998, while all other dependent and explanatory variables are measured as 1992-1999 averages. We focus on this period because most of our dependent variables are not available after 1999. Table 12 reports regressions using *OSIN*3 to measure original sin. (The results are robust to using *OSIN*2, as shown in Appendix Table A2.) Because *OSIN*3 captures only one part of the currency composition of the foreign debt (it does not include information on bank loans), its precision depends on how representative bonded debt is in total external liabilities. To take account of this fact, we weigh all observations by the share of securities in total foreign debt.[14]

All regressions control for the level of development (*LGD_PC*, which denotes the log of GDP per capita), the degree of openness (*OPEN*), and the level of foreign debt (*SHARE2*, which denotes total debt instruments plus total loans divided by GDP). We do not have much guidance regarding the expected signs of these controls. Although the theory of optimum currency areas suggests that there should be a negative association between exchange rate volatility and openness, previous empirical studies (e.g. Honkapohja and Pikkareinen 1992, Bayoumi and Eichengreen 1997, Eichengreen and Taylor 2003) have not found much support for this hypothesis. They tend to find that any

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[13] *RVER* is equal to the standard deviation of exchange rate depreciation divided by the standard deviation of the reserves over M2 ratio. Hausmann, Panizza and Stein (2001) provide further details on the construction of this index.

[14] Formally, the weight is equal to (total debt instruments)/(total bank loans + total debt instruments). In the appendix, we show that the results are robust to dropping the weights.

effect of openness is dominated by the effect of country size; in other words, the empirically relevant corollary of the theory of optimum currency areas is that small countries prefer to peg. The recent literature on fear of floating (Calvo and Reinhart 2002) suggests that there should be a negative correlation between level of development and desired levels of exchange rate volatility – although it also suggests that less developed countries may sometimes be less successful at limiting volatility in practice. We of course expect a negative correlation between exchange rate flexibility and share of foreign debt, on the grounds that exchange rate variability will then wreak havoc with debt service costs. This is because the share of foreign debt should amplify the negative effect of original sin. In fact, we do find some evidence that the interaction between original sin and share of foreign debt amplifies the effect of original sin on exchange rate flexibility (the results, however, are not very robust).

As expected, original sin is negatively correlated with exchange rate flexibility.[15] The coefficients are always statistically significant when we run regressions using the full sample of countries. In the cases of *RVER*, the coefficient is not significant (with a p value of approximately 0.19) when we exclude financial centers from the regression.[16]

The coefficients are also economically important. Column 1, for instance, suggests that complete elimination of original sin is associated with a jump of one point and a half in the Levy-Yeyati and Sturzenegger 3-way exchange rate classification. Countries previously inclined to peg will move to an intermediate regime (to limited flexibility), while countries previously following policies of limited flexibility will be

[15] The regressions for LYS are estimated using weighted tobit, while the regressions for RESM2 and RVER are estimated using weighted least squares.

inclined to float. Viewed in this way, original sin provides an explanation for the fear-of-floating phenomenon. In the case of reserves over M2, redemption from original sin would move a country from the 75th percentile to the 25th percentile of the distribution of this ratio.

Here it is important to worry about reverse causality. Whereas we have argued that more original sin leads to less exchange rate variability, authors like Burnside, Eichenbaum and Rebelo (2001) argue that less exchange rate instability leads to more original sin. Stabilizing the exchange rate, in their view, creates moral hazard; it conveys the impression that the government is socializing exchange risk, encouraging the private sector to accumulate unhedged exposures. In fact, many analysts have argued that original sin (or liability dollarization) is caused mainly by fixed exchange rates. The problem should go away with the recent move towards floating rates. However, our data should dispel this hope. Of the 25 developing countries with the most flexible exchange rate regimes during the 1993-1998 period, according to the average value of the LYS index, 22 of them had a value of OSIN3 equal to 1. The time series evidence points in the same direction: there has been movement to greater flexibility of exchange rates but scant movement out of original sin except for countries that are in line to join the euro.[17]

The fact that original sin is associated with less exchange rate flexibility has the implication that interest rates have to do more of the work when the country is hit by shocks, making monetary policy less accommodating and domestic interest rates more

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[16] However, doing so involves eliminating the bulk of the contrast between low and high measures of original sin.

[17] We also experimented with some instrumental variables, using country size as an instrument for original sin and they left our results unchanged.

volatile.[18] Prudent borrowers will therefore prefer dollar debts, since the alternative will be riskier (see the Chamon and Hausmann paper presented in chapter 8). Moreover, a volatile interest rate will tend to limit the development of the market in long-term debt.

Original Sin and output and capital-flow volatility

We now explore the correlation between original sin and the volatility of growth and capital flows. There are several reasons for anticipating that the phenomenon will be associated with relatively high levels of volatility. For one thing, original sin limits the scope and effectiveness of countercyclical monetary policies. In addition (as already noted), dollar liabilities limit the ability of central banks to avert liquidity crises in their role as lenders of last resort. Finally, dollar-denominated debts and real exchange rate interact to create uncertainty over the cost of dollar debt service while the associated volatility of domestic interest rates heighten the uncertainties associated with local debt service, thus lowering credit ratings and making capital flows more fickle and volatile (Hausmann, 2003).

Table 13 examines the correlation between original sin and the volatility of output and capital flows. We measure output volatility as the standard deviation of GDP growth over the period 1992-1999 and capital flow volatility as the standard deviation of capital flows (as a share of domestic credit) over the same period. We control for the level of

[18] The relationship between original sin and interest rate volatility is documented in Hausmann, Panizza and Stein (2001).

development, openness, foreign debt, and volatility of terms of trade (*VOL_TOT*). Again, all equations are estimated by weighted least squares.[19]

Original sin is significantly associated with relatively high levels of output and capital-account volatility. It accounts for a quarter of the difference in output volatility between developed and developing countries; in a horserace between original sin and terms-of-trade volatility, original sin is the only one that remains statistically significant. It is equally important in explaining capital flow volatility: original sin again explains approximately a quarter of the difference in volatility between developing and OECD countries.

4. Conclusion

This chapter has developed and utilized a series of numerical indicators of the incidence of original sin. These are designed to capture both its international and domestic dimensions, both bank debts and securitized obligations, and both hedged and unhedged exposures. This is a more comprehensive and informative set of measures than has been available to investigators before. These indicators and the methods we use to construct them should be of interest quite independently of the particular uses to which we put them.

These indicators allow us to establish the importance of original sin for the macroeconomic problems afflicting emerging markets. We show that countries suffering from original sin have found it difficult to participate in the movement toward greater

[19] These results are robust to dropping the weights and using alternative measures of original sin, as shown

currency flexibility or to exploit its benefits. Because exchange rates movements imbue monetary policy with wealth effects that limit its effectiveness, interest rates must do more of the work when the economy is buffeted by shocks. It follows that interest rates are more volatile and pro-cyclical in such countries, and more volatile interest rates and fragile financial positions imply correspondingly greater macroeconomic volatility. Output fluctuations are wider in countries with original sin. Capital flows are more volatile and prone to reversal. Countries burdened with original sin have lower credit ratings and hence more tenuous access to international capital markets than even their levels of indebtedness and other creditworthiness indicators would lead one to predict.

Thus, the fact that the external debts of emerging markets are disproportionately denominated in foreign currency goes a long way toward explaining why their economies are more volatile and crisis prone than those of their advanced-country counterparts. A key challenge is thus to identify and distinguish the channels and mechanisms through which inability to borrow in the domestic currency creates this additional volatility. It is this issue that is taken up by the next set of chapters in this volume.

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in Appendix Table A3.

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Table 1: International bonded debt, by country groups and currencies

	Total Debt Instruments Issued by residents		Total Debt Instruments Issued by residents in own currency		Total debt instrument issued in groups' currency		Share of own currency	Share of groups' currency
1993-1998								
Major financial centers	939.1	34%	493.6	64%	1868.4	68.1%	52.6%	199.0%
Euroland	855.9	31%	198.4	26%	647.5	23.6%	23.2%	75.7%
Other Developed Countries	390.1	14%	68.6	9%	128.2	4.7%	17.6%	32.9%
Developing Countries	269.0	10%	6.3	1%	16.8	0.6%	2.3%	6.3%
International Organizations	289.7	11%	0.0	0%	0.0	0.0%	0.0%	0.0%
ECU	0.0	0%	0.0	0%	82.8	3.0%	0.0%	0.0%
Total	2743.7	100 %	766.8	100%	2743.7	100.0 %	27.9%	100.0%
1999-2001								
Major financial centers	2597.7	45%	1773.6	61%	3913.8	67.8%	68.3%	150.7%
Euroland	1885.6	33%	1071.5	37%	1722.2	29.8%	56.8%	91.3%
Other Developed Countries	477.6	8%	45.9	2%	89.9	1.6%	9.6%	18.8%
Developing Countries	434.0	8%	11.6	0%	47.4	0.8%	2.7%	10.9%
International Organizations	378.4	7%	0.0	0%	0.0	0.0%	0.0%	0.0%
ECU	0.0	0%	0.0	0%	0.0	0.0%	0.0%	0.0%
Total	5773.3	100%	2902.5	100%	5773.3	100.0 %	50.3%	100.0%

Major financial centers: The US, Japan, the UK, and Switzerland
Source: Bank for International Settlements

Figure 1: Distribution of debt by issuers and currencies (1999-2001)

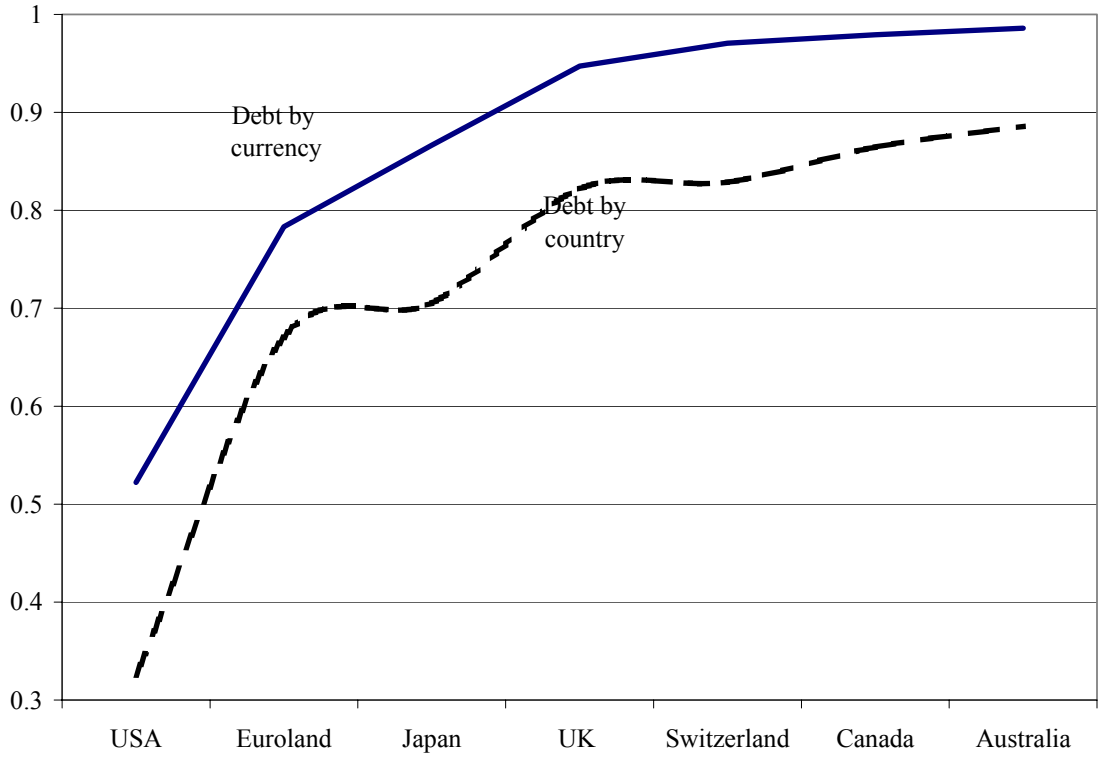


Table 2: Cross-border Bank Claims

	Total Bank Debt of residents (BIL USD)		1995-1998 Total debt in major five currencies		Share in Major Five Currencies
Major Financial Centers	3,141	44.9%	2,448	44.02%	77.9%
Euroland	1,637	23.4%	1,479	26.60%	90.3%
Other Developed Countries	263	3.8%	167	3.00%	63.5%
Offshore	502	7.2%	434	7.80%	86.4%
Developing Countries	1,305	18.7%	995	17.89%	76.2%
International Organizations	23	0.3%	17	0.31%	71.4%
Unallocated	127	1.8%	22	0.40%	17.7%
Total	6,998	100.0%	5,561	100.00 %	79.5%
	Total Bank Debt by residents (BIL USD)		**1999-2001 Total debt in major five currencies**		**Share in Major Five Currencies**
Major Financial Centers	3,691	47.3%	3,146	49.59%	85.2%
Euroland	2,263	29.0%	2,080	32.79%	91.9%
Other Developed Countries	356	4.6%	223	3.52%	62.8%
Offshore	458	5.9%	381	6.01%	83.1%
Developing Countries	887	11.4%	673	10.61%	75.8%
International Organizations	18	0.2%	17	0.27%	93.7%
Unallocated	134	1.7%	19	0.30%	14.5%
Total	7,808	100.0%	6,344	100.00 %	81.3%

Major financial centers: The US, Japan, the UK, and Switzerland
Source: Bank for International Settlements

Table 3: composition outstanding of international securities issued by non-US residents and held by US investors. (2001)

	USD	EUR	JPY	GBP	OWN	Other	Total	Share of Total	Share of international securities (a)	Securities by currency (b)	Currency share (c)
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
Int. 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

(a) Share of international securities held by US investors over total international bonds issued in 2001 by non-US resident

(b) and (c) International securities (and their share) held by US investors in each of the currency groups (for instance, at the end of 2001 US investor held USD97.3 billion worth of international securities denominated in euro, this corresponds to 15 percent of the total international securities held by US investors)

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 United Kingdom. The value reported under OWN for financial centers corresponds to issues in Swiss francs.

Source: Authors calculations based on Tables 16 and 17 in Report on US holdings of foreign securities. Us Treasury, Available at http://www.treas.gov/tic/shc2001r.pdf

Table 4: Measures of original sin by country groupings (simple average)

Group	OSIN1 1993-1998	OSIN1 1999-2001	OSIN2 1993-1998	OSIN2 1999-2001	OSIN3 1993-1998	OSIN3 1999-2001	USSIN1 2001
Financial centers	0.58	0.53	0.34	0.37	0.07	0.08	0.63
Euroland	0.86	0.52	0.55	0.72	0.53	0.09*	0.56
Other Developed	0.90	0.94	0.80	0.82	0.78	0.72	0.66
Offshore	0.98	0.97	0.95	0.98	0.96	0.87	0.90
Developing	1.00	0.99	0.98	0.99	0.96	0.93	0.96
LAC	1.00	1.00	1.00	1.00	0.98	1.00	0.99
Middle East & Africa	1.00	0.99	0.97	0.99	0.95	0.90	0.99
Asia & Pacific	1.00	0.99	0.95	0.99	0.99	0.94	0.96
Eastern Europe	0.99	1.00	0.97	0.98	0.91	0.84	0.91

* In the 1999-2001 period it is impossible to allocate the debt issued by non-residents 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.

Figure 2: Original Sin by Country Groups

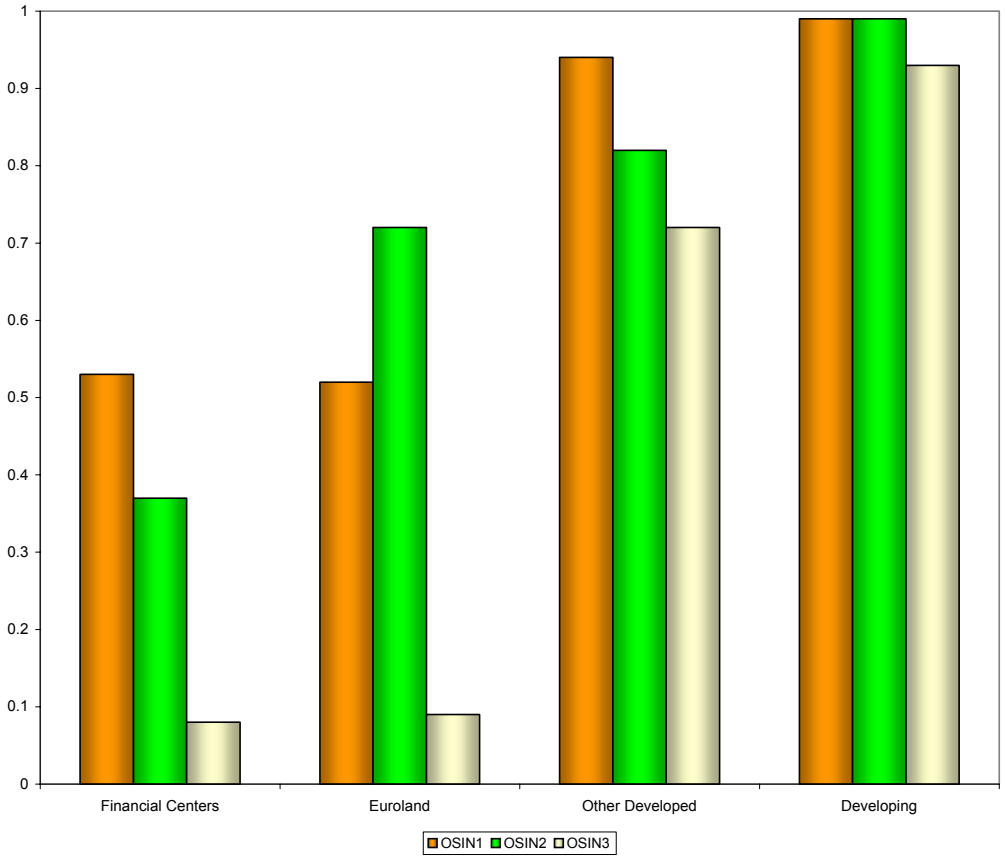


Table 5: Countries with OSIN3 below 0.8, excluding financial centers

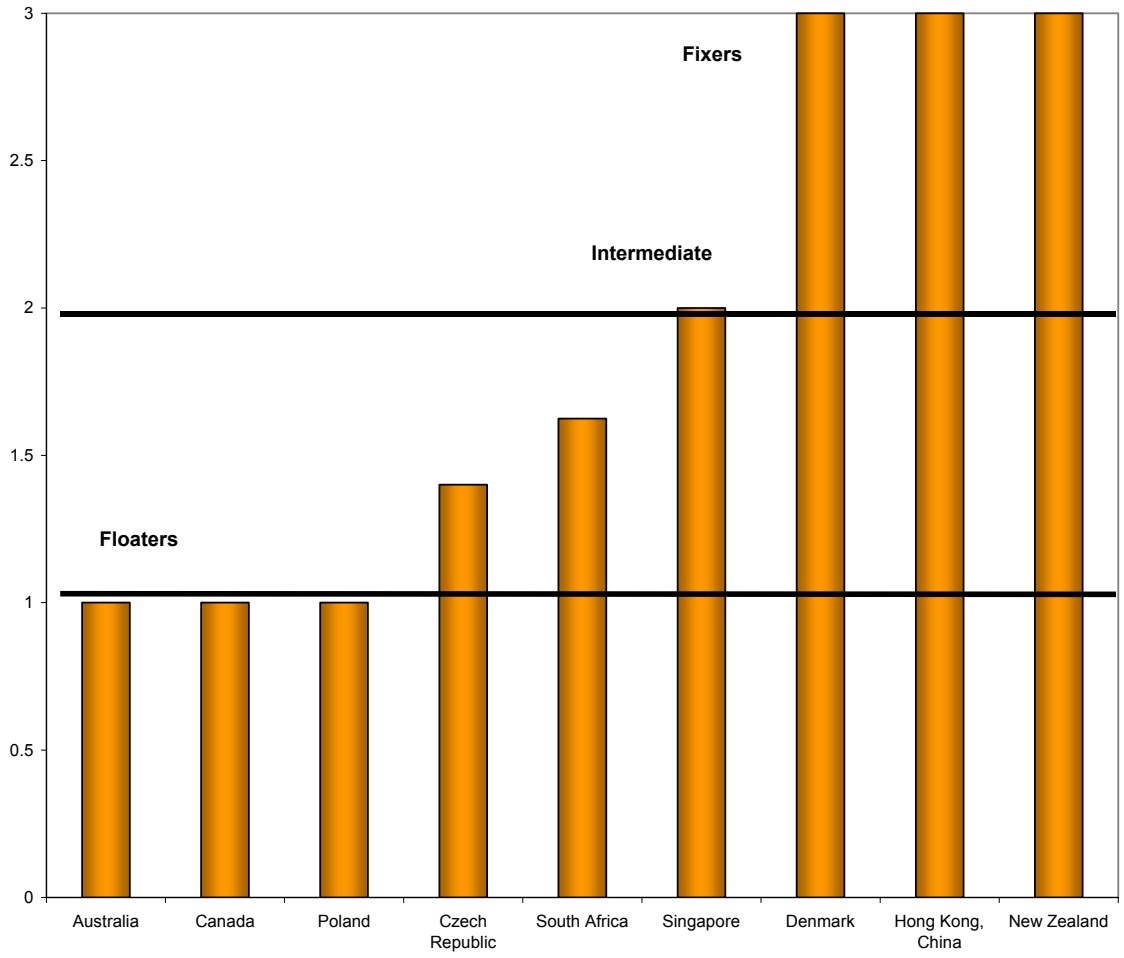
	Non Euroland			Euroland	
Country	1993-98	1991-01	Country	1993-98	1991-01
Czech Republic	0.0	0.00	Italy	0.00	0.00
Poland	0.82	0.00	France	0.23	0.12
New Zealand	0.63	0.05	Portugal	0.42	0.24
South Africa	0.44	0.10	Belgium	0.76	0.39
Hong Kong	0.72	0.29	Spain	0.59	0.42
Taiwan	1.00	0.54	Netherlands	0.64	0.47
Singapore	0.96	0.70	Ireland	0.94	0.59
Australia	0.55	0.70	Greece	0.93	0.60
Denmark	0.80	0.71	Finland	0.96	0.62
Canada	0.55	0.76	Austria	0.90	0.68

Table 6: OSIN3 in 1993-1998 and the Flandreau-Sussman classification, circa 1850

	Mean	St. Dev.	N	Difference with respect to gold clauses
Gold clauses	0.86	0.28	31	0.00
Mixed clauses	0.53	0.39	6	0.36 (0.016)**
Domestic Currency	0.34	0.36	5	0.52 (0.000)***
Total	0.75	0.35	42	

P values of the mean comparison test in parentheses

Figure 3: Original Sin and Exchange Rate Regime



The Exchange rate regime is measured using the index developed by Levy-Yeyati and Sturzenegger (2000) averaged over the 1992-1998 period. 1 corresponds to a floating rate and 3 corresponds to a fixed rate.

Table 7: Measures of domestic original sin by country

DSIN		*DSIN2*	
Taiwan	0.011	Czech Republic	0.588
India	0.036	Hong Kong	0.621
South Africa	0.052	Egypt	0.790
Slovak Republic	0.133	Mexico	0.837
Thailand	0.135	Greece	0.880
Singapore	0.275	Brazil	0.915
Israel	0.288	Argentina	1.000
Hungary	0.296	Venezuela	1.000
Poland	0.300	Turkey	1.000
Philippines	0.358	Indonesia	1.000
Chile	0.545	Malaysia	1.000

Figure 4: Domestic and International Original Sin

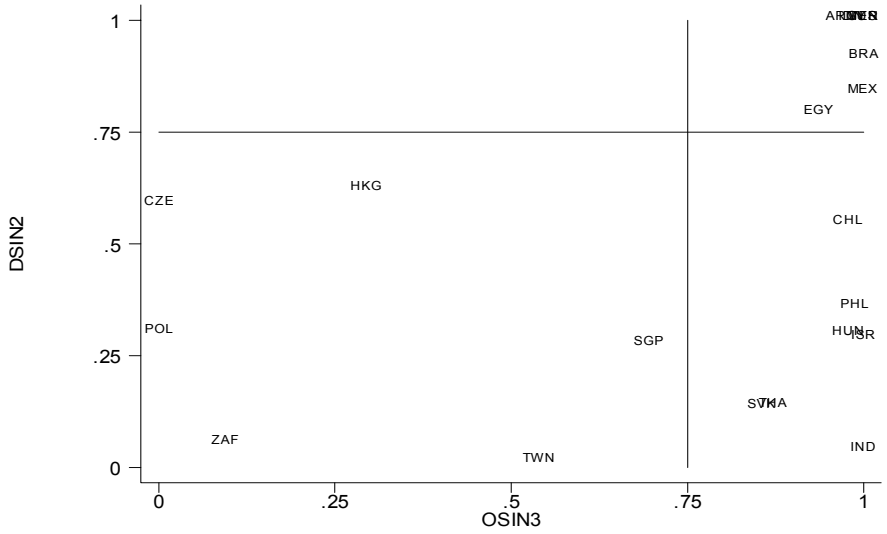


Table 8: Volatility of GDP Growth (1980-1999)

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

Table 9: Volatility of the Real Exchange rate

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

Table 10: Large Drops in Dollar GDP

Country	Year	Change in Dollar GDP	Change in Real GDP	Country	Year	Change in Dollar GDP	Change in Real GDP
Suriname	1995	-94%	-7%	Jordan	1990	-40%	-19%
Iran, Islamic Rep.	1994	-93%	21%	Guatemala	1987	-40%	3%
Suriname	1994	-91%	-35%	Syrian Arab Republic	1988	-40%	-13%
Iran, Islamic Rep.	1993	-91%	23%	Trinidad and Tobago	1987	-38%	-20%
Nigeria	1999	-74%	-2%	Togo	1982	-38%	-15%
Nigeria	1987	-68%	28%	Mexico	1982	-38%	8%
Uruguay	1984	-67%	-8%	South Africa	1985	-38%	4%
Egypt, Arab Rep.	1991	-63%	4%	Ecuador	1987	-38%	1%
Indonesia	1998	-60%	7%	Egypt, Arab Rep.	1992	-37%	6%
Sierra Leone	1986	-57%	-10%	Indonesia	1999	-37%	-7%
Mexico	1983	-56%	-9%	Egypt, Arab Rep.	1990	-36%	10%
Uruguay	1983	-55%	-17%	Trinidad and Tobago	1986	-36%	-13%
Costa Rica	1982	-54%	-10%	Swaziland	1985	-36%	2%
Nigeria	1986	-52%	1%	Namibia	1985	-35%	15%
Syrian Arab Republic	1989	-48%	9%	Paraguay	1985	-35%	13%
Jamaica	1985	-46%	4%	Ecuador	1999	-33%	-2%
Honduras	1991	-46%	-4%	Jamaica	1984	-33%	12%
Dominican Republic	1985	-46%	4%	Papua New Guinea	1999	-33%	-5%
Togo	1994	-45%	-12%	Mexico	1995	-33%	1%
Chile	1983	-45%	-13%	Sierra Leone	1998	-31%	-22%
Sierra Leone	1990	-44%	-15%	Sweden	1982	-31%	-1%
Dominican Republic	1986	-44%	10%	Papua New Guinea	1998	-31%	-4%
Senegal	1994	-43%	-4%	Madagascar	1988	-31%	7%
Korea, Rep.	1998	-41%	-5%	Jamaica	1992	-30%	-10%
Jordan	1989	-41%	-20%	Morocco	1982	-30%	1%
Thailand	1998	-41%	-12%	Venezuela	1984	-30%	4%
Honduras	1990	-40%	0%	AVERAGE		-46%	-2%

Figure 5: Credit Rating and Debt to Revenue Ratios

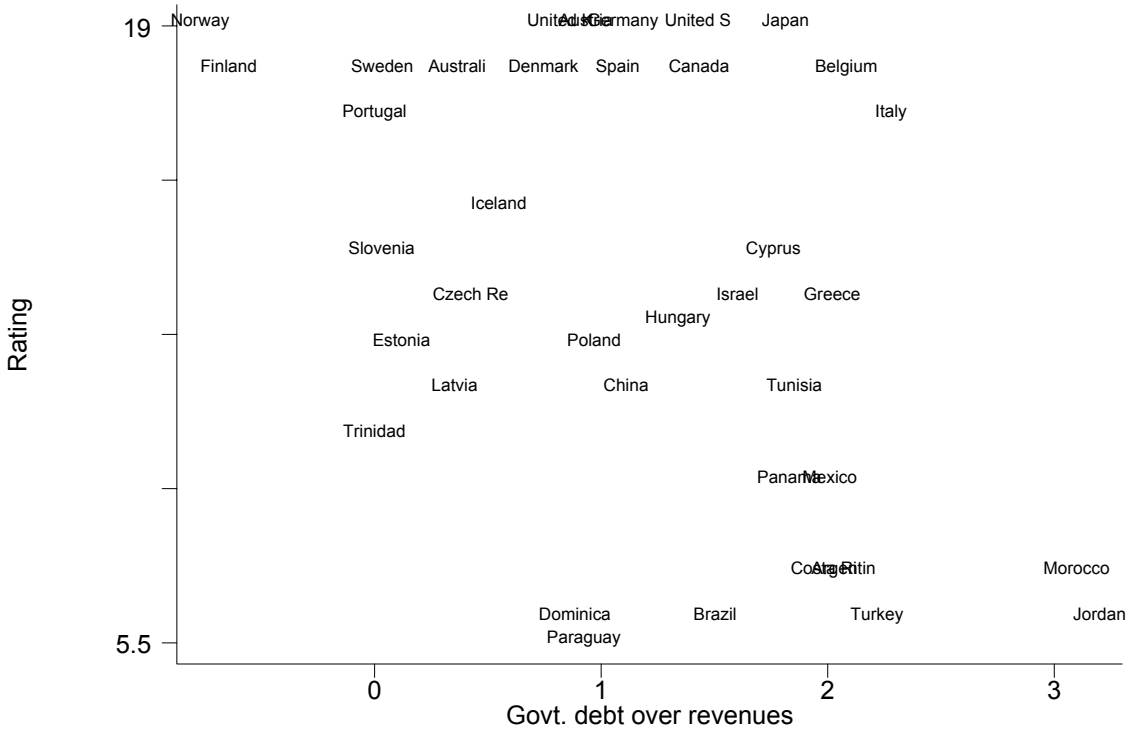


Table 11: Original Sin and credit ratings

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

t statistics in parentheses (weighted Tobit estimations)
*** significant at 10%; ** significant at 5%; *** significant at 1%**

Table 12: Original Sin and Exchange rate flexibility

	(1)	(2)	(3)	(4)	(5)	(6)
				Dropping Financial Centers		
	LYS	RESM2	RVER	LYS	RESM2	RVER
OSIN3	1.503	0.248	-0.801	1.112	0.339	-0.598
	(3.56)***	(3.74)***	(2.02)**	(2.45)**	(3.10)***	(1.33)
LGDP_PC	0.302	-0.053	0.026	0.285	-0.052	0.025
	(2.89)***	(1.85)*	(0.61)	(2.77)***	(1.81)*	(0.56)
OPEN	0.198	-0.014	1.017	0.153	-0.014	1.021
	(0.92)	(0.41)	(2.88)***	(0.72)	(0.41)	(2.93)***
SHARE2	0.290	-0.036	-0.570	0.297	-0.030	-0.544
	(0.96)	(0.66)	(2.36)**	(0.98)	(0.54)	(2.29)**
Constant	-2.188	0.531	0.104	-1.644	0.435	-0.084
	(1.94)*	(1.73)*	(0.17)	(1.46)	(1.35)	(0.13)
Observations	75	65	65	71	62	62
R-squared		0.37	0.62		0.34	0.65

Robust t statistics in parentheses (Weighted OLS for RESM2 and RVER, Weighted Tobit for LYS)
*significant at 10%; ** significant at 5%; *** significant at 1%

Table 13: Original Sin and Volatility

	(1)	(2)	(3)	(4)
			Dropping Financial Centers	
	VOL_GROWTH	VOL_FLOW	VOL_GROWTH	VOL_FLOW
OSIN3	0.011	7.103	0.015	7.498
	(1.96)*	(3.58)***	(2.45)**	(2.69)**
LGDP_PC	-0.012	-3.214	-0.012	-3.322
	(2.14)**	(2.56)**	(2.09)**	(2.40)**
OPEN	-0.001	-4.181	-0.000	-4.333
	(0.12)	(1.20)	(0.08)	(0.83)
VOL_TOT	-0.000	0.223	-0.000	0.223
	(0.86)	(1.08)	(0.89)	(1.02)
SHARE2	-0.014	0.147	-0.015	0.949
	(1.72)*	(0.04)	(1.51)	(0.14)
Constant	0.135	32.825	0.131	33.282
	(2.25)**	(2.39)**	(2.15)**	(2.22)**
Observations	77	33	73	29
R-squared	0.40	0.64	0.40	0.62

Robust t statistics in parentheses
*significant at 10%; ** significant at 5%; *** significant at 1%

Appendix

Table A1: Measures of original sin by country

COUNTRY	OSIN1	OSIN1	OSIN2	OSIN2	OSIN3	OSIN3	USSIN1
	1993-1998	1999-2001	1993-1998	1999-2001	1993-1998	1999-2001	2001
Algeria	1		1		1		
Argentina	0.98	0.97	0.98	0.97	0.98	0.97	0.98
Aruba	1		1		1		1
Australia	0.69	0.82	0.63	0.7	0.55	0.7	0.79
Austria	0.95	0.7	0.9	0.69	0.9	0.69	0.74
Bahamas, The	1	1	1	1	1	1	0.99
Bahrain	1	1	1	1	1	1	
Barbados	1	1	1	1	1	1	1
Belgium	0.88	0.46	0.79	0.56	0.79	0.39	0.23
Bolivia	1		1		1		
Brazil	1	1	1	1	1	1	0.99
Bulgaria	1	1	1	1	1	1	1
Canada	0.78	0.85	0.76	0.83	0.55	0.76	0.8
Chile	1	1	1	0.98	1	0.98	1
China	1	1	1	1	1	1	0.99
Colombia	1	1	1	1	1	1	
Costa Rica	1	1	1	1	1	1	0.92
Cyprus	0.95	0.96	0.95	0.96	0.95	0.96	1
Czech Republic	1	1	0.88	0.84	0	0	0.71
Denmark	0.92	0.95	0.8	0.74	0.8	0.71	0.43
Dominican Republic	1	1	1	1	1	1	
Ecuador	1	1	1	1	1	1	
Egypt, Arab Rep.		1		0.94		0.94	1
El Salvador	1	1	1	1	1	1	1
Estonia	1	1	1	0.95	1	0.83	1
Finland	0.98	0.65	0.96	0.62	0.96	0.62	0.78
France	0.59	0.35	0.52	0.42	0.23	0.12	0.46
Germany	0.69	0.37	0.67	0.48	0	0	0.35
Ghana	1	1	1	1	1	1	1
Greece	0.99	0.78	0.93	0.6	0.93	0.6	
Guatemala	1	1	1	1	1	1	0.98
Hong Kong, China	0.89	0.81	0.89	0.82	0.72	0.29	0.96
Hungary	1	1	1	0.98	1	0.98	0.44
Iceland	1	1	1	0.99	0.99	0.99	
India	1	1	1	1	1	1	1
Indonesia	0.98	0.99	0.94	0.98	0.94	0.98	0.98
Ireland	0.98	0.6	0.94	0.59	0.94	0.59	0.79
Israel	1	1	1	1	1	1	0.93
Italy	0.86	0.37	0.65	0.51	0	0	0.27
Jamaica	1	1	1	1	1	1	0.96
Japan	0.64	0.53	0.25	0.35	0	0	0.1
Jordan	1	1	1	1	1	1	1
Kazakhstan	1	1	1	1	1	1	1
Kenya	1		1		1		1
Korea, Rep.	1	1	1	1	1	1	0.95
Latvia	1	1	1	0.96	1	0.96	
Lebanon	1	1	1	1	1	1	1
Lithuania	1	1	1	1	1	1	1
Luxembourg	0.66	0.44	0.58	0.47	0	0.25	0.92
Malaysia	1	1	0.99	1	0.99	1	0.99
Malta	1	1	1	1	1	1	1
Mauritius	1	1	1	1	1	1	

Mexico	1	1	1	1	1	1	0.99
Moldova	1	1	1	1	1	1	1
Morocco	1	1	1	1	1	1	1
Netherlands	0.76	0.51	0.64	0.48	0.64	0.47	0.76
Netherlands Antilles	1	1	1	1	1	1	1
New Zealand	0.93	0.98	0.62	0.56	0.62	0.05	0.36
Nicaragua	1	1	1	1	1	1	1
Norway	0.99	0.99	0.98	0.89	0.98	0.89	0.93
Oman	1	1	1	1	1	1	
Pakistan	1	1	1	1	1	1	1
Panama	1	1	1	1	1	1	1
Papua New Guinea	1	1	1	1	1	1	
Peru	1	1	1	1	1	1	1
Philippines	0.99	1	0.98	0.99	0.98	0.99	1
Poland	0.97	0.99	0.95	0.89	0.82	0	0.69
Portugal	0.97	0.44	0.42	0.59	0.42	0.24	0.68
Qatar	1	1	1	1	1	1	
Romania	1	1	1	1	1	1	1
Russian Federation	1	1	1	0.98	1	0.98	1
Singapore	0.97	0.94	0.96	0.78	0.96	0.7	0.97
Slovak Republic	1	1	0.96	0.97	0.87	0.85	1
Slovenia	1	1	1	1	1	1	1
South Africa	0.99	0.88	0.91	0.76	0.44	0.09	0.59
Spain	0.96	0.52	0.59	0.61	0.59	0.42	0.19
Sri Lanka	1	1	1	1	1	1	1
Suriname	1	1	1	1	1	1	
Sweden	0.98	0.98	0.95	0.91	0.95	0.91	0.68
Switzerland	0.84	0.8	0.29	0.25	0	0	0.89
Taiwan	1	0.99	1	0.62	1	0.54	0.52
Thailand	0.99	0.88	0.98	0.87	0.98	0.87	0.96
Trinidad and Tobago	1	1	0.99	1	0.66	1	1
Tunisia	1	1	1	1	1	1	1
Turkey	1	1	1	1	1	1	0.99
Ukraine	1	1	1	1	1	1	1
United Kingdom	0.56	0.64	0.26	0.31	0.26	0.31	0.89
United States	0.3	0.17	0.65	0.44	0	0	
Uruguay	1	1	1	1	1	1	1
Venezuela	1	1	1	1	1	1	
Zimbabwe	1		1		1		1

Table A2: Original Sin and Exchange Rate Flexibility

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
			Dropping Financial Centers				Dropping Financial Centers				Dropping Financial Centers	
	LYS	LYS	LYS	LYS	RESM2	RESM2	RESM2	RESM2	RVER	RVER	RVER	RVER
OSIN2	1.401		0.230		0.415		0.733		-1.820		-1.229	
	(1.83)*		(0.24)		(3.54)***		(4.26)***		(3.04)***		(1.87)*	
OSIN3		1.503		1.112		0.248		0.339		-0.801		-0.598
		(3.56)***		(2.45)**		(3.74)***		(3.10)***		(2.02)**		(1.33)
LGDP_PC	0.143	0.302	0.105	0.285	-0.002	-0.053	0.005	-0.052	-0.093	0.026	-0.078	0.025
	(1.25)	(2.89)***	(0.93)	(2.77)***	(0.13)	(1.85)*	(0.27)	(1.81)*	(1.62)	(0.61)	(1.33)	(0.56)
OPEN	0.094	0.198	0.042	0.153	0.049	-0.014	0.048	-0.014	0.743	1.017	0.751	1.021
	(0.43)	(0.92)	(0.20)	(0.72)	(1.15)	(0.41)	(1.13)	(0.41)	(1.98)*	(2.88)***	(1.99)*	(2.93)***
SHARE2	0.344	0.290	0.351	0.297	0.000	-0.036	-0.003	-0.030	-0.305	-0.570	-0.310	-0.544
	(1.86)*	(0.96)	(1.98)*	(0.98)	(0.00)	(0.66)	(0.08)	(0.54)	(1.82)*	(2.36)**	(1.89)*	(2.29)**
Constant	-0.764	-2.188	0.710	-1.644	-0.132	0.531	-0.503	0.435	2.215	0.104	1.513	-0.084
	(0.52)	(1.94)*	(0.44)	(1.46)	(0.54)	(1.73)*	(1.70)*	(1.35)	(2.64)**	(0.17)	(1.71)*	(0.13)
Observations	75	75	71	71	65	65	62	62	65	65	62	62
R-squared					0.18	0.37	0.14	0.34	0.52	0.62	0.51	0.65

Robust t statistics in parentheses (Weighted OLS for RESM2 and RVER, Weighted Tobit for LYS)
*significant at 10%; ** significant at 5%; *** significant at 1%

Table A3: Original Sin and Macroeconomic Volatility

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
			Dropping Financial Centers				Dropping Financial Centers	
	VOL_GROWTH	VOL_GROWTH	VOL_GROWTH	VOL_GROWTH	VOL_FLOW	VOL_FLOW	VOL_FLOW	VOL_FLOW
OSIN2	0.016*		0.026		11.194		12.937	
	(1.68)		(2.10)**		(3.25)***		(2.78)**	
OSIN3		0.011		0.015		7.103		7.498
		(1.96)*		(2.45)**		(3.58)***		(2.69)**
LGDP_PC	-0.006	-0.012	-0.006	-0.012	-3.191	-3.214	-3.242	-3.322
	(2.02)**	(2.14)**	(1.85)*	(2.09)**	(2.69)**	(2.56)**	(2.38)**	(2.40)**
OPEN	0.005	-0.001	0.005	-0.000	-6.320	-4.181	-7.062	-4.333
	(1.15)	(0.12)	(1.14)	(0.08)	(2.00)*	(1.20)	(1.58)	(0.83)
VOL_TOT	-0.000	-0.000	-0.000	-0.000	0.393	0.223	0.382	0.223
	(0.39)	(0.86)	(0.46)	(0.89)	(2.32)**	(1.08)	(2.18)**	(1.02)
SHARE2	-0.003	-0.014	-0.003	-0.015	5.074	0.147	5.609	0.949
	(1.14)	(1.72)*	(1.11)	(1.51)	(2.32)**	(0.04)	(1.70)	(0.14)
Constant	0.070	0.135	0.058	0.131	26.478	32.825	25.758	33.282
	(1.88)*	(2.25)**	(1.43)	(2.15)**	(1.97)*	(2.39)**	(1.57)	(2.22)**
Observations	77	77	73	73	33	33	29	29
R-squared	0.21	0.40	0.19	0.40	0.65	0.64	0.61	0.62

Robust t statistics in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%

Table A4: Original Sin and Credit Rating

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	RATING1	RATING1	RATING1	RATING1	RATING1	RATING1	RATING1	RATING1	RATING1	RATING1	RATING1	RATING1
										Dropping Financial Centers		
OSIN2	-15.252	-12.718			-9.497	-11.078			-14.487	-11.874		
	(4.35)***	(3.78)***			(1.70)*	(1.81)*			(4.03)***	(3.46)***		
OSIN3			-5.845	-5.644			-5.470	-4.147			-5.214	-4.955
			(4.08)***	(4.01)***			(2.24)**	(1.84)*			(3.31)***	(3.21)***
DE_GDP	-2.981		-2.421		7.352		-1.837		-2.969		-2.285	
	(3.22)***		(2.50)**		(0.91)		(0.57)		(3.20)***		(2.32)**	
DE_RE		-0.736		-0.999		0.445		-0.346		-0.775		-0.975
		(2.14)**		(2.49)**		(0.12)		(0.37)		(2.25)**		(2.39)**
LGDP_PC	2.392	2.273	2.916	2.670	2.302	2.247	2.906	2.621	2.389	2.235	2.976	2.729
	(7.10)***	(5.63)***	(8.48)***	(6.16)***	(6.84)***	(5.48)***	(8.36)***	(5.99)***	(7.10)***	(5.54)***	(8.36)***	(5.97)***
DE_GDPSIN2					-11.011							
					(1.28)							
DE_RE_SIN2						-1.232						
						(0.32)						
DE_GDPSIN3							-0.673					
							(0.19)					
DE_RE_SIN3								-0.732				
								(0.77)				
SHARE2	1.501	1.589	2.187	2.787	1.569	1.597	2.213	3.013	1.518	1.656	1.810	2.405
	(2.66)**	(2.36)**	(1.43)	(1.52)	(2.83)***	(2.38)**	(1.44)	(1.64)	(2.69)***	(2.47)**	(1.09)	(1.18)
Constant	6.174	4.723	-8.058	-5.962	1.450	3.372	-8.315	-6.950	5.435	4.248	-9.119	-7.037
	(1.09)	(0.77)	(2.12)**	(1.28)	(0.22)	(0.45)	(2.06)**	(1.45)	(0.95)	(0.69)	(2.29)**	(1.44)
Observations	56	49	56	49	56	49	56	49	53	46	53	46

t statistics in parentheses (weighted Tobit estimations)
* significant at 10%; ** significant at 5%; *** significant at 1%

Table A5:Robustness Analysis (including developing country dummy)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
	LYS3	LYS3	RESM2	RESM2	RVER	RVER	VOL_GROWTH	VOL_GROWTH	VOL_FLOW	VOL_FLOW	RATING1
LGDP_PC	0.271	0.265	-0.029	-0.031	-0.100	-0.118	-0.014	-0.015	-2.817	-3.058	1.937
	(1.74)*	(1.72)*	(0.61)	(0.65)	(1.31)	(1.55)	(1.60)	(1.60)	(1.67)	(1.61)	(4.02)***
OSIN3	1.535	1.136	0.205	0.286	-0.577	-0.236	0.013	0.019	6.894	7.306	-4.760
	(3.48)***	(2.39)**	(3.40)***	(2.61)**	(1.45)	(0.68)	(2.52)**	(2.94)***	(3.35)***	(2.48)**	(3.49)***
OPEN	0.199	0.153	-0.013	-0.013	1.012	1.016	-0.001	-0.000	-4.016	-4.287	
	(0.92)	(0.72)	(0.38)	(0.38)	(3.14)***	(3.26)***	(0.10)	(0.05)	(1.12)	(0.81)	
SHARE2	0.289	0.298	-0.047	-0.041	-0.511	-0.468	-0.015	-0.016	0.241	1.060	1.752
	(0.96)	(0.99)	(0.89)	(0.76)	(2.42)**	(2.36)**	(1.84)*	(1.65)	(0.07)	(0.16)	(1.23)
DEVELOPING	-0.105	-0.069	0.095	0.083	-0.507	-0.578	-0.009	-0.010	1.095	0.722	-3.006
	(0.26)	(0.17)	(1.11)	(0.92)	(2.05)**	(2.38)**	(0.59)	(0.68)	(0.30)	(0.19)	(2.71)***
VOL_TOT							-0.000	-0.000	0.221	0.222	
							(0.82)	(0.85)	(1.06)	(1.00)	
DE_GDP2											-2.458
											(2.73)***
Constant	-1.888	-1.450	0.299	0.250	1.338	1.210	0.159	0.157	28.750	30.633	1.595
	(1.17)	(0.91)	(0.61)	(0.52)	(1.75)*	(1.54)	(1.70)*	(1.68)*	(1.57)	(1.51)	(0.32)
Observations	75	71	65	62	65	62	77	73	33	29	56
R-squared			0.39	0.35	0.65	0.69	0.41	0.41	0.64	0.62	

Robust t statistics in parentheses
*significant at 10%; ** significant at 5%; *** significant at 1%

Table A6:Robustness Analysis (regressions without weights)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
	LYS3	LYS3	RESM2	RESM2	RVER	RVER	VOL_GROWTH	VOL_GROWTH	VOL_FLOW	VOL_FLOW	RATING1
LGDP_PC	0.180	0.175	-0.006	-0.006	-0.023	-0.036	-0.006	-0.006	-3.271	-3.388	2.815
	(1.70)*	(1.70)*	(0.31)	(0.33)	(0.44)	(0.74)	(2.01)**	(2.02)**	(2.50)**	(2.27)**	(8.82)***
SIN33_A	1.149	0.789	0.230	0.252	-0.560	-0.051	0.012	0.015	6.432	7.101	-4.879
	(2.78)***	(1.78)*	(3.10)***	(1.79)*	(1.37)	(0.14)	(2.39)**	(2.58)**	(2.43)**	(1.87)*	(3.68)***
OPEN	0.103	0.040	0.055	0.055	0.713	0.744	0.005	0.005	-1.838	-1.927	
	(0.49)	(0.20)	(1.21)	(1.19)	(1.79)*	(1.93)*	(1.15)	(1.17)	(0.49)	(0.29)	
SHARE2	0.327	0.339	-0.002	-0.002	-0.328	-0.326	-0.003	-0.003	1.242	1.460	1.387
	(1.82)*	(1.92)*	(0.05)	(0.05)	(1.85)*	(1.92)*	(1.32)	(1.24)	(0.43)	(0.28)	(2.35)**
VOL_TOT							-0.000	-0.000	0.361	0.356	
							(0.39)	(0.44)	(2.07)**	(1.97)*	
DE_GDP2											-2.484
											(2.59)**
Constant	-0.765	-0.337	0.078	0.061	0.453	0.040	0.071	0.070	31.213	31.693	-7.673
	(0.68)	(0.31)	(0.37)	(0.25)	(0.71)	(0.07)	(2.17)**	(2.09)**	(2.16)**	(1.81)*	(2.20)**
Observations	75	71	65	62	65	62	77	73	33	29	56
R-squared			0.19	0.11	0.44	0.49	0.22	0.20	0.65	0.61	

Robust t statistics in parentheses
*significant at 10%; ** significant at 5%; *** significant at 1%