ISSN 1749-8279

World Economy & Finance
Research Programme

Working Paper Series

WEF 0001

The Role of Foreign Currency Debt in Financial Crises: 1880-1913 vs. 1972-1997

Christopher M Meissner
Michael D Bordo

March 2006

World Economy & Finance Research Programme
▪ Birkbeck, University of London ▪ Malet Street ▪ London ▪ WC1E 7HX ▪

The Role of Foreign Currency Debt in Financial Crises: 1880-1913 vs. 1972-1997*

March 2, 2006

Michael D. Bordo
Rutgers University and NBER

Christopher M. Meissner
University of Cambridge, King's College and NBER

Abstract

We show that exposure to foreign currency debt does not necessarily increase the risk of having a financial crisis. Some countries do not suffer from financial fragility despite *original sin*. Before 1913 British offshoots and Scandinavia afflicted with it avoided financial meltdowns. Today many advanced countries have original sin but few have had crises. In both periods, aggregate balance sheet mismatches are associated with a greater likelihood of a crisis. The evidence suggests that foreign currency debt is dangerous when mis-managed. This is part of the difference between developed countries and emerging markets both of which borrow in foreign currency.

Keywords: Original Sin; currency mismatch; crisis; debt intolerance; balance sheets.

JEL Classifications: E44, F10, F34, N20

* We thank Antonio David and Wagner Dada for excellent research assistance. Comments from an anonymous referee, Mario Blejer, Luis Catão, Carlo Cottarelli, Barry Eichengreen, Marc Flandreau, Daniel Lederman, Kim Oosterlinck, Anna Schwartz, Paul Wachtel and participants at conferences at Humboldt University Berlin, the Bank of England, the Emerging Markets Finance conference at Cass Business School, NBER Summer Institute, the 2005 Dubrovnik Economic Conference, and the IMF are also appreciated. Errors remain our responsibility. The financial assistance from ESRC grant RES 000-22-0001 and ESRC World Economy and Finance Programme grant RES-156-25-0014 is gratefully acknowledged. Corresponding Author: Christopher M. Meissner, Faculty of Economics, University of Cambridge, Austin Robinson Building, Sidgwick Avenue, Cambridge, CB3 9DD, United Kingdom. Tel: +44 1223 33 52 00 Fax: +44 1223 33 54 75 Email: chris.meissner@econ.cam.ac.uk

1. Introduction

The period from 1870-1913 was a period of globalization in both goods and financial markets comparable to the present era of globalization. It was also a period rife with emerging market financial crises with great resonance for the experience that we have observed in the past decade. In both eras many emerging countries faced frequent currency crises, banking crises and twin crises. They also faced a number of debt crises coming on the heels of banking and currency trouble. In both periods many of these countries suffered from what Eichengreen and Hausmann (1999) refer to as *original sin.* The external debt that they accumulated to finance their development was almost strictly denominated in foreign currency or in terms of gold (or had gold clauses) before 1914, just as emerging market debt today is largely denominated in dollars, euros or yen. When the exchange rate depreciates, debt service in gold or foreign currency becomes very difficult leading to an increased likelihood of default, the consequent drying up of external funding and economic collapse.

The emerging country experience stands in contrast to that of the advanced core countries which are financially mature, have credibility and either issue bonds denominated in terms of their own currency or manage their hard currency debt carefully. There were few crises in these countries. This leads us to ask whether debt structure or other factors explain differences in crisis incidence. So in addition to looking into original sin as a determinant of crises, we investigate whether balance sheet mismatches (cf. Goldstein and Turner, 2004) or poor reputation and *debt intolerance* (cf. Reinhart, Rogoff and Savastano 2003) matter.

We have developed a database to allow us to identify and distinguish original sin and balance sheet crises from more traditional currency and banking crises for roughly 30 countries (both advanced and emerging) from 1880-1913 and over 40 countries between 1972 and 1997 the post-Bretton Woods period. We have data both on type of crisis incidence and on the fundamentals that economists believe are determinants of crises.[1]

[1] A caveat worth keeping in mind is that the original sin data and our mismatch data especially in the recent period are fairly incomplete and researchers still lack the coverage necessary to make definitive conclusions. Our data set is also somewhat unique in that the coverage and quality of the available data from 100 years ago are better than contemporary data. Nevertheless, we use the data of limited quality as a determinant of the probability of having a particular type of crisis using standard pooled probit models so as to show the correlation between original sin, mismatch and financial crises.

Our results do not find unambiguous support for the idea that hard currency debt is always associated with more financial turbulence. In fact, we find evidence that countries with significant or full-blown original sin can be divided into two sub-groups. Today countries like Greece, Ireland, Israel, Spain, Sweden, and Singapore have had relatively few crises. On the other hand, countries like Argentina, Malaysia, Thailand, Indonesia and Brazil seem to suffer from financial fragility, manifested by more frequent and more encompassing crises. We also find an historical parallel in the late nineteenth century. Australia, Canada, New Zealand, Norway, and the US had relatively little trouble with financial crises in terms of frequency or virulence but all were afflicted with high original sin. We discuss these differing experiences and conclude by illustrating that good financial management of the original sin condition, strong financial development and agile responsiveness to crises seem to explain the variation in outcomes.

2. Financial Crises, Balance Sheets and Hard Currency Debt: An Analytical Framework

Current work on the mechanics of crises suggests that banking trouble, currency crises and debt crises are inter-related phenomena. This is different from the first generation literature on currency crises that viewed these events as arising from unsustainable fiscal policy under a pegged exchange rate. It is also different from a strand of the literature which views banking crises as arising uniquely from poor supervision, weak structure or stochastic liquidity runs. Our view is that while some countries had crises that unfolded in ways the older generation of models would predict, other countries faced financial meltdown by having twin (banking and currency crises) or even triple crises, where, in addition to a large depreciation and disruption in the banking sector, sovereign debt went into default.

One important factor determining the ultimate outcome may be an interaction between the nature of the debt contracts in place and the robustness of the financial system. Our framework for thinking about financial crises is very much parallel to that enunciated in Mishkin (2003) which in turn is inspired by an open-economy approach to the credit channel transmission mechanism of monetary policy. Balance

sheets, net worth and informational asymmetries are key ingredients in this type of a model.

Initial trouble might begin in the banking sector for a number of reasons. One possibility is that international interest rates rise. This worsens the balance sheets of non-financial firms and banks alike. As the number of non-performing loans rises and net worth falls, a decline in lending can occur contributing further to output losses. At this point, internationally mobile capital may take a decidedly pessimistic view of returns in the debtor country and either stop coming in (a sudden stop) or reverse itself leaving significant short-term financing gaps.

This reversal leads to more trouble in the financial sector and increased stress for non-financial firms which are forced to cut investment because of the lack of financing. Governments may have trouble making interest payments on debt coming due as capital markets become unwilling to continue rolling debt over. The capital flow reversal, if large enough, could also force the abandonment of an exchange rate peg and a large change in the nominal exchange rate. Floating regimes could also see large depreciation occur under such a scenario.

A view inspired by the events of the late 1990s regarding the impact of such exchange rate changes is that they may be contractionary.[2] This is where original sin enters the picture. The majority of obligations for nearly all countries are in foreign currency or, in the late nineteenth century they may have also been denominated in terms of a fixed amount of gold or payable at a fixed exchange rate. Depreciation vis-à-vis creditor countries or breaking the link between gold and the domestic currency could lead to an increase in the real value of debt. This is a redistribution of wealth from domestic borrowers to their creditors who are expecting a certain amount of gold or foreign currency.[3] When net worth matters for lending decisions, this decline in the net worth of debtors can lead to another round of "disintermediation" causing widespread bankruptcies due to liquidity problems. All else equal, the deterioration to debtors' balance sheets would be more severe the greater the amount of fixed interest rate hard currency debt outstanding.

[2] Theoretical work by Céspedes, Chang and Velasco (2004) demonstrates how under certain plausible circumstances original sin can lead to contractionary depreciations. Their theoretical model divides countries into a financially robust region and a financially vulnerable region. The latter experience contractionary depreciations.

[3] Eichengreen, Hausmann and Panizza (2003) argue that what matters is the aggregate external mismatch and if all debt is domestic, that one sector's losses are the others' gains. Our view however is that net worth matters. When a debtor's net worth deteriorates, borrowing capacity falls, and the capital markets seize up. This is one reason why we should focus on domestic and external hard currency debt rather than just foreign holdings (or issues) of hard currency debt.

2.1 The Role of Original Sin

It has been the case since at least the 18th century that debt issued on international capital markets has been denominated in the currency of the market of issue and not the currency of the issuing country. A large amount of domestically issued debt was payable in a fixed amount of gold or at a fixed exchange rate. Similarly in the recent past, debt issued on international markets, and even a significant proportion of domestic issues, are made payable in foreign currencies or at a fixed exchange rate. It has also long been noted that such debt can become more onerous to repay in the face of depreciations, and that since emerging markets often face rapid exchange rate depreciations associated with sudden stops and reversals of capital inflows, loose monetary policy, or terms of trade shocks these countries are the victims of such a volatile combination.

Eichengreen and Hausmann (1997) argued that the danger of exchange rate fluctuations in the face of foreign currency borrowing might oblige many countries to adopt hard currency pegs. They coined the term "original sin" because they argued foreign currency denominated debt was imposed by international capital markets. Nations with poor reputations, and *even nations with ostensibly good reputations or solid fundamentals*, are obliged to issue debt in key international currencies. In other words, domestic policies or problems were not the only reason countries could not borrow in their own currencies.

One key controversy remains. Exactly how harmful is original sin? Work by Eichengreen and Hausmann with Ugo Panizza (Eichengreen, Hausmann and Panizza 2005) has shown that countries with higher original sin have higher exchange rate volatility and higher macroeconomic volatility. Marc Flandreau (2003) argues that in the nineteenth century depreciation increased the debt burden because of original sin which led to sovereign debt crises. He illustrates this with reference to several cases. But we are unaware of any work which has attempted to find a systematic empirical association between original sin and financial crises either in the past or for the period between 1972 and 1997.[4]

[4] Our conclusions differ from Flandreau's as we take on a wider set of hypotheses and cases. Empirical work by Flandreau and Zúmer (2004) which regresses sovereign bond yields on a ratio of interest service to government revenues and a number of other variables also argues that hard currency or gold

For the historical period, we collected data from various national sources on hard currency debt and augmented and compared this with data made available by Flandreau and Zúmer (2004). What we refer to as hard currency debt is government debt that carried a gold clause or was made payable at a fixed rate in a foreign currency.[5] Our measure of original sin is the ratio of this quantity to total public debt outstanding.

This measure is different from the measure we use for the 1972-1997 period. For this period we use the measure of original sin defined in Eichengreen, Hausmann, and Panizza (2005). This measure of international original sin for country *i* based on securities issued by residents and non-residents internationally is

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

We must be clear that there is a severe limitation in the contemporary original sin data. Data is only available for the years 1993 to 1997. We calculate the within country average of the observations available. We then use this average value for all the years in which a country appears in the data set. This broadens the time span of our sample but obviously creates some measurement error in our key explanatory variable and obviates any "within" style regressions. We are confident that the bias imparted is not too severe. This relies on the fact that original sin is extremely slow to move over time and for most countries it does not move at all over the observation period. [6]

One key difference between our nineteenth century measure and the contemporary measure that we use is that in the historical period we look at

---

debt was dangerous. Their tests are quite different from ours since our dependent variables are debt crises, banking crises, or currency crises. Frankel and Rose (1996) examined "currency crashes," external debt and exchange rate fluctuations, but their approach to measuring original sin, its impact and the type of crises considered is also different than ours. Specifically, they look at the transmission of shocks from the core through the interest rate on foreign currency debt.

[5] The data appendix from Bordo and Meissner (forthcoming) has more to say about the structure of this debt. Flandreau and Zúmer (2004) highlight just some of the difficulties in defining this type of debt. Italian bonds for example had de facto gold clauses for foreigners but not for residents, but de jure gold clauses for both classes of creditors for a certain proportion of the debt. Likewise, Spain arbitrarily implemented a residency distinction for manner of repayment around 1900. US debt was sometimes vague ex ante about the terms of repayment and often repayment was promised "in specie". Mostly this was meant to be gold but could have meant silver which secularly depreciated against gold after 1873. Still our measure is at least a good proxy for the variable of interest.

[6] Australia, Canada and South Africa saw large declines in their original sin measures over the 1980s. Because of this we understate their measures in the 1970s. In the econometrics this is likely to lead to slight upward bias of the positive effect of original sin on crisis incidence since these countries had few crises but actually had high original sin.

government debt issued in domestic and international markets instead of looking only at international issues. The data from the latter period leaves out domestically issued debt.

One reason we collected the domestic data in the early period is because many domestic issues of the day carried gold clauses. As described above, in the case where monetary authorities devalued the local currency in terms of gold this would have an effect similar to a depreciation when a country had foreign currency debt. In either event, real debt repayments for local currency gold clause debt and for foreign currency debt would both increase.[7] Hence, in the early period we do not classify debt as "debt issued in (local) currency *i*" if it contained a "gold clause" stipulating a fixed quantity of gold per unit of local currency payable. Only debt payable in local paper currency, without mention of the gold-local currency exchange rate upon payment of coupons and principal, is included in the ratio above.

The question then arises of how related our measures are in the two periods, and this hinges on how domestic original sin relates to international original sin. Unfortunately, at the time of writing, there is not much data readily available to answer this question. Eichengreen, Hausman and Panizza (2003) collected this data for two dozen countries for a limited number of years and showed that in several of these, domestic original sin diverges distinctly from the level of original sin. But for the most part, original sin and domestic original sin are highly correlated and so we are comfortable using the international measure.[8]

Figure 1 shows the averages of the original sin measure between 1880 and 1913. This reveals a counterintuitive ranking. Many countries with poor fiscal history, a shaky exchange rate policy and economic backwardness have low original sin. However, this is consistent with previous findings by Flandreau and Sussman (2005) and Eichengreen, Hausmann and Panizza (2005). Financial centers have less original sin. Small peripheral countries have a lot of original sin. Countries with ostensibly rotten fiscal institutions and poor international track records have intermediate levels of original sin. Notice that Spain, Russia, Austria-Hungary, Italy and Argentina are all towards the lower middle of the spectrum.[9]

[7] We assume here that nominal depreciations are equivalent to real depreciations.
[8] The share of each kind of debt (domestic and external issues) will also obviously matter. This could be one reason why we find below that more developed countries with larger pools of domestic savings and larger domestic debt markets are able to deal with measures of original sin that are quite high.
[9] In Bordo, Meissner and Redish (2005) and Bordo and Meissner (forthcoming) we discuss the qualitative and historical evidence on the evolution of original sin and present several case studies..

Figure 2 displays the within country averages of original sin for the 1993 to 1997 period. Again, a counter-intuitive ranking comes forth if one believes that poor financial development and a lack of credibility matter for original sin. Amongst the countries with measures of original sin between 0.8 and 1, we see highly developed countries such as Belgium, Finland, Ireland, Singapore and Sweden. At the same time, nearly all emerging markets except perhaps South Africa also have high levels of original sin. Figures 1 and 2 then provoke the question: are fundamentals (both those directly observable and those that are less easy to systematically operationalize) more important for explaining crisis incidence than the actual level of hard currency debt or original sin?

2.2 Currency Mismatches

Goldstein and Turner (2004) responded to this fundamental question by arguing that currency "mismatches" are the main potential problem with foreign currency debt. Countries that have foreign currency liabilities which are not offset by foreign currency assets may be more likely than countries with more foreign assets to find it difficult to repay their foreign currency debts in the event of a depreciation The way we choose to measure mismatch is different from Goldstein and Turner and slightly closer to that used in Eichengreen, Hausmann and Panizza (2003).[10] For country *i* we have

$$\text{Mismatch}_i = \frac{\text{total hard currency debt outstanding - international reserves}}{\text{exports}} \qquad (2)$$

For the nineteenth century, our measure of reserves usually only includes gold reserves held at the central bank, in the banking system or held by the government treasury. The sources are listed in the appendix to Bordo and Meissner (forthcoming). For the twentieth century we use international reserves as given in data underlying Bordo et. al. (2001).

For the twentieth century, we use the total of external debt given in the World Bank's *Global Development Finance* or the level of external debt given by the IMF's

[10] Eichengreen Hausmann and Panizza (2003) report that the correlation between their measure of mismatch and the Goldstein and Turner measure is 0.82.

International Financial Statistics for countries not listed in the former. For the nineteenth century, total hard currency debt (domestic and international issues) is calculated directly if the data is available or by multiplying the total debt outstanding by the percentage of total debt that is payable in gold or foreign currencies. Our expectation is that a higher mismatch measure should be correlated with more financial crises. Nevertheless, our measure does leave out a significant fraction of total assets and liabilities in the economy. The median of our twentieth century mismatch measure is 0.95 with a standard deviation of 1.3. In the nineteenth century the values are 0.79 and 2.66.

2.3 Debt Intolerance

Reinhart, Rogoff and Savastano (2003) have coined the term *debt intolerance* to describe why emerging market countries run into debt problems even with low debt to GDP ratios. Their evidence suggests that past defaults generate poor sovereign ratings. These countries face much higher borrowing costs at a given level of debt to GDP. There is a running dispute as to whether original sin is simply a manifestation of such problems.

Accordingly we include a measure of default history in our empirical models. For the nineteenth century sample, we interact a public debt to government revenue ratio with an indicator variable that equals one if a country had at least one default episode between 1800 and 1880. In the twentieth century sample our debt sustainability measure changes to the debt to output ratio since output data is more reliable and our debt measures include more than just government debt. We interact this ratio with an indicator that equals one if there was a default in the country between 1800 and 1971. If the increase in the probability of a financial crisis for a marginal increase in the debt to revenue or debt to GDP ratio is larger for a peripheral country or a past defaulter, we would argue there is evidence in support of the debt intolerance hypothesis.

2.4 Other Data and Hypotheses

The literature on predicting financial crises with econometric techniques is abundant.[11] Our approach is inspired by the pared down methodology of Frankel and Rose (1996) who looked at currency crashes at the annual level. Glick and Hutchinson (2001) explore twin crises in emerging markets, and our methodology to gauge the interaction between banking, currency and debt crises in part resembles theirs.

We attempt to control for as many important macro-economic fundamentals as possible while still maintaining some comparability over time. The list includes (with controls for the later period in parentheses) total outstanding government debt divided by government revenue (debt to GDP), growth in the terms of trade, the trade balance divided by nominal GDP, the domestic long-term interest rate, an indicator for whether the country maintained a gold standard (or a pegged exchange rate), growth of the money supply, the ratio of gold reserves in the banking system to notes in circulation (the ratio of reserves to M2), and the yield on British long-term bonds (the unweighted average of G7 long-term interest rates). Our sources, and definitions of these variables are located in the data appendix, in Bordo and Meissner (forthcoming) and the NBER working paper version of this paper.

A complete list of the included countries for the basic specifications is also found in the data appendix. The specifications from the 1880-1913 sample include roughly 21 countries which were also examined in Bordo, Eichengreen, Klingebiel, and Martínez-Peria (2001). We have added information on crises and macro data for nine other countries. These new additions include Austria-Hungary, Egypt, India, Mexico, New Zealand, Russia, South Africa, Turkey, and Uruguay. However limitations in availability of the macro data prevent all of these countries from appearing in each and every specification. For the 1972-1997 sample, the number of countries that actually appear in the estimations numbers roughly 36 countries in the typical econometric model.

2.5 Crises, 1880-1913

[11] See Berg and Patillo (1999) for a broad comparison of some important papers in this literature.

In Figure 3 we present the frequency of various types of crises (banking, currency, twin, debt, "third generation" crises and all types of crisis together).[12] This is the number of years a country was in crisis divided by total possible years of observation. We use the country-year as the unit of observation and eliminate all country-years that witness ongoing crises from the denominator (except for third generation crises where we do not eliminate ongoing banking and currency crises) to come up with a total number for years of observation. We see the pattern found in Bordo et. al. (2001) in terms of the relative frequency of types of crises. The predominant form of crises before 1914 was banking crises, followed by currency crises, twin and then debt crises.[13] By comparison, the most recent period seems much more crisis prone. Today the incidence of currency crises is quite high and debt crises accompanied by banking and/or currency crises are much more frequent although still quite uncommon overall.

Figures 4 and 5 present scatter plots of the percentage of the sample period a country was in a crisis episode versus our measure of original sin. In the pre-World War I era, there appears to be an inverse U relationship between debt crises and original sin. Countries with intermediate ranges of original sin seem to take longer to resolve their debt crises than those at either end of the spectrum. No such pattern is evident in the latest period. In fact there appears to be a direct positive relationship between the severity of debt crises and the average level of original sin and similarly for currency and banking crises. But still there is a much larger variance in experience at the upper levels of original sin.

3. Statistical Findings

Our statistical approach uses pooled probit specifications.[14] The dependent variable is the first year of a debt crisis, currency crisis, or banking crisis. Our data set is an unbalanced panel, and the observational unit is the country year. We omit

[12] Our crisis dates and the methodology we use to classify years of crisis are listed in the appendix. We define a crisis as "third generation" if there was a debt crisis accompanied by either a banking crisis (ongoing or in the first year) a currency crisis or both in the same or previous year.

[13] Debt crises were not demarcated by Bordo et al. (2001)

[14] Endogeneity of the regressors as well as usual specification problems may be present. We attempted to mitigate endogeneity biases in un-reported specifications by using lagged values of the explanatory variables. Results in these cases did not change drastically in qualitative terms. Of course this solution is only valid if variables are not too persistent. Also, using lags creates measurement error issues which are likely to be problematic for consistent estimation.

country years that include ongoing crises. Throughout, we control for the lack of statistical independence between intra-country observations by using heteroscedasticity robust, country clustered standard errors.[15] We first present specifications with as many variables as is feasible. Finally after using pooled probits we move to linear probability models with country fixed effects to control for time invariant unobservable variables that could cause spurious inference in the pooled probit models.

Our basic finding is that currency mismatches are a much more robust determinant of financial crises than original sin, although original sin by itself does contribute to crises. Mismatch enters as a direct determinant, and along the lines of the framework sketched above, there is some evidence that currency mismatches also contribute to debt crises indirectly. This is because mismatches are often at the root of banking and currency crises which themselves are statistically significant determinants of debt problems. Moreover, in avoiding debt crises and financial meltdowns there seems to be an important role for the level of financial and economic development and other hard to measure factors.

2.1 Debt Crises

Tables 1 and 2 present results from several specifications. The initial year of a debt crisis is the dependent variable. Table 1 is for the 1880 to 1913 sample and Table 2 is for the 1972-1997 sample.

Column one of Table 1 presents a comprehensive specification that includes a variable set as large as possible and which also allows for controls for original sin and currency mismatches. We see that there is an inverse U shaped pattern in original sin and in mismatches.[16] There is also evidence of debt intolerance. These variables are statistically significant (at better than the 90 percent level of confidence) at the means

[15] We estimated, but do not report, random effects probit models as well but found them to perform weakly as they are known to do when the number of explanatory variables is large relative to the sample size.

[16] The reason we allow for squared terms is twofold: first, scatter plots suggested there might be such a relationship; second, including a simple linear term yields a coefficient on original sin that is negative and statistically insignificant. The latter result contradicts the basic theoretical proposition in the literature, but could also arise due to omitted variables biases which we discuss below. The squared term allows us to readily illustrate these two possibilities simultaneously

for each of these controls.[17] Figure 6 illustrates the marginal effect of original sin for various values together with two standard error confidence bands.

The size of the estimated coefficients on the hard currency debt ratios are also economically significant. Figure 7 presents the predicted probabilities of a debt crisis for various values of the ratio of hard currency debt to total debt. We hold all controls at their mean except the currency crisis indicator and the lagged banking crisis indicator which take on the value one or zero. Here one can easily see the economic significance of this measure of original sin especially in the range of original sin equal to 50 percent where the predicted probability of having a debt crisis peaks. One also can appreciate the interaction between banking crises, currency crises and debt crises. At an original sin level of 50 percent, having a banking crisis in the previous year and a currency crisis in the same year increases the predicted probability of a debt crisis by over 10 times from 0.023 to 0.25. Column 2 pares down the specification dropping the controls for mismatch to see if multicollinearity between mismatch and original sin is a problem. We still see a similar quadratic form. Column 3 leaves out original sin and leaves in the mismatch variables. Mismatch itself does not appear to be a statistically significant direct determinant of debt crises in the nineteenth century.[18] We explore possible interpretations of the inverse U pattern below.

Most other variables have signs that fit our priors: more gold reserves relative to notes outstanding, a larger trade surplus to GDP ratio, not being on the gold standard, a lower long-term interest rate**,** and a calm international environment in capital markets, as measured by the interest rate on British consols, are all associated with lower probabilities of debt crises. The statistical significance of the coefficients on these variables varies however.[19] There is also evidence, as we have seen, that currency crises and banking crises are positively associated with the outbreak of a debt default. This is some support for the balance sheet view of crises discussed above.

[17] The statistical significance of the interaction effects and polynomial terms must be approached with caution. We are interested in the statistical significance of the partial derivative of the probability with respect to say hard currency debt at various values. We do not report the statistical significance of such an effect for the debt intolerance interactions or for the interactions of variables with GDP. We do however present simulated confidence bands and the mean partial effect of original sin arising from the quadratic in original sin in figures below. These were calculated using code made available by William Clark at http://homepages.nyu.edu/%7emrg217/interaction.html.

[18] This is true even if we exclude the squared mismatch term.

[19] Perhaps the positive coefficient on the gold standard variable is compatible with theories that argue that rigid exchange rate policies amplify negative external shocks more than flexible rates. But since the statistical significance varies a lot by specification, we do not see overwhelming evidence for any hypothesis suggesting a positive or negative coefficient here. Multicollinearity between this variable and the reserves variable could matter here too. See Edwards (2003) for a wide-ranging discussion of exchange rate regimes and crises.

We also provide a measure of the fit of the model. This is gauged by the percentage of actual crises that were predicted to be crisis episodes, and the percentage of non-crisis years that are predicted to be non-crisis years. We use a predicted probability of greater than 0.1 to classify a country as having a debt crisis. This is a low threshold, but debt crises are relatively rare in the raw sample. The sample frequency is 0.01. For the debt crises, the type I errors are fairly small and the type II errors are mainly concentrated in the country years immediately preceding or coming after actual crises.[20]

Table 2 presents the results of similar specifications for debt crises for the 1972-1997 period. Column 1 shows that there is a positive but statistically insignificant relationship between our measure of original sin and debt crises. In column 1 there is also no sign of mismatch being a statistically significant determinant of debt crises and no evidence of debt intolerance. Similar to the nineteenth century, we do see a positive and statistically significant association between currency crises and debt crises. Having a currency crisis raises the probability of having a debt crisis by over 5 percentage points. The point estimates on contemporary and lagged values of banking crises are positive but not statistically significant.

To take the strain off the sample with so many explanatory variables, we pare down the specification in column 2 and find that original sin has a positive impact on the likelihood of a crisis, and it is now close to being statistically significant at standard levels of confidence. Column 4 eliminates the original sin measure and reinstates the mismatch measure to see if collinearity might have been the reason for the low precision in column 1. Indeed in column 4 we see that mismatches increase the susceptibility to debt crises and the marginal effect is statistically significant at very high levels of confidence. A one point increase in the mismatch ratio (equivalent to one standard deviation) would imply that the probability of a debt crisis increases by 0.02.

Column 3 introduces the logarithm of GDP per capita and its square as a control variable.[21] This allows us to show how GDP per capita interacts with original

[20] We use the 0.1 barrier for currency and banking crises. Our maximum predicted probabilities rarely exceed 0.2 for any type of crisis.

[21] We tried simply interacting original sin with GDP per capita but the results seemed counterintuitive. We do not report this specification even though we cannot rule out such a specification for any other reason. We found the marginal effect of original sin was negative and approached zero for higher levels of GDP per capita. On the other hand the marginal effect of GDP per capita was negative and approached zero as original sin increased. We also interacted original sin directly with GDP per capita

sin to affect crisis outcomes. When we do this we see that middle income countries, roughly where the emerging markets would be located, are the most likely to have a crisis when other control variables are held constant. Figure 8 shows this by presenting the predicted probability of a crisis for various levels of per capita output holding original sin at 1 (its maximum and also the modal value). We also compare those probabilities when the currency crisis indicator is one and zero so as to show, yet again, that at any level of output per capita currency crises and debt crises are likely to come together when original sin is high. It should be noted that the hump shaped pattern does not disappear whether we include or exclude the mismatch position. We return to this finding below in our discussion and conclusions.

3.2 Currency Crises

Table 3 presents results of specifications where the dependent variable is the probability of having a currency crisis between 1880 and 1913.[22] There are 17 events to be predicted in this sample. None of the variables are statistically significant at standard levels of confidence except for the gold cover ratio. Endogeneity is a worry here since quite obviously this variable would be much lower in the midst of an attack on a currency.

In terms of marginal effects, we still see a quadratic in original sin in column 2 and a positive relationship between the mismatch variable in column 3. Some marginal effects of the other variables have the expected signs while others do not. However, nothing in column 2 or 3 is statistically significant except for the trade balance to GDP which has a positive sign as it did in the Frankel and Rose (1996) study of the late twentieth century.[23] Lagging this variable causes the magnitude of the coefficient and its statistical significance to fall also suggesting some endogeneity problems.

The positive coefficient on the mismatch variable suggests that original sin is dangerous, but that countries that have original sin may be able to avoid currency

---

and its square. The marginal effects were consistent with the idea that original sin's marginal impact is largest at intermediate levels of per capita GDP.

[22] The exchange rate enters our original sin and debt variables. We note that our results here are similar in qualitative terms when we use one or two lags of mismatch, hard currency to total debt and the debt to revenue ratio.

[23] The marginal effect of changes in the current account in their paper was statistically insignificant. The seemingly counter-intuitive result that net exporters have a higher chance of a crisis seems to arise from the fact that the small peripheral countries in our sample tend to be net exporters while GB, France and Switzerland, for example, have highly negative ratios for this variable.

crises if they manage to collect adequate reserves or are sufficiently open. Since the outbreak of a debt crisis seems to be associated with currency crises (see Table 1), this is limited evidence that poorly managed original sin is indirectly associated with currency crises.

In Table 4 we present specifications that try to explain currency crises between 1972 and 1997. Contrary to the finding of the nineteenth century, there is evidence that more original sin leads to a higher chance of a currency crisis, but this is only when we do not control for the mismatch position. Mismatches however are associated with currency crises both controlling for original sin (column 1) and not controlling for original sin (column 3). This result is again highly suggestive that proper management of original sin can help alleviate currency crises. Since currency crises were seen to be a determinant of debt crises, low mismatch has the indirect effect of helping avoid debt crises too.

The current account is negatively related to currency crises (as is intuitive). Increases in long-term interest rates lead to more crises as do rapid increases in the money supply. There is some weak evidence that a banking crisis in the previous year is associated with a currency crisis (p-value 0.16). Overall the models in the nineteenth century fit poorly as judged by the high Type I errors while the models of the twentieth century make far fewer of such errors. The opposite is true of type II errors. In the latter sample, far too many currency crises are predicted to occur when in fact no currency crisis does occur.

3.3 Banking Crises

Tables 5 and 6 show that there is some evidence that banking crises are associated with original sin and currency mismatches. Between 1880 and 1913, we see a quadratic or inverse U impact of hard currency debt as we did with debt crises in the earlier period. However we cannot reject the hypothesis that the entire marginal effect is zero at standard levels of confidence. Between 1972 and 1997 we see that the impact of more original sin is higher in low and middle income countries than in high income countries. There is also evidence of a straightforward positive link between mismatch and banking crises in the twentieth century.

Columns 2 and 3 of Table 5 re-run the basic specification of column 1 to see if collinearity between original sin and mismatch contributed to the lack of precision. It

turns out the coefficients are not much different from column 1 and their statistical significance does not change dramatically in either specification.[24] In terms of fit, all of the models seem nearly equivalent by the log likelihood values. Only about 20 percent of actual sample crises are predicted reliably. Most of the other controls have the expected signs but are not statistically significant except the trade surplus to GDP ratio. We do see positive marginal effects on the currency crisis indicators but neither of them are statistically significant at conventional levels.

Table 6 turns to the late twentieth century. In column 1 we see results similar to the debt crisis specifications for the same period in Table 2. Original sin and mismatch are positively related to crises, but the coefficients are both statistically indistinguishable from zero when both variables are included. Column 2 demonstrates that the coefficient on original sin is not likely to be statistically indistinguishable from zero simply because of collinearity with the mismatch control. In column 3 we interact the logarithm of GDP per capita with original sin. A marginal increase in original sin has a smaller positive impact on banking crises at higher levels of GDP per capita. The predicted probability drops by more than one third when moving from a per capita income level of slightly less than $3,000 (e.g. Mexico, Malaysia, Thailand, Brazil in 1995) to an income level matching the average of Austria, Canada, Denmark, or the US of roughly $22,000.[25]

Finally column 4 shows that the marginal effect of a mismatch is positive and statistically significant. A one point increase in the mismatch variable would lead to a substantive increase in the predicted probability of a banking crisis of roughly 0.02 percentage points.

The other controls that are statistically significant are the growth of the money supply (positive coefficient), the trade surplus to GDP ratio (negative) and the long-term interest rate (positive). We find negative point estimates for the marginal effects of currency crises and lagged currency crises, but these are not close to being statistically significant.

Overall the results suggest that original sin itself is not incontrovertibly an important determinant of banking crises. However, hard currency debt that results in a mismatch seems to be associated with a higher chance of having a crisis. Countries

[24] One possibility why mismatch is not significant here, while it seems to be in the twentieth century, is that the measure here relates only to public debt and borrowing. In the twentieth century sample the measure includes both public and private borrowing. As we shall show below, controlling for such heterogeneity shows mismatch is positively correlated to banking crises in the nineteenth century.
[25] These figures are measured in real 1989 US dollars.

with a higher GDP per capita, may also have the capacity to make original sin less dangerous.

3.4 Sensitivity Analysis: Omitted Variables and Heterogeneity

In our nineteenth century sample we found some evidence that after a certain point more hard currency debt relative to the total seemed to be associated with fewer debt crises and banking crises. In the late twentieth century, we also see some evidence that original sin interacts in a complex way with GDP per capita. These findings could be due to a simple econometric specification problem. Namely our original sin variables could be correlated with unobservables or omitted observables. This could be the case if those countries most at risk of a crisis took care to protect their financial systems or had developed more effective ways of dealing with crises despite their high levels of original sin.[26] If these factors were time invariant, an econometric solution to such a problem is to include country-level indicator variables or "fixed effects".

Since this is infeasible to do in a limited dependent variable model with our particular data configuration, we move to a country "fixed effects" linear probability model. Table 7 re-specifies the baseline models of debt, currency and banking crises for the early period in this way. Like the previous results, the models fit fairly poorly since there are so few crises compared to non-crisis years. Many of the coefficients on the basic macro controls are statistically insignificant.

Nevertheless, we find the same quadratic in original sin for debt and banking crises that we found above, but it is not statistically significant. We take away three lessons from column 1 and column 3. The fact that the quadratic shape (i.e., the point estimates on original sin and its square are positive and negative respectively) does not disappear suggests that it is unlikely to be time invariant unobservables which are

[26] The endogeneity of the level of original sin should be explored and other experiences across time should be compared. The endogeneity bias would appear to be small. Eichengreen, Hausmann and Panizza (2003, 2005), and Flandreau and Sussman (2005) take the view that original sin is inversely related to country size. Having a financial center also decreases original sin. Being large and/or having a financial center makes for liquid markets in the domestic currency and increases the demand for such assets in the portfolio of international investors. Because of this, "endogeneity" may be less of an issue than one might conjecture at the outset. Evidence from Australia, New Zealand and the US in Bordo, Meissner and Redish (2005) suggests that wars and large shocks that closed international markets and forced governments into the domestic markets catalyzed the process. Still other factors are obviously necessary for these factors to be viable explanations.

causing the inverse U. If it were simply a case of omitted time invariant variables we would have expected the inclusion of fixed effects to reveal a statistically significant and positive relationship between original sin and crises, and (unreported regressions) excluding the square term does not reveal such a pattern. At the same time, there are two other possible interpretations of column 1 and column 3. One is that since original sin moves relatively slowly over time the fixed effects would naturally be unable to estimate the impact of original sin on crises. But equally we could also conclude that hard currency debt is not associated with debt or banking crises once proper controls are included. Only more clever identification strategies or more data will be able confirm which one of these assertions is correct.

If one accepts the point estimates on original sin in column 1 and 3 of Table 7, then it is impossible to argue that empire status, resource endowments or better institutions explain how places like the US, Canada, Australia and Scandinavia managed to carry high original sin and also avoid severe financial crises. We believe this is because they all had strong and flexible financial systems that could avert total crisis in times of stress, good fiscal institutions, and borrowed largely for productive investments. We also reject the notion that credible adherence to the gold standard was decisive here. This seems to us an ex post justification. We recall that nations often revoked convertibility (e.g. the dollar was inconvertible from 1861 to 1879, pro-silver forces were close enough to victory to matter until 1896, and the franc was inconvertible between 1871 and 1878). Moreover, if a credible commitment to gold was the main similarity between this group and the European Core, debt contracts should not have been any different from those in France, Great Britain and Germany where there was never an exchange rate or gold clause. Instead, this group of countries always had gold clauses, fixed exchange rate clauses in its debt or else its debt was payable directly in sterling. It is crucial to emphasize that financial markets treated these countries differently ex ante from the leading financial centers.

There is also little evidence that in the nineteenth century a smaller mismatch *directly* helped avoid debt crises. This also suggests the possibility that these original sin "survivors" had a more active approach to managing crises or their financial systems evolved dynamically in a way that helped stave off financial meltdown following major shocks. Oppositely there is little evidence that places like Argentina, Brazil, Greece, Italy, and Portugal faced financial meltdowns because of time-

invariant characteristics such as "bad government" or institutions or simply because they were in the geographic or economic periphery.[27]

Table 7 also reveals a striking *chain of association* that is readily consistent with the third generation crisis framework outlined above. Column 3 shows mismatches are associated with banking crises. These in turn are associated with the advent of a currency crisis. Column 1 then reveals that both banking and currency crises are associated with debt crises. So while the direct impact of hard currency debt on debt crises is absent in terms of statistical significant in Table 7, an indirect effect along the lines of third generation crises is clearly evident here. Again, this suggests that good debt management and avoidance of mismatches are at the root of preventing financial meltdown.

We also estimate a fixed effects linear probability model for the 1972-1997 period and report these results in Table 8. Given that our original sin variable is time invariant by construction, we are unable to control for it. But we can control for mismatch. The key determinants of debt crises seem to be the debt output ratio, interest rates and also the existence of a currency crisis. Most of the other coefficients are not statistically significant.

Like in the early sample we observe an *indirect* connection between mismatches and debt crises in this sample. The chain of logic points to the following conclusion. Better borrowing safeguards in the form of lower mismatches could stem the explosion of a currency crisis. Since contemporary and lagged currency crises appear to be strongly associated with debt crises in column 1 of Table 8 it is likely that smaller mismatches can limit exposure to debt crises.

The evidence from controlling for unobservables and country-specific heterogeneity provides very mixed evidence (at best) for the idea that original sin itself is the culprit for major financial meltdowns. On the other hand mismatch matters. Lower mismatches seem to be associated in both periods with fewer outbreaks of currency or banking crises. Stemming these types of crises by avoiding

[27] In other un-reported specifications, we left out fixed effects and tried using proxies for good institutions and financial development in our probit models. We included the ratio of the money stock to GDP, a British Empire indicator, a central bank indicator and a branch banking indicator. None of these variables eliminated the quadratic pattern or gave rise to a conditionally positive relationship between original sin and debt crises, currency crises or banking crises. In the debt crisis specifications, it is not feasible to estimate the equations with an empire dummy simply because no included dominion, colony or other member of the British Commonwealth ever had a debt default in this period. This indicator would be a perfect predictor of not having a debt crisis. So we are left clinging to the notion that the countries with lots of original sin like the US Canada, Australia and New Zealand and perhaps the Scandinavian countries were different along other dimensions than those captured by these proxy variables. Caballero, Cowan and Kearns (2005) talk about currency-trust and country-trust which could be factors at play here but which are not easily captured with any one explanatory variable.

mismatches could mean the difference in avoiding the onset of a debt default or a total financial meltdown. The presence of original sin makes implementing safeguards important. Reserve accumulation and/or openness to exports seem to be viable strategies to avoid troubling currency and banking runs which in turn could limit the likelihood of a debt crisis outcome.

4. Discussion: Some Countries *do not* suffer from crises despite having original sin.

Our results above suggest an inverse U association between debt crises and original sin. More original sin is associated with a higher likelihood of a debt crisis up to a point, and then observations with levels of original sin greater than 50 to 60 percent face a lower likelihood of a crisis. The inverse U relationship suggests a division of the countries in the nineteenth century sample into three groups. The first group includes the financial centers of Europe with low or no original sin and few crises. The second group includes the periphery countries of the Latin American cone and the Mediterranean region of Europe with their episodes of fiscal profligacy (Greece and Portugal) and periods of instability in their banking systems (e.g., Argentina with its new banking laws of the 1880s and Italy prior to the financial sector restructuring that took place in the 1890s).[28] Countries in the third group possessed stable institutions, but also strong and flexible financial systems usually able to cope with crises as they emerged (e.g., the US, Japan, Denmark, and Sweden) or intricate correspondent banking relationships and colonial ties (e.g., Australia, Canada, and New Zealand).

In Figure 8 we see a hump in predicted probabilities where the countries with mid-level GDP per capita have the highest probabilities of a financial crisis. This also leads us to suggest that countries today can be broken into three categories when original sin is high. First, we have the poorest countries of the world (e.g., Colombia, Nigeria, and Pakistan) which, despite suffering from original sin, rely relatively little on external finance. Next, the middle income emerging markets (e.g., Argentina, Brazil, Korea, Mexico, and Taiwan) which rely on external financing are the ones most at risk of seeing their hard currency liabilities interact with currency crashes leading to a debt default episode. Then, there are the highly developed countries (e.g.,

[28] See the capsule histories of these crisis episodes included in Bordo et. al. (2001) for a brief summary and further reading. Bordo and Meissner (forthcoming) also report in more detail the experiences of the US, Australia, Brazil and Argentina in the 1890s.

Belgium, Canada, Denmark, Norway, Spain, and Sweden) which also suffer from high liability dollarization. Nevertheless, either external financing is less significant or they have the capability to deal with shocks to the financial system in ways we have not controlled for and hence to avoid crises. Finally countries with low original sin and high development are placed in a fourth category.

We schematically illustrate this four part categorization in Figure 9. Here the "radar" graph plots variables of interest on each radiating axis and the lines connecting the particular values represent the different groups of countries. We divided countries into four groups based on GDP per capita and levels of original sin. The first are those with GDP per capita lower than $2,900 where the average level of original sin between 1993 and 1997 was 0.99 percent. The second are those with GDP per capita between $2,900 and $8,100 with an average value of average original sin equal to 0.76, and finally two groups with GDP above $8,100 one with an original sin level greater than 20 percent and also one with less than 20 percent. Next we chose variables of interest such as the average trade deficit within each group, the average time spent without final resolution of a debt crisis, the average predicted probability of a debt crisis (based on the model in column 3 of table 2) and the median predicted probability based on the same model, and our mismatch variable.

The richest countries are lower on all five dimensions. The middle income, emerging markets are highest on these dimensions except for the average predicted probability of having a debt crisis.[29] Trade deficits are twice as high on average in these countries, and they have a median predicted probability twice as high as the less developed countries. It would also appear that many of the world's richest countries have significant original sin and still have a low chance of a debt crisis. Moreover the figure shows that rich countries with high original sin and low crisis frequency run bigger trade surpluses or lower deficits and also control their mismatch positions much better than the middle income countries making them even less prone to crisis episodes.

5. Conclusions

[29] This measure is sensitive to the GDP cutoff point. If we lower it slightly then we include a few more countries like Chile and Venezuela which had debt crises. This reverses the ordering on this dimension. In any case the difference is not significant.

Our central finding is that hard currency debt alone does not always generate a higher likelihood of a financial crisis. Some countries in the nineteenth century with very high levels of original sin were less prone to debt crises than those with intermediate levels. In the late twentieth century, many advanced countries still have original sin but most have avoided severe crises. On the other hand, emerging markets which also suffer from original sin fell victim to debt crises and had high financial instability.

The lesson from the long-run appears to be that sound debt management, and the development of sound fiscal and financial capacity will allow countries to escape financial turmoil. But we also find evidence that backing up hard currency debt with foreign reserves and having a larger export sector for a given level of hard currency debt helps decrease the incidence of debt, currency and banking crises. Mismatches matter. So even if countries have not yet developed the foundations of good finances, they can in the meantime minimize the risks of choppy financial waters by limiting their mismatch position.

The interaction effects we tested for suggest to us a very visible division of various types of countries. Three or four categories seem to be apparent. The financial centers with low original sin and strong financial fundamentals obviously avoid crises. Other highly developed countries that are small in terms of global output, and carry high original sin also avoid severe financial crises. In terms of less developed countries, there are many which are relatively closed to external capital flows or have yet to kick start the development process. These countries also have original sin but are not too exposed to volatile capital movements. The most dangerous combination seems to be high original sin in an emerging market. These countries saw huge capital inflows in the 1880s, the late 1970s and early 1980s and again in the early 1990s. Their fragility to current account reversals and the virulence of crises at the end of each of these three major episodes is no doubt explained in part by exposure to hard currency liabilities.

Given that third generation crises remain a possibility, the historical evidence we present suggests that better aggregate balance sheet management is necessary to help avoid crises. It will also keep financial turbulence from becoming a financial catastrophe. At the same time, history shows that in the face of hard currency debt, low mismatch is no substitute for the development of sound monetary, fiscal, and financial policies and institutions. Continued progress on this front will allow countries to avoid the downside of otherwise beneficial cross-border capital flows.

Data Appendix

General notes:

For the 1972-1997 sample most of our macroeconomic variables come from Bordo et. al. (2001) and sources are described therein. Where a variable was missing we filled it in according to the descriptions below and in the text. Table A.1 shows the countries included in our estimation samples.

Debt:

1880-1913: In general we have defined external debt or hard currency debt as the amount of long-term debt outstanding issued abroad plus the amount of domestic gold debt outstanding. Internal debt refers to the outstanding stock of domestic paper currency debt.

1972-1997: Data are from the World Bank's *Global Development Finance* database. This includes many varieties of international obligations including private, official and multilateral debt. We supplemented this with external debt values from the *International Financial Statistics* when the GDF database had missing values.

Original Sin:

One key difference between markets today and in the nineteenth century is that recently debt has been issued in quite a few small country currencies by agents from leading countries allowing opportunities for debt swaps. That is, for some countries, the numerator and the denominator in the difference term differ substantially because many other countries issue debt in their currency. To the best of our knowledge it does not appear that foreigners pre-1914 were issuing debt in other exotic currencies. In the pre-1914 case, original sin was not reduced through swaps (Flandreau, 2003 p. 20) hence we can restrict attention in the numerator of this expression to securities issued in local currency (without gold clauses) only by residents.

Long-term interest rates:

1880-1913 This is the interest rate on long-term bonds underlying data from Obstfeld and Taylor (2003).

Exchange rate regimes:

Data on gold standard adherence comes from data underlying Meissner (2005) augmented with data from Obstfeld and Taylor (2003)

Default Indicator:

1880-1913: Our default indicator equals one if there were one or more defaults prior to 1880.

1972-1997: Our default indicator equals one if there were one or more defaults prior to 1972.

All data is taken from a spreadsheet underlying Reinhart, Rogoff and Savastano (2003).

Crisis Dating:

As in Bordo et. al (2001) we date currency and banking crises using both qualitative and quantitative evidence. For all countries besides Austria-Hungary, Russia, New Zealand, South Africa, Mexico, Turkey, Egypt, Uruguay and India we have relied on the dates of Bordo et. al. in both periods. In the earlier period we have tried to date currency crises, when possible, by using an approach based on the exchange market pressure (EMP) methodology which looks at changes in reserves, the exchange rate and the interest rate.

Debt crisis dates were based on Beim and Calomiris (2001). Only private lending to sovereign nations is considered when building those default dates. Not every instance of technical default is included in the chronology, the authors identified periods (six months or more) where all or part of interest/principal payments were suspended, reduced or rescheduled. Some of those episodes are outright debt repudiations, while others were reschedulings agreed upon mutually by lenders and borrowers. Also data is taken from a spreadsheet underlying Reinhart, Rogoff and Savastano (2003).

References

Beim, D. O., Calomiris, C.W., 2001. Emerging Financial Markets. MacGraw-Hill, New York.

Berg, A., Patillo, C., 1999. Are Currency Crises Predictable? A Test. IMF Staff Papers, 46 (2) 107-138.

Bordo, M. D., 2003. Market Discipline and Financial Crises Policy; An Historical Perspective. Research in Financial Services: Private and Public Policy. 15, 154--182.

Bordo, M. D., Eichengreen, B., Klingebiel, D., Martinez-Peria, M. S., 2001. Is the Crisis Problem Growing More Severe? Economic Policy 32, 51--75.

Bordo, M. D., Flandreau, M., 2003. Core Periphery, Exchange Rate Regimes and Globalization, in: Bordo, M. D., Taylor, A. M. and Williamson, J. G. (Eds.), Globalization in Historical Perspective. University of Chicago Press, Chicago, pp. 417--468.

Bordo, M. D., Jonung, L., 1996. Monetary regimes, inflation, and monetary reform: An essay in honor of Axel Leijonhufvud, in: Vaz, D., Velupillai, K. (Eds.), Inflation, Institutions, and Information: Essays in Honor of Axel Leijonhufvud. Macmillan, London, pp 157--244.

Bordo, M. D., Meissner, C.M. forthcoming., Financial Crises, 1880-1913: The Role of Foreign Currency Debt, in: Edwards, S., Esquivel, G., Marquez, G. (Eds.), *Growth, Protection and Crises: Latin America from an Historical Perspective*.

Bordo, Michael D., Meissner, C.M. and Redish, A., 2005. "How 'Original Sin' was overcome: the evolution of external debt denominated in domestic currencies in the United States and the British Dominions 1800-2000." in Barry Eichengreen and Ricardo Hausmann (Eds.), *Other People's Money* University of Chicago Press, Chicago, pp. 122--153.

Bordo, M. D., Schwartz, A., 1996. The Operation of the Specie standard-Evidence for Core and Peripheral Countries, in: de Macedo, J., Eichengreen, B. and Reis, J. (Eds.) *Currency Convertibility: The Gold Standard and Beyond*. London, Routledge, pp. 11-82.

Caballero, R., Cowan, K., Kearns, J., 2005. Fear of Sudden Stops: Lessons from Australia and Chile. Journal of Policy Reform 8 (4) 313—354.

Céspedes, L. F., Chang, R. and Velasco, A., 2004. Balance Sheets and Exchange Rate Policy. American Economic Review 94 (4), 1183--1193.

Edwards, S., 2003. Exchange Rate Regimes, Capital Flows and Crisis Prevention, in: Feldstein, M. (Ed.) Economic and Financial Crises in Emerging Markets. University of Chicago Press, Chicago, pp. 31--78.

Eichengreen, B., Hausmann, R., 1999. Exchange Rates and Financial Fragility, in: Federal Reserve Bank of Kansas City (Ed.), New Challenges for Monetary Policy, pp. 329--368.

Eichengreen, B., Hausmann, R., Panizza, U., 2003. Currency Mismatches, Debt Intolerance, and Original Sin: Why they are not the Same and Why it Matters. NBER working paper 10036, Cambridge.

Eichengreen, B., Hausmann, R. Panizza, U., 2005. The Pain of Original Sin, in: Eichengreen, B., Hausmann, R. (Eds.), Other People's Money. University of Chicago Press, Chicago, pp. 13--47.

Flandreau, M., 2003. Crises and punishment: moral hazard and the pre-1914 international financial architecture, in: Flandreau, M. (Ed.) Money Doctors: The Experience of International Financial Advising, 1850-2000. Routledge, London, pp 13--48.

Flandreau, M., Sussman, N., 2005. Old Sins. in: Eichengreen, B. and Hausmann, R. (Eds.), Other People's Money, University of Chicago Press, Chicago, pp 154--89.

Flandreau, M., Zúmer, F., 2004. The Making of Global Finance. OECD: Paris.

Frankel, J., Rose, A.K., 1996. Currency Crashes in Emerging Markets: An Empirical Treatment, *Journal of International Economics* 41, 351-66.

Glick, R. Hutchinson, M., 2001. Banking and Currency Crises: How Common are Twins? in: Financial Crises in Emerging Markets, Glick, R., Moreno, R., Spiegel, M.M. (Eds.) Cambridge University Press, New York, pp 35--69.

Goldstein, M., Turner, P. 2004. Controlling Currency Mismatches in Emerging Market Economies. Institute of International Economics: Washington.

Meissner, C. M., 2005. New World Order: Explaining the International Diffusion of the Gold Standard, 1870-1913, *Journal of International Economics* 66, 385--406.

Mishkin, F. S., 2003. Financial Policies and the Prevention of Financial Crises in Emerging Market Countries in: Martin Feldstein (Ed.) Economic and Financial Crises in Emerging Markets. University of Chicago Press, Chicago pp. 93--130.

Obstfeld, M, Taylor, A.M., 2003. Sovereign Risk ,Credibility and the Gold Standard, 1870-1913 versus 1925-1931, Economic Journal, 113 (487), 1--35.

Reinhart, C, Rogoff, K. Savastano, M., 2003. Debt Intolerance, Brookings Papers on Economic Activity 1, 1--74.

Table 1 Determinants of Debt Crises, 1880-1913

Regressors	*(1)*	*(2)*	*(3)*
Hard currency debt as	0.075**	0.061**	---
a percentage of total debt	(0.031)	(0.030)	
Square of hard currency	-0.073**	-0.069**	---
debt ratio	(0.030)	(0.027)	
Debt/Revenue	-0.002*	-0.001	-0.001
	(0.001)	(0.001)	(0.002)
Debt/Revenue*Pre-1880 Default	0.009***	0.003	0.005*
	(0.003)	(0.002)	(0.003)
Pre-1880 Default	-0.221***	-0.058	-0.129*
	(0.018)	(0.062)	(0.074)
Mismatch	0.003	---	0.005
	(0.003)		(0.005)
Square of mismatch	-0.001	---	-0.001
	(0.0004)		(0.001)
Trade balance/GDP	-0.054	0.002	0.002
	(0.044)	(0.055)	(0.058)
Long-term interest rate	0.004	0.003**	0.005*
	(0.002)	(0.001)	(0.003)
Consol interest rate	0.017	0.014	0.021
	(0.011)	(0.016)	(0.017)
Gold standard dummy	0.022	0.006	0.015
	(0.017)	(0.013)	(0.012)
Growth of the money supply	-0.031	-0.020	-0.023
	(0.025)	(0.017)	(0.016)
Gold reserves/notes in circulation	-0.072**	-0.034	-0.057**
	(0.035)	(0.028)	(0.027)
Currency crisis in *t*	0.060**	0.031	0.075*
	(0.026)	(0.022)	(0.041)
Currency crisis in *t*-1	-0.001	0.012	0.0004
	(0.008)	(0.016)	(0.010)
Banking crisis in *t*	0.017	-0.004	0.038
	(0.013)	(0.010)	(0.031)
Banking crisis in *t*-1	0.049	0.034	0.015
	(0.033)	(0.021)	(0.017)
constant	-4.11	-4.72	-6.33
	(3.52)	(2.35)**	(2.77)**
Number of obs	530	530	530
Percentage of Correct Positives	83.3	66.7	83.3
Percentage of Correct Negatives	98	98.6	98.8
Psuedo R-squared	0.64	0.50	0.56
log-likelihood value	-11.93	-16.3	-14.3

Notes: Dependent variable is a binary indicator for a debt crisis. Marginal effects of variables on the probability of a crisis are reported. Robust clustered standard errors

are in parentheses. See the text for precise definitions of variables. Positive signifies crisis year; * p-value < 0.1; ** p-value < 0.05; *** p-value < 0.01

Table 2 Determinants of Debt Crises, 1972-1997

Regressors	*(1)*	*(2)*	*(3)*	*(4)*
Original Sin	0.016*	0.008*	0.002	---
	(0.010)	(0.005)	(0.002)	
Debt/Output	0.001***	0.001***	0.001***	---
	(0.0002)	(0.0001)	(0.0001)	
Debt/Output*Pre-1970 Default	0.0001	---	---	---
	(0.0002)			
Pre-1970 Default	-0.034	---	---	---
	(0.043)			
Mismatch	-0.003	---	---	0.020***
	(0.006)			(0.006)
ln (real GDP per capita)	---	---	0.316**	---
			(0.145)	
square of ln (real GDP per capita)	---	---	-0.019**	---
			(0.009)	
Trade balance/GDP	0.002	0.002	0.001	-0.0001
	(0.001)	(0.001)	(0.001)	(0.002)
Long-term interest rate	0.009***	0.006**	0.001	0.005**
	(0.003)	(0.003)	(0.004)	(0.002)
G7 average long term interest rate	0.004	0.004	0.005	0.007***
	(0.004)	(0.004)	(0.158)	(0.003)
Pegged exchange rate regime	-0.033***	-0.025***	-0.018***	-0.008
	(0.009)	(0.007)	(0.005)	(0.015)
Currency crisis in t	0.053*	0.049*	0.054**	0.061*
	(0.030)	(0.029)	(0.026)	(0.036)
Currency crisis in t-1	0.045	0.034	0.024	0.071**
	(0.028)	(0.023)	(0.015)	(0.033)
Banking crisis in t	-0.000	0.005	0.009	0.010
	(0.016)	(0.015)	(0.013)	(0.018)
Banking crisis in t-1	0.020	0.016	0.014	0.002
	(0.018)	(0.017)	(0.016)	(0.022)
constant	-26.68	-26.77	-52.17	-4.42
	(9.69)	(9.69)	(17.44)	(0.63)
Number of obs	520	530	524	571
Percentage of Correct Positives	82.3	82.3	93.75	50
Percentage of Correct Negatives	93.8	93.9	95.4	91.1
Psuedo R-squared	0.50	0.49	.54	0.25
log-likelihood value	-37.82	-37.8	-32.33	-64.55

Notes: Dependent variable is a binary indicator for a debt crisis. Marginal effects of variables on the probability of a crisis are reported. Robust clustered standard errors are in parentheses.

See the text for precise definitions of variables. Positive signifies crisis year; * p-value < 0.1; ** p-value < 0.05; *** p-value < 0.01

Table 3 Determinants of Currency Crises, 1880-1913

Regressors	*(1)*	*(2)*	*(3)*
Hard currency debt as	-0.009	0.019	---
a percentage of total debt	(0.057)	(0.044)	
Square of hard currency	-0.003	-0.011	---
debt ratio	(0.061)	(0.047)	
Mismatch	0.002	---	0.003
	(0.003)		(0.003)
Debt/Revenue	-0.002	-0.001	-0.003
	(0.003)	(0.002)	(0.002)
Growth of terms of trade	0.524	---	---
	(0.374)		
Trade balance/GDP	0.138	0.191**	0.226***
	(0.101)	(0.089)	(0.087)
Long-term interest rate	0.004	0.004	0.003
	(0.004)	(0.003)	(0.004)
Consol interest rate	-0.004	0.007	0.004
	(0.026)	(0.023)	(0.025)
Gold standard dummy	0.038	---	---
	(0.025)		
Growth of the money supply	-0.051	-0.041	-0.041
	(0.109)	(0.067)	(0.069)
Gold reserves/notes in circulation	-0.052*	-0.024	-0.019
	(0.028)	(0.023)	(0.023)
Banking Crisis in *t*	0.035	---	---
	(0.052)		
Banking Crisis in *t-1*	0.084	---	---
	(0.083)		
constant	-1.51	-1.79	-1.57
	(1.27)	(1.05)	(1.05)
Number of obs	500	555	555
Percentage of Correct Positives	11.7	0	5.9
Percentage of Correct Negatives	94	98	98.8
Psuedo R-squared	0.0871	0.0479	0.053
log-likelihood value	-67.72	-72.35	-71.94

Notes: Dependent variable is a binary indicator for a currency crisis. Marginal effects of variables on the probability of a crisis are reported. Robust clustered standard errors

are in parentheses. See the text for precise definitions of variables. Positive signifies crisis year. * p-value < 0.1; ** p-value < 0.05; *** p-value < 0.01

Table 4 Determinants of Currency Crises, 1972-1997

Regressors	*(1)*	*(2)*	*(3)*
Original Sin	0.0007	0.001**	---
	(0.001)	(0.001)	
Mismatch	0.040***	---	0.032***
	(0.013)		(0.011)
Debt/Output	0.001**	0.001***	0.0004
	(0.000)	(0.000)	(0.0003)
Growth of terms of trade	-0.001	---	---
	(0.002)		
Trade balance/GDP	-0.007**	-0.007***	-0.007***
	(0.003)	(0.003)	(0.003)
Pegged exchnage rate regime	0.066	---	---
	(0.057)		
Long-term interest rate	0.022***	0.012***	0.014***
	(0.007)	(0.004)	(0.003)
G7 average long term interest rate	-0.012*	-0.010	-0.007
	(0.007)	(0.007)	(0.006)
Growth of the money supply	0.00005***	0.0001***	0.00006***
	(0.00001)	(0.00004)	(0.00001)
M2 / Reserves	0.007***	0.007***	-0.001
	(0.002)	(0.001)	(0.001)
Banking Crisis in *t*	-0.038	---	-0.063
	(0.054)		(0.048)
Banking Crisis in *t-1*	0.095	---	0.096
	(0.078)		(0.071)
constant	-2.83	-2.22	-1.76
	(0.55)	(0.35)	(0.31)
Number of obs	419	609	641
Percentage of Correct Positives	83.6	89.4	77.9
Percentage of Correct Negatives	52.7	37.4	46.1
Psuedo R-squared	0.13	0.07	0.082
log-likelihood value	-150.71	-226.56	-232.44

Notes: Dependent variable is a binary indicator for a currency crisis. Marginal effects of variables on the probability of a crisis are reported. Robust clustered standard errors are in parentheses. See the text for precise definitions of variables. Positive signifies crisis year. * p-value < 0.1; ** p-value < 0.05; *** p-value < 0.01

Table 5 Determinants of Banking Crises, 1880-1913

Regressors	*(1)*	*(2)*	*(3)*
Hard currency debt as	0.018	0.035	---
a percentage of total debt	(0.075)	(0.067)	
Square of hard currency	-0.024	-0.037	---
debt ratio	(0.078)	(0.072)	
Debt/Revenue	-0.002	-0.0002	-0.002
	(0.003)	(0.002)	(0.003)
Mismatch	0.004	---	0.004
	(0.003)		(0.004)
Growth of terms of trade	-0.592	-0.542	-0.578
	(0.381)	(0.378)	(0.387)
Trade balance/GDP	0.364**	0.323**	0.356**
	(0.176)	(0.160)	(0.163)
Gold standard dummy	-0.006	0.000	-0.010
	(0.022)	(0.019)	(0.020)
Growth of the money supply	0.038	0.030	0.029
	(0.069)	(0.071)	(0.072)
Gold reserves/notes in circulation	0.025	0.026	0.038
	(0.030)	(0.024)	(0.029)
Long-term interest rate	0.004	0.006	0.004
	(0.005)	(0.006)	(0.005)
Consol interest rate	0.023	0.026	0.024
	(0.026)	(0.026)	(0.025)
Currency crisis in *t*	0.073	0.079	0.075
	(0.070)	(0.075)	(0.072)
Currency crisis in *t*- 1	0.072	0.068	0.073
	(0.075)	(0.074)	(0.080)
constant	-2.75	-2.94	-2.75
	(0.94)	(0.89)	(0.92)
Number of obs	496	496	496
Percentage of Correct Positives	16.6	22.2	16.6
Percentage of Correct Negatives	96.6	96.8	96.4
Psuedo R-squared	0.07	0.07	0.07
log-likelihood value	-71.56	-71.99	-71.63

Notes: Dependent variable is a binary indicator for a banking crisis. Marginal effects of variables on the probability of a crisis are reported. Robust clustered standard errors are in parentheses. See the text for precise definitions of variables.

Positive signifies crisis year. * p-value < 0.1; ** p-value < 0.05; *** p-value < 0.01

Table 6 Determinants of Banking Crises, 1972-1997

Regressors	*(1)*	*(2)*	*(3)*	*(4)*
Original Sin	0.001	0.001	0.050***	---
	(0.001)	(0.001)	(0.016)	
Mismatch	0.017	---	---	0.020**
	(0.011)			(0.010)
Original Sin * ln(real GDP per capita)	---	---	-0.005***	---
			(0.002)	
ln(real GDP per capita)	---	---	0.496***	---
			(0.158)	
Debt/Output	-0.0004	-0.0001	-0.0003	-0.0002
	(0.0005)	(0.004)	(0.0004)	(0.0003)
Growth of terms of trade	-0.001	-0.001	-0.001	-0.001
	(0.001)	(0.001)	(0.001)	(0.001)
Trade balance/GDP	-0.006**	-0.004	-0.006**	-0.003
	(0.003)	(0.002)	(0.003)	(0.002)
Pegged exchnage rate regime	-0.002	-0.008	-0.015	0.014
	(0.023)	(0.021)	(0.020)	(0.021)
Growth of the money supply	0.00005*	0.00007***	0.0007***	0.00006*
	(0.0003)	(0.00002)	(0.00002)	(0.00003)
M2 / Reserves	0.001	0.002	0.002	0.00006
	(0.002)	(0.002)	(0.002)	(0.00007)
Long-term interest rate	0.013***	0.011**	0.014**	0.008*
	(0.005)	(0.004)	(0.007)	(0.005)
G7 average long term interest rate	0.0001	0.002	-0.002	0.002
	(0.006)	(0.006)	(0.007)	(0.007)
Currency crisis in *t*	-0.015	-0.012	-0.012	-0.026
	(0.032)	(0.031)	(0.032)	(0.028)
Currency crisis in *t*-1	-0.021	-0.023	-0.021	-0.032
	(0.032)	(0.029)	(0.029)	(0.028)
constant	-3.54	-3.85	-53.78	-2.72
	(0.91)	(1.00)	(16.6)	(0.58)
Number of obs	345	367	367	405
Percentage of Correct Positives	40	40	50	32
Percentage of Correct Negatives	85.8	88.1	87.3	85.5
Psuedo R-squared	0.11	0.091	0.13	0.07
log-likelihood value	-68.13	-70.56	-67.18	-87.57

Notes: Dependent variable is a binary indicator for a banking crisis. Marginal effects of variables on the probability of a crisis are reported. Robust clustered standard errors are in parentheses.

See the text for precise definitions of variables. Positive signifies crisis year. * p-value < 0.1; ** p-value < 0.05; *** p-value < 0.01

Table 7 Fixed Effects Estimations, 1880-1913

Regressors	*Debt Crises* *(1)*	*Currency Crises* *(2)*	*Banking Crises* *(3)*
Hard currency debt as	0.112	-0.142	0.158
a percentage of total debt	(0.095)	(0.141)	(0.152)
Square of hard currency	-0.127	-0.084	-0.150
debt ratio	(0.093)	(0.139)	(0.152)
Debt/Revenue	0.017***	0.0001	-0.006
	(0.005)	(0.008)	(0.009)
Mismatch	-0.001	0.012	0.027***
	(0.010)	(0.009)	(0.010)
Square of mismatch	-0.001*	---	---
	(0.000)		
Growth of terms of trade	-0.303	0.716	-0.677
	(0.343)	(0.577)	(0.591)
Trade balance/GDP	-0.313*	0.030	0.405
	(0.162)	(0.279)	(0.285)
long term interest rate	0.046***	0.002	0.006
	(0.007)	(0.009)	(0.009)
Gold standard dummy	-0.013	0.004	-0.076*
	(0.023)	(0.039)	(0.039)
Growth of the money supply	-0.031	-0.116	0.155
	(0.055)	(0.087)	(0.096)
Gold reserves/notes in circulation	0.040	0.023	0.021
	(0.034)	(0.059)	(0.060)
Consol	0.094***	-0.0001	0.055
	(0.026)	(0.044)	(0.044)
Currency Crisis in *t*	0.089***	---	0.077*
	(0.027)		(0.047)
Currnecy Crisis in *t-1*	0.034	---	0.072
	(0.029)		(0.050)
Banking Crisis in *t*	0.011	0.041	---
	(0.025)	(0.041)	
Banking Crisis in *t-1*	0.043*	0.087**	---
	(0.024)	(0.040)	
constant	-0.322***	0.103	-0.106
	(0.086)	(0.151)	(0.153)
Number of obs	478	500	496
R-squared	0.1	0.0012	0.01
F-stat	7.86***	1.23	2.32***

Notes: Dependent variable is a binary indicator for a banking crisis. Estimation is by OLS with country indicators. See the text for precise definitions of variables. R-squared is the overall R-squared. * p-value < 0.1; ** p-value < 0.05; *** p-value < 0.01

Table 8 Fixed Effects Estimations, 1972-1997

Regressors	*Debt Crises* *(1)*	*Currency Crises* *(2)*	*Banking Crises* *(3)*
Mismatch	-0.001	0.057**	0.031
	(0.012)	(0.025)	(0.023)
Debt/Output	0.002***	0.001	-0.001
	(0.001)	(0.001)	(0.001)
Trade balance/GDP	0.001	-0.009**	-0.005
	(0.002)	(0.004)	(0.004)
Growth of terms of trade	---	-0.001	-0.0006
		(0.001)	(0.001)
M2 / Reserves	---	-0.0	-0.0001
		(0.0004)	(0.0003)
G7 average long term interest rate	0.007	0.003	-0.003
	(0.005)	(0.012)	(0.010)
Long-term interest rate	0.004	0.009	0.012
	(0.005)	(0.011)	(0.009)
Pegged exchnage rate regime	0.005	0.047	0.010
	(0.025)	(0.060)	(0.050)
Growth of the money supply	---	0.00009*	0.00009
		(0.00005)	(0.0001)
Currency Crisis in *t*	0.057**	---	-0.016
	(0.024)		(0.040)
Currnecy Crisis in *t-1*	0.069***	---	-0.025
	(0.023)		(0.040)
Banking Crisis in *t*	0.007	-0.038	---
	(0.027)	(0.054)	
Banking Crisis in *t-1*	0.034	0.079	---
	(0.028)	(0.056)	
constant	-0.167***	-0.148	-0.026
	(0.045)	(0.114)	(0.094)
Number of obs	571	491	405
R-squared	0.09	0.05	0.02
F-stat	5.96***	2.64***	0.77

Notes: Dependent variable is a binary indicator for a banking crisis. Estimation is by OLS with country indicators. See the text for precise definitions of variables. R-squared is the overall R-squared. * p-value < 0.1; ** p-value < 0.05; *** p-value < 0.01

Figure 1 Average Ratio of Hard Currency Public Debt to Total Public Debt, 1880-1913

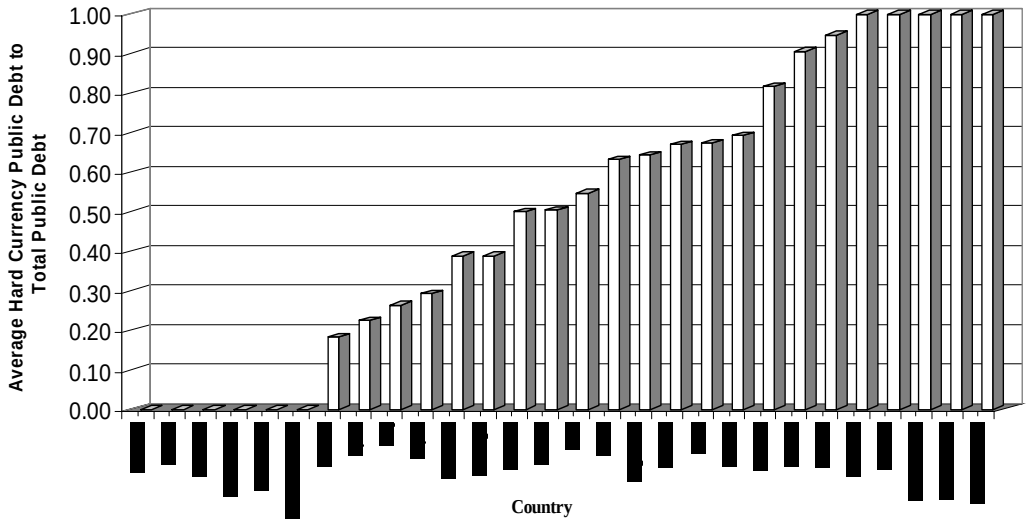
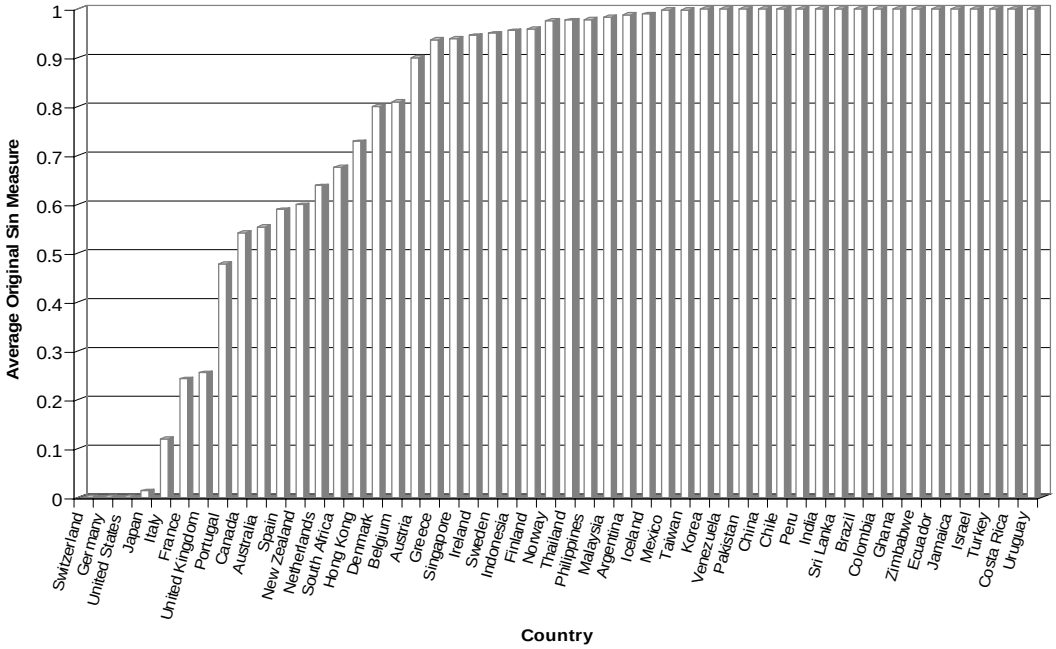


Figure 2 Average Level of Original Sin Between 1993 and 1997



Notes: Data come from Eichengreen, Hausmann and Panizza (2005)

Figure 3 Crisis Frequency in Percentage Probability per Year, 1880-1913 versus 1972-1997.

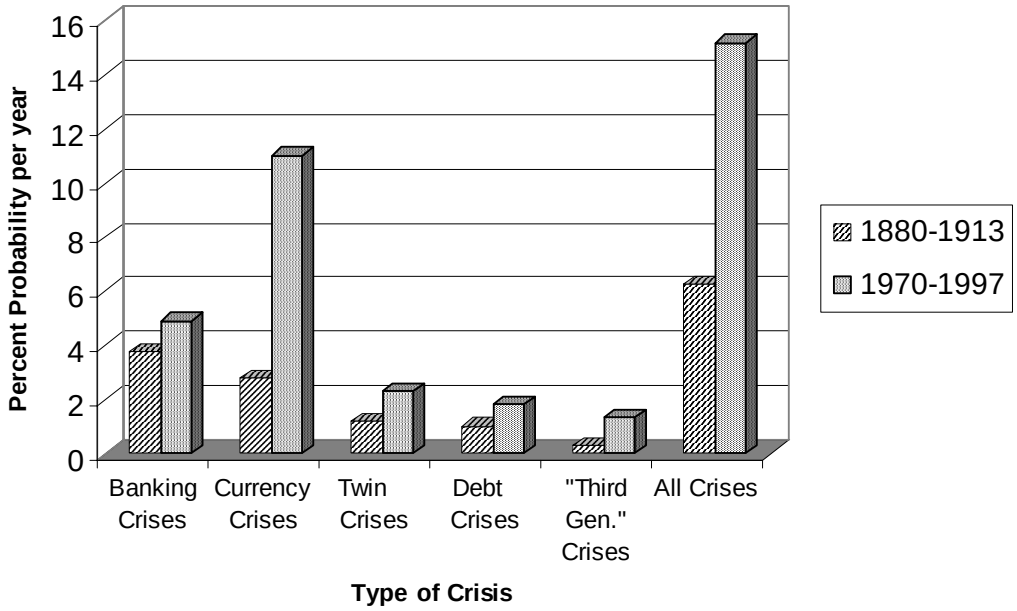
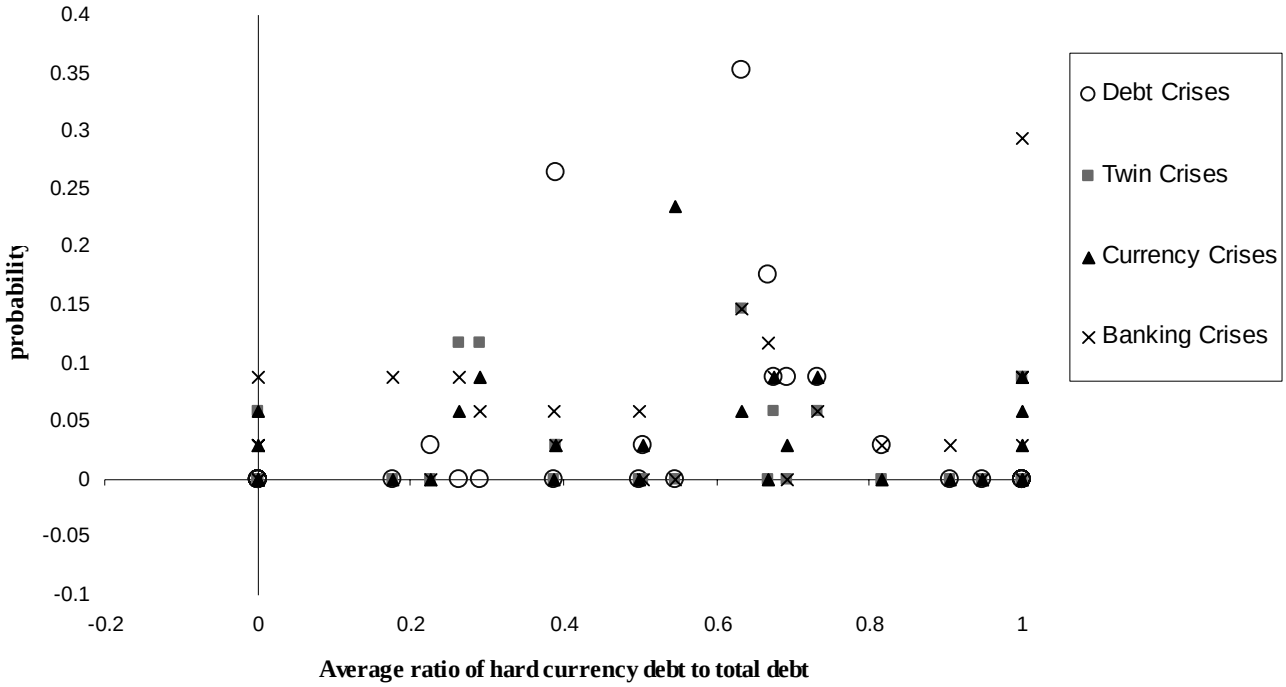
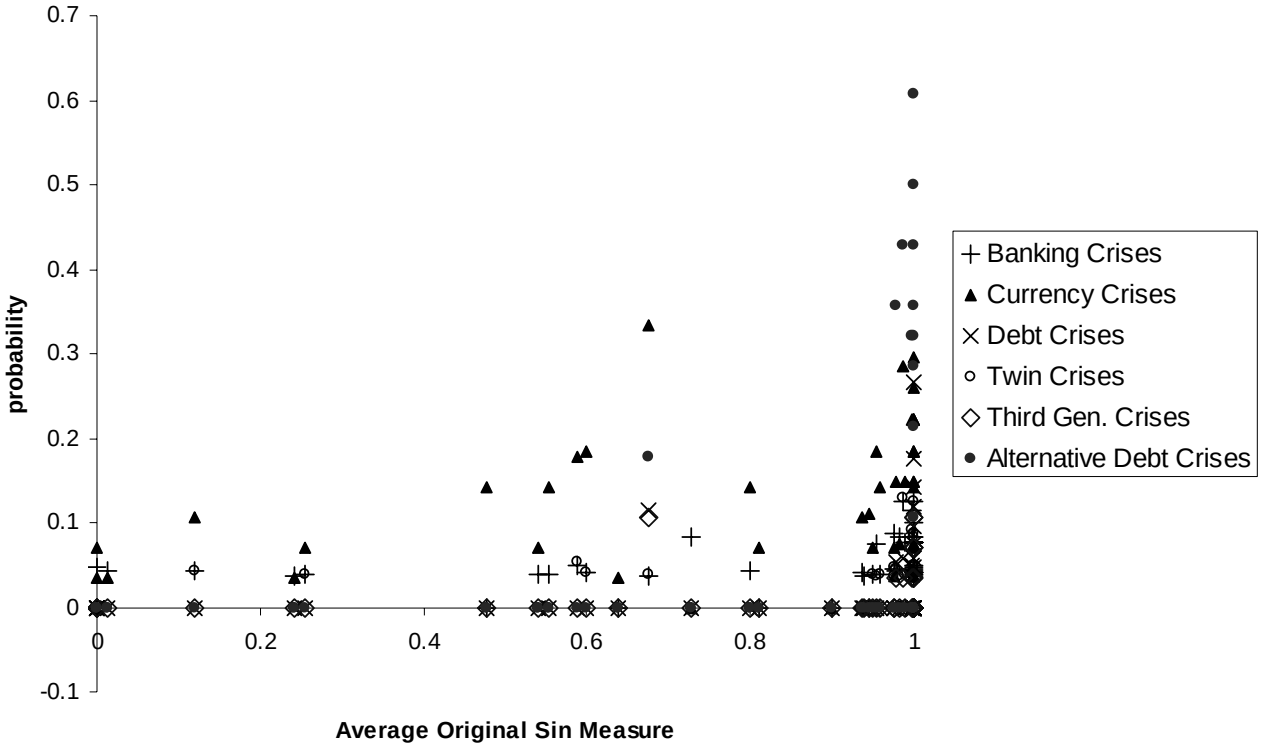


Figure 4 Crisis Frequencies By Country versus the Average Level of Hard Currency Public Debt to Total Public Debt, 1880-1913



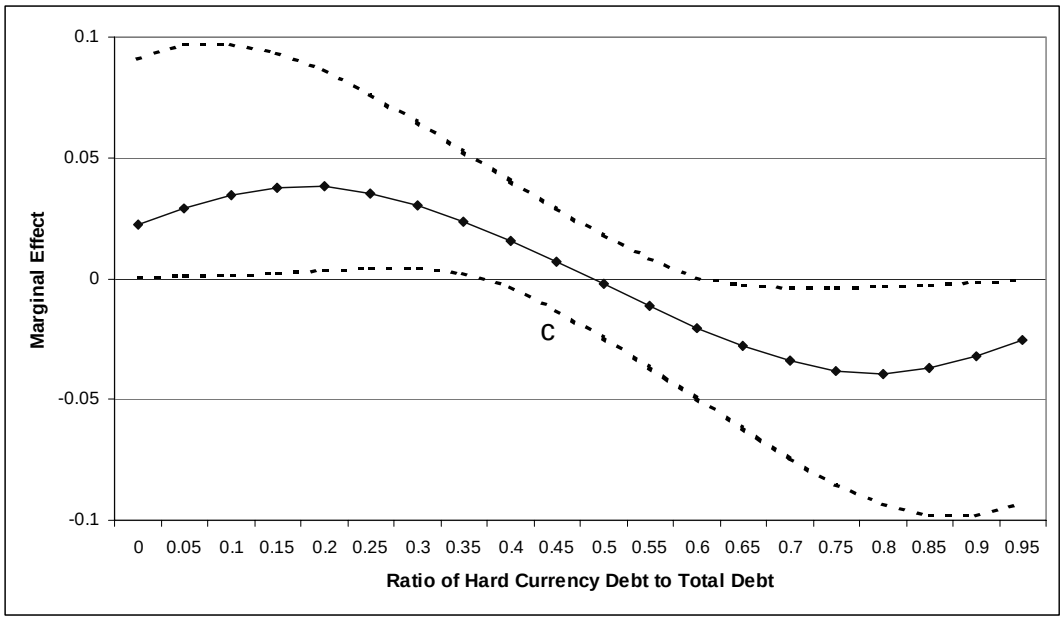
Notes: Crisis frequencies are calculated by dividing the number of years in which a country experienced a crisis by the total sample years. Both numerator and denominator exclude years of ongoing crisis. However, the debt crises series is calculated as the percentage of the period spent without a resolution of a debt default

Figure 5 Crisis Frequencies By Country versus the Average Level of Original Sin, 1972-1997



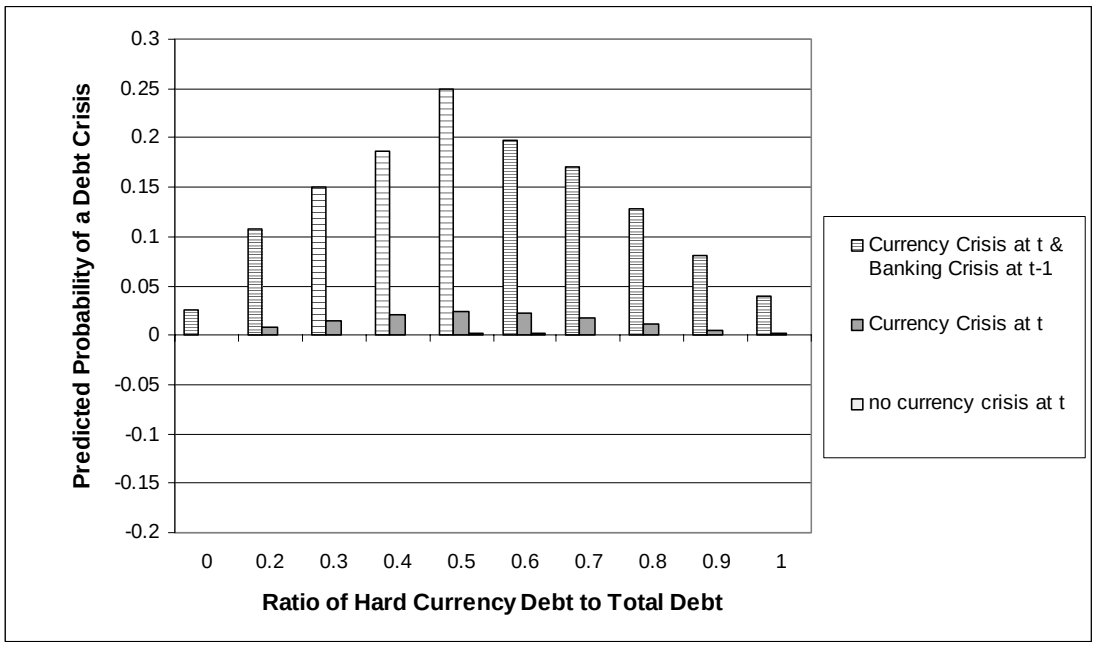
Note: Crisis frequencies are calculated by dividing the number of years in which a country experienced a crisis by the total sample years. Both numerator and denominator exclude years of ongoing crisis. However, alternative debt crises is the percentage of the period spent without a resolution of a debt default.

Figure 6 Marginal Effect of the Ratio of Hard Currency Debt to Total Debt



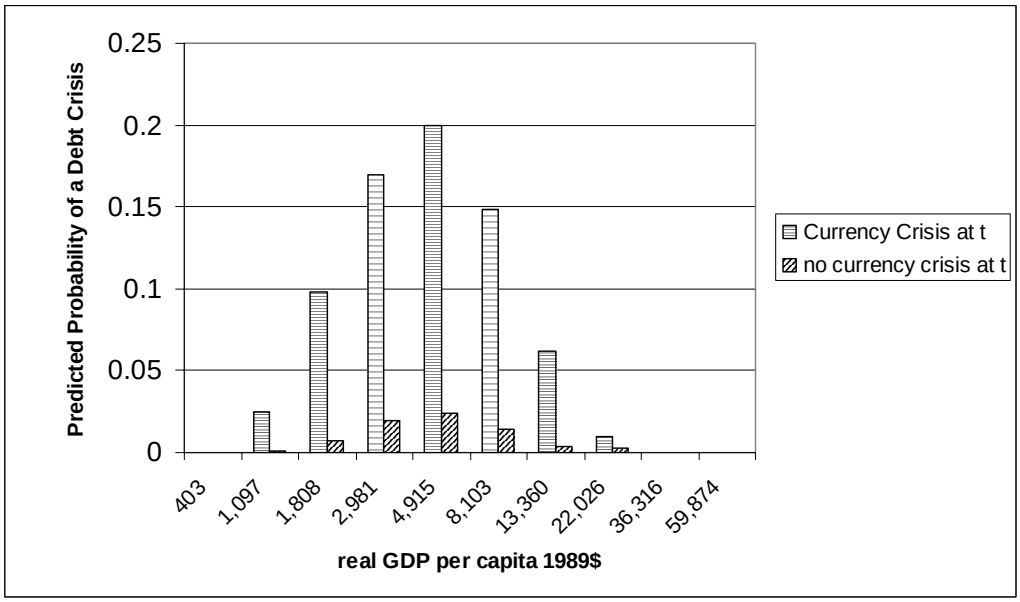
Notes: Figures are calculated based on the model in column 1 of Table 1. Currency crisis indicator equals one, lagged banking crisis equals one and other variables are at their sample means.

Figure 7 Predicted Probabilities of a Debt Crisis, 1880-1913



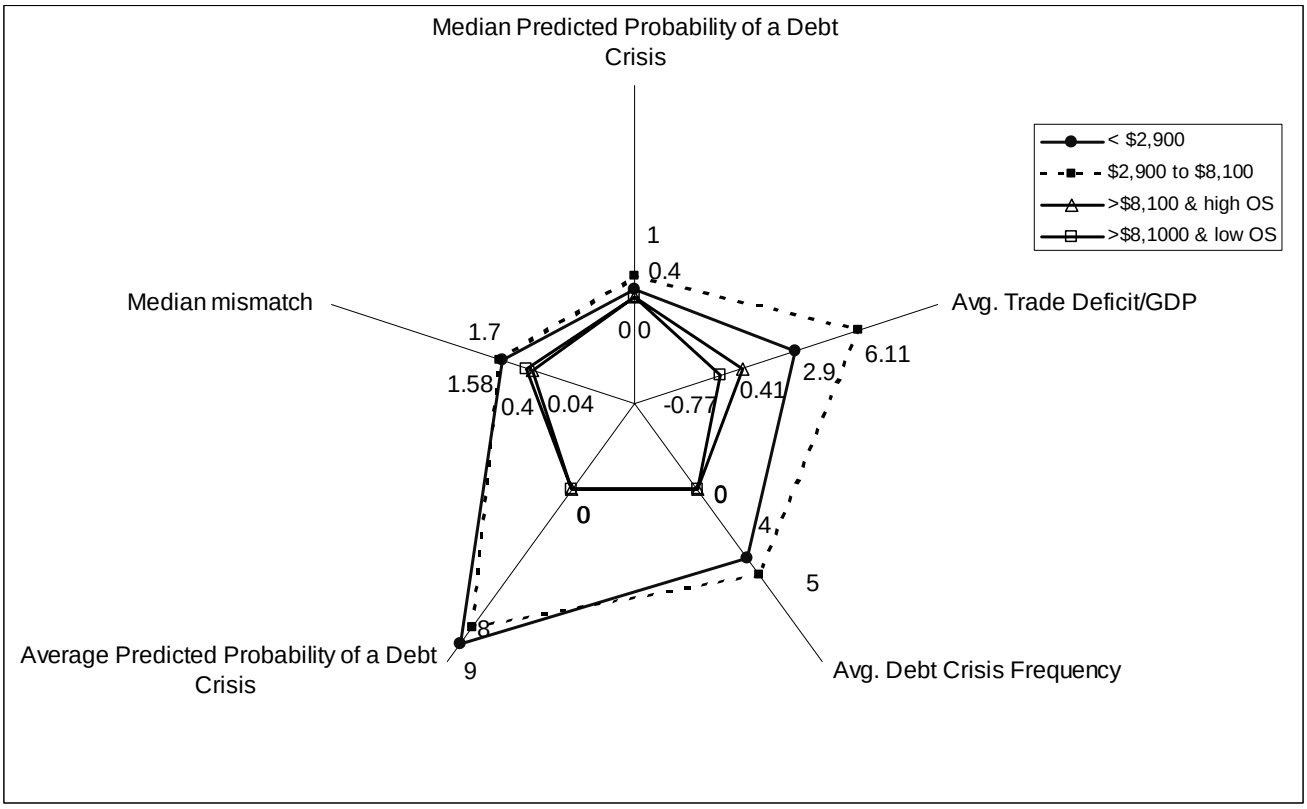
Notes: Figures are calculated based on the model in column 1 of Table 1. The probabilities are evaluated at the sample means of the control variables with the exception of the currency crisis and banking crisis variables as indicated above.

Figure 8 Predicted Probabilities of a Debt Crisis, 1972-1997.



Notes: Figures are calculated based on the model in column 3 of Table 2. The probabilities are evaluated at the sample means of the control variables with the exception of the currency crisis indicator which is zero or one and output which varies as displayed.

Figure 9 "Radar" Chart Showing the Four-Part Categorization of Countries, 1972-1997.



Notes: The figure shows four bands of countries. They are divided on their GDP measures. The first category being all country year observations where real GDP per capita is less than $2,900. Low OS means an observation's average original sin was less than or equal to 20 percent. High original sin implies a measure of greater than 20 percent. All measures on each axis are on the same scale. Predicted and actual probabilities are based on the 0 to 100 scale. The predicted probabilities come from the model estimated in column 3 of Table 2.

Table A.1 Countries in the Estimation Samples

Countries in the 1972-1997 Estimation Sample		Countries in the 1880-1913 Estimation Sample	
Argentina	Nigeria	Argentina	Italy
Australia	Norway	Australia	Japan
Bangladesh	Pakistan	Austria	Netherlands
Belgium	Paraguay	Belgium	Norway
Brazil	Peru	Brazil	Portugal
Colombia	Philippines	Canada	Russia
Costa Rica	Senegal	Denmark	Spain
Cote D'ivoire	Sri Lanka	France	Sweden
Canada	Spain	Germany	Switzerland
Chile	Sweden	Greece	United States
Denmark	Thailand		
Ecuador	Turkey		
Egypt	Uruguay		
Ghana	United Kingdom		
India	United States		
Indonesia	Venezuela		
Jamaica	Zimbabwe		
Malaysia			
Mexico			