Volume Title: The Decline of Latin American Economies: Growth, Institutions, and Crises

Volume Author/Editor: Sebastian Edwards, Gerardo Esquivel and Graciela Márquez, editors

Volume Publisher: University of Chicago Press

Volume ISBN: 0-226-18500-1

Volume URL: http://www.nber.org/books/edwa04-1

Conference Date: December 2-4, 2004

Publication Date: July 2007

Title: Financial Crises, 1880–1913: The Role of Foreign Currency Debt

Author: Michael D. Bordo, Christopher M. Meissner

URL: http://www.nber.org/chapters/c10655

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Financial Crises, 1880–1913
The Role of Foreign Currency Debt

Michael D. Bordo and Christopher M. Meissner

4.1 Introduction

The period from 1870 to 1913 was a period of globalization in both goods and financial markets that is comparable to the present era of globalization. Also, it was a period rife with emerging market financial crises, which has great resonance for the experiences 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. In the terminology of Eichengreen and Hausmann (1999), many of these countries suffered from *original sin.* The external debt that they accumulated to finance their development was almost totally denominated in foreign currency or in terms of gold (or had gold clauses) before 1914, just as emerging market debt today is almost entirely denominated in dollars, euros, or yen. When the exchange rate depreciates, debt service in gold or foreign currency becomes very difficult—leading to default, the consequent drying up of external funding, and economic collapse.

The emerging country experience was in contrast to that of the advanced core countries, which were financially mature, had credibility, and could issue bonds denominated in terms of their own currency. There were few

Michael D. Bordo is a professor of economics at Rutgers University and a research associate at the National Bureau of Economic Research. Christopher M. Meissner is a University Lecturer at the University of Cambridge, a fellow at King's College, and a faculty research fellow at the National Bureau of Economic Research.

We thank Antonio David and Wagner Dada for excellent research assistance. Comments from Luis Catão, Barry Eichengreen, Marc Flandreau, Daniel Lederman, Kim Oosterlinck, Anna Schwartz, and participants at a conference at Humboldt University, Berlin, are also appreciated. Errors remain our responsibility. The financial assistance from ESRC grant RES 000-22-0001 is gratefully acknowledged.

crises in these countries. This leads us to ask whether these very different debt structures might play a role in explaining the difference in crisis incidence. We also wonder if debt management policies that created or alleviated balance sheet mismatches mattered, as discussed in Goldstein and Turner (2004). Finally, we examine whether poor reputation and accumulated default experience was a problem, as hypothesized by Carmen Reinhart, Kenneth Rogoff, and Miguel Savastano (2003) in their work on *debt intolerance*.

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 thirty countries (both advanced and emerging) from 1880–1913. We have data both on the type of crisis incidence and on the fundamentals that economists believe are determinants of crises.

Our results do not find unambiguous support for the idea that hard currency debt for emerging markets is always associated with more financial turbulence. In fact, we find evidence that the emerging markets of the day that had significant amounts of original sin can be divided into two subgroups. One group includes countries such as Argentina, Brazil, Chile, Italy, and Portugal, each of which suffered a financial catastrophe between 1880 and 1913. The other group, including Australia, Canada, New Zealand, Norway, and the United States, had relatively little trouble with financial crises in terms of frequency or virulence. We ascribe this to special country characteristics that other independent peripheral countries did not possess.

We also find that many countries matched their hard currency liabilities with hard currency reserves or took out such debt in proportion to their export earning potential. This helped reduce exposure to currency and banking crises and kept banking and currency crises that did occur from becoming too severe. Nevertheless, even after controlling for the mismatch position, original sin still appears to be associated with crises for many vulnerable countries. Finally, there is a possibility that countries with better international repayment records were able to avoid debt crises despite high levels of debt.

4.2 History, Financial Crises, Balance Sheets, and Hard Currency Debt

In this paper we view banking trouble, currency crises, and debt crises that occur in the same or consecutive years as interrelated phenomena. This is perhaps different from first-generation models that viewed currency crises as events arising from unsustainable fiscal policy under a pegged exchange rate. It is also different from a strand of the literature that 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 the 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 model.

In our view, 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 nonfinancial firms and banks alike. As the number of nonperforming 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 obviously increases stress for nonfinancial firms that 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 contemporary view of the impact of such exchange rate changes is that they may be contractionary.[1] This is where original sin enters the picture. Since the majority of obligations for nearly all countries are in foreign currency or, in the late nineteenth century, denominated in terms of a fixed amount of gold, depreciation vis-à-vis creditor countries or breaking the link between gold and the domestic currency could lead to increases 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.[2] When net worth matters for lending decisions, this decline in the net worth of creditors can lead to another round of "disintermediation," causing widespread bankruptcies due to liquidity problems. All else equal,

1. Theoretical work by Céspedes, Chang, and Velasco (2004) demonstrates how under certain very plausible circumstances original sin can lead to contractionary depreciations.

2. Eichengreen, Hausmann, and Panizza (2003) argue that what matters is the aggregate external mismatch, and that 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 focus on domestic and external hard-currency debt rather than just foreign holdings (or issues) of hard-currency debt.

the deterioration to debtors' balance sheets would be more severe the greater the amount of fixed interest rate hard-currency debt outstanding.

There is some contention in the literature as to whether all is in fact equal. Goldstein and Turner (2004) have argued that often countries insure themselves against exchange rate movements. Hard currency debt can be, and often is, backed up by hard currency assets. Alternatively, countries could have enough export capacity to offset changes in liabilities due to exchange rate swings. To gauge the actual effect of original sin one must take account of the mismatch position or the entire balance sheet position of an economy. We describe how we do this in the following. Moreover, Reinhart, Rogoff, and Savastano (2003) have argued that original sin is a proxy for a weak financial system and poor fiscal control. As we describe later, we control for some of these fundamentals, too, allowing for a test of this hypothesis.

4.2.1 The Role of Original Sin

It has been the case since at least the eighteenth 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. 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 or very loose monetary policy, these countries are more often the victims of such a volatile combination.

Over the last ten years, these phenomena have started to be addressed in the economics literature. Eichengreen and Hausmann (1999) 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 that foreign currency-denominated debt was imposed by international capital markets. Nations with poor reputations, and *even nations with 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. Because of original sin and the problems that could be generated in the face of a devaluation, Eichengreen and Hausmann (1999) argued that exchange rate policy was of the utmost importance, even for those countries where fundamentals and fiscal policies were sound but which might fall victim to a liquidity run.

While we have a bit more to say about the origins of original sin in section 4.4.4, one key controversy remains. Exactly how harmful is original sin? Early work by Eichengreen and Hausmann used mainly anecdotal evidence both on the incidence of original sin and its effects. Very recent work by the same authors along 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. 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.[3]

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 debt that carried a gold clause or was made payable at a fixed rate in a foreign currency.[4] Our measure of original sin is the ratio of this quantity to total public debt outstanding.

This measure is different from, but related to, the measures of original sin defined in Eichengreen, Hausmann, and Panizza (2005). One of their measures of international original sin for country *i* based on securities issued by residents and nonresidents internationally is

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

One key difference between markets today and in our period under study is that recently debt has been issued in quite a few small-country currencies by agents from lending 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, 20), hence we can restrict attention in the numerator of this expression to securities issued in local currency (without gold clauses) only by residents.

The other key difference between our measure and the workhorse mea-

3. 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 debt was dangerous. Their tests are quite different from ours since our dependent variables are debt crises, banking crises, currency crises, or twin 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 different than ours.

4. Our data appendix 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. U.S. 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.

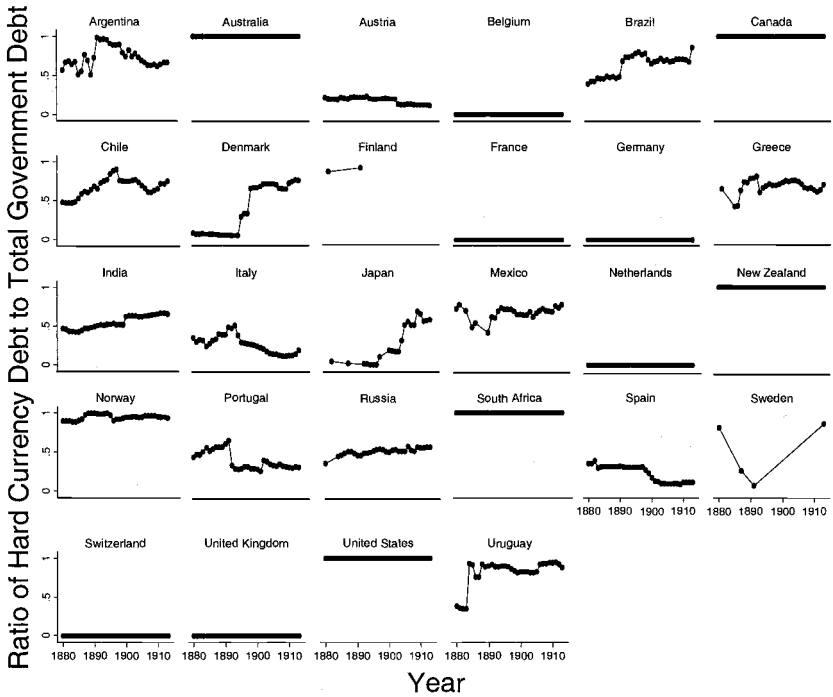

Fig. 4.1 Hard currency debt as a percentage of total public debt, 1880–1913

sure in Eichengreen, Hausmann, and Panizza (2005) is that we look at debt issued in domestic and international markets instead of looking only at international issues. One reason we view this as important is because many domestic issues of the day carried gold clauses. As described previously, in the case where monetary authorities devalued the local currency in terms of gold this would have a similar effect 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.[5] Hence, we do not classify debt as "debt issued in 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.

Figure 4.1 shows the ratio of hard-currency government debt to total

5. We are finessing the question of what happens to the real exchange rate and prices in general. We assume here that nominal depreciations are perhaps equivalent to real depreciations in the short-run because of sticky prices. On the domestic side we assume going off gold or a depreciation implies a depreciation of the local currency versus gold and that domestic prices are constant over the short run.

government debt by country between 1880 and 1913. Our time series plots reveal most countries' measure of original sin to be constant over time. Some countries' situations worsened. Japan became more exposed to foreign currency debt as it entered global capital markets from the late 1890s. Argentina and Brazil converted local currency paper debt into gold clause debt in the 1890s. Only Spain and Italy appear to have decidedly decreased their reliance on hard currency debt relative to internal currency debt. These nations often had floating currencies throughout the period. As noted by Flandreau and Sussman (2005), their situations appear similar to those of Russia and Austria-Hungary, countries which had relatively low degrees of original sin and which also had floating currencies over most of the period we cover. These are the counterexamples to those who believe that poor fiscal history, a shaky exchange rate policy, and economic backwardness are causes of original sin. Nearly all of these countries had previous episodes of debt default and chronically poor fiscal situations. We subsequently return to this story.

The long-run averages of our original sin measure in figure 4.2 also reveal a counterintuitive ranking, but are 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 toward the lower middle of the spectrum. However, some countries with sound fiscal, financial, and monetary records, like Denmark and Sweden, also fall into this range. These countries, like others in west-

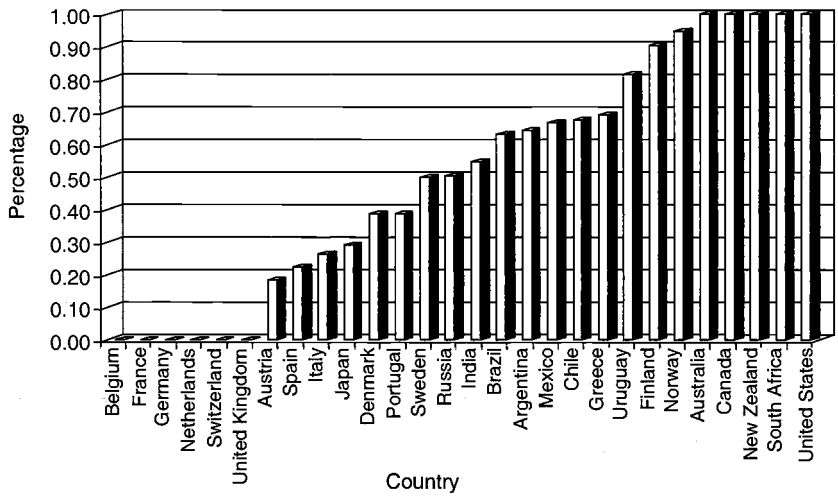

Fig. 4.2 Average ratio of hard currency public debt to total public debt, 1880–1913

ern Europe, had financial institutions that were evolving in the same direction as the core. The question then becomes: are these fundamentals, along with the historical and current fiscal positions, more important for explaining crisis incidence than the actual level of hard-currency debt?

4.2.2 Currency Mismatches

Goldstein and Turner (2004) have argued that currency mismatches are the main problem with foreign currency debt. Countries that have foreign currency liabilities that 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. On the margin, changes in the exchange rate can become a problem the greater the mismatch, as local currency assets lose value in terms of foreign liabilities. Goldstein and Turner have three key ingredients in their overall measure of a nation's mismatch. They first use the difference between all reported foreign assets and foreign currency liabilities outstanding. They then divide this measure by exports (or imports if the difference is positive) to account for openness to trade.[6] For example, the mismatch decreases when exports are higher because a depreciation would likely attract a larger amount of extra revenue and thus such a country would be more naturally hedged. Finally, they premultiply this ratio by the ratio of all reported foreign currency liabilities to all reported liabilities outstanding.

Data on bank and nonbank foreign assets is difficult to assemble today and probably impossible for the pre-World War I era. We focus on the government's mismatch and believe this is a relatively good proxy for the economy-wide mismatch. The functional form we choose is different from Goldstein and Turner and slightly closer to that found in Eichengreen, Hausmann, and Panizza (2003).[7] For country i we have

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

Our measure of reserves usually only includes gold reserves held at the central bank, in the banking system, or held by the government treasury.

6. Goldstein and Turner (2004) choose a functional form so that the boost to exports from a depreciation improves a nation's balance sheet. Though the Goldstein and Turner measure (and our version of theirs) is one measure of the balance sheet position, it is not the ideal measure of a nation's balance sheet. There are omitted ingredients that could make a difference to the balance sheet. For example, for this period, one could theoretically refine this measure by including foreign currency and gold revenues collected through tariffs, exports to gold standard countries, and imports from such countries as a measure of hard currency earnings and liabilities, and foreign assets held in banks. Most of these data would be impossible to collect for a reasonable number of observations. Also, in section 4.4 we discuss how the omission in our mismatch measure of certain types of assets could explain the fact that some countries with high original sin seem less crisis prone.

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

The sources are listed in the appendix. 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. A higher mismatch measure should be correlated with fewer financial crises. As such it compares with the Goldstein and Turner measure. Nevertheless, it does take a different functional form and potentially does leave out a significant fraction of total assets and liabilities in the economy. One should also note that as the mismatch measure increases, damage to the net worth of a country inflicted by a depreciation should be smaller.[8]

The mismatch measure above risks combining flow measures (exports) with stock measures. As an alternative measure of mismatch, we substitute the amount of total hard-currency debt outstanding by the total amount of interest payments due in gold or foreign currency. This is estimated as the product of the ratio of hard currency debt outstanding to the total interest payments on all types of debt.[9] Interest payments come from Flandreau and Zúmer (2004) and are only available for a smaller set of countries.

4.2.3 Debt Intolerance

A new literature on sovereign financial difficulties emphasizes the role of past defaults in creating current difficulties. Reinhart, Rogoff, and Savastano (2003; RRS) have coined the term *debt intolerance.* This line of research tries to explain why some countries are able to sustain very high debt-to-GDP ratios while other emerging-market countries run into debt problems with comparatively low debt-to-GDP ratios. Their evidence suggests that past defaults generate poor sovereign ratings. Countries with worse track records in international capital markets suffer greater financial fragility due to increased borrowing costs at a given level of debt to GDP. An alternative view might be that default history or sovereign ratings are proxies for other underlying structural or institutional problems. Hence we would also like to control for such fundamentals, as far as possible, to allow for the possibility of graduation from debt intolerance.

Given these hypotheses, we would like our tests to include a measure of default history. Accordingly, we take two routes to control for this. First we interact a public debt to government revenue ratio with an indicator

8. Goldstein and Turner (2004) note that net worth increases with depreciation for net creditors. To get around the fact that an increase in the denominator of mismatch would decrease the mismatch measure for net creditors they divide by imports when assets exceed liabilities. For all of the results we present we divide by exports. We also tried dividing by imports when appropriate. The two measures have a correlation of 0.999. Our results do not change significantly when we divide by imports for those observations with positive numerators.

9. Of course, different face value interest rates for paper and gold debts will affect how accurate this measure is for the countries that have original sin measures between 0 and 1. The actual difference between the face value interest rate for a gold and paper debt was one percentage point for Brazil in the 1890s.

variable that equals one if a country had at least one default episode between 1800 and 1880. Alternatively, we interact the debt-to-revenue ratio with an indicator equal to one if the country is in the periphery.[10] If the increase in the probability of a financial crisis for a marginal increase in the debt-to-revenue ratio is larger for a peripheral country or a past defaulter, we would argue there is evidence in support of the debt intolerance hypothesis.

4.2.4 Other Data and Hypotheses

The literature on predicting financial crises with econometric techniques is abundant. Our approach is inspired by the pared down methodology of Frankel and Rose (1996), who looked at currency crashes at the annual level. Many subsequent papers have made modifications to this early attempt and have largely been equally unsuccessful at accurately predicting any type of financial crisis.[11] However, some approaches and explanatory variables have done reasonably well in predicting crises, or at least being strongly and statistically significantly correlated with crises in a way consonant with priors based on economic theory.

We attempt to control for the union of the most important variables from the extant literature that is applicable to the time period at hand. The list includes total outstanding government debt divided by government revenue, growth in the terms of trade, the deviation of the real exchange rate from the period average, the current account balance divided by nominal GDP, the yield spread between British consols and long-term government bonds, an indicator for whether the country maintained a gold standard, growth of the money supply, the ratio of gold reserves in the banking system to notes in circulation, and the GDP-weighted average spread on British consols for long-term bonds. The variables used depend on which type of crisis we are examining and are well indicated in the respective tables. Our sources and definitions of these variables are located in the data appendix.

Our sample includes the twenty-one countries examined in Bordo et al. (2001). We have also added information on crises and macrodata for nine other countries. These new additions include Austria-Hungary, Egypt, India, Mexico, New Zealand, Russia, South Africa, Turkey, and Uruguay. To the best of our knowledge, this is the most comprehensive macrohistorical data set ever constructed to analyze the determinants of various types of financial crises.

10. The periphery indicator comes from Obstfeld and Taylor (2003). The periphery countries are Argentina, Austria-Hungary, Brazil, Chile, Egypt, Finland, Greece, India, Italy, Japan, Mexico, Portugal, Russia, Spain, Turkey, and Uruguay.

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

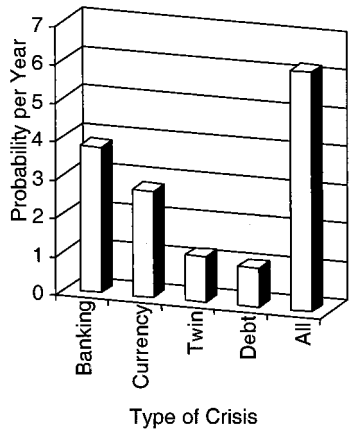

Fig. 4.3 Crisis frequency in percent probability per year, 1880–1913

4.2.5 Crises, 1880–1913

In figure 4.3 we present the frequency of various types of crises (banking, currency, twin, debt, and any type of crisis).[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, to come up with a total number for years of observation. We note the pattern found in Bordo et al. (2001) in terms of the relative frequency of types of crises (i.e., that the predominant form of crises before 1914 was banking crises, followed by currency crises, twin, and debt crises).[13] Nevertheless, the absolute magnitude of the probability for each type of crisis increases slightly compared to their figure with our addition of another ten countries.

Figures 4.4 and 4.5 present scatter plots of the percentage of time a country was in a crisis episode versus our measure of original sin and our mismatch variables.[14] There appears to be a quadratic 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.

It seems intuitive that the financial centers which were more economically developed had fewer crises than nations like Russia, Argentina, and

12. Our crisis dates and the methodology we use to classify years of crisis are listed in the appendix.

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

14. Our measure of the percentage of time spent in a crisis is the ratio of the number of years in which a crisis first occurred or was ongoing divided by the number of years in the sample, which is 34. For debt crises, the numerator is the number of years in which there was no resolution or international agreement on debt repayment.

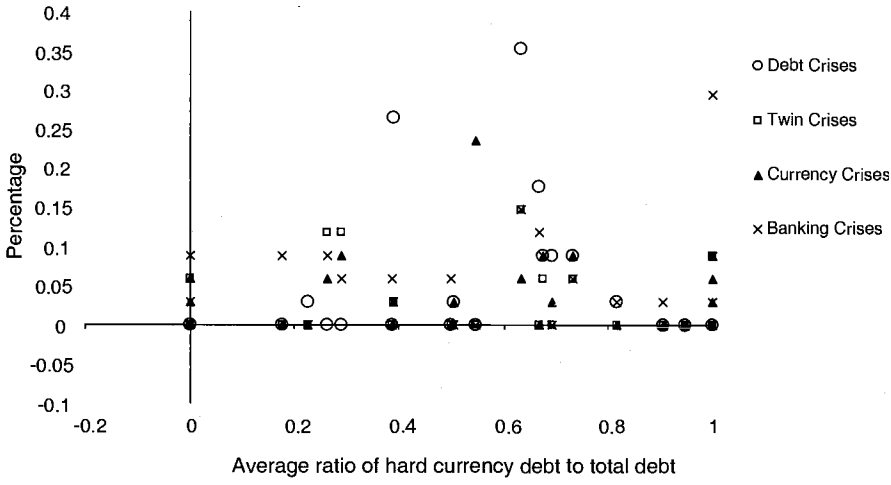

Fig. 4.4 Crisis frequencies by country versus the average level of hard currency public debt to total public debt, 1880–1913

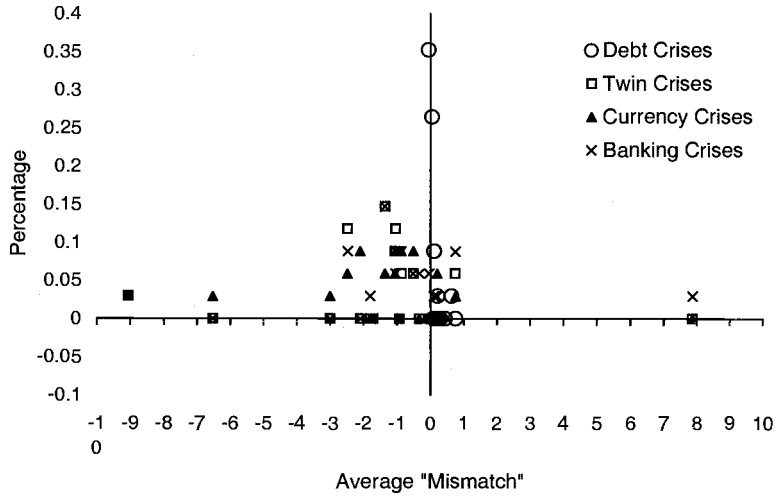

Fig. 4.5 Crisis frequencies by country versus the average level of the "mismatch" measure, 1880–1913

Notes: The mismatch variable for debt crises uses interest payments. The mismatch for other types of crises uses debt outstanding. See text for explanations.

Italy. But what about the countries with high measures of original sin but fewer crises? These data points include primarily the British offshoots like Australia, Canada, New Zealand, and the United States, but also small European countries like Norway and Finland. Perhaps this hump-shaped relationship is evidence that original sin is not always related to more finan-

cial fragility. It could be that these countries avoided crises because of their strong financial systems and fiscal institutions, especially when compared to the southern European periphery and the Latin American countries, which make up most of the observations in the middle ground. The next section looks at some case studies that illuminate this finding. The following section uses econometrics to control for a host of other plausible factors that might be omitted from this sample scatter plot. We conclude that for debt crises and banking crises this quadratic relationship is still visible and quite meaningful in telling us what matters for managing original sin.

4.3 Historical Evidence

How well does the overarching framework of financial crises discussed previously match up to the historical record? What role did contemporaries assign to hard currency debt and fiscal mismanagement as causes of the numerous financial crises that occurred between 1880 and 1913? We discuss the cases of Argentina, Brazil, Australia, and the United States to address these questions. These places shared the distinction of being peripheral capital-importing countries, and so these, in many respects, make for good comparisons in a case study.[15] Figures 4.6 through 4.9 plot the levels of our original sin measure, the mismatch variable (measured using total debt outstanding), and the gold reserve ratio for them. The original sin and mismatch variables look fairly similar in levels. They also take the same paths in the run-up to their crises. The notable exception to this pattern is the evolution of the ratios of gold to bank notes in circulation. These are rather high and fairly level for Australia and the United States, but they are low and decreasing for Brazil and Argentina. This highlights the division of the periphery into the two subgroups we mentioned earlier. All four of these countries had a financial crisis in the 1890s. Brazil and Argentina had near total financial meltdowns and sovereign debt defaults. Australia and the United States experienced relatively serious banking crises in 1893 but by no means faced financial disintegration. They both avoided debt default and massive currency depreciations. The robustness of the financial systems and the governments' fiscal position, along with a few other idiosyncratic factors, make the difference between the outcomes.

Perhaps the most notorious of the late nineteenth-century crises is the Baring crisis that hit London and Argentina in late 1890.[16] In Argentina,

15. It is debatable whether the United States qualifies as a peripheral country in this period; indeed, our periphery indicator does not classify it as such. Its real income in both total and per capita terms was as high as the advanced countries of western Europe that comprised the core countries. It was also similar in overall economic development. However, before 1900 it was, like the other emergers, a major capital importer. See Bordo and Schwartz (1996) and Flandreau and Jobst (2004).

16. See Eichengreen (1997) for an in-depth discussion of this event and a comparison between it and the Mexican crisis of 1994.

this crisis was a triple crisis involving a banking meltdown, a currency crisis, and a suspension of payments on national debt. The 1880s witnessed a "fiesta financiera." Fiscal excess and a dubious banking situation reigned. Government spending also took off in the 1880s. Much of the spending was financed by local and foreign borrowing, and it was unaccompanied by short-term revenue increases. Bank lending to the national and state governments increased at a harried pace. Foreign purchases of the large amount of (paper peso) bonds issued by local mortgage banks rose throughout the 1880s. Note issues by banks in excess of statutory levels also made the Argentine position even more precarious. There was also a lack of political will to increase tax revenues from import duties in the late 1880s.

Borrowing became harder and harder for Argentina in the late 1880s. As foreign lending started to dry up, the government propped up the mortgage banks through the mortgage bond (*cedulas*) market by guaranteeing that these bonds, which were originally issued in paper, would be paid in gold. This policy increased Argentina's hard-currency liabilities as a percentage of the total at a time when reserves were being used (unsuccessfully) to prop up the paper peso. Figure 4.6 shows how this simultaneously raised the original sin measure and made the mismatch worse.

When the Bank of England raised its discount rate from 2.5 to 6 percent in 1889, the disaster exploded. Baring, overextended because of Argentina's insolvency, was bailed out by a consortium of British banks in a lifeboat operation arranged by the Bank of England (Bordo 2003). The government of Argentina suspended payments on its debts. The two major banks

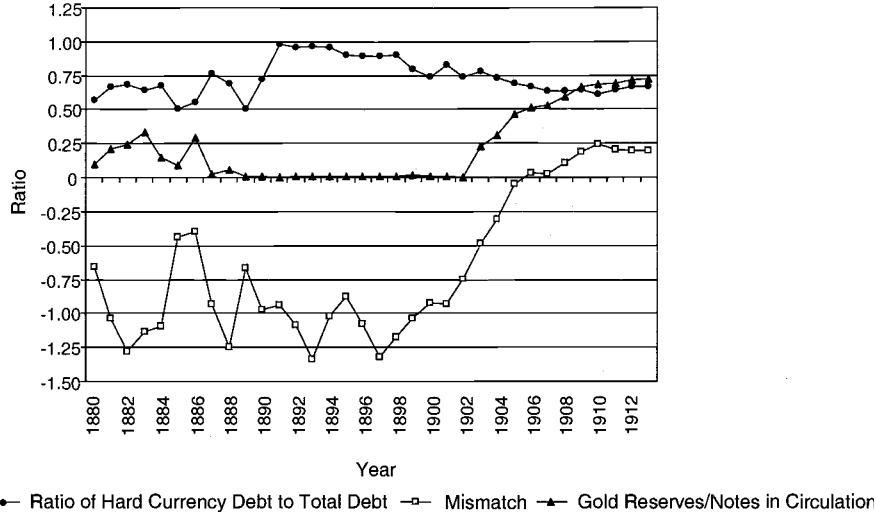

Fig. 4.6 Original sin, mismatch, and gold cover ratio for Argentina, 1880–1913

of Buenos Aires were liquidated in 1890. The most notable facets of this crisis are its near textbook sequence of events and the striking move by Argentine authorities to "dollarize" its debts when in such a precarious position. The ease with which this occurred suggests that decreasing currency risk made the debt seem more attractive for foreign investors. But of course this would only be true as long as these investors neglected the possibility that depreciation itself would cause the debt burden to become unsustainable.

It is also extremely interesting that Brazil (also under a floating exchange rate regime) undertook a local currency to hard-currency debt conversion in 1890 similar in effect to Argentina's. The government converted 5 percent paper bonds to 4 percent gold bonds and instituted collection of tariffs in gold in order to help pay these obligations. Levy (1995) argues that authorities viewed gold bonds as a less expensive way to fund deficits. The conversion itself helped raise Brazil's original sin measure from less than 0.5 to nearly 0.7 (see figure 4.7). According to our data, the Brazilian mismatch using total debt service worsened from –1.26 to –1.38 while the mismatch measure using interest service improved from –0.058 to –0.049. Neither move seems extremely large in comparison with the increase in the original sin measure we have seen. But this conversion surely contributed to Brazil's fragility, culminating in the banking crisis of 1897 and the currency and debt crisis of 1898.

Like in Argentina, the run-up to the Brazilian crisis witnessed fairly

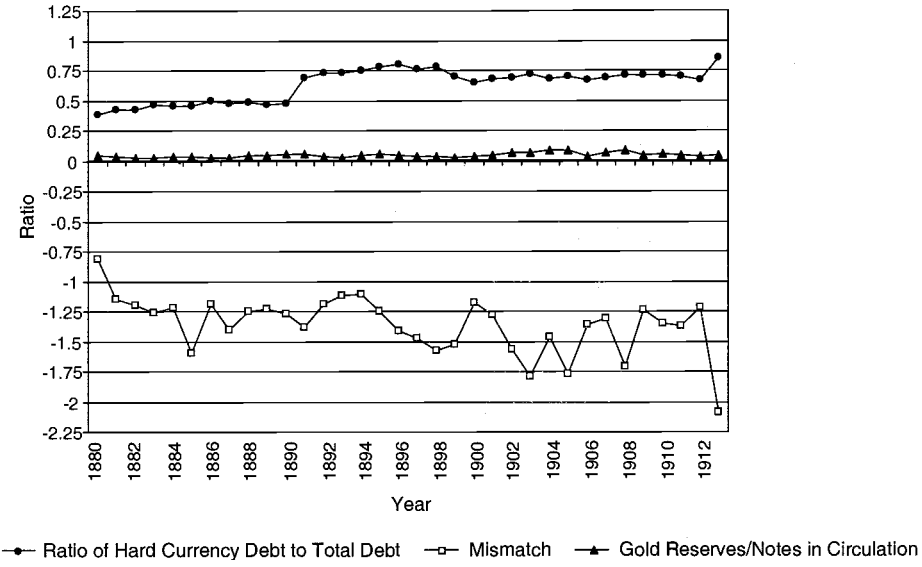

Fig. 4.7 Original sin, mismatch, and gold cover ratio for Brazil, 1880–1913

heavy depreciation of the real as well as civil unrest. The price of coffee, an important export, also tumbled. The depreciation of the real was caused by excessive note issues, weak bank regulation, and continual government pressure for advances. Moreover, the gold tariff was eliminated in 1891, further damaging the government's balance sheet. The government reassumed the monopoly over note issues from the domestic banks of issue in 1895.

All was not bleak in the 1890s. London markets accepted new issues from Brazil, and these funds were used to continue servicing the external debt. Moreover, coffee prices recovered somewhat and rubber exports began to take off. If the government had not embarked upon a number of new military operations and continued with the construction of military installations up to 1898, the fiscal position might not have looked so grim. As it happened, the banking crisis of 1897 and heavy depreciation in 1897 conspired to create a currency crash and finally a suspension on debt payments in 1898.

For the United States and Australia the 1890s were also a turbulent decade. Australia had a banking crisis in 1893. The U.S. Treasury suffered heavy gold losses in 1891 (see figure 4.8). In 1893 the United States was hit by a short-lived banking panic coupled with more gold reserve losses. Despite the turbulence, neither country ended up with a debt crisis, the exchange rates were not allowed to depreciate, and the banking systems withstood the pressure. Moreover, it is worthwhile to note that, by our

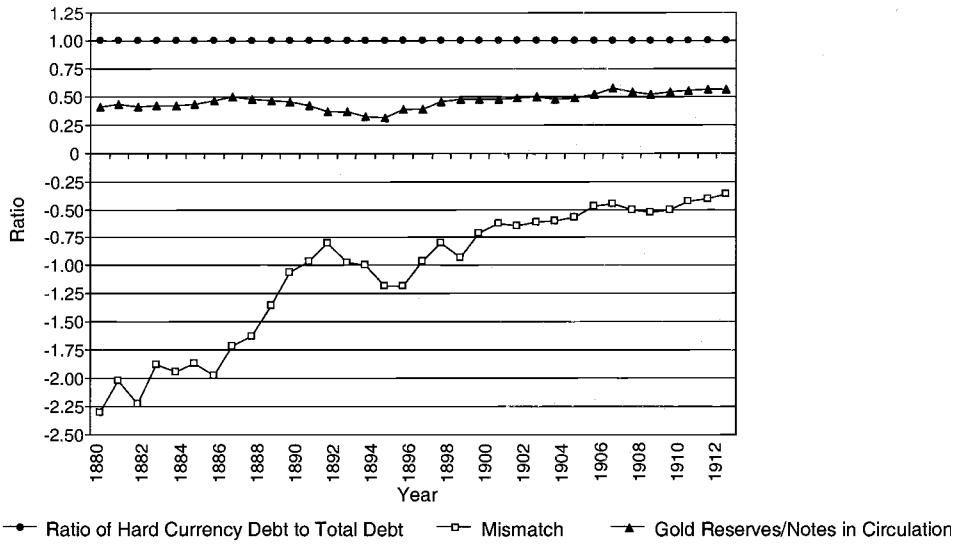

Fig. 4.8 Original sin, mismatch, and gold cover ratio for the United States, 1880–1913

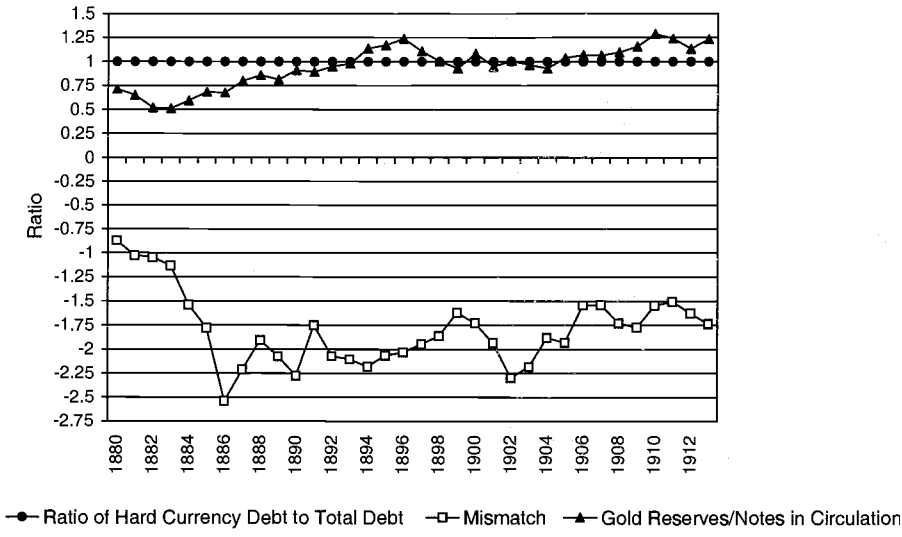

Fig. 4.9 Original sin, mismatch, and gold cover ratio for Australia, 1880–1913

measures, Australia at this time had a debt-to-revenue ratio of roughly nine, which is in the 90th percentile of our sample, and a slightly worse mismatch position than Brazil had in the 1890s.

The story of the crisis in Australia (see figure 4.9) is that land speculation had reached a frenzied pace by the early 1890s. Banks were lending for long-term projects. Historians have called attention to the maturity mismatch that characterized such lending. A tariff rise in 1892 contributed to falling government revenues, probably weakening market confidence at the same time. London markets also tightened up in response to global financial turmoil in the early 1890s. Banks formed an association to protect themselves in 1892, but public depositor confidence was shattered in 1893 when an important bank was allowed to fail. Finally, export prices fell, making debt servicing all the more difficult.

Some observers have claimed that the crisis was not all that severe and that recovery had begun by 1893 (Dowd 1992). Adalet and Eichengreen (2005) emphasize that the crisis and current account reversal that accompanied it depended on deflation and a reduction in expenditures. They note that debt default never occurred as it did in Argentina and later in Brazil, perhaps because membership in the British Empire ruled it out.

Policy measures that surely helped alleviate the financial severity of the crisis include: a five day bank holiday, the government policy, which allowed for a slight increase in the legal maximum note issue, and paper money being declared legal tender in New South Wales. Dowd also suggests that no balance sheet problems or disintermediation occurred, since

there is no evidence that advances declined during the period. Moreover, he observes that the biggest banks had prudently prepared for the worst by 1890 by divesting themselves of speculative assets.

In the United States, a combination of luck and a strong financial system averted a total meltdown in the 1890s. The main characteristic of the currency turbulence in 1891 and in 1893 was the heavy loss of the Treasury's reserves. Open market purchases of securities by the Treasury, a tax of 40 cents per $1,000 on gold exports, the McKinley tariff, and a bumper crop in the United States, which was swiftly exported to Europe, where there was a major crop failure, all combined to avert massive disaster and bring calm to markets by late 1891.

In 1893 international markets once again doubted the U.S. commitment to the gold standard. A move to a de facto silver standard was factored into expectations.[17] The closure of the mint to silver in June 1893 in India created expectations of continued depreciation of silver in terms of gold. This would have meant continuing depreciation against gold currencies for a silver-based dollar, and so provided a possible speculative opportunity. In fact, a self-fulfilling attack on the dollar was nearly successful. The Treasury's gold reserves dropped quickly and obligations to repay debt in gold stood at a high level. Markets speculated that gold reserves would continue to diminish. This contributed to further gold outflows. In June of 1893 the clearing house syndicate of New York met, but many banks were still pushed to the limit of their legal reserve requirements. Nevertheless, prominent political defeats for prosilver activists, including the repeal of the Sherman Silver Purchase Act (a sop to prosilver forces passed in 1890) helped assuage market fears. A rescue package engineered by Belmont and Morgan, who purchased $62 million in bonds yielding nearly $35 million in gold for the treasury, also helped suppress the attack.

The strength of the U.S. and the Australian financial systems in comparison to the South American cases mentioned earlier is evident here.[18] We think that the outbreak of crisis in these examples follows a fairly systematic pattern, very similar in nature to the framework laid out previously. This is so especially as it relates to credit expansion, overindebtedness, and vulnerability induced by rises in foreign interest rates. But there is a major divergence at the point when we try to understand how hard-currency debt matters. For the two southern cone countries, hard-currency debt proved dangerous and default ensued. For Australia and the United States, two places where debt was payable strictly in a fixed amount of gold or foreign currency, balance sheet effects did not overwhelm the

17. Calomiris (1992) argues that markets were expecting a good chance of a temporary suspension of gold convertibility and a small devaluation of the dollar.

18. Caballero, Cowan, and Kearns (2004) look at the success of dealing with capital market shocks over the last 100 years and make an interesting comparison between Australia and Chile.

economies. Exchange rate commitments did not fail. Most importantly, the financial systems were robust. And finally, in Australia, Empire made the difference. In the United States, Belmont and Morgan and the material interests and strength of the New York banking industry mattered. These are key differences from Argentina and Brazil. The U.S. and Australian case illustrate why original sin is not always dangerous. The statistical work we turn to now provides more support for these assertions.

4.4 Statistical Findings

Our statistical approach is fairly basic. We seek mainly to find a multivariate way to summarize the data by correlating crisis probabilities with a set of explanatory variables.[19] We use probit specifications, and the dependent variable is the first year of a debt crisis, currency crisis, banking crisis, or twin crisis. Our data set is an unbalanced panel, and the observational unit is the country year. We omit country years that include ongoing crises. Throughout, we control for the lack of statistical independence between country observations by using heteroscedasticity robust, country-clustered standard errors.[20] We first present specifications with as many variables as is feasible and then as a robustness check we drop the most statistically insignificant variables so as to avoid possible collinearity problems and to include more observations.[21]

One thing we find consistently, even when conditioning on other variables and in other sensitivity analysis, is a quadratic relationship between the ratio of hard currency debt to total debt and the frequency of debt and banking crises. This suggests that original sin may contribute to more financial crises but that sometimes the damage can be limited by other means.

Holding our measure of the currency mismatch constant however, no relationship between original sin and currency crises is apparent. We view most currency crises as a symptom of capital flight from a crumbling financial sector and liquidity problems, and think that original sin is *indirectly* associated with currency crises. As the framework provided previously would predict, we see that initial problems in the banking sector

19. Endogeneity of the regressors as well as usual specification problems may be present in our specifications. We attempted to mitigate endogeneity biases in unreported 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 that are likely to be problematic for estimation.

20. We estimated random effects probit models as well but found them to perform weakly. The estimated correlation between within-country observations was poorly estimated.

21. The appendix lists the key variables and their availability for each country so the reader can see what the various samples look like. The issue of model specification is, of course, not trivial. We are taking a decidedly reduced form approach, and we use the econometrics as supplements to the qualitative theoretical conclusions and historical record.

(proxied by one-year ahead indicators of debt crises and banking crises) are strongly associated with currency crises. Hence one possibility is that original sin affects debt sustainability or the soundness of the banking sector, and then these problems with debt and the banking system can create a currency run, which further contributes to balance sheet trouble and possibly financial implosion.

Moreover, we document a link between currency crises and mismatches or weak reserve positions. This is evidence supportive of the idea that the outbreak of currency crises is the symptom of liquidity problems or perhaps deeper solvency troubles in the economy that contribute to speculative capital outflows and sudden stops. Some weak evidence shows that mismatches are associated with debt crises, too. Finally, some inconclusive evidence points also to debt intolerance as a factor in debt crises, without ruling out a role for original sin or mismatches.

4.4.1 Debt Crises

Table 4.1 presents results from various specifications where the initial year of a debt crisis is the dependent variable. Column (1) presents a comprehensive specification that includes a variable set as large as possible and that also allows for controls for original sin and currency mismatches. We see that there is a quadratic in original sin, in mismatches (as measured using interest payments rather than total debt outstanding), and there is evidence of debt intolerance. These variables are statistically significant (at better than the 90 percent level of confidence) at the means for each for each of these controls.[22] The size of the estimated coefficients is symptomatic of the low predicted incidence of debt crises. Since the incidence in the sample is barely two percent, this is understandable.

We interpret the quadratic in original sin as stating that more original sin is associated with a higher likelihood of a debt crisis, but those observations with very high levels of original sin face a lower likelihood. Again, these are the countries in the areas of recent settlement like Canada, Australia, New Zealand, and the United States, which had strong financial systems, good fiscal institutions, and which borrowed largely for productive investments.

In terms of mismatch, there is evidence that past a certain level a better

22. As usual in a probit model, the actual marginal effect, the standard error, and statistical significance depend on the levels of the covariates in a nonlinear way. We calculated these effects for each observation for particular specifications and found that magnitudes and statistical significance varied considerably (e.g., see figures 4.10 and 4.11). On the whole, we often find that the coefficients of interest are statistically significant and have the most impact at the extremes of the empirical distributions. Moreover, the statistical significance of the interaction effect 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 (e.g., the average) but do not always report the *p*-values here. For simplicity we focus mainly on this first partial derivative.

Table 4.1 Determinants of debt crises

Regressors	(1)	(2)	(3)	(4)
Hard-currency debt as a percentage of total debt	6.44 (1.89)***	2.32 (0.92)**		3.44 (1.07)***
Square of hard-currency debt ratio	–4.71 (2.05)***	–3.46 (0.61)***		–4.33 (0.82)***
Debt/Revenue	–0.40 (0.11)***	0.16 (0.07)**	0.23 (0.08)***	–0.05 (0.12)
Debt/Revenue · pre-1880 default	1.04 (0.26)***			0.28 (0.15)
Pre-1880 default	–8.81 (2.83)***			–2.74 (1.18)**
Mismatch	7.41 (4.17)		4.16 (1.67)**	
Square of mismatch	–25.7 (13.13)**		–11.40 (6.61)	
Growth of terms of trade	–31.93 (19.66)	–13.98 (11.42)	–13.22 (9.86)	–16.56 (14.24)
ln (deviation of real exchange rate from period average)	–6.02 (4.33)	–2.39 (1.72)	–2.46 (1.77)	–3.22 (2.06)
Trade balance/GDP	–4.94 (5.22)			
Spread on U.K. consol	–0.18 (0.17)			
Gold standard dummy	1.65 (0.73)***			
Growth of the money supply	–1.59 (3.14)			
Gold reserves/notes in circulation	–12.01 (3.43)***	–3.76 (2.11)	–5.69 (1.41)***	–4.32 (1.19)***
Market portfolio spread	3.44 (1.72)***	1.92 (0.77)**	2.40 (1.15)**	1.77 (0.86)**
Constant	–3.88 (3.67)	–5.72 (1.31)***	–6.30 (2.24)***	–3.80 (1.31)***
No. of observations	371	533	427	533
Percentage of correct positives	83	66.67	66.67	66.67
Percentage of correct negatives	97	98	97	98
Pseudo R^2	0.60	0.45	0.45	0.48
Log-likelihood value	–12.11	–17.9	–17.21	–17.04

Notes: Dependent variable is a binary indicator for a debt crisis. "Robust" clustered standard errors are in parentheses. See the text for precise definitions of variables. Positive signifies crisis year.

***Significant at the 1 percent level.

**Significant at the 5 percent level.

mismatch position leads to a lower likelihood of a debt crisis.[23] But the quadratic pattern suggests that in the neighborhood of an intermediate level of mismatch a marginally better mismatch is associated with a higher chance of a default. The reason is likely to be because those countries that have in fact recently defaulted on their debt but still have the fundamentals that strongly suggest a default have cut their interest payments and thereby have drastically improved their mismatch position (e.g., Argentina and Brazil in the mid-1890s). This makes it appear as if intermediate mismatch positions are associated with fewer crises, when in fact the opposite is the case. We think that the data show that better mismatches are intuitively associated with a lower chance of a debt debacle.

Most other variables have signs that fit our priors. Improvements in the terms of trade, real depreciations, more gold reserves relative to notes outstanding, slower growth of monetary aggregates, and a calmer international environment in capital markets are all associated with lower probabilities of debt crises. The statistical significance of the coefficients on these variables varies, however. Meanwhile, lower local bond spreads (statistically insignificant) and adherence to the gold standard (statistically significant) imply a higher propensity to have a crisis. The positive coefficient on the gold standard does not disappear if we include it in the other specifications, but the coefficient is not statistically indistinguishable from zero.[24]

In figure 4.10 we also present a scatter plot of the marginal effects of the hard-currency debt ratios (calculated at the actual values of the covariates) versus the actual levels of hard-currency debt. We see that for intermediate ranges of original sin that the coefficient varies a lot but is likely to be positive, whereas, toward the extremes, the marginal effects are likely to be near zero or even negative. Figure 4.11 presents the *z*-statistics for the test that the marginal effect is different from zero. When evaluated at the actual values, only a minority of these have *z*-statistics high enough to be considered statistically significant. Only the highest in absolute value are significant. This roughly backs up the visual impression received from the previous figure.

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 noncrisis years that are predicted to be noncrisis 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

23. Recall that our mismatch variable increases as the mismatch decreases.

24. Unreported, likelihood ratio tests between the shorter and longer models cannot reject their equivalence. Perhaps the positive coefficient on the gold standard variable is compatible with theories that argue that rigid exchange rates 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. See Edwards (2003) for a thorough discussion of exchange rate regimes and crises.

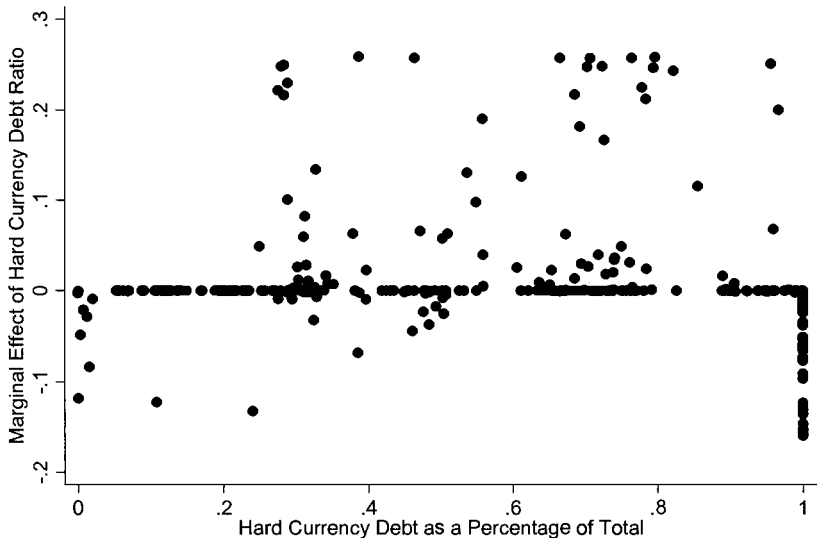

Fig. 4.10 Marginal effect of the ratio of hard currency debt to total debt
Note: Figures are calculated based on the model in column (1) of table 4.1.

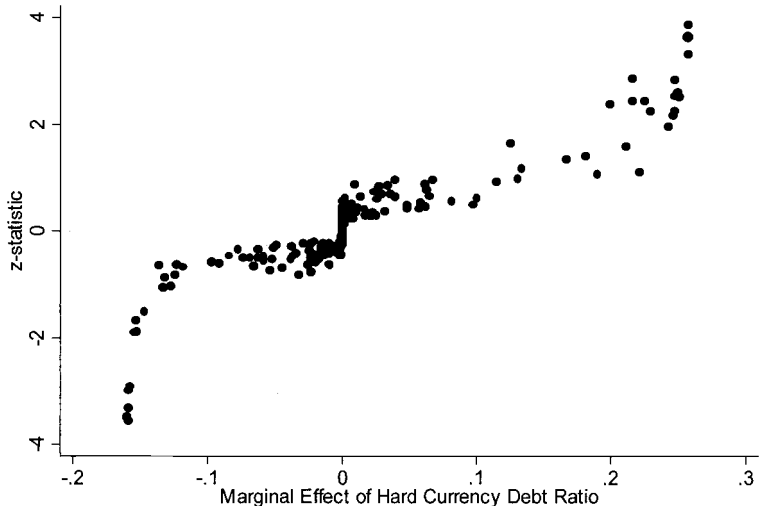

Fig. 4.11 *Z*-statistics by observation from a test of the hypothesis that the marginal effect is zero

fit is relatively good and the type II errors are mainly concentrated in the country years immediately preceding or coming after actual crises.[25]

Column (2) of table 4.1 pares down the number of variables in the specification and looks more closely at the relationship between original sin and debt crises. The quadratic is still evident. The point where the partial derivative of the predicted probability with respect to a change in the hard currency debt ratio became negative is located around 0.35—the point where over a third of all debt becomes payable in hard currency. At the average ratio of hard-currency debt to total debt of 0.45, the marginal effect of an increase in the hard currency to total debt ratio is not statistically distinguishable from zero. It is also interesting to note that observations where the gold cover ratio is high and the level of hard-currency debt is very low or very high provide excellent predictors for the outcome "no debt crisis." For column (1) the statistical software (Stata) reports that over 140 of such outcomes are completely determined. We believe this is the reason why the statistical significance of these factors is so high, and we are reassured that these findings are consistent with priors based on the theoretical framework outlined earlier.[26]

Column (3) shows that mismatches between *interest payments* in hard currency and available reserves can also contribute to crises.[27] Mismatch ratios extend from –0.45 to 1.7, while the marginal effects, evaluated at each observation's covariates and defined as a function of the actual mismatch, extend from about –1 to 2.7. For mismatch ratios from –0.45 to about 0.2, the marginal effects are zero or positive. For mismatch ratios between 0.2 and 0.5, a marginally better mismatch position decreases the predicted likelihood of a debt crisis (i.e., there is a negative coefficient). After a mismatch ratio of around 0.5 is attained, the marginal effect returns to zero. This is to say that there appears to be a point where additions to the reserve base relative to foreign currency interest payments or increases in export capacity have a limited effect on crisis probability. Our previous discussion is one reason why improvements in the mismatch ratio are associated with more crises at low/intermediate levels of the variable.

25. For other types of crises we fail to correctly classify many crisis episodes even at low thresholds. We use the 0.1 barrier for currency and banking crises and 0.03 for the even rarer twin crises. Obviously, our tabulations are sensitive to these thresholds. Our maximum predicted probabilities rarely exceed 0.2 for any type of crisis. Further modifications to the methodology to allow for the rare events nature of the data should be pursued in further work on the topic.

26. The hard-currency debt ratio is not a perfect predictor of debt crises.

27. We found no evidence that mismatches, measured using total debt outstanding (instead of interest payments due), were statistically significant. If we use the mismatch variable with debt outstanding in column 1 instead of current interest payments, we find a statistically insignificant quadratic with nearly the same shape as the reported regressions. If we enter the mismatch variable by itself without the square term then there is a statistically significant and positive relationship between (better) mismatches and debt crises. Our discussion of why there is a quadratic in mismatches probably explains the counterintuitive positive relationship, and the insignificance of the quadratic of the mismatch could be due to errors in trying to capture the actual mismatch position.

Column (4) addresses the relationship between debt intolerance and debt crises in a slightly larger sample than in column (1). Like in column (1), an increase in the debt-to-revenue ratio is negatively associated with crisis incidence when a country has no previous default history. However, when a country had a default prior to 1880, a higher debt-to-revenue ratio increases the chance of having a debt crisis (p-value 0.06). This would appear to be evidence in favor of the debt intolerance hypothesis, but it does not come at the expense of a role for original sin or other debt management policies. Moreover, there still appears to be a quadratic in original sin in this specification.

4.4.2 Currency Crises

Column (1) of table 4.2 presents an inclusive specification where the dependent variable is the probability of having a currency crisis. There are seventeen events to be predicted in this sample. Few variables are statistically significant except for the market portfolio spread and two indicator variables that indicate if a debt crisis or a banking crisis occurred in the next year.

The practical reason we include these *leads* for debt crises and banking crises is because they are good proxies for initial troubles in the banking sector or for unsustainable debt levels.[28] The theoretical reason is that we view a financial crisis unfolding in three stages: first, problems in the banking sector and deterioration in bank, firm, and government balance sheets arise; this generates a currency crisis; finally, a more widespread crisis may ensue, resulting in a full-blown banking crisis and/or debt default. The results in table 4.2 are consistent with this story.

In terms of signs on the coefficients, we still see a quadratic in original sin (though of opposite shape to that found in table 4.1)—a negative relationship between our mismatch variable and no sign of debt intolerance. Some parameters on the other variables have the expected signs while others do not. However, nothing in column (1) besides the crisis leads and the market spread is statistically significant.[29]

28. Better indicators for early trouble in the banking sector might include growth rates of nonperforming assets or bank insolvencies in the year of the currency crisis. None of these are available in a systematic way. In terms of debt, various ratios could be used to judge sustainability. Another reason we use this variable is to show how currency crises precede debt crises and hence indirectly feed through to balance sheet problems associated with original sin.

29. As Flandreau and Zúmer (2004) have emphasized, the debt revenue ratio and the original sin variables can increase when the nominal exchange rate changes and when there is hard-currency debt. To the extent that this supports the argument that a banking crisis or a debt crisis is more likely with a depreciation, then there is no problem here. One problem could arise if we predict currency crises with variables that are functions of the nominal exchange rate. To avoid this issue we tried lagging such variables in the currency crisis specifications. Our results regarding such variables in the currency crisis regressions are similar in qualitative terms when we use one or two lags of mismatch, external to total debt and the debt to revenue ratio.

Table 4.2 Determinants of currency crises

Regressors	(1)	(2)	(3)	(4)
Hard-currency debt as a percentage of total debt	–0.53	–0.34		
	(0.72)	(0.71)		
Square of hard-currency debt ratio	0.40	0.18		
	(0.75)	(0.76)		
Debt/Revenue	–0.03	–0.03	–0.06	–0.04
	(0.04)	(0.04)	(0.04)	(0.04)
Debt/Revenue · periphery indicator	–0.09	–0.11		–0.09
	(0.10)	(0.10)		(0.09)
Periphery indicator	0.72	0.59		0.47
	(0.44)	(0.50)		(0.46)
Mismatch	–0.08	–0.12	–0.07	–0.12
	(0.11)	(0.10)	(0.04)	(0.08)
Growth of terms of trade	8.72	7.56		
	(6.35)	(6.82)		
ln (deviation of real exchange rate from period average)	0.19	–0.1	0.02	0.06
	(0.66)	(0.78)	(0.78)	(0.75)
Trade balance/GDP	0.79	1.31	3.25	2.65
	(1.73)	(1.81)	(1.45)**	(1.26)**
Spread on U.K. consol	–0.02	–0.04		
	(0.07)	(0.08)		
Gold standard dummy	0.43			
	(0.52)			
Growth of the money supply	–0.89			
	(1.01)			
Gold reserves/notes in circulation	–0.34	–0.18	–0.19	–0.13
	(0.45)	(0.44)	(0.27)	(0.40)
Market portfolio spread	0.73	0.75	0.47	0.48
	(0.18)***	(0.20)***	(0.16)***	(0.16)***
Debt crisis in $t + 1$	0.83	0.68	0.42	0.50
	(0.34)**	(0.34)**	(0.33)	(0.38)
Banking crisis in $t + 1$	0.74	0.68	0.71	0.70
	(0.31)**	(0.27)**	(0.30)**	(0.30)**
Constant	–3.00	–2.69	–2.24	–2.48
	(0.79)***	(0.57)***	(0.29)***	(0.47)***
No. of observations	499	505	613	613
Percentage of correct positives	23.5	17.6	23.5	23.5
Percentage of correct negatives	95.4	95.8	96.4	96.1
Pseudo R^2	0.12	0.10	0.10	0.11
Log-likelihood value	–63.8	–65.3	–69.6	–68.57

Notes: Dependent variable is a binary indicator for a currency crisis. "Robust" clustered standard errors are in parentheses. See the text for precise definitions of variables. Positive signifies crisis year.

***Significant at the 1 percent level.

**Significant at the 5 percent level.

We pare down the specification in column (2) and find an intuitive negative relationship between the mismatch variable (measured using total debt outstanding rather than interest payments), which is significant only at the 81 percent level of confidence. This is some very weak evidence that liquidity problems are at play in a currency crisis. The trade balance has a positive sign, as it did in the Frankel and Rose (1996) study of the late twentieth century. Lagging this variable causes the magnitude of the coefficient and its statistical significance to fall, suggesting some endogeneity problems.

We give mismatches a second chance in column (3). Mismatches are associated with a higher probability of a currency crash (p-value of 0.09). This finding does not suggest that original sin is innocuous, but rather suggests that countries that have original sin may be able to avoid currency crises if they manage to collect adequate reserves or are sufficiently open. Moreover, it may back up the argument in Eichengreen, Hausmann, and Panizza (2003) that original sin is a second-best outcome. If countries cannot issue own-currency debt and then are forced by market discipline to hold costly reserves to insure themselves against currency speculation, this may not be socially optimal. Finally, we note that a higher gold cover ratio is associated with a lower probability of a crisis, although it is not statistically significant, and a greater trade surplus relative to GDP is associated with a higher chance of a currency crisis.[30]

In column (4) we drop some of the least significant variables and focus on debt intolerance. This makes for a slightly larger sample. There is no sign that a spotty record on debt combines with the debt burden to generate an increased chance of currency crises. The interaction of the debt ratio with the periphery dummy is negative and larger in absolute terms than the uninteracted coefficient. But all coefficients are far from statistically significant. Though we do not report it, using the pre-1880 default indicator only makes this negative result stronger. It also makes the coefficient on mismatch become highly statistically significant and negative. This implies that improvement in the mismatch is associated with less of a chance of a crisis.

4.4.3 Banking Crises

Banking crises also seem to be associated with original sin and currency mismatches, but not with debt intolerance. The latter might be expected as international perceptions of sovereign debt management and fiscal constraints might not necessarily have an effect on the liquidity or solvency of the banking system. On the other hand, banking trouble associated with

30. The seemingly counterintuitive 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 Great Britain, France, and Switzerland, for example, have highly negative ratios for this variable and have had, of course, very few crises.

currency mismatches and hard-currency liabilities might be expected. We have already seen that currency crises are likely to be followed by banking crises.

When the exchange rate changes precipitously, bank balance sheets could be at risk, for various reasons. In countries with bond-based banking systems, if governments neglected to redeem their bonds in gold terms or had to default because of the increased burden placed on them by gold debt, bank balance sheets could suffer. For similar reasons, if loans are made by international banks or through domestic banks that have international liabilities, currency depreciation could easily impair the net worth of the banking sector. International lending through correspondent banks was prevalent in South America—for example, through the Rothschilds (Brazil) and the House of Baring (in Argentina). Moreover, our results suggest that when countries have a stronger gold reserve position the danger of hard currency debt is lower.

Column (1) of table 4.3 shows again the quadratic relationship between hard currency debt and banking crises. It also shows a significant and negative relationship between our mismatch variable and the probability of a crisis. The existence of a central bank, adherence to the gold standard, lower growth of the money supply (or of the note circulation), appreciation of the real exchange rate, lower gold cover ratios, higher trade deficits, and improvement in the terms of trade are associated with lower chances of a crisis. The square of original sin, mismatch, the trade balance, and the gold standard variable are significant at better than the 10 percent level.[31] Little else is statistically significant here, and the signs on the gold cover ratio and the trade balance are opposite of what one might expect.

Column (2) of table 4.3 shows how the coefficients on the two controls for original sin provide a quadratic fit, but both are statistically insignificant. Nevertheless, the mismatch control has a negative sign and is significant at the 86 percent level of confidence. Column (3) drops the mismatch variable and provides more support for a link between original sin and banking crises as the standard errors on the original sin variables shrink in relation to their point estimates, making them both significant at about the 90 percent level of confidence. Finally, column (4) provides no evidence of debt intolerance. However, mismatches are again significant, as is the negative relationship between the gold standard and banking crises.

Table 4.4 shows that finding determinants of twin crises is more difficult. In the comprehensive specification of column (1), only the trade balance is significant at conventional levels. Nevertheless, the quadratic relationship between original sin and such crises is evident, and each coefficient is

31. The negative gold standard coefficient may be contradictory to the positive coefficient we found in table 4.1. Again, the results are fragile to the particular specification so there is little we can say definitively.

Table 4.3 Determinants of banking crises

Regressors	(1)	(2)	(3)	(4)
Hard-currency debt as a percentage of total debt	1.32	0.62	1.10	
	(0.71)	(0.92)	(0.67)	
Square of hard-currency debt ratio	–2.36	–0.90	–1.20	
	(0.70)***	(0.84)	(0.71)	
Debt/Revenue	–0.05	–0.05	–0.01	–0.05
	(0.05)	(0.04)	(0.02)	(0.05)
Debt/Revenue · periphery indicator	–0.04			
	(0.08)			
Periphery indicator	–1.15			
	(0.92)			
Debt/Revenue · pre-1880 default				–0.10
				(0.07)
Pre-1880 default				0.02
				(0.52)
Mismatch	–0.17	–0.07		–0.16
	(0.07)**	(0.05)		(0.08)**
Growth of terms of trade	–7.01			–6.67
	(5.47)			(5.52)
ln (deviation of real exchange rate from period average)	–0.81	–0.24	–0.21	–0.33
	(0.85)	(0.72)	(0.70)	(0.29)
Trade balance/GDP	6.50	4.93	4.17	4.60
	(2.11)***	(1.98)**	(1.83)**	(2.41)
Central bank indicator	–0.54	–0.12	–0.02	0.07
	(0.43)	(0.28)	(0.23)	(0.32)
Gold standard dummy	–0.87	–0.33	–0.23	–0.65
	(0.42)**	(0.33)	(0.28)	(0.35)
Growth of the money supply	1.03	0.67	0.65	
	(1.11)	(0.87)	(0.88)	
Gold reserves/notes in circulation	0.82	0.99	0.65	0.78
	(0.47)	(0.40)***	(0.25)***	(0.48)
Market portfolio spread	0.38	0.41	0.39	0.42
	(0.30)	(0.27)	(0.25)	(0.25)
Constant	–0.82	–2.26	–2.43	–1.95
	(0.84)	(0.39)***	(0.34)***	(0.53)***
No. of observations	485	549	549	491
Percentage of correct positives	27.7	10.5	5.2	21
Percentage of correct negatives	96	97.1	98.1	96.6
Pseudo R^2	0.11	0.07	0.06	0.08
Log-likelihood	–68.46	–76.9	–77.8	–74.1

Notes: Dependent variable is a binary indicator for a banking crisis. "Robust" clustered standard errors are in parentheses. See the text for precise definitions of variables. Positive signifies crisis year.

***Significant at the 1 percent level.

**Significant at the 5 percent level.

Table 4.4 Determinants of twin crises

Regressors	(1)	(2)	(3)
Hard-currency debt as a percentage of total debt	1.33	0.39	1.51
	(0.77)	(0.47)	(0.61)**
Square of hard-currency debt ratio	–1.83		–1.46
	(0.98)		(0.72)**
Hard-currency ratio · (reserves/imports)		–1.21	
		(0.89)	
Reserves/Imports		1.42	
		(0.66)**	
Debt/Revenue	0.008	0.04	0.03
	(0.08)	(0.03)	(0.02)
Debt/Revenue · periphery indicator	–0.05		
	(0.13)		
Periphery indicator	–0.42		
	(0.65)		
Mismatch	–0.09		
	(0.09)		
Growth of terms of trade	–11.39		
	(8.38)		
ln (deviation of real exchange rate from period average)	0.18	–0.13	0.09
	(0.47)	(0.37)	(0.33)
Trade balance/GDP	5.14		3.11
	(2.6)**		(1.80)
Spread on U.K. consol	0.08		
	(0.06)		
Gold reserves/notes in circulation	–0.52	–1.57	–0.56
	(0.61)	(0.53)***	(0.41)
Market portfolio spread	0.12	0.25	0.16
	(0.22)	(0.13)	(0.15)
Constant	–2.04	–2.68	–2.58
	(0.51)***	(0.45)***	(0.25)***
No. of observations	497	625	605
Percentage of correct positives	50	50	50
Percentage of correct negatives	89.9	87	88.7
Pseudo R^2	0.13	0.10	0.11
Log-likelihood value	–35.6	–38.3	–37.9

Notes: Dependent variable is a binary indicator for a twin crisis. "Robust" clustered standard errors are in parentheses. Positive signifies crisis year. See the text for precise definitions of variables.

***Significant at the 1 percent level.

**Significant at the 5 percent level.

significant at a bit better than the 90 percent confidence level (p-values are 0.083 and 0.060 respectively). In column (2) we control for mismatches with an interaction between original sin and the reserve-to-import ratio. We find that the debt revenue ratio is positively associated with twin crises (p-value 0.118) and that higher gold cover ratios and a more tranquil international

environment (p-value 0.053) are associated with fewer twin crises.[32] The interaction terms suggest that more reserves decrease the chances of having a twin crisis, but this effect is not statistically significant. The specification in column (2) also suggests that a higher ratio of reserves to imports is associated with a greater chance of a twin crisis. Perhaps this is because crisis-prone countries stock up on reserves prior to a crisis. Column (3) eliminates some of the variables and still finds a hump-shaped relationship (positive below a ratio of about 0.5 and negative above) between original sin and twin crises, with each coefficient significant when evaluated at the means. Further specifications revealed no particular relationships between our other measure of mismatches, default history, and twin crises.

4.4.4 Robustness and Reflections

Earlier, 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. One possibility is that the level of original sin is correlated with factors or characteristics of countries we have left out of the analysis. That is to say, perhaps those most at risk take care to protect their financial systems from crises or have effective ways of dealing with crises despite their high levels of original sin. If these factors were constant over time, an econometric solution to such a problem is to include country-level indicator variables.

Since this is infeasible to do in a limited dependent variable model with our particular data configuration, we move to a "fixed effects" linear probability model estimated by ordinary least squares (OLS). Table 4.5 respecifies the models of column (1) from tables 4.1 through 4.4 in this way. Like the previous results, the models fit fairly poorly since there are so few crises compared to noncrisis years. Many of the coefficients on the basic macro-controls are statistically insignificant. Nevertheless, the results regarding the coefficients on the original sin and mismatch variables are qualitatively very similar to the findings in the previous tables.

For debt crises, we find evidence of the very same quadratic pattern from table 4.1. We cannot reject the hypothesis that the coefficients on hard-currency debt and its square are different from zero at the 95 percent confidence level. For currency crises, the link between a crisis and original sin is indirect and seems to be coming through the outbreak of banking problems or eventual debt crises. Also, columns (3) and (4) show that better mismatches are associated with lower chances of having a banking crisis or a

32. Throughout the paper we have used the GDP-weighted spread on consols as a time-specific measure of international capital market turbulence. It is also a fact that this measure declines strongly over time and could be picking up other factors, such as increased liquidity in international capital markets, a more tranquil political environment, the shift from deflation after 1896 (as Flandreau, Le Cacheux, and Zúmer [1998] argue), and other environmental factors that change over time in step.

Table 4.5 "Fixed effects" linear probability specifications

Regressors	Debt crises (1)	Currency crises (2)	Banking crises (3)	Twin crises (4)
Hard-currency debt as a percentage of total debt	0.14	–0.11	0.14	0.08
	(0.10)	(0.14)	(0.16)	(0.10)
Square of hard-currency debt ratio	–0.29	–0.06	–0.19	–0.19
	(0.11)***	(0.14)	(0.16)	(0.11)
Debt/Revenue	0.01	0.004	–0.01	0.002
	(0.01)	(0.01)	(0.01)	(0.01)
Debt/Revenue · periphery indicator		–0.01	0.0003	0.003
		(0.02)	(0.01)	(0.01)
Debt/Revenue · pre-1880 default	0.01			
	(0.01)			
Mismatch	0.11	–0.01	–0.03	–0.02
	(0.09)	(0.01)	(0.01)***	(0.01)***
Square of mismatch	–0.11			
	(0.08			
Growth of terms of trade	–0.39	0.66	–0.72	–0.51
	(0.43)	(0.58)	(0.62)	(0.41)
ln (deviation of real exchange rate from period average)	–0.22	0.02	–0.11	–0.03
	(0.06)***	(0.08)	(0.08)	(0.05)
Trade balance/GDP	–0.18	–0.01	0.29	0.1
	(0.20)	(0.29)	(0.30)	(0.20)
Spread on U.K. consol	0.04			
	(0.01)***			
Central bank indicator			0.02	
			(0.08)	
Gold standard dummy	–0.02	–0.08	–0.08	
	(0.03)	(0.04)	(0.04)	
Growth of the money supply	0.02	–0.12	0.23	
	(0.06)	(0.09)	(0.10)**	
Gold reserves/notes in circulation	0	0.03	0.03	0.01
	(0.07)	(0.06)	(0.07)	(0.04)
Market portfolio spread	–0.01	0.04	0.02	–0.002
	(0.02)	(0.03)	(0.03)	(0.02)
Debt crisis in $t + 1$		0.08		
		(0.05)		
Banking crisis in $t + 1$		0.1		
		(0.04)**		
Constant	–0.14	0.05	0.04	0.01
	(0.06)**	(0.09)	(0.11)	(0.06)
No. of observations	371	499	485	497
R^2	0.06	0.004	0.008	0.01
F-stat	6.81	1.34	1.93	2.02

Notes: Dependent variable is a binary indicator for a banking crisis. Estimation is by OLS. "Robust" clustered standard errors are in parentheses. See the text for precise definitions of variables.

***Significant at the 1 percent level.

**Significant at the 5 percent level.

twin crisis. The coefficients are highly statistically significant as well. For these latter types of crisis it could be said that better reserve positions or being more open to exports for a given level of original sin helped avoid trouble.

We are also apparently left with the result that time-invariant underlying fundamentals like empire status or resource endowments cannot explain how places like the United States, Canada, Australia, and Scandinavia managed to carry high original sin and also avoid severe financial crises. This suggests the possibility that these places had a more active approach to managing crises or that their financial systems were structured in a way that helped stave off financial meltdown following a major shock.[33] Opposite these 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.

In part, such omitted factors may be playing a role in giving rise to the hump-shaped relationship between crisis probability and hard-currency debt.[34] They probably explain why the positive marginal effect of original sin becomes negative at high levels of original sin. Predicted values of having a debt crisis from the regression in column (2) of table 4.1 and the actual values of original sin are shown in figure 4.12. The countries at the far right end of the figure (the United States, Canada, and Australia) with total foreign currency and gold clause debt were special cases.[35] They may have had other means of protecting themselves from reversals and long, drawn-out crises.

33. 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 United States 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.

34. In other un-reported specifications, we 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 bank 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 small countries with lots of original sin, like 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 (2004) talk about currency-trust and country-trust, which could be factors at play here but are not easily captured by any one explanatory variable.

35. Two data points, Argentina in 1893 and 1894, just after the Baring crisis, are notable exceptions to the rest of the scatter. The fact that the crisis had not yet been fully resolved explains why the predicted values are so high, and because of this we do not believe that this negates the quadratic relationship we have identified.

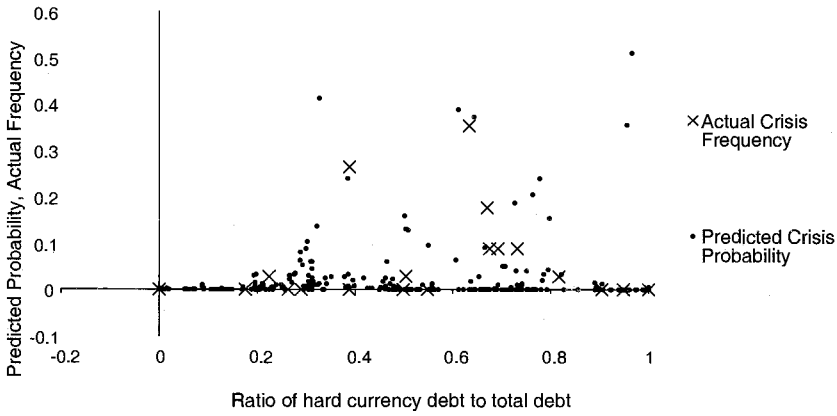

Fig. 4.12 Actual and predicted debt crisis frequencies versus the ratio of hard currency public debt to total public debt, 1880–1913

Notes: Predicted values come from the probit "regression" in column (2) of table 4.1. They are the predicted probabilities arising from the probit likelihood function using the estimated coefficients and evaluating the function at the actual covariates for each country year observation. Actual frequencies of debt crises are calculated as in figure 4.4. The actual frequencies are plotted against the period average values of the hard currency debt ratio. The predicted probabilities are plotted against the ratio in the given year. See text for other definitions.

The United States was lucky to have had a deep and relatively well-functioning financial system, allowing it to resolve crises rapidly. Public debt levels were fairly low, were well-managed since Alexander Hamilton's funding plan in 1790, and from a long-term perspective had sound economic fundamentals. Canada, Australia, and New Zealand had branch banking. The short maturities at which intermediaries lent their funds allowed for more prudent risk-taking by borrowers. The dominions and the United States, then, shared the fundamentals, the fiscal institutions, and the creditor protections necessary to maintain good borrowing practices.

The commitment and ability to maintain gold pegs in the British Commonwealth were stronger and more durable than in the independent countries with sovereign governments and national monetary systems. New Zealand banks held large sterling asset positions in London and also had an incentive to maintain the peg against sterling. Creditors to the dominions often felt that repayment was a certainty because many issues carried the guarantee of the British government. Debt was also given trustee status later in this period. This channelled Trustee Saving Bank funds into colonial securities, raising bond prices and making investors feel that such securities were less risky than they probably were. In such a case, this debt was less likely to give rise to self-fulfilling crises.

All of this suggests that without the special relationships and other idiosyncrasies that allowed for a robust reaction in turbulent times unique to

these British offshoots and the United States (and perhaps others, such as the Scandinavian countries), original sin is positively associated with the frequency of crises. The countries in the southern cone of Latin America and southern and eastern Europe (e.g., Argentina, Brazil, Portugal, Spain, Italy, Greece, and Russia) that embraced global financial flows but did not adequately fortify their financial systems each faced at least one severe financial crisis enveloping the banking system, the currency, and usually the national debt between 1880 and 1913.[36]

The other group of countries toward the left hand side of figure 4.12 deserves some mention too. First, many financial centers, like Great Britain, France, and the Netherlands are here. Their low levels of original sin, liquid markets, and sound fundamentals made crisis management easier. One notable exception that looks more like a periphery country, however, seems to have been Austria-Hungary, which had established a significant domestic debt market in our period. This likely reflected much-improved fiscal fundamentals (see Flandreau and Komlos 2002 and Komlos 1987).[37]

A number of other European countries in the middle group that had lower levels of original sin than the settler countries and Scandinavia but were financially crisis prone (e.g., Spain, Portugal, and Italy) had sizeable domestic currency debt markets, and some even had sovereign bond issues denominated in their own currencies listed on the exchanges in London and Paris. These countries were quite open to international trade and had developed financial centers much earlier, reflecting their entrepôt position within European trade (Flandreau and Sussman 2005).

While the precedent of domestic debt issue had been established in these countries, fiscal and financial soundness did not prevail. In reaction to their vulnerability, some of these countries developed methods of crisis prevention not used in the dominions or in the United States. The affidavit system required domestic creditors be paid in paper money while foreigners were paid in gold (see Tattara 2003). But these experiences also further demonstrate that hard currency debt made it more difficult to manage a crisis event, and the repercussions of a bad shock were all the greater when not dealt with in a just and efficient way.

Overall, our results suggest that the contemporary theoretical framework that views balance sheets as important determinants of financial crises are just as valid during the late nineteenth century. Like the late twentieth century, this period was one of freely flowing cross-border cap-

36. Eichengreen, Hausmann, and Panizza (2003, 15) might agree: "In particular, countries with strong institutions, capable of running strong policies, are in the best position to cope with the potential mismatch problem." To solve the problem of original sin, policymakers must decide whether it is easier to take steps to eliminate original sin or to fortify the financial system and live with original sin in the medium run.

37. There was also an effort to increase the transparency of the budgetary process and an increase in creditors' protection in this period. See Becker (1913).

ital flows that met with various levels of financial sophistication and fiscal rigor in its global reach for yield. As financial weaknesses became apparent, the markets reacted in ways reminiscent of the financial crises of the 1990s.

4.5 Conclusions

We believe we have found some interesting features in the data that have not previously been systematically addressed in either contemporary or historical literatures. Most importantly, we find that hard-currency debt may not always generate financial crises. Some countries with very high levels of original sin have apparently been less prone to debt crises than those with intermediate levels. Aside from these extreme cases where original sin seems less dangerous, there appears to be a positive relationship between original sin and the incidence of debt crises.

It is interesting that we find that holding our currency mismatch measure constant, more original sin makes countries more crisis prone up to a certain point, and then less vulnerable to debt crises that are often the culmination of a full-blown financial catastrophe. One plausible explanation is that countries with high levels of original sin also had natural hedges, better balance sheets, or better ways of dealing with financial stress that are hard to quantify. This is compelling, because we know anecdotally that the dominions had large sterling balances and that they had good fiscal institutions. A question for further research is whether it was the structure of their financial systems or the actual level of sterling bank assets which we cannot determine. We tend to think it is the former rather than the latter.

Holding original sin levels constant, we also find that mismatches matter. When countries have hard-currency obligations, they seem less prone to debt, banking, or currency crises when they offset these liabilities with gold reserves or are more open. This obviously does not negate the idea that original sin could be responsible for currency and banking trouble. Those countries that do not hold sufficient reserves in their banking sectors, which may be a reflection of either weak banking structure, and/or a lack of political will to take adequate insurance, face a higher chance of a crisis situation. The absence of original sin could be an improvement for such countries if the goal is to reduce crisis incidence.[38] At the same time, it also highlights our key finding—that countries can and have found ways to avoid financial fragility when they have dollarized liabilities.

These results also tend to confirm that it is difficult to find robust determinants of financial crises. This suggests that standard econometric ap-

38. This, of course, leaves open the question of social optimality. Perhaps hard-currency debt is a disciplining device, or asset holders would be worse off without hard-currency debt. The question deserves more research.

proaches may not be resoundingly successful or that the theory is too abstract to deal with the messy reality of historical crisis episodes. These complications are in addition to the other data problems we mentioned. Still, as a means of summarizing the data, multivariate analysis can be useful.

The ostensible quadratic relationship between hard-currency debt relative to total debt and debt crises is the most novel. Why is it there? We believe that this quadratic is obscuring a positive relationship between hard-currency debt and debt crises that exists for the average small, independent, emerging market type of country.

So the lesson for today's and tomorrow's emerging market economies is to become more like today's advanced countries. Many of the leading economies today had original sin even as they received massive capital inflows from abroad. They also faced limited exposure to crises. What was involved was following careful debt management policies and the development of sound fiscal and financial institutions. In the interim, large foreign exchange reserves and a strong export position can also help governments and firms to navigate the choppy waters of global finance.

Data Appendix

General Notes

Debt: In general we have defined external debt or hard currency debt as the amount outstanding of long-term debt issued abroad plus the amount outstanding of domestic gold (or silver) debt. Internal debt refers to the outstanding stock of debt payable exclusively in domestic currency. However, in a few cases listed below we have not been able to discern from the sources how much of the domestic or internal debt was payable in gold. More work will have to be put into these cases. However, one will note that for these cases the total amount of domestic debt is rather small.

Real exchange rates: The real exchange rate is defined as the product of the exchange rate (price of local currency per pound) and the U.K. price level divided by the local price level. Price levels come from Obstfeld and Taylor (2003). We use the percentage deviation from the within country average to obviate problems with levels. The average is taken over the entire period 1880–1913.

Market portfolio spread: We use a GDP-weighted average spread of long-term bonds against the British consol constructed by Obstfeld and Taylor (2003) to control for time-specific international changes in capital markets.

Exchange rate regimes: Data on gold standard adherence comes from Meissner (2005), augmented with data from Obstfeld and Taylor (2003).

Default indicator: Our default indicator was created if there were one or more defaults prior to 1880. This 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. 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 the 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). We have relied extensively on data underlying Bordo et al. and Obstfeld and Taylor (2003). We cite these papers below though data is available by personal communication.

Argentina

Total outstanding government debt, external hard-currency debt, and domestic paper debt: Total funded debt from 1880 to 1913 from Vázquez-Presedo (1988). The external debt data from 1880 to 1891 comes from Conde (1995). The percentage of debt serviced in gold was taken from Flandreau and Zúmer (2004).

Government revenue: Flandreau and Zúmer (2004).

Terms of trade: Obstfeld and Taylor (2003).

Interest service on debt: Flandreau and Zúmer (2004).

Real exchange rate: Obstfeld and Taylor (2003).

Exports: Flandreau and Zúmer (2004).

Imports: Barbieri (2000).

Nominal GDP: Obstfeld and Taylor (2003).

Yield spread between British consols: Obstfeld and Taylor (2003).

Growth of the money supply: Data underlying Bordo et al. (2001).

Gold reserves: Flandreau and Zúmer (2004).

Notes in circulation: Flandreau and Zúmer (2004).

Australia

Total outstanding government debt, external hard-currency debt, and domestic paper debt: Total debt: Ferguson and Schularick (2006); percentage

of debt payable in gold or foreign currency, Bordo, Meissner, and Redish (2005).
Government revenue: Mitchell (1993a).
Terms of trade: Obstfeld and Taylor (2003).
Real exchange rate: Obstfeld and Taylor (2003).
Exports: Mitchell (1993a).
Imports: Mitchell (1993a).
Nominal GDP: Bordo et al. (2001).
Yield spread between British consols: Obstfeld and Taylor (2003).
Growth of the money supply: Data underlying Bordo et al. (2001).
Gold reserves: Mitchell (1993a).
Notes in circulation: Mitchell (1993a).
GDP-weighted average spread on British consol: Obstfeld and Taylor (2003).

Austria-Hungary

Total outstanding government debt, external hard-currency debt, and domestic paper debt: The source is the statistical yearbooks for both countries. External debt consists of domestic gold debt and foreign currency debt. Internal debt is domestic paper debt. Data for 1880 is from Flandreau and Zúmer (2004).
Interest service on debt: Flandreau and Zúmer (2004).
Government revenue: Flandreau and Zúmer (2004).
Terms of trade: Obstfeld and Taylor (2003).
Real exchange rate: Obstfeld and Taylor (2003).
Exports: Flandreau and Zúmer (2004).
Imports: Mitchell (1992).
Nominal GDP: Obstfeld and Taylor (2003).
Yield spread between British consols: Obstfeld and Taylor (2003).
Growth of the money supply: Bordo et al. (2001).
Gold reserves: Flandreau and Zúmer (2004).
Notes in circulation: Flandreau and Zúmer (2004).

Belgium

Total outstanding government debt, external hard-currency debt, and domestic paper debt: Total public debt from *Annuaire Statistique and Fenn's Compendium.* Level of debt payable in gold is from Flandreau and Zúmer (2004).
Interest service on debt: Flandreau and Zúmer (2004).
Government revenue: Flandreau and Zúmer (2004).
Terms of trade: Obstfeld and Taylor (2003).
Real exchange rate: Obstfeld and Taylor (2003).
Exports: Flandreau and Zúmer (2004).
Imports: Barbieri (2000).

Nominal GDP: Obstfeld and Taylor (2003).
Yield spread between British consols: Obstfeld and Taylor (2003).
Growth of the money supply: Bordo et al. (2001).
Gold reserves: Flandreau and Zúmer (2004).
Notes in circulation: Flandreau and Zúmer (2004).

Brazil

Total outstanding government debt, external hard-currency debt, and domestic paper debt: Debt in foreign currency (1880–1914), domestic paper, and gold debt (1880–1912) from *Statistical Yearbook* and Levy (1995). For 1913 and 1914 the data given in the sources for external debt only included foreign currency debt and was denominated in sterling.
Interest service on debt: Flandreau and Zúmer (2004).
Government revenue: Flandreau and Zúmer (2004).
Terms of trade: Clemens and Williamson (2004).
Real exchange rate: Obstfeld and Taylor (2003).
Exports: Flandreau and Zúmer (2004).
Imports: Barbieri (2000).
Nominal GDP: Obstfeld and Taylor (2003) and Bordo et al. (2001).
Yield spread between British consols: Obstfeld and Taylor (2003).
Growth of the money supply: Bordo et al. (2001).
Gold reserves: Flandreau and Zúmer (2004).
Notes in circulation: Flandreau and Zúmer (2004).

Canada

Total outstanding government debt, external hard-currency debt, and domestic paper debt: Bordo, Meissner, and Redish (2005).
Government revenue: Mitchell (1993b).
Terms of trade: Obstfeld and Taylor (2003).
Real exchange rate: Obstfeld and Taylor (2003).
Exports: Mitchell (1993b).
Imports: Mitchell (1993b).
Nominal GDP: Bordo et al. (2001).
Yield spread between British consols: Obstfeld and Taylor (2003).
Growth of the money supply: Data underlying Bordo et al. (2001).
Gold reserves: Mitchell (1993b).
Notes in circulation: Mitchell (1993b).

Chile

Total outstanding government debt, external hard-currency debt, and domestic paper debt: External and domestic debt from 1880 to 1897 from Molino (1898; no information about domestic gold debt). From 1898 onward the source is the statistical yearbook for Chile for internal gold,

external and domestic paper debt. 1911–12, total and foreign debt come from Ferguson and Schularick (2006).
Government revenue: Mitchell (1993b).
Terms of trade: Obstfeld and Taylor (2003).
Real exchange rate: Obstfeld and Taylor (2003).
Exports: Barbieri (2000).
Imports: Barbieri (2000).
Nominal GDP: Obstfeld and Taylor (2003).
Growth of the money supply: Data underlying Bordo et al. (2001).
Gold reserves: 1887–95, Molino (1898).
Notes in circulation: Mitchell (1993b).

Denmark

Total outstanding government debt, external hard-currency debt, and domestic paper debt: For 1880, 1886 and 1890 the source is *Fenn's Compendium.* No information about domestic gold debt was available but our numbers are highly consistent with Flandreau and Zúmer's (2004) for the total debt payable in gold. Total debt: 1881, 1882, 1884, 1885, 1887–89, 1891–93, Ferguson and Schularick (2006). 1894–1913, Statistical Yearbook. Debt payable in gold 1881–85, 1887–89, 1891–93, Flandreau and Zúmer (2004); 1894–1913 Statistical Yearbook.
Interest service on debt: Flandreau and Zúmer (2004).
Government revenue: Flandreau and Zúmer (2004).
Terms of trade: Obstfeld and Taylor (2003).
Real exchange rate: Obstfeld and Taylor (2003).
Exports: Flandreau and Zúmer (2004).
Imports: Barbieri (2000).
Nominal GDP: Bordo et al. (2001).
Yield spread between British consols: Clemens and Williamson (2004).
Growth of the money supply: Bordo et al. (2001).
Gold reserves: Flandreau and Zúmer (2004).
Notes in circulation: Flandreau and Zúmer (2004).

Egypt

Total outstanding government debt, external hard-currency debt, and domestic paper debt: 1880–1915 total public debt, Government revenues and government expenditures from Crouchley (1938). Consumer Price Indexes 1913 to 1915, Money supply 1901–15 (includes Currency and Bank notes in circulation and deposits in savings banks), are from Mitchell (1993b) and Crouchley. For foreign trade aggregates and crisis dates the source is Crouchley.
Government revenue: Mitchell (1993a).
Terms of trade: Obstfeld and Taylor (2003).

Real exchange rate: Obstfeld and Taylor (2003).
Exports: Barbieri (2000).
Imports: Barbieri (2000).
Nominal GDP: Obstfeld and Taylor (2003).
Yield spread between British consols: Obstfeld and Taylor (2003).
Growth of the money supply: Bordo et al. (2001).
Gold reserves: Not available.
Notes in circulation: Not available.

Finland

Total outstanding government debt, external hard-currency debt, and domestic paper debt: 1880–1915 public debt in marks from statistical yearbook. 1881, 1891 foreign and domestic debt from *Fenn's Compendium.* It appears that the entire debt was external before 1915. Yearbook presents total debt from 1880 to 1901 and then only foreign debt from 1901 to 1915, but the values for external and total debt in 1901 are the same. If we consider the data from *Fenn's,* the ratio of external to total was 88 percent in 1881 and 92 percent in 1891.
Government revenue: Not available.
Terms of trade: Obstfeld and Taylor (2003).
Real exchange rate: Obstfeld and Taylor (2003).
Exports: Mitchell (1992).
Imports: Mitchell (1992).
Nominal GDP: Bordo et al. (2001).
Yield spread between British consols: Obstfeld and Taylor (2003).
Growth of the money supply: Data generously made available by Alan M. Taylor, UC Davis.
Gold reserves: Obstfeld and Jones (2003).
Notes in circulation: Mitchell (1992).

France

Total outstanding government debt, external hard-currency debt, and domestic paper debt: Flandreau and Zúmer (2004).
Government revenue: Flandreau and Zúmer (2004).
Interest service on debt: Flandreau and Zúmer (2004).
Terms of trade: Obstfeld and Taylor (2003).
Real exchange rate: Obstfeld and Taylor (2003).
Exports: Flandreau and Zúmer (2004).
Imports: Barbieri (2000).
Nominal GDP: Bordo et al. (2001).
Yield spread between British consols: Obstfeld and Taylor (2003).
Growth of the money supply: Bordo et al. (2001).
Gold reserves: Flandreau and Zúmer (2004).
Notes in circulation: Flandreau and Zúmer (2004).

Germany

Total outstanding government debt, external hard-currency debt, and domestic paper debt: State debt is excluded; Flandreau and Zúmer (2004).
Interest service on debt: Flandreau and Zúmer (2004).
Government revenue: Flandreau and Zúmer (2004).
Terms of trade: Obstfeld and Taylor (2003).
Real exchange rate: Obstfeld and Taylor (2003).
Exports: Flandreau and Zúmer (2004).
Imports: Barbieri (2000).
Nominal GDP: Bordo et al. (2001).
Yield spread between British consols: Clemens and Williamson (2004).
Growth of the money supply: Data underlying Bordo et al. (2001).
Gold reserves: Flandreau and Zúmer (2004).
Notes in circulation: Flandreau and Zúmer (2004).

Greece

Total outstanding government debt, external hard-currency debt, and domestic paper debt: 1881, external and total debt from *Fenn's.* 1885–1913, Flandreau and Zúmer (2004).
Interest service on debt: Flandreau and Zúmer (2004).
Government revenue: Flandreau and Zúmer (2004).
Terms of trade: Obstfeld and Taylor (2003).
Real exchange rate: Prices from Flandreau and Zúmer (2004), exchange rates, Bordo and Jonung (1996).
Exports: Flandreau and Zúmer (2004).
Imports: Barbieri (2000).
Nominal GDP: Kostelenos (1995).
Yield spread between British consols: Obstfeld and Taylor (2003).
Growth of the money supply: Data underlying Bordo et al. (2001).
Gold reserves: Flandreau and Zúmer (2004).
Notes in circulation: Flandreau and Zúmer (2004).

India

Total outstanding government debt, external hard-currency debt, and domestic paper debt: Funded rupee debt and funded sterling debt from Reserve Bank of India *Banking and Monetary Statistics of India* (1954). No information about domestic gold debt. Money supply data from Goldsmith (1983).
Government revenue: Mitchell (1993a).
Terms of trade: Obstfeld and Taylor (2003).
Real exchange rate: Obstfeld and Taylor (2003).
Exports: Mitchell (1993a).
Imports: Mitchell (1993a).

Nominal GDP: Obstfeld and Taylor (2003).
Yield spread between British consols: Obstfeld and Taylor (2003).
Growth of the money supply: Data underlying Bordo et al. (2001).
Gold reserves: Not available.
Notes in circulation: Mitchell (1993a).
Population: Clemens and Williamson (2004).

Italy

Total outstanding government debt, external hard-currency debt, and domestic paper debt: Total and foreign debt from Zamagni (1998, 1999). Foreign debt includes only rendita interest paid abroad in foreign currency or gold. See Flandreau and Zúmer (2004) for a short discussion on this point.
Interest service on debt: Flandreau and Zúmer (2004).
Government revenue: Flandreau and Zúmer (2004).
Terms of trade: Obstfeld and Taylor (2003).
Real exchange rate: Obstfeld and Taylor (2003).
Exports: Flandreau and Zúmer (2004).
Imports: Barbieri (2000).
Nominal GDP: Bordo et al. (2001).
Yield spread between British consols: Obstfeld and Taylor (2003).
Growth of the money supply: Bordo et al. (2001)
Gold reserves: Flandreau and Zúmer (2004).
Notes in circulation: Flandreau and Zúmer (2004).

Japan

Total outstanding government debt, external hard-currency debt, and domestic paper debt: Internal and external debt from 1892–1913, *Statistical Yearbook of Japan,* no information was given about domestic gold debt. 1882 and 1887 foreign and total debt from Fenn's (no information about domestic gold debt). Total debt 1880–91 from Kikuchi (1904). 1897 foreign debt source is Furuya (1928), which includes government foreign bonds, domestic bonds sold abroad, domestic bonds shipped abroad, and corporation bonds. This series hence may contain some paper bond issues held abroad which would contaminate our measure of original sin. The amounts would not be large, we conjecture.
Government revenue: Mitchell (1993a).
Terms of trade: Obstfeld and Taylor (2003).
Real exchange rate: Obstfeld and Taylor (2003).
Exports: Mitchell (1993a).
Imports: Barbieri (2000).
Nominal GDP: Bordo et al. (2001).
Yield spread between British consols: Obstfeld and Taylor (2003).

Growth of the money supply: Data underlying Bordo et al. (2001).
Gold reserves: Jones and Obstfeld (2000).
Notes in circulation: Masayoshi (1899).

Mexico

Total outstanding government debt, external hard-currency debt, and domestic paper debt: External and internal debt from Bazant (1968), Ludlow & Marichal (1998) and Perez-Siller (1995). Only includes federal debt, no information about domestic gold or silver debt. Total debt and foreign debt 1881, 1883, 1885, 1891, 1892, 1895, 1897–1904, 1906–10, Ferguson and Schularick (2006).
Government revenue: Mitchell (1993b).
Terms of trade: Obstfeld and Taylor (2003).
Real exchange rate: Obstfeld and Taylor (2003).
Exports: Barbieri (2000).
Imports: Barbieri (2000).
Nominal GDP: Not available.
Yield spread between British consols: Obstfeld and Taylor (2003).
Growth of the money supply: Mitchell (1993b). Money supply includes deposits in commercial banks and currency and bank notes in circulation.
Gold reserves: Not available.
Notes in circulation: Mitchell (1993b).
Population: Clemens and Williamson (2004).

The Netherlands

Total outstanding government debt, external hard-currency debt, and domestic paper debt: Total consolidated debt sources are statistical yearbook and *Fenn's*. Except 1882–85, Flandreau and Zúmer (2004). Following Flandreau and Sussman (2005), Netherlands had no hard currency debt.
Interest service on debt: Flandreau and Zúmer (2004).
Government revenue: Flandreau and Zúmer (2004).
Terms of trade: Obstfeld and Taylor (2003).
Real exchange rate: Obstfeld and Taylor (2003).
Exports and Imports: Smits, Horlings, and van Zanden (1999).
Exports: Flandreau and Zúmer (2004).
Imports: Barbieri (2000).
Nominal GDP: Obstfeld and Taylor (2003).
Yield spread between British consols: Obstfeld and Taylor (2003).
Growth of the money supply: 1880–99 measured as the growth of M3. 1901–13, growth of money supply is the growth of M2. Data generously made available by Alan M. Taylor.

Gold reserves: Flandreau and Zúmer (2004).
Notes in circulation: Flandreau and Zúmer (2004).

New Zealand

Total outstanding government debt, external hard-currency debt, and domestic paper debt: Bordo, Meissner, and Redish (2005).
Government revenue: Mitchell (1993a).
Terms of trade: Obstfeld and Taylor (2003).
Real exchange rate: Obstfeld and Taylor (2003).
Imports: Mitchell (1993a).
Exports: Mitchell (1993a).
Nominal GDP: Bordo et al. (2001), Obstfeld and Taylor (2003).
Yield spread between British consols: Obstfeld and Taylor (2003).
Growth of the money supply: Data underlying Bordo et al. (2001).
Gold reserves: Not available.
Notes in circulation: Mitchell (1993a).

Norway

Total outstanding government debt, external hard-currency debt, and domestic paper debt: External and domestic debt from statistical yearbook. No information about whether the domestic debt was payable in specie. It is possible that the domestic debt actually had gold clauses. Still, the amount of domestic debt as a part of the total is very small.
Interest service on debt: Flandreau and Zúmer (2004).
Government revenue: Flandreau and Zúmer (2004).
Terms of trade: Obstfeld and Taylor (2003).
Real exchange rate: Obstfeld and Taylor (2003).
Exports: Flandreau and Zúmer (2004).
Imports: Mitchell (1992).
Nominal GDP: Bordo et al. (2001).
Yield spread between British consols: Obstfeld and Taylor (2003).
Growth of the money supply: Data underlying Bordo and Jonung (1996).
Gold reserves: Flandreau and Zúmer (2004).
Notes in circulation: Flandreau and Zúmer (2004).

Peru

Total outstanding government debt, external hard-currency debt, and domestic paper debt: Not available.
Government revenue: Mitchell (1993b).
Terms of trade: Clemens and Williamson (2004).
Real exchange rate: Not available.
Current account surplus: Not available.
Nominal GDP: Not available.

Yield spread between British consols: Clemens and Williamson (2004).
Growth of the money supply: Not available.
Gold reserves: Not available.
Notes in circulation: Not available.
Population: Clemens and Williamson (2004).

Portugal

Total outstanding government debt, external hard-currency debt, and domestic paper debt: Total debt, 1880–1913, Flandreau and Zúmer; percentage of debt serviced in gold, Flandreau and Zúmer (2004).
Interest service on debt: Flandreau and Zúmer (2004).
Government revenue: Flandreau and Zúmer (2004).
Terms of trade: Obstfeld and Taylor (2003).
Real exchange rate: Obstfeld and Taylor (2003).
Exports: Flandreau and Zúmer (2004).
Imports: Barbieri (2000).
Nominal GDP: Bordo et al. (2001).
Yield spread between British consols: Obstfeld and Taylor (2003).
Growth of the money supply: 1880–90. Growth of circulation in hands of public and commercial bank deposits. Data from Alan M. Taylor by private correspondence. 1891–1913, Bordo et al. (2001).
Gold reserves: Flandreau and Zúmer (2004).
Notes in circulation: Mitchell (1992).

Russia

Total outstanding government debt, external hard-currency debt, and domestic paper debt: 1880, 1887, 1891 total debt from *Fenn's.* 1880 hard currency debt from *Fenn's.* Foreign debt is reported as including domestic gold debt and internal debt. Total debt: 1881–84, 1885–86, 1888–90, 1893, 1894, Ferguson and Schularick (2004). 1885 total debt, Pasvolsky and Moulton (1924). 1895 to 1913, total debt. Percentage of debt serviced in gold, 1884–1913, Flandreau and Zúmer (2004).
Interest service on debt: Flandreau and Zúmer (2004).
Government revenue: Flandreau and Zúmer (2004).
Terms of trade: Clemens and Williamson (2004).
Real exchange rate: Obstfeld and Taylor (2003).
Current account surplus: Obstfeld and Taylor (2003).
Exports: Flandreau and Zúmer (2004).
Imports: Barbieri (2000).
Nominal GDP: Obstfeld and Taylor (2003).
Yield spread between British consols: Obstfeld and Taylor (2003).
Growth of the money supply: Kahan (1989).
Gold reserves: Flandreau and Zúmer (2004).
Notes in circulation: Flandreau and Zúmer (2004).

South Africa

Before union the data is constructed as an aggregate from available data from Cape of Good Hope, Natal, Orange Free State, and Transvaal.
Total outstanding government debt, external hard-currency debt, and domestic paper debt: Bordo, Meissner, Redish (2005).
Government revenue: Mitchell (1993a).
Terms of trade: Not available.
Exports: Global Financial Database.
Imports: Global Financial Database.
Nominal GDP: 1911–13, Mitchell (1993a).
Yield spread between British consols: Not available.
Growth of the money supply: Mitchell (1993a).
Gold reserves: Not available.
Notes in circulation: Not available.
Population: Schuman (1938).

Spain

Total outstanding government debt, external hard-currency debt, and domestic paper debt: External and internal debt from Acha (1976). No information about gold debt.
Interest service on debt: Flandreau and Zúmer (2004).
Government revenue: Flandreau and Zúmer (2004).
Terms of trade: Obstfeld and Taylor (2003).
Real exchange rate: Obstfeld and Taylor (2003).
Exports: Flandreau and Zúmer (2004).
Imports: Barbieri (2000).
Nominal GDP: Bordo et al. (2001).
Yield spread between British consols: Obstfeld and Taylor (2003).
Growth of the money supply: Data underlying Bordo et al. (2001).
Gold reserves: Flandreau and Zúmer (2004).
Notes in circulation: Flandreau and Zúmer (2004).

Sweden

Total outstanding government debt, external hard-currency debt, and domestic paper debt: Total debt (dette publique en obligations) and internal debt 1913 *Statistical Yearbook* of Sweden. Foreign debt 1880, 1887, 1891 from *Fenn's.* No information about domestic gold debts.
Government revenue: Flandreau and Zúmer (2004).
Terms of trade: Obstfeld and Taylor (2003).
Real exchange rate: Obstfeld and Taylor (2003).
Exports: Flandreau and Zúmer (2004).
Imports: Barbieri (2000).
Nominal GDP: Bordo et al. (2001).

Yield spread between British consols: Obstfeld and Taylor (2003).
Growth of the money supply: Bordo et al. (2001).
Gold reserves: Flandreau and Zúmer (2004).
Notes in circulation: Flandreau and Zúmer (2004).

Switzerland

Total outstanding government debt, external hard-currency debt, and domestic paper debt: 1880–1913, Flandreau and Zúmer (2004).
Interest service on debt: Flandreau and Zúmer (2004).
Government revenue: Flandreau and Zúmer (2004).
Terms of trade: Obstfeld and Taylor (2003).
Real exchange rate: Obstfeld and Taylor (2003).
Exports: Flandreau and Zúmer (2004).
Imports: Barbieri (2000).
Nominal GDP: Bordo et al. (2001).
Yield spread between British consols: Obstfeld and Taylor (2003).
Growth of the money supply: Bordo et al. (2001).
Gold reserves: Flandreau and Zúmer (2004).
Notes in circulation: Flandreau and Zúmer (2004).

Turkey

Total outstanding government debt, external hard-currency debt, and domestic paper debt: Not available.
Government revenue: 1884–1900, Du Velay (1903); for 1880, 1901–03, 1908–10 Shaw (1975).
Terms of trade: Obstfeld and Taylor (2003).
Real exchange rate: Not available.
Exports: Global Financial Database.
Imports: Barbieri (2000).
Nominal GDP: Not available.
Yield spread between British consols: Obstfeld and Taylor (2003).
Growth of the money supply: Not available.
Gold reserves: Not available.
Notes in circulation: Not available.
Population: Clemens and Williamson (2004).

Great Britain

Total outstanding government debt, external hard-currency debt, and domestic paper debt: 1880–1913 total debt, Flandreau and Zúmer (2004). Great Britain had no hard currency debt in this period, to the best of our knowledge.
Government revenue: Flandreau and Zúmer (2004).
Interest service on debt: Flandreau and Zúmer (2004).
Terms of trade: Obstfeld and Taylor (2003).

Real exchange rate: Obstfeld and Taylor (2003).
Exports: Flandreau and Zúmer (2004).
Imports: Barbieri (2000).
Nominal GDP: Bordo et al. (2001).
Growth of the money supply: Bordo et al. (2001).
Gold reserves: Flandreau and Zúmer (2004).
Notes in circulation: Flandreau and Zúmer (2004).

United States

Total outstanding government debt, external hard-currency debt, and domestic paper debt: Total debt, 1880–1913: Ferguson and Schularick (2006). All debt is payable in gold following Bordo, Meissner, and Redish (2005).
Government revenue: Mitchell (1993b).
Terms of trade: Obstfeld and Taylor (2003).
Real exchange rate: Obstfeld and Taylor (2003).
Exports: Barbieri (2000).
Imports: Barbieri (2000).
Nominal GDP: Bordo et al. (2001), Obstfeld and Taylor (2003).
Yield spread between British consols: Obstfeld and Taylor (2003).
Growth of the money supply: Bordo et al. (2001).
Gold reserves: Obstfeld and Jones (2003).
Notes in circulation: Mitchell (1993b).

Uruguay

Total outstanding government debt, external hard-currency debt, and domestic paper debt: Internal and external debt from *Statistical Yearbook,* no information about domestic gold debt.
Government revenue: Mitchell (1993b).
Terms of trade: Not available.
Real exchange rate: 1900–13, Obstfeld and Taylor (2003).
Exports: Barbieri (2000).
Imports: Barbieri (2000).
Nominal GDP: Clemens and Williamson (2004).
Yield spread between British consols: Obstfeld and Taylor (2003).
Growth of the money supply: 1901–13, Mitchell (1993b).
Gold reserves: Not available.
Notes in circulation: Mitchell (1993b).
Population: Clemens and Williamson (2004).

Table 4A.1 Crisis dates, 1880–1913

Year	Argentina	Australia	Austria	Belgium	Brazil	Canada	Chile	Denmark	Egypt	Finland	France	Germany	Greece	India	Italy	Japan	Mexico	Netherlands	New Zealand	Norway	Portugal	Russia	South Africa	Spain	Sweden	Switzerland	Turkey	U.K.	U.S.	Uruguay
1880							DC										DC										DC			
1881																							BC							
1882			BC																					DC						
1883																														
1884																	BC											BC		
1885	CC							BC					CC									DC								
1886																														
1887							CC																							
1888											CC																			
1889					BC, CC						BC												BC							
1890	BC, CC, DC				BC																							BC	CC	
1891	BC				CC								BC						BC, CC	CC							CC	DC		
1892																					DC									
1893		BC				CC						CC			BC				BC										BC, CC	
1894													DC		CC															
1895																														
1896																														
1897					BC													BC							BC					
1898					CC, DC		BC, CC																							
1899																														
1900					BC				CC	BC						CC														
1901					BC							BC				BC														
1902																														
1903																			CC				BC							
1904																CC														
1905																														
1906																														
1907							BC	BC	BC		BC	CC			BC	BC	BC								BC				BC	
1908	CC					CC		BC							CC	CC														
1909																														
1910																														
1911																														
1912																														
1913																														BC

Note: CC represents currency crises; BC represents banking crises; DC represents debt crises.

Table 4A.2 Data availability for countries and years

Variable	Argentina	Australia	Austria	Belgium	Brazil	Canada	Chile	Denmark	Egypt	Finland	France	Germany	Greece	India	Italy	Japan	Mexico	Netherlands	New Zealand	Norway	Portugal	Russia	South Africa	Spain	Sweden	Switzerland	Turkey	U.K.	U.S.	Uruguay
Original sin	1880–1913	1880–1913	1880–1913	1880–1913	1880–1913	1880–1913	1880–1913	1880–1913	—	1881, 1891	1880–1913	1880–1913	1885–1913	1880–1913	1880–1913	1880–1913	1880–1881, 1883, 85–86, 1890–1912	1880–1913	1880–1913	1880–1913	1880–1913	1880, 1884–1913	1880–1913	1880–1913	1880, 1887, 1881, 1913	1880–1913	—	1880–1913	1880–1913	
Debt/ Revenue	1880–1913	1880–1913	1880–1912	1880–1913	1880–1913	1880–1913	1880–1913	1880–1913	1880–1913	—	1880–1913	1880–1913	1881–1882, 1884–1913	1880–1913	1880–1913	1880–1913	1880–1881, 1883, 85–86, 89–1912	1880–1913	1880–1913	1881–1913	1880–1912	1880–1912	1910–1913	1880–1913	1881–1912	1880–1913	—	1880–1913	1880–1913	1880, 1884–1913
Mismatch																1882, 1887														
Debt	1880–1913	1880–1913	1880–1913	1880–1913	1880–1913	1880–1913	1887–1895	1880–1913	—	1881, 1891	1880–1913	1880–1913	1881, 1885–1913	—	1880–1913	1892–1897, 1903–1913	—	1880–1913	—	1880–1913	1880–1912	1880, 1884–1913	—	1880–1913	1880, 1887, 1891, 1813	1885–1913	—	1880–1913	1880–1913	—
Interest	1880–1913	—	1880–1912	1880–1913	1881–1913	—	—	1880–1913	—	—	1880–1913	1880–1913	1881, 1885–1913	—	1880–1913	1881–1913	—	1880–1913	—	1880–1913	1880–1913	1880, 1884–1912	—	1880–1913	1880, 1887, 1831	1885–1913	—	1880–1913	—	—
Terms of trade	1881–1913	1881–1913	1881–1913	1881–1913	1881–1913	1881–1913	1881–1913	1881–1913	1881–1913	1881–1913	1881–1913	1881–1913	1881–1913	1881–1913	1881–1913	1881–1913	1881–1913	—	1881–1913	1881–1913	1881–1913	1881–1913	—	1881–1913	1881–1913	—	1881–1913	1881–1913	1881–1913	1881–1913
Real exchange rate	1885–1913	1880–1913	1880–1913	1880–1913	1880–1913	1880–1913	—	1880–1913	1886–1913	1880–1913	1880–1913	1880–1913	1880–1913	1880–1913	1880–1913	1885–1913	1886–1913	1880–1913	1880–1913	1880–1913	1880–1913	1885–1913	—	1880–1913	1880–1913	1880–1913	—	1880–1913	1880–1913	1900–1913
Trade balance	1884–1913	1880–1913	1880–1913	1880–1913	1880–1913	1880–1913	1880–1913	1880–1913	1886–1913	1880–1913	1880–1913	1880–1913	1880–1912	1880–1913	1880–1913	1880–1913	—	1880–1913	1880–1913	1880–1913	1880–1913	1880–1897	—	1880–1913	1880–1913	1885–1913	—	1880–1913	1880–1913	1900–1913
Bond spread	1880–1913	1880–1913	1880–1913	1880–1913	1880–1913	1880–1913	1880–1913	1880–1913	1880–1913	1911–1913	1880–1913	1880–1913	1880–1913	1880–1913	1880–1913	1880–1913	1880–1913	1880–1913	1880–1913	1880–1913	1880–1913	1880–1913	—	1880–1913	1880–1913	1893–1912	1880–1913	1880-1913	1880–1913	1880–1913
Gold standard	1880–1913	1880–1913	1880–1913	1880–1913	1880–1913	1880–1913	1880–1913	1880–1913	1880–1913	1880–1913	1880–1913	1880–1913	1880–1913	1880–1913	1880–1913	1881–1913	1880–1913	1880–1913	1880–1913	1880–1913	1880–1913	1880–1913	—	1880–1913	1880–1913	1880–1913	1880–1913	1880–1913	1880–1913	1885–1913
Growth of money supply	1885–1913	1881–1913	1881–1913	1881–1913	1881–1913	1881–1913	—	1886–1913	1902–1913	1880–1902, 1912–1913	1881–1913	1881–1913	1881–1913	1881–1913	1881–1913	1881–1913	1902–1911	1880–1913	1881–1913	1881–1913	1880–1911	1881–1913	1881–1913	1881–1913	1881–1913	1881–1913	—	1881–1913	1881–1913	1901–1913
Ratio of gold reserves to notes	1880–1913	1880–1913	1880–1913	1880–1913	1880–1913	1880–1913	1887–1895	1880–1913	—	1880–1913	1880–1913	1880–1913	1880–1913	—	1880–1913	1880–1897	—	1880–1913	—	1880–1913	1880–1913	1880–1913	—	1880–1913	1880–1913	1883–1913	—	1880–1913	1880–1913	—
Central bank indicator	1880–1913	1880–1913	—	1880–1913	1880–1913	1880–1913	1880–1913	1880–1913	—	1880–1913	1880–1913	1880–1913	1880–1913	1880–1913	1880–1913	1880–1913	1880–1913	1880–1913	1880–1913	1880–1913	1880–1913	—	1880–1913	1880–1913	1880–1913	1880–1913	1880–1913	1880–1913	1880–1913	1880–1913

Note: Long dash indicates no data are available for this variable and country.

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