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Abstract

The long history of sovereign debt and the associated enforcement problem have attracted researchers in many fields. In this paper, we survey empirical work by economists, historians, and political scientists. As we review the empirical literature, we emphasize parallel developments in the theory of sovereign debt. One major theme emerges. Although recent research has sought to balance theoretical and empirical considerations, there remains a gap between theories of sovereign debt and the data used to test them. We recommend a number of steps that researchers can take to improve the correspondence between theory and data.

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1. Introduction

Sovereign states have borrowed money for hundreds of years. *Sovereign debt* was one of the first financial assets ever traded, and continues to comprise a significant fraction of global financial assets. Unlike private debt, sovereign debt is especially difficult to enforce. For centuries, the legal doctrine of sovereign immunity limited suit against defaulting sovereigns, while few government assets are available for attachment in foreign jurisdictions.

The long history of sovereign debt and the associated enforcement problem have attracted researchers in many fields. In this paper, we survey empirical work by economists, historians, and political scientists. As we review the empirical literature, we emphasize parallel developments in the theory of sovereign debt. One major theme emerges. Although recent research has sought to balance theoretical and empirical considerations, there remains a gap between theories of sovereign debt and the data used to test them. We recommend a number of steps that researchers can take to improve the correspondence between theory and data.

2. Sovereign Debt

In this section we describe research on the quantity, currency composition, and maturity structure of sovereign debt, as well as contractual clauses that govern restructuring in the event of a default.

Measuring the Stock of Sovereign Debt

Data on the stock of sovereign debt are typically presented at *face value*. Defined as the undiscounted sum of future principal repayments (including, in the case of consols, principal that is repaid at infinity), face values have two obvious problems. First, they do not discount future flows, and thus treat similar-sized payments separated in time as equivalent. Second, they only capture principal repayments. Thus, two debts with equal cash-flows divided into principal and interest in different proportions will have different face values.

To correct for differences in contractual structure, analysts should compute the face value of a common portfolio of debts that replicates the cash flows of the original debt. For instance, they could calculate face values as if each payment were a maturing zero-coupon bond, a concept Dias, Richmond and Wright (2011) refer to as *zero-coupon equivalent (ZCE) face values*. To correct for differences in timing, analysts should compute the *present value* of the debt. Alternatively, they could measure a debts *market value*. However, market values are not available for small borrowers and untraded debts, such as official loans, project credits, and many bank loans.

The ideal measure depends on the purpose for which the data will be used. When assessing the sovereign's debt burden, for example, we typically wish to know the amount of contracted payments. Market values would be misleading, because market values fall when traders expect the sovereign to default. Conversely, when measuring how much creditors expect to recover following a default, market values are more informative than contracted payments.

How Important Is Sovereign Debt as an Asset Class?

Sovereign debts have always been one of the largest classes of financial assets. To illustrate their importance, Table 1 presents public debt as a share of all assets.

The first set of columns gives the face value of all securities on London Stock Exchange, the world's largest and most important capital market for most of the 19th and early 20th Centuries. In 1853, British public debt accounted for 70% of listed securities, and foreign public debt totaled another 6%. Over the next 60 years the value of sovereign debt continued to rise, but corporate stock grew at an even faster pace. Consequently, on the eve of World War I, sovereign debt was only 35% of the London market.

Table 1: Sovereign Debt as a Share of All Financial Assets

	Listed in London				London and Some Foreign			World			
	1853[a]	1873[a]	1893[a]	1913[a]	1933[a]	1950[a]	1950[b]	1950[c]	1978[c]	1990[d]	2010[d]
Total Assets	£1.2b	£2.3b	£4.9b	£11.2b	£18.5b	£15.2b	£14.3b	--	--	$54t	$212t
Public Debt	76%	59%	39%	35%	59%	78%	60%	22%	11%	17%	19%
Of which: UK	70%	38%	18%	14%	38%	66%	57%	--	--	--	--
Foreign & Colonial	6%	21%	21%	21%	21%	11%	3%	--	--	--	--

[a]Data from *Stock Exchange Official Intelligence* as reported in Michie (2001) Tables 3.2 and 5.1. All securities at face value. Data refer to securities listed on the London Stock Exchange, except for 1933 and 1950 which includes foreign and colonial public sector securities listed abroad.
[b]Data from *Stock Exchange Official Intelligence* as reported in Michie (2001) Table 8.1. All securities at market value. Data refer to securities listed on the London Stock Exchange, plus foreign and colonial public sector securities listed abroad.
[c]Data from Goldsmith (1985) Table 1 on share of government debt in financial assets, all measured at market values.
[d]Data from Roxburgh, Lund and Piotrowski (2011) Exhibit E1 on public debt securities at face value, relative to other debt at face value and equities at market value.

The next set of columns covers securities listed in London, plus sovereign bonds—but not private securities—listed abroad. Here, the face value of public debt was £10.9 billion (59% of the total) in 1933, and £11.9 billion (78% of the total) in 1950. Many public debts traded at substantial discounts, however, due to defaults during the Great Depression and World War II. Consequently, the market value of sovereign debt (column 1950b) was lower than its face value (column 1950a), not only in absolute terms but also as a share of total assets.

The final group of columns gives the market value of financial assets worldwide. Government debt made up almost 22% of the global total in 1950, but fell to 11% in 1978. The change reflects, among other things, the decline of international capital

flows under the Bretton-Woods system and the inward-oriented development strategies that many less developed countries were adopting.

From its nadir in the 1970s, sovereign debt has grown in prominence and now accounts for about 19% of global financial assets. A number of factors help explain this resurgence. Beginning in the 1970s, governments dismantled controls that had impeded capital flows for much of the postwar period. At the same time, the surge in oil prices left petroleum exporters with a windfall that needed to be invested overseas (the so-called "recycling of petro-dollars"). In the next section, we quantify the indebtedness of sovereign countries.

How Indebted Are Sovereign Countries?

Figure 1 depicts the evolution of sovereign indebtedness for an aggregate of 72 low and middle income countries (Dias, Richmond and Wright 2011, 2012). Each line plots a different measure of debt scaled by the Gross National Income (GNI) of the country. All measures peak in 1987 at the height of the debt crisis, with the contractual face value of debt peaking around 40% of GNI, while ZCE face values peak at over 60%. The medium gray lines show that the market value of sovereign debt (estimated using a constant 10% rate, and market yields) lies below its face value, with the discount declining toward the end of the sample. The aggregate disguises significant variation across countries. The ZCE face value of debt, which controls for differences in contractual structure of debts across countries, peaked around 80% of GNI for the countries of Latin America, compared to 110% in sub-Saharan Africa, and less than 50% in East and South Asia (Dias, Richmond and Wright 2011).

Neither face values nor market values are necessarily informative as to the burden of servicing a country's debt. Dias, Richmond and Wright (2012) measure a country's debt burden as the "equivalent variation" of debt forgiveness (the extra resources required to make a country as well off as if it had no debt) and show that, for a variety of market imperfections, this can be calculated by valuing the cash-flows of a country's debts using the consumption capital asset pricing model. As shown in Figure 1, this internal country value always lies below the market valuation. This is consistent with economic theory: when capital markets are imperfect – for example, because of borrowing constraints or default risk – borrowing countries will value current resources more, and future resources less, than creditors.

Debts levels of the magnitude presented in Figure 1 are a challenge for theories of sovereign debt. Early theory predicted that, as a result of sovereign immunity, markets for sovereign debt should collapse. More recent theory postulates that sovereign states repay their debts in order to retain future credit market access, or to avoid trade sanctions or military intervention. Calibrated versions of these theories, however, struggle to produce ZCE face values greater than 10% of GNI (Aguiar and Gopinath 2006, Arellano 2008, Hamann 2004). More recent variations that allow for

long-maturity debt or positive recovery rates in the event of default show promise in producing greater debt levels.

What is the Maturity of Sovereign Debt?

Countries with large amounts of short-term debt are vulnerable to "roll-over crises," which occur when the government cannot issue new loans to repay maturing ones (Cole and Kehoe 1999, 2000, Chang and Velasco 2000). In the mid-1990s, Mexico, Indonesia, Korea, Thailand, Russia, and Brazil all experienced debt crises that were exacerbated by having debts with short maturities (Rodrik and Velasco 1999).

To summarize the maturity structure of sovereign debt, researchers often use *contractual maturity*, the date of the last principal repayment. Another common measure is *Macaulay duration*, defined as the elasticity of a debt's present value with respect to a constant discount rate (typically a market yield), and calculated as the discounted cash-flow weighted average of the dates of future cash-flows.

Both measures are suboptimal. Contractual maturities are uninformative about the profile of cash-flows over the life of a debt, and duration has the counter-intuitive property that it discounts more distant payment dates. Moreover, two countries with equivalent debt portfolios will have different durations, simply because of different discount rates. Likewise, duration fluctuates with interest rates, even though debt contracts have not changed. An alternative measure that avoids these problems is the undiscounted cash-flow weighted average of the dates of future cash-flows, which we refer to as the *zero-coupon-equivalent weighted average life* of a debt portfolio.

Using unpublished data from Dias, Richmond and Wright (2011, 2012), we compute each of these measures for the year 2000 for a sample of 137 low and middle income countries. Across countries, contractual maturity varied from 10 to 40 years (see also Broner, Lorenzoni and Schmukler 2010). In contrast, duration—assuming a 5% discount rate—ranged from 3.4 to 14.2 years, with a mean of 7.1. These durations exceed the estimates from previous studies with smaller samples (Cruces, Buscaglia and Alonso 2002), and are longer than what economists typically use to calibrate models of debt (Hatchondo and Martinez 2009, Chatterjee and Eyigungor 2008).

Finally, the ZCE weighted average life in the database was just over 9 years, with some countries as low as 3.9 and others as high as 19. Dias, Richmond and Wright (2011) also find that the ZCE-weighted average lives of sovereign bonds have changed substantially over time, rising from 6 years during the 1980s, to 15 years during the Brady restructuring process, and trending back to 10 years by the end of the sample.

As noted above, short-maturity sovereign debt could contribute to sovereign debt crises. This concern is accentuated by the finding that maturities tend to shorten during debt crises. Arellano and Ramanarayanan (2012) measured the duration

(using a risk fee interest rate) of new bond issues by 4 emerging market economies. During crises, the duration of new debt issues fell by about 1-2 years. Arellano and Ramanarayanan (2012) also illustrate the problems associated with using contractual maturity: whereas duration fell during crises, contractual maturities often lengthened.

Why Do Countries Issue Debt in Foreign Currencies?

Sovereigns expose themselves to risk not only by borrowing at short maturities, but also by issuing debt that must be repaid in foreign currencies. At first glance, the reason for foreign currency issuance seems obvious: if debt were issued in domestic currency, the sovereign could implicitly default by unexpectedly increasing the inflation rate. Issuing in foreign currency forecloses this option, and presumably results in lower borrowing costs. However, when debts are denominated in foreign currencies, the sovereign is vulnerable to exchange rate risk.

How much borrowing is in foreign currencies? Eichengreen, Hausmann and Panizza (2005a) report that between 93% and 100% of all developing country debt is issued in foreign currencies, depending on the measure used. Moreover, outside the main financial centers and Europe, developed countries have between 70% and 90% of their obligations in foreign currencies.

The debts tend to be concentrated in a handful of currencies. Dias, Richmond and Wright (2011) constructed a sample of long term debts owed by 100 developing countries from 1979 to 2006. At any given time, countries had borrowed in about 75 different currencies. However, almost 70% of all debt in 2000 was denominated in U.S. dollars, and the five most important currencies (Dollar, Yen, Euro, Special Drawing Right, and Deutschmark) accounted for more than 90% of the total.

Researchers have found surprisingly little relationship between foreign currency debt issues and measures of inflation or currency depreciation (for example, Eichengreen and Hausmann 1999, or Eichengreen, Hausmann and Panizza 2005b). This led Eichengreen and Hausmann (1999) to refer to the preponderance of foreign-currency debt as “original sin,” in reference to the Christian theological doctrine that all of humanity is in a state of sin as a result of the original “fall of man.”

Some have conjectured that domestic-currency debt markets are rare due to the fixed costs of opening of such markets, and the need for a large market to produce sufficient levels of liquidity. Consistent with these claims, Bordo, Meissner and Redish (2003) argue that Canada, Australia, New Zealand and South Africa developed domestic-currency debt markets when major shocks—such as wars or the breakdown of the Bretton-Woods System—made it worthwhile to pay the necessary fixed costs. Furthermore, large countries are substantially more likely to issue debt in their own currency (Eichengreen, Hausmann and Panizza 2005b).

Sovereign Debt Contracts and Clauses

The risk to creditors also depends on where debts are issued and how debt contracts are written. Das, Papaionnou, and Trebesch (2012) studied the sovereign bonds of 43 emerging market countries in 2009. The majority of bonds were governed by New York law (66% by value, 67% by number). Around a quarter were governed by London law (28% by value, 22% by number), and the remainder were governed by either German or Japanese law. Each of these jurisdictions has its own norms for handling defaults.

In recent decades, policymakers have designed contracts that would make it easier to restructure debts, if necessary (Taylor 2002, Eurogroup 2011). They have called for collective action clauses, which allow a super-majority of creditors to impose a settlement on a minority of holdout creditors; engagement clauses, which facilitate the formation of representative groups to negotiate with the sovereign; and aggregation clauses, to help creditors negotiate collectively even if they hold different debt securities.

To document the use of such clauses, Bradley and Gulati (2012) and Choi, Gulati and Posner (2012a,b) collected details on bonds issued between 1990 and 2011. They found that 34% required unanimity to change payment terms, but 66% contained collective action clauses that permitted changes if a super-majority (typically two-thirds, three-quarters, or 85%) of creditors consented. Moreover, the frequency of collective action clauses has risen over time. Prior to the Argentine default in 2001, roughly 95% of sovereign bonds (by number) issued in New York required unanimity to change payment terms (see also Richards and Gugiatti 2003). After the default, only 21% required unanimity.

Aggregation clauses, which allow the holders of diverse debt instruments to vote collectively to restructure all debts, have now been included in the bonds of four nations (Argentina, Dominican Republic, Greece, and Uruguay), with plans to introduce them in all Eurozone bonds starting in 2013 (Eurogroup 2011). Engagement clauses have also become more common, especially in bonds issued in London. Between 1992 and 2002 only 5% of bonds included such clauses, compared with 34% today.

Finally, researchers have studied *pari passu* clauses, which obligate sovereigns to treat creditors equally. Holdout creditors have successfully used *pari passu* clauses to obtain full repayment on bonds in a number of cases (Pitchford and Wright 2012). Moreover, debt contracts increasingly contain versions of the clause that are especially favorable to holdout creditors; this version of the clause was absent in sovereign bonds prior to 1981, but now exists in 74% of bonds issued by the main emerging market borrowers, and in 21% of sovereign bonds generally (Choi, Gulati and Posner 2012a; Gulati and Scott 2011). This trend is surprising: if borrowers and lenders dislike the use of the *pari passu* clause by holdout creditors, we might expect the clause to become less common (Wright 2011 provides one interpretation).

3. Sovereign Default

In this section we examine the phenomenon of sovereign default. We examine how often defaults occur, how long they last, and how creditors and debtors fare in the aftermath of default.

What Is Sovereign Default?

Defined narrowly, default occurs when the debtor violates the legal terms of the debt contract. For example, the debtor might fail to pay interest or principal within the specified grace period, or might breach some other contractual provision. However, this narrow definition overlooks situations in which the sovereign threatens to default and creditors respond by "voluntarily" revising the contract.

In recognition of this problem, credit ratings agencies like Standard and Poor's (S&P) define a default as beginning either when the sovereign breaks the contract, or when the sovereign "tenders an exchange offer of new debt with less favorable terms than the original issue" (Beers and Chambers 2006). We prefer this broader definition.

To illustrate how definitions matter, consider the 2012 restructuring of Greek sovereign debt. At the time of writing, Greece's actions had not triggered a narrow default: the government had not missed any payments, and creditors had not alleged a technical breach. Nevertheless, Greece demanded new terms and creditors consented, causing ratings agencies to conclude that a default had occurred. The Argentine debt crisis provides another example. All three major ratings agencies—S&P, Moody's and Fitch—listed Argentina as defaulting in November 2001, when it announced its intention to suspend payments, even though the government did not break a contract until January 2002, when it failed to make a required payment.

Finally, researchers use different criteria for grouping decisions into a single default episode. If a country defaults within one year of restructuring its debts, we treat the sequence as part of the same default episode. Our criteria imply that Mexico was in continuous default from 1982 to 1990, a judgment shared by S&P. However, other researchers reach different conclusions. For example, Borensztein and Panizza (2009) record four distinct Mexican defaults during the 1980s, Cruces and Trebesch (2012) list five, and Arteta and Hale (2008) count 23.

How Often Do Countries Default?

We now summarize the frequency of defaults over the past two centuries. Our data, which extend the work of Tomz and Wright (2005), cover 176 sovereign entities (counting countries and their historical counterparts as separate entities) from 1820 to

the present.[1] The sovereigns were in existence for a total of 17,237 country-years. In 80% of those observations, sovereigns had outstanding debt and were, therefore, candidates for default.

In building the database, we restricted attention to national-level debts or debts guaranteed at the national level. We also focused on debts to private creditors, although we also gathered data on the rescheduling of debts owed to official creditors under the auspices of the Paris Club. Moreover, we made no distinction between default and repudiation; between defaults on interest and defaults on principal; or between defaults that covered only part of a sovereign's debts, versus defaults that affected all debts.[2] Finally, we do not include as defaults bouts of inflation that reduce the real value of debt issued in domestic currency.

In our database, there were 251 defaults by 107 distinct entities. The most frequent defaulters were Ecuador, Mexico, Uruguay, and Venezuela; each experienced at least 8 distinct spells of default, exemplifying a phenomenon Reinhart and Rogoff (2004) call "serial default." Ecuador and Honduras have each spent more than 120 years in default, beginning with their initial loans as members of the Central American Confederation in the 1820s, and Greece has been in default for more than 90 years of our sample. The largest default in history (by present value) was the 2012 Greek restructuring that covered more than €200b of privately held debt, followed by Argentina in 2001 and Russia in 1918.

Figure 2 documents the occurrence of sovereign default through history. The solid line (left-hand scale) plots the proportion of borrowing countries that were in default on their debts to commercial creditors from the end of the Napoleonic Wars to the present. The gray columns (right-hand scale) depict the number of new defaults in each year. The dark gray captures defaults only on commercial creditors; the light gray represents restructurings only of bilateral debts of official creditors under the auspices of the Paris Club; and the medium gray shows defaults on both commercial and official creditors.

The solid line reveals four episodes in which at least 30% of the worlds' debtors (by number) have been in default, giving rise to the notion of a global default crisis. The first episode began in the 1820s, when a number of newly independent countries issued debt and immediately defaulted. The second episode, occurring in the 1870s, was associated with wars in Central and South America, followed by a fall in commodity prices. The third episode centers on the Great Depression, and the fourth is the global debt crisis of the 1980s. Figure 2 also shows defaults on official debts

[1] Alternative datasets of default events include: Purcell and Kaufman (1993), also used by Beim and Calomiris (2001); Suter (1990,1992), which forms the basis of the S&P dataset (Beers and Chambers 2006); Sturzenegger and Zettelmeyer (2007); Arteta and Hale (2008); Reinhart and Rogoff (2009); and Cruces and Trebesch (2012).

[2] We also do not include "debt crises" without a sovereign default (Pescatori and Sy 2007).

after World War II.[4] To date, there have been 425 renegotiations of official debts under the Paris Club.

The frequency of default is sensitive to the sample being analyzed. In our database, the unconditional probability of a borrower entering a default is 1.8% per year. This is similar to the 2% default probability that is a target for many calibrated models of sovereign default. However, this estimate averages over all countries, including many developed countries that have never defaulted. It also averages over time periods in which there was little borrowing and hence little incentive to default (for example, the Bretton-Woods system of restricted capital flows). If we restrict attention to countries that defaulted at least once, or look across all countries but exclude the years 1945-1980, the probability of default rises to 2.2%.

The frequency of default also depends on how one aggregates events. Our method of aggregation produces a fewer number of longer defaults. Other methods generate much higher default probabilities. For example, Arteta and Hale (2008) record 100 restructuring episodes with commercial creditors by 30 countries over a 25 year period, resulting in a 13% default probability per year.

The fact that this moment of the data is sensitive to reasonable changes in the definition of default suggests that an alternative moment – one more robust to changes in definition – should be used to calibrate models of default. One possibility is the fraction of time debtors spend in default. Across the entire sample, debtors spend almost 19% of the time in default.

How Long Do Defaults Last?

Like the probability of default, the duration of a default is sensitive to the definition researchers use. According to S&P, a default ends when "a settlement occurs and Standard & Poor's concludes that no further near-term resolution of creditors' claims is likely" (Beers and Chambers 2006). Defined in this way, the mean length of a default across the entire sample is 9.9 years, dropping to 7.8 years for the period since 1970. The mean is driven by a small number of long-lasting defaults, such as the Russian repudiation of 1917. It may, therefore, be preferable to focus on the median, which is 6.5 years over the entire sample of 251 defaults.

There is substantial variation in the observed lengths of defaults, with the standard deviation 10.5 years. The distribution is also right-skewed with a skewness coefficient of 2.1. As noted by Pitchford and Wright (2008), these facts suggest that the distribution of default lengths is approximately exponential. An exponential distribution of default lengths would result from a model in which the probability that a sovereign emerges from default is constant through time. This is a common

[4] The data on defaulted official debts is restricted to Paris Club restructurings and hence excludes the Inter-Allied War Debts.

assumption in calibrated sovereign default models, and an implication of the calibrated model of sovereign debt restructuring studied in Pitchford and Wright (2008).

How Large Are Creditor Losses in a Sovereign Default?

Many theoretical models assume that creditors lose their entire claim when a sovereign defaults. This is far from true. Defaults typically conclude with a settlement in which old defaulted debt is exchanged for new debt securities.

Measures of creditor losses ("haircuts") compare the value of the old securities to the settlement offer. *Nominal haircuts* (Alesina and Weder 2002, Yue 2010) value both old and new debts at face value, ignoring that defaulted debts trade at a discount to face value, and that debts issued during a settlement tend to mature over a longer time horizon. The *market haircut* instead compares the market value of the settlement to the face value of the defaulted debt. This measure is easy to compute and appropriate when pricing sovereign debt, but it overstates the value of defaulted debt and hence exaggerates creditors' losses. To correct the problem, one should value old and new debts using the same discount rates, as in Sturzenegger and Zettelmeyer (2008), who used the discount rates implied by the prices of the settlement debts ("exit yields").

Several estimates of market haircuts (Cline 1995, Benjamin and Wright 2008) use aggregate debt data from the Debtor Reporting System (World Bank, various) to estimate creditor losses for as many as 90 defaults.[5] However, these data do not include losses due to maturity extensions. More recent estimates of creditor losses have involved security-level data. Sturzenegger and Zettelmeyer (2008), for example, estimate both the market and SZ-haircut for 22 restructurings, while Cruces and Trebesch (2012) provide estimates for 180 restructurings.

Despite the differences in definitions, and despite wide divergence in the estimates for individual restructurings, all the measures give similar quantitative results. Benjamin and Wright (2008) estimate an average market haircut of 38%, while Cruces and Trebesch (2012) estimate a 40% market haircut and a 37% SZ-haircut. Both measures also show that defaults by the low income countries of sub-Saharan Africa resulted in larger haircuts. Wright (2011a) finds a 50% market haircut (using the Benjamin and Wright 2008 data) for low-income countries, while Cruces and Trebesch (2012) find an 87% SZ haircut for the sample of Highly Indebted Poor Countries. Benjamin and Wright (2008) also report a strong positive correlation (0.66) between default length and haircut across restructurings.

[5]Other haircut estimates for smaller samples were constructed using different data by Jorgensen and Sachs (1989), Rieffel (2003), Bedford et al. (2005), Finger and Mecagni (2007) and Díaz-Cassou et al. (2008).

How Does Sovereign Indebtedness Change After a Default?

Theoretical models of sovereign default often assume that a sovereign emerges from default without debt. This is not true in practice, and likely affects the quantitative performance of these models. After all, sovereigns that have no debt do not default, making serial default less likely.

Benjamin and Wright (2008) show for their sample of 90 defaults that indebtedness, measured by the ratio of the face value of debt to GDP, does not fall, and may even rise, after a default. The median country ends the year of the settlement with a debt-to-GDP ratio 5 percentage points higher than when they entered default. The increases in indebtedness are largest for low income countries (Easterly 2002 and Wright 2011a).

The deferral of current, and the restructuring of future, repayments may also bring debt relief. Sturzenegger and Zettelmeyer (2008) and Zettelmeyer, Trebesch and Gulati (2012) propose a measure of debt relief that values a country's new debt stock at the interest rates that prevail during non-crisis times. As these rates tend to be lower than those immediately following a settlement, this measure produces values for debt relief that are smaller than creditor losses. In the recent Greek restructuring, a 65% haircut for creditors was associated with a 60% reduction in the value of debt to the sovereign, while in Uruguay in 2003, a 13% haircut was associated with a 5% *increase* in the value of the sovereigns debt. An alternative approach based on the welfare cost of indebtedness measure of Dias, Richmond, and Wright (2012) which allows maturity extensions to raise welfare, could be a topic of future research.

Do debt restructurings improve a country's welfare? Depetris, Chavin and Kraay (2005) study 62 low-income countries between 1989 and 2003 and find no relationship between debt relief and indicators of country welfare such as GDP growth, investment rates, and public spending. Conversely, Arslanalp and Henry (2005) find large (60% on average) appreciations in the stock markets of middle income countries following debt relief under the Brady Plan.

How Does Default Affect Access to International Debt Markets?

Although many models of sovereign debt assume that default is punished by disruption of capital market access, there is considerable controversy as to whether this is true in practice (Borensztein and Panizza 2009 and Panizza, Sturzenegger and Zettelmeyer 2009). In part, this reflects the nature of the problem: realized borrowing is affected by the country's demand for credit, and so different equilibrium outcomes need not reflect a reduced supply of credit. It also reflects different notions of what "normal" credit market access looks like, and hence different notions of what constitutes a disruption of that access.

We begin by examining evidence on the quantity of borrowing. The data for the 19th Century are unambiguous. In a study of 16 sovereign defaulters between 1820 and 1870, Tomz (2007) finds that only Greece was able borrow while in default. More importantly, the Greek case is the "exception that proves the rule": after having defaulted in 1826, Greece was only able to borrow in 1833 after securing loan guarantees from England, France and Russia.

The picture for the early to mid 20th Century is muddled by disruptions to capital markets from two world wars followed by restrictions on capital flows under Bretton-Woods. Following the end of World War 2, few countries borrowed internationally regardless of their past credit history leading some researchers to suggest that defaulting countries were not punished (Jorgenson and Sachs 1989, Eichengreen 1989).

For the modern (post 1970) period, official lending and bank decisions to roll-over past-due debt to avoid capital charges complicate the picture. Gelos, Sahay and Sandleris (2011) partially correct for this by defining a country as having market access if the country borrows using either bonds or syndicated bank loans, *and* if the face value of that country's debts increases. They find that being in default is associated with less access, with the average country taking 4.7 years to re-access markets following a default, with delays in re-access declining to 2.9 years more recently (not including unresolved defaults like Argentina 2001).

The debt stock of a country may increase without new borrowing if interest arrears are capitalized of if a country retires low face value debt by issuing high face value debt. To correct for this, Dias, Richmond and Wang (2012) define "normal" market access to be "net resource transfers" as defined by the World Bank in excess of 1% of GDP. By this measure, half of defaulting countries do not regain market access within seven years of the end of the default. This echoes the finding of Levy Yeyati (2009) who finds that net resource transfers fall by between 0.1% and 1% of GDP following a default. Dias, Richmond and Wang (2012) also find faster market re-access following excusable defaults: half of all countries experiencing a natural disaster regain access within 3 years. Similarly, Cruces and Trebesch (2012) find that market access was slower following defaults that imposed haircuts in excess of 50%.

We next turn to evidence on the price of sovereign borrowing. In a study of 30 sovereign borrowers in 1872, Tomz (2007) finds that recent defaulting sovereigns were charged more than 25%, previous defaulters and new borrowers in excess of 8%, and countries with a good credit record around 5.5%. Significant yield differences survive controlling for measures of indebtedness and export earnings. Cruces and Trebesch (2012) find that the average defaulter paid between 300 and 400 basis more to borrower than non-defaulters in the modern period, with spreads above 500 basis points for sovereigns that imposed a haircut above 37%. Ozler (1992,1993) finds a small (20 basis point) effect of the defaults of the 1930s on borrowing in the period after 1970, with the size of the effect likely attenuated by the long time period involved.

These results are silent as to the mechanism that leads to higher spreads. If default reveals only that a country is a poor credit risk, higher yields should simply reflect the increased risk of lending. If high yields reflect punitive interest rates, however, then investors in these debts should earn excess returns. Lindert and Morton (1989) studied the *ex post* realized returns to holding sovereign debt from 1850 to 1983 and found no evidence of higher returns. Likewise, Klingen, Weder and Zettelmeyer (2004) found that returns on emerging market debt from 1970-2000 equaled those on US treasuries.

Taken together, and given the state of international capital markets in the early to mid 20th Century, we choose to emphasize the results for both the modern, and 19th Century, periods. Here the evidence suggests that market access is reduced both during, and for a period after, a default.

Other Costs of Default

Beyond losing access to capital, a country that defaults could suffer costs in other areas of international relations. For instance, it could become a target of military intervention. The idea of using arms to extract repayment may seem odd today, but many scholars believe this mode of enforcement prevailed until the early twentieth century. Finnemore (2003), for example, writes that militarized debt collection was "accepted practice" until the Second Hague Peace Conference in 1907. Mitchener and Weidenmier (2010) add that gunboat diplomacy was "effective and commonly used" to enforce debts before 1913.

Tomz (2007) maintains, however, that creditor governments generally did not use—or even threaten to use—force on behalf of bondholders. Even the 1902 intervention against Venezuela, often cited as the main example of a bondholder war, occurred because of tort claims, not debt default. Moreover, historical patterns of lending and repayment contradict the gunboat hypothesis. Investors lent to countries they had no chance of coercing, and debtors repaid militarily strong creditors no more often than weak ones. Notwithstanding these historical debates, all agree that today countries do not use military intervention to enforce debt contracts.

Default may also lead to a decline in international trade (Bulow and Rogoff 1989). Trade could suffer for at least three reasons. First, creditors could use tariff and nontariff barriers to reduce trade with the defaulter. As Lane (2004, 2) notes, "The imposition of trade sanctions on the offending country" is "the classic punishment … in the sovereign debt literature." Second, default could lead to the collapse of trade credit, thereby increasing the costs of trade (Kohlscheen and O'Connell 2007). Finally, creditors could seize the debtor's foreign assets, including tradable goods.

Researchers have begun compiling evidence about the effect of default on trade. When countries default on official Paris Club debt, they experience a decline in trade relative to levels one would expect given the standard "gravity" model (Rose 2005;

Borensztein and Panizza 2010). It remains unclear why these changes in trade occur. If the decline were due to trade sanctions, trade with creditor countries would fall faster than trade with other countries. But Martinez and Sandleris (2011) found that default disproportionately depressed trade with non-creditors, and Agronovsky and Trebesch (2009) showed that exports to creditors actually rose after debt restructuring. Studies of earlier time periods cast additional doubt on the trade sanctions hypothesis (English 1996, Tomz 2007).

Evidence for the trade credit mechanism is equally ambiguous. Commercial credit shrinks in the aftermath of default, and exports of sectors that depend on external credit tend to suffer the most (Zymek 2012). However, the impact on commercial credit is brief, and not sufficient to explain the total drop in trade (Borensztein and Panizza 2009).

Finally, there is little evidence of asset seizures following a default. For much of history, the doctrine of sovereign immunity prevented creditors from suing a defaulter in foreign courts (Wright 2012). Moreover, even if creditors could win a judgment, they would find little to take, since most borrowing countries do not own extensive assets in foreign jurisdictions. Several recent court cases have illustrated the near-impossibility of taking sovereign assets as compensation for default (Wright 2001, Doemeland et al 2008, Pitchford and Wright 2012, and Kolb 2011).

Cole and Kehoe (1998) suggested a different mechanism in which default leads to costs in other spheres of international relations. Default could signal that the government is unreliable, not just in debt, but in international affairs more generally. Foreigners might, therefore, be less willing to make direct investments or enter into trade agreements, environmental pacts, and military alliances with the offending state. The concept of reputational spillovers seems plausible, but few have tried to test it empirically (Fuentes and Saravia 2010; Rose and Spiegel 2009; Tomz and Wright 2010). This seems like an especially promising area for future research.

Do Countries Default in "Bad Times"?

The relationship between output and default is potentially informative about the incentives of a sovereign to default. On the one hand, models of sovereign debt with incomplete debt contracts predict that defaults occur when output is low (Eaton and Gersovitz 1981). On the other hand, "limited commitment" models with fully state contingent securities imply that the temptation to default is strongest when output is high (Kletzer and Wright 2001, Wright 2001).

The widespread belief that sovereigns default only in bad times was challenged by Tomz and Wright (2007), who found a weakly negative relationship between default and output in a sample of 175 sovereign borrowers from 1820 to 2005. Defining low output as periods in which annual GDP data was below its Hodrick-Prescott trend, Tomz and Wright showed that sovereigns defaulted when output was below trend

only 60% of the time, and that the average deviation of output from trend at the start of a default was only -1.6%. This result was robust for different time periods, samples of countries, and approaches to measuring trends in output. By contrast, calibrated default models predict that defaults almost always occur when output is below trend, with an average deviation from trend in excess of 8%.

This finding remains controversial. While Benjamin and Wright (2009) and Durdu, Nunes and Sapriza (2010) confirm these results using similar methods on different samples, De Paoli, Hoggarth, and Saporta (2006) and Reinhart and Rogoff (2011) find large output costs using different methods. Both of the latter studies emphasize that the output costs are larger when default is accompanied by a banking or currency crisis, with defaults in isolation associated with small output declines.

Tomz and Wright (2007) suggest ways to reconcile their findings with the predictions of incomplete debt contract models. Perhaps bad times should be measured by changes in exports, government revenues, or world interest rates, rather than output. Another explanation is time aggregation: if sovereign default is associated with short, sharp declines in output, the relationship may be more clearly evident in quarterly data than in annual statistics (Mendoza and Yue 2011). Indeed, Levy Yeyati and Panizza (2011) find a strong negative relationship at quarterly frequency in a sample of 23 defaults.

4. The Price of Sovereign Debt

In this section, we discuss issues that arise in the measurement of bond prices and returns. We illustrate these issues using research on the effect of the Gold Standard – a fixed exchange rate regime that existed in various forms between 1870 and 1931 – on borrowing costs.

Measuring the Cost of Borrowing

Long time series of data on the prices of sovereign bonds exist for many countries. The fact that most sovereigns do not regularly issue bonds in liquid markets, however, creates some practical problems. First, it is typically not possible to examine the yields on identical instruments issued by different countries. Hence, yield differences may reflect differences in instruments as much as differences in the characteristics of the country. Second, the absence of liquid markets means that price data can be volatile and are often missing. This leads many researchers to ignore capital gains on bonds and measure returns using the *coupon yield* (the ratio of the coupon to the price of the bond).

When looking at the history of bond yields, these issues are compounded with a third problem: many sovereign bonds took on forms that are exotic by modern standards. For example, 19th Century bonds often included sinking fund arrangements and

redemption clauses that gave sovereigns the obligation or the right to redeem bonds at pre-specified times. These embedded options make it difficult to calculate yields to maturity.

These difficulties need not be practical concerns if differences in bond contracts are uncorrelated with the institutions or variables of interest to the researcher. However, this does not appear to be the case. Countries that were deemed at greater risk of default tended to issue bonds at a discount with sinking fund arrangements requiring payment at par. Both of these features produce an upward trend in bond prices as the bond approaches either maturity or the date at which sinking fund redemptions take place, and hence falling coupon yields over time. By contrast, better credit risks sometimes issued bonds at a premium to par, which imparts a downward trend on their prices, and an upward trend on coupon yields. Researchers have responded to these problems in various ways, which we illustrate using the example of the effect the Gold Standard and borrowing costs.

What Effect Did Adherence to the Gold Standard Have on Borrowing Costs?

In an influential study, Bordo and Rockoff (1996) examined the coupon yields at an annual frequency of a sample of bonds issued by 10 sovereigns between 1870 and 1914, a period during which a number of countries adopted the gold standard. They found that adoption of the gold standard was associated with lower coupon yields of around 30 to 40 basis points per year, which hey attribute to a “good housekeeping seal of approval”. Obstfeld and Taylor (2003) find similar results in a sample of 20 countries from 1870 to 1914, even after controlling for the stock of sovereign debt. However, they find that the re-adoption of gold in the interwar period was not associated with a reduction in borrowing costs.

Ferguson and Schularick (2006) expand the sample to include the colonies and dominions of the British Empire. They find that lower borrowing costs for countries on gold do not survive controlling for membership of the British Empire.

The use of coupon yields means that these results *may* be a statistical artifact. For example, if the countries that adopted the gold standard in the 1870-1914 period were initially poor credit risks, they would have issued debts at a discount and with sinking fund arrangement. This would have imparted a mechanical downward trend to coupon yields that coincides their their adoption of the gold standard. Evidence for this comes from two recent studies which attempt to correct for these problems and find no evidence that the gold standard reduced borrowing costs.

Flandreau and Zumer (2004) also study coupon yields on the debt of 20 countries but are careful to choose bonds for which the embedded options are unlikely to be used. They find that the gold standard has no effect on yields after controlling for differences in monetary and fiscal policies. Alquist and Chabot (2011) collect monthly

price data and compute holding period returns (which include capital gains) for a large number of sovereigns between 1870 and 1907. Data on capital gains are very volatile, but including them eliminates both sources of the drift in coupon yields .The authors estimate a factor pricing model for sovereign bonds and find no evidence of a "gold standard" or "empire" effect after controlling for exposure to common risk factors.

5. Domestic Politics

Most theories of sovereign debt emphasize international enforcement mechanisms. Governments repay foreign debts, it is said, to avoid adverse international reactions such as exclusion from foreign credit or punishment in other spheres of foreign affairs. In recent years, though, scholars have begun examining how domestic politics affects the calculation to repay. This is a welcome development. When governments appropriate funds to service the foreign debt, they are making a political decision to prioritize foreign obligations over alternative goals that might be more popular with domestic constituents. In this section, we review recent work about the effect of domestic politics on sovereign debt.

Nondiscrimination

Why would citizens ever want their government to repay foreigners, instead of defaulting on foreign debts and directing the savings toward domestic purposes? One possibility is that governments cannot repay their debts selectively (Broner, Martin and Ventura 2010; Broner and Ventura 2011; Guembel and Sussman 2009). If a government owes money to both foreigners and domestic citizens and cannot honor obligations to one group while defaulting on the other, the government might opt to pay creditors abroad, instead of declaring a comprehensive default that would also hurt creditors at home.

The argument seems most plausible in situations when debts take the form of bonds that are traded on secondary markets. If default ever loomed, foreign investors could sell the bonds to citizens of the country that was contemplating default. The transfer of ownership would increase the political costs of default, by putting bonds in the hands of people who could pressure the government to honor its debts. At the same time, the anonymity of secondary markets would make discrimination difficult. Not knowing who owns the debt, the government would find it hard to repay locals at the expense of foreigners.

Several facts seem consistent with this theory. First, many governments have large stocks of domestic as well as foreign debt. Reinhart and Rogoff (2011) assembled data on public debt for 64 countries beginning in 1914 and found that nearly two-thirds of public debt had been held by domestic residents historically. The stock of domestic debt has varied across countries and over time, however, in ways that should affect the incentive to repay. Future researchers should study the size and

membership of the domestic creditor community, thereby offering new insight into the political consequences of default.

Second, for most of recorded history, private investors financed foreign governments almost entirely through bonds that were traded on international capital markets. Although the situation changed in the late 1960s, when commercial banks began lending to foreign governments on a large scale, bond issues have outstripped bank loans in every year since the mid-1990s. Moreover, emerging markets have repaid bondholders at a higher rate than commercial banks (Tomz 2007).

Other facts seem inconsistent with the theory. Most importantly, governments have often favored domestic creditors over foreign ones. Gelpern and Sester (2004, 794) examined recent defaults and concluded that, "in the world of sovereign debt, local and foreign investors buying the same paper rarely achieve what anyone would recognize as equal treatment." Some governments discriminate among holders of identical assets. Others transform their debt stocks in ways that permit discrimination. In 2000-2001, for example, Argentina induced domestic residents to shift into new instruments, which received better treatment than the bonds foreigners continued to hold.

Evidence from earlier periods supports the same conclusion. Waldenstrom (2010) studied bond markets during World War II, a time when capital controls segmented international markets. He found that yields on Danish bonds were lower in Denmark, where only Danish citizens could trade, than in Sweden, where foreign investors were active. The difference in yields is consistent with a model in which sovereigns can favor domestic investors over foreign ones.

Governments also have the means to treat some foreigners more favorably than others. In the interwar period, Germany offered full service to British investors but only partial payment to Americans. Agents implemented this policy by stamping each bond to indicate "U.K. domicile" or "U.S.A. domicile." Likewise, Romania serviced British-owned bonds, while withholding payment from American investors (Tomz 2007). These examples demonstrate that even when bonds are traded on international markets, governments can favor some bondholders over others.

Although governments can discriminate, they do not always exercise the option. Erce and Diaz-Cassou (2011) analyzed ten recent defaulters and found that four discriminated against foreign creditors; three adopted a neutral approach; and three afforded preferential treatment to foreign creditors. The authors admit, however, the three cases in the latter category—Argentina, Russia, and Ukraine—are contentious. Indeed, some researchers conclude that those same countries discriminated in favor of domestic residents (on Argentina and Russia, see Gelpern and Sester 2004; on Ukraine, see Sturzenegger and Zettelmeyer 2007).

Future research should investigate why governments discriminate in some cases but not in others, and whether domestic creditors get better treatment on average. We

expect that conclusions will depend on the definition of default. S&P defines a domestic default as a situation in which the government explicitly violates the loan contract and excludes bursts of inflation that reduce the value of local currency debt. Applying the S&P definition, Kohlscheen (2010a) found that governments defaulted on external debts twice as often as domestic debts. Reinhart and Rogoff (2011) define domestic defaults to include government abrogation of debt contracts or inflation rates above 20%. With this broader definition, they found that defaults on external debt were no more common than defaults on domestic debt.

Distribution

Even if governments could default selectively, some citizens may nonetheless prefer to repay the external debt. The reason is that debt repayment creates economic winners and losers (Frieden 1989, 1991). On the one hand, repayment often requires fiscal adjustment that falls more heavily on some citizens than on others. Governments in crises historically have met their foreign obligations by imposing austerity programs that hurt government employees, the unemployed, and the poor (Johnson and Salop 1980; Vreeland 2002).On the other hand, a government that honors its foreign debts can preserve its international reputation, benefiting domestic constituents who value future transactions with foreigners. These domestic preferences could affect the government's decision to repay or default.

As a first step toward testing these hypotheses, Tomz (2004) analyzed a unique public opinion survey that was administered in Argentina during the debt crisis of 2001-2002. On average, people working in the public sector were less inclined to support the repayment of foreign debt than those in the private sector. Similarly, citizens who were poor or unemployed were less likely to support repayment than those with greater assets and more job security. On the other side of the ledger, citizens who assigned high utility to future capital infusions had a much stronger preference for debt repayment. Finally, the correlation between economic self-interest and policy preferences held most strongly for sophisticates, who scored the highest on a test of economic knowledge that was embedded in the survey.

Curtis, Jupille, and Leblang (2012) analyze the 2011 referendum on debt repayment in Iceland. They found that citizens voted their pocketbook interests. People with extensive investment assets, and those who would suffer from higher borrowing costs, voted for repayment; the unemployed voted for default. However, contrary to expectations, the connection between personal economic interest and voting behavior did not depend on voter sophistication, perhaps because extensive media coverage had made nearly all Icelanders knowledgeable about the issue. Future research should take advantage of public opinion polls in developed and developing countries to better understand domestic political cleavages and how they affect the incentive to default.

Domestic Institutions

Domestic groups have more political influence in some political systems than in others. Some authors argue that democracies are more creditworthy than autocracies, due to the greater frequency of checks and balances, or veto points, in democratic regimes. In an influential paper, North and Weingast (1989) argued that the Glorious Revolution enhanced the creditworthiness of the British government by empowering the parliament as a counterweight to the crown. Cox (2011) offers a related historical account: British creditworthiness improved when the parliament "established a workable system to hold the king's advisors accountable—what we now call ministerial responsibility."

The effect of checks and balances depends critically on the preferences of citizens and interest groups, however. In a detailed analysis of British and French history, Stasavage (2003) showed that checks and balances do not change outcomes unless groups with veto power have diverse attitudes about debt default. If, on the contrary, domestic groups agree on how to handle public debts, structural checks and balances are irrelevant. Stasavage (2011) subsequently examined the effect of representative assemblies in medieval and early modern Europe. He showed that assemblies enhanced creditworthiness in geographically small trade-dependent states, which had powerful mercantile interests that monitored the public credit.

Preliminary research suggests that, on average, veto players increase creditworthiness. For example, coalition governments default less often than unified ones (Saiegh 2009). Likewise, countries with strong courts are seen as more creditworthy than countries without independent judiciaries (Biglaiser and Staats 2012). Finally, parliamentary regimes pay their debts more often than other types of democracies (Kohlscheen 2010b, Van Rijckeghem and Weder 2009). It is not clear how to interpret these findings, though. Many presidential regimes—in which bills typically require the consent of both the executive and the legislature—have more veto points than parliamentary ones. We need more cross-country research about who enjoys veto power on issues of debt.

We also need more research on the policy to which a government would revert if one or more players blocked action. Does default require an affirmative act by government officials, or could it occur passively due to the failure of leaders to appropriate the funds for debt repayment? If repayment requires affirmative action, the presence of veto players could lead to a war of attrition (Alesina and Drazen 1991) between competing groups, which could delay payments to foreign creditors. Thus, the presence of veto players could either increase or decrease the probability of default, depending on the reversion point. This seems like an important area for future research.

Authors argue that democracies are more creditworthy than autocracies, not only because of constitutional checks and balances, but also because voters in a democracy would punish incumbents for defaulting on the foreign debt. Research

about the effect of electoral democracy on debt has generated contradictory conclusions, however. Schultz and Weingast (2003) offer historical examples of democracies that could borrow more money, on better terms, than autocracies. In a large-scale statistical test, though, Saiegh (2005) found that democracies were more likely to reschedule their debts, and paid interest rates at least as high as autocracies. Enderlein, Müller, and Trebesch (2011) add that democracies are significantly more "aggressive" toward foreign creditors, as measured by an index of the coerciveness of debt rescheduling. Finally, democracies have not enjoyed higher credit ratings than autocracies (Archer, Biglaiser, and DeRouen 2007).

More research is needed to reconcile these contradictory findings. Perhaps beliefs about creditworthiness are manifested most clearly in the volume of lending, rather than interest rates or default rates. Consistent with this idea, Nelson (2009) and Beaulieu, Cox, and Saiegh (2012) show that democracies attract more foreign capital than autocracies.

5. Conclusions and Future Directions

Empirical research on sovereign debt has advanced remarkably in recent years. Progress has occurred for three reasons. First, researchers have assembled new datasets that reveal previously unknown facts about sovereign debt. We now have an unprecedented amount of information about the stock, maturity, currency composition, and contractual features of sovereign debt for most countries in the world, over longs sweeps of history. We also know how often countries have defaulted, how long defaults have lasted, and how defaults have been resolved. These discoveries would not have been possible without heroic efforts to unearth data from archives, and to harmonize statistics from disparate sources.

Second, researchers have used the new data to assess theories of sovereign debt. The central puzzle in the literature is the problem of enforcement: what motivates sovereigns to repay, and why do investors ever lend to them? Theorists have posited that governments repay to avoid the loss of access to international capital markets, the disruption of foreign trade, or damage to the country's reputation in other spheres of international affairs. Armed with new data, researchers are beginning to quantify these costs. At the same time, researchers are gaining insight about how investors fare when defaults occur. Macroeconomists can and should use these facts to judge and recalibrate models of debt.

Third, new data are shedding light on the economic and political conditions that contribute to default. How do business cycles in the borrowing country or the global economy affect the probability of default? Given that the choice between default and repayment is partly political, how do the preferences of voters and interest groups matter, and what role do political institutions play in determining whether sovereigns repay? We suspect these questions will become major foci in the literature, and will offer new opportunities for collaboration across the social sciences.

Throughout this essay, we have not only highlighted the discoveries that empirical researchers have made, but also identified gaps between theory and data. To some extent, the gaps exist for practical reasons: key measures remain unavailable for some concepts, countries, and time periods. Addressing these problems will require a continual, collaborative commitment to data collection. Even without new data, it should be possible to improve the dialogue between theoretical and empirical research. We have offered guidance for choosing which existing measures speak most directly to theory. We have also cited recent empirical findings that should inform the next generation of theoretical work. It is only by combining theory and data that future research will advance our understanding of sovereign debt, a central issue for economics, politics, and international relations.

References

1. Agronovsky A, Trebesch C. 2009. Trade credit during financial crises: Do negotiated agreements work? In *Credit, Currency, or Derivatives: Instruments of Global Financial Stability Or Crisis?*, ed. JJ Choi, MG Papaioannou. London: Emerald Publishing Group

2. Aguiar M, Gopinath G. 2006. Defaultable Debt, Interest Rates and the Current Account. *Journal of International Economics* 69: 64-83

3. Alesina A, Drazen A. 1991. Why are Stabilizations Delayed? *American Economic Review* 81: 1170-88

4. Alesina A, Weder B. 2002. Do Corrupt Governments Receive Less Foreign Aid? *American Economic Review* 92: 1126-37

5. Alquist R, Chabot B. 2011. Did gold-standard adherence reduce sovereign capital costs? *Journal of Monetary Economics* 58: 262-72

6. Archer CC, Biglaiser G, DeRouen K. 2007. Sovereign Bonds and the "Democratic Advantage": Does Regime Type Affect Credit Rating Agency Ratings in the Developing World? *International Organization* 61: 341-65

7. Arellano C. 2008. Default Risk and Income Fluctuations in Emerging Economies. *American Economic Review* 98: 690-712

8. Arellano C, Ramanarayanan A. 2012. Default and the Maturity Structure in Sovereign Bonds. *Journal of Political Economy* 120: 187-232

9. Arslanalp S, Henry PB. 2005. Is Debt Relief Efficient? *Journal of Finance* 60: 1017-52

10. Arteta C, Hale G. 2008. Sovereign debt crises and credit to the private sector. *Journal of International Economics*. 74: 53-69

11. Beers DT, Chambers J. 2006. Default Study: Sovereign Defaults At 26-Year Low, To Show Little Change In 2007. *Standard & Poors RatingsDirect*

12. Bedford P, Penalver A, Salmon C. 2005. Resolving sovereign debt crises: the market-based approach and the role of the IMF. *Financial Stability Review*: 91-99

13. Beim DO, Calomiris CW. 2001. *Emerging Financial Markets*. New York: McGraw-Hill

14. Benjamin D, Wright MLJ. 2008. Recovery Before Redemption: A Theory of Delays in Sovereign Debt Renegotiations. *UCLA Working Paper.*

15. Beaulieu E, Cox GW, Saiegh S. 2012. Sovereign Debt and Regime Type: Reconsidering the Democratic Advantage. *International Organization* 66: 709-38

16. Biglaiser G, Staats JL. 2012. Finding the “Democratic Advantage” in Sovereign Bond Ratings: The Importance of Strong Courts, Property Rights Protection, and the Rule of Law. *International Organization* 66: 515-35

17. Bordo MD, Rockoff H. 1996. The Gold Standard as a "Good Housekeeping Seal of Approval". *Journal of Economic History* 56: 389-428

18. Bordo MD, Meissner C, Redish A. 2003. How "Original Sin" Was Overcome: The Evolution of External Debt Denominated in Domestic Currencies in the United States and the British Dominions 1800-2000. *NBER Working Paper* 9841

19. Borensztein E, Panizza U. 2009. The Costs of Sovereign Default. *IMF Staff Papers* 56: 683-741

20. Borensztein E, Panizza U. 2010. Do Sovereign Defaults Hurt Exporters? *Open Economies Review* 21: 393-412

21. Bradley M, Gulati M. 2012. Collective Action Clauses for the Eurozone: An Empirical Analysis. *Duke Working Paper*

22. Broner F, Martin A, Ventura J. 2010. Sovereign Risk and Secondary Markets. *American Economic Review* 100: 1523-55

23. Broner F, Ventura J. 2011. Globalization and Risk Sharing. *Review of Economic Studies* 78: 49-82

24. Broner, FA, Lorenzoni, G, and Schmukler, SL. 2010. Why do emerging economies borrow short term? CREI working paper

25. Bulow J, Rogoff K. 1989. A Constant Recontracting Model of Sovereign Debt. *Journal of Political Economy* 97: 155-78

26. Chang R, Velasco A. 2000. Banks, Debt Maturity and Financial Crises. *Journal of International Economics* 51: 169-94

27. Chatterjee S, Eyigungor B. 2012. Maturity, Indebtedness and Default Risk. *American Economic Review* 102: 2674-99

28. Choi SJ, Gulati M, Posner EA. 2012a. The Evolution of Contractual Terms in Sovereign Bonds. *Journal of Legal Analysis* 4: 131-79

29. Choi SJ, Gulati GM, Posner EA. 2012b. The Dynamics of Contract Evolution. *NYU Center for Law, Economics and Organization Working Paper* 12-16

30. Cline WR. 1995. *International Debt Reexamined*. Washington, DC: Institute for International Economics.

31. Cole HL, Kehoe TJ. 2000. Self-Fulfilling Debt Crises. *Review of Economic Studies* 67

32. Cole HL, Kehoe TJ. 1999. A self-fulfilling model of Mexico's 1994–1995 debt crisis. *Journal of International Economics* 41: 309-30

33. Cole HL, Kehoe PJ. 1998. Models of Sovereign Debt: Partial Versus General Reputations. *International Economic Review* 39: 55-70

34. Cox GW. 2011. War, Moral Hazard, and Ministerial Responsibility: England After the Glorious Revolution. *Journal of Economic History* 71: 133-61

35. Cruces JJ, Trebesch C. 2010. Pricing Haircuts: Do Markets Punish Low Recovery Values in Sovereign Debt Restructurings? *Unpublished Paper, Free University of Berlin*

36. Cruces JJ, Buscaglia M, and Alonso J. 2002. The term structure of country risk and valuation in emerging markets. *Working paper, Universidad Nacional de La Plata*

37. Curtis KA, Jupille J, Leblang D. 2012. "I Save for Icesave: Self-Interest and Sovereign Debt Resettlement." *Unpublished manuscript, Univ. Colorado*

38. Das US, Papaioannou MG, Trebesch C. 2012. Sovereign Debt Restructurings 1950–2010: Literature Survey, Data, and Stylized Facts. *IMF Working Paper* 12

39. De Paoli B, Hoggarth G, Saporta V. 2006. Costs of sovereign default. *Bank of England Financial Stability Paper* 1

40. Depetris Chauvin N, Kraay A. 2005. What Has 100 Billion Dollars Worth of Debt Relief Done for Low Income Countries. *World Bank Working Paper*

41. Dias DA, Richmond C, Wang T. 2012. Duration of Capital Market Exclusion: An Empirical Investigation. *UIUC Working Paper*

42. Dias DA, Richmond C, Wright MLJ. 2012. In For A Penny, In for 100 Billion Pounds: Quantifying The Welfare Effects of Debt Relief. *UCLA Working Paper*.

43. Dias DA, Richmond C, Wright MLJ. 2011. The Stock of External Sovereign Debt: Can We Take the Data At 'Face Value'? *NBER Working Paper* 17551.

44. Díaz-Cassou J, Erce-Domínguez A, Vázquez-Zamora JJ. 2008. Recent Episodes of Sovereign Debt Restructurings: A Case-Study Approach. *Bank of Spain Documentos Ocasionales* 804

45. Doemeland D, Gil Sander F, Braga CAP. 2008. The Economics of Odious Debt. *World Bank Report* 402

46. Durdu CB, Nunes R, Sapriza H. 2010. News and Sovereign Default Risk in Small Open Economies. *Federal Reserve Board International Finance Discussion Paper* 997

47. Easterly, W. 2002. "How did heavily indebted poor countries become heavily indebted? Reviewing two decades of debt relief." *World Development* 30(10): 1677-1696.

48. Easterly W. 2001. Growth implosions, debt explosions, and my Aunt Marilyn: Do growth slowdowns cause public debt crises? *World Bank Policy Research Working Paper* 2531.

49. Eaton J, Gersovitz M. 1981. Debt with potential repudiation: Theoretical and empirical analysis. *Review of Economic Studies* 48: 289-309

50. Eden M, Kraay A, Qian R. 2012. Sovereign Defaults and Expropriations: Empirical Regularities. *Unpublished Paper, World Bank*

51. Eichengreen B. 1989. The U.S. Capital Market and Foreign Lending, 1920-1955. In *Developing Country Debt and Economic Performance*, ed. JD Sachs, pp. 107-55

52. Eichengreen B, Hausmann R. 1999. Exchange Rates and Financial Fragility. In *New Challenges for Monetary Policy*, pp. 329-68. Kansas City: Federal Reserve Bank of Kansas City

53. Eichengreen B, Hausmann R, Panizza U. 2005b. The Mystery of Original Sin. In *Other People's Money*, ed. B Eichengreen, R Hausmann, pp. 233-65. Chicago: University of Chicago Press

54. Eichengreen B, Hausmann R, Panizza U. 2005a. The Pain of Original Sin. In *Other People's Money*, ed. B Eichengreen, R Hausmann, pp. 13-47. Chicago: University of Chicago Press

55. Enderlein H, Müller L, Trebesch C. 2011. Democracies Default Differently: Regime Type and Sovereign Debt Crisis Resolution. *Unpublished manuscript*

56. English WB. 1996. Understanding the Costs of Sovereign Default: American State Debts in the 1840's. *American Economic Review* 86: 259-75

57. Erce A, Diaz-Cassou J. 2011. Selective Sovereign Defaults. *Unpublished manuscript, Banco de España*

58. Ferguson N, Schularick M. 2006. The Empire Effect: The Determinants of Country Risk in the First Age of Globalization, 1880 1913. *Journal of Economic History* 66: 283-312

59. Finger H, Mecagni M. 2007. Sovereign Debt Restructuring and Debt Sustainability: An Analysis of Recent Cross-country Experience. *IMF Occasional Paper* 255

60. Finnemore M. 2003. *The Purpose of Intervention: Changing Beliefs about the Use of Force.* Ithaca, New York: Cornell University Press

61. Flandreau M, Zumer F. 2004. *The Making of Global Finance 1880-1913*. Paris: OECD

62. Frieden JA. 1989. Winners and Losers in the Latin America Debt Crisis. In *Debt and Democracy in Latin America*, ed. B Stallings, R Kaufman. Boulder, Colorado: Westview Press

63. Frieden JA. 1991. *Debt, Development, & Democracy*. Princeton, NJ: Princeton Univ. Press.

64. Fuentes M, Saravia D. 2010. Sovereign defaulters: Do international capital markets punish them? *Journal of Development Economics* 91: 336-47

65. Gelos RG, Sahay R, Sandleris G. 2011. Sovereign borrowing by developing countries: What determines market access? *Journal of International Economics* 83: 243-54

66. Gelpern A, Setser B. 2004. Domestic and external debt: the doomed quest for equal treatment. *Georgetown Journal of International Law* 35: 795-814

67. Goldsmith RW. 1985. *Comparative national balance sheets: a study of twenty countries, 1688-1978*. Chicago: University of Chicago Press

68. Guembel A, Sussman O. 2009. Sovereign Debt without Default Penalties. *Review of Economic Studies* 76: 1297-320

69. Gulati GM, Scott RE. 2011. The Three and a Half Minute Transaction: Boilerplate and the Limits of Contract Design. Manuscript.

70. Hamann F. 2004. Sovereign Risk, Macroeconomic Fluctuations and Default. *Unpublished Paper, North Carolina State University*

71. Hatchondo JC, Martinez L. 2009. Long-duration bonds and sovereign defaults. *Journal of International Economics* 79: 117-25

72. Johnson O, Salop J. 1980. Distributional Aspects of Stabilization Programs in Developing Countries. *IMF Staff Papers* 27: 1-23

73. Jorgensen E, Sachs J. 1989. Default and Renegotiation of Latin American Foreign Bonds in the Interwar Period. In *The International Debt Crisis in Historical Perspective*, ed. B Eichengreen, PH Lindert, pp. 48-85. Cambridge, MA and London: MIT Press

74. Kletzer KM, Wright BD. 2000. Sovereign Debt as Intertemporal Barter. *American Economic Review* 90: 621-39

75. Klingen C, Weder B, Zettelmeyer J. 2004. How Private Creditors Fared in Emerging Debt Markets, 1970-2000. *IMF Working Paper* 04

76. Kohlscheen E. 2010a. Domestic vs external sovereign debt servicing: an empirical analysis. *International Journal of Finance & Economics* 15: 93-103

77. Kohlscheen E. 2010b. Sovereign risk: constitutions rule. *Oxford Economic Papers* 62: 62-85

78. Kohlscheen E, O'Connell SA. 2007. A Sovereign Debt Model with Trade Credit and Reserves. *Unpublished Paper, University of Warwick*

79. Kolb RW. 2011. Sovereign Debt: Theory, Defaults, and Sanctions. In *Sovereign Debt: From Safety to Default*, ed. RW Kolb, pp.3-13. Hoboken: John Wiley & Sons.

80. Lane PR. 2004. Perspectives on Long-Term External Debt. *Topics in Macroeconomics* 4: 1-21

81. Levy Yeyati E, Panizza U. 2011. The elusive costs of sovereign defaults. *Journal of Development Economics* 94: 95-105

82. Levy Yeyati E. 2009. Optimal Debt? On the Insurance Value of International Debt Flows to Developing Countries. *Open Economies Review* 20: 489-507

83. Lindert PH, Morton PJ. 1989. How Sovereign Debt Has Worked. In *Developing Country Debt and Economic Performance.* ed. JD Sachs, pp. 39-106

84. Martinez JV, Sandleris G. 2011. Is it punishment? Sovereign defaults and the decline in trade. *Journal of International Money and Finance* 30: 909-30

85. Mendoza EG, Yue VZ. 2012. A General Equilibrium Model of Sovereign Default and Business Cycles. *Quarterly Journal of Economics* 127: 889-946

86. Michie R. 2001. *The London Stock Exchange: A History*. Oxford: Oxford University Press

87. Mitchener KJ, Weidenmier MD. 2010. Supersanctions and sovereign debt repayment. *Journal of International Money and Finance* 29: 19-36

88. Nelson RM. 2009. *Essays on the Politics of Sovereign Debt Markets*. Ph.D. diss., Harvard University.

89. North DC, Weingast BR. 1989. Constitutions and Commitment: The Evolution of Institutional Governing Public Choice in Seventeenth-Century England. *Journal of Economic History* 49: 803-32

90. Obstfeld M, Taylor AM. 2003. Sovereign Risk, Credibility and the Gold Standard: 1870-1913 versus 1925-31. *Economic Journal* 113: 241-75

91. Özler Ş. 1992. The evolution of credit terms: An empirical study of commercial bank lending to developing countries. *Journal of Development Economics* 38: 79-97

92. Özler Ş. 1993. Have Commercial Banks Ignored History? *American Economic Review* 83: 608-20

93. Panizza U, Sturzenegger F, Zettelmeyer J. 2009. The Economics and Law of Sovereign Debt and Default. *Journal of Economic Literature* 47: 651-98

94. Pescatori A, Sy ANR. 2007. Are Debt Crises Adequately Defined? *IMF Staff Papers* 54: 306-37

95. Pitchford R, Wright MLJ. 2012. Holdout Creditors in Sovereign Debt Restructuring: A Theory of Negotiation in a Weak Contractual Environment. *Review of Economic Studies* 79: 812-37

96. Pitchford R, Wright MLJ. 2007. Restructuring the Sovereign Debt Restructuring Mechanism. *UCLA Working Paper*

97. Purcell JFH, Kaufman JA. 1993. *The Risks of Sovereign Lending: Lessons from History*. New York: Salomon Brothers

98. Rieffel L. 2003. *Restructuring sovereign debt: the case for ad hoc machinery*. Washington, D.C.: Brookings Institution Press.

99. Reinhart CM, Rogoff KS. 2011. The Forgotten History of Domestic Debt. *Economic Journal* 121: 319-50

100. Reinhart CM, Rogoff KS. 2009. *This Time Is Different: Eight Centuries of Financial Folly*. Princeton: Princeton University Press.

101. Reinhart CM, Rogoff KS. 2004. Serial Default and the "Paradox" of Rich-to-Poor Capital Flows. *American Economic Review* 94: 53-58

102. Richards A, Gugiatti M. 2003. Do Collective Action Clauses Influence Bond Yields? New Evidence from Emerging Markets. *International Finance* 6: 415-47

103. Rodrik D, Velasco A. 1999. Short-Term Capital Flows. *NBER Working Paper* 7364

104. Rose AK, Spiegel MM. 2009. Noneconomic Engagement and International Exchange: The Case of Environmental Treaties. *Journal of Money, Credit and Banking* 41: 337-63

105. Rose AK. 2005. One reason countries pay their debts: renegotiation and international trade. *Journal of Development Economics*. 77: 189-206

106. Roxburgh C, Lund S, Piotrowski J. 2011. *Mapping Global Capital Markets 2011*: McKinsey Global Institute

107. Saiegh SM. 2005. Do Countries Have a "Democratic Advantage"? *Comparative Political Studies* 38: 366-87

108. Saiegh SM. 2009. Coalition Governments And Sovereign Debt Crises. *Economics and Politics* 21: 232-54

109. Schultz KA, Weingast BR. 2003. The Democratic Advantage: Institutional Foundations of Financial Power in International Competition. *International Organization* 57: 3-42

110. Stasavage D. 2003. *Public Debt and the Birth of the Democratic State: France and Great Britain, 1688–1789*. New York: Cambridge Univ. Press.

111. Stasavage D. 2011. *States of Credit: Size, Power, and the Development of European Polities*. Princeton: Princeton Univ. Press.

112. Sturzenegger F, Zettelmeyer J. 2007. *Debt Defaults and Lessons from a Decade of Crises*. Boston: MIT Press

113. Sturzenegger F, Zettelmeyer J. 2008. Haircuts: Estimating investor losses in sovereign debt restructurings, 1998-2005. *Journal of International Money and Finance* 27: 780-805

114. Sturzenegger F, Zettelmeyer J. 2006. Creditors Losses versus Debt Relief: Results from a Decade of Sovereign Debt Crises. *Journal of the European Economic Association.* 5: 343-51

115. Suter C. 1990. *Schuldenzyklen in der Dritten Welt : Kreditaufnahme, Zahlungskrisen und Schuldenregelungen peripherer Lèander im Weltsystem von 1820 bis 1986*. Frankfurt am Main: A. Hain.

116. Suter C. 1992. *Debt cycles in the world-economy : foreign loans, financial crises, and debt settlements, 1820-1990*. Boulder, Colo.: Westview Press

117. Taylor JB. 2002. Sovereign Debt Restructuring: A US Perspective. Washington, DC

118. Tomz M. 2007. *Reputation and International Cooperation: Sovereign Debt Across Three Centuries*. Princeton: Princeton University Press

119. Tomz M. 2004. Interests, Information, and the Domestic Politics of International Agreements. *Unpublished manuscript, Stanford*

120. Tomz M, Wright MLJ. 2010. Sovereign Theft: Theory and Evidence about Sovereign Default and Expropriation. In *The Natural Resources Trap: Private Investment Without Public Commitment*, ed. W Hogan, F Sturzenegger, pp. 69-110. Cambridge, MA: MIT Press

121. Tomz M, Wright MLJ. 2007. Do Countries Default in "Bad Times"? *Journal of the European Economic Association.* 5: 352-60

122. Van Rijckeghem C, Weder B. 2009. Political institutions and debt crises. *Public Choice* 138: 387-408

123. Vreeland JR. 2002. The Effect of IMF Programs on Labor. *World Development* 30: 121-39

124. Waldenström D. 2010. Why does sovereign risk differ for domestic and external debt? Evidence from Scandinavia, 1938–1948. *Journal of International Money and Finance* 29: 387-402

125. World Bank. various. *Global Development Finance*. Washington D.C.: World Bank

126. Wright MLJ. 2012. Sovereign Debt Restructuring: Problems and Prospects. *Harvard Business Law Review* forthcoming

127. Wright MLJ. 2011a. Restructuring Sovereign Debts with Private Sector Creditors: Theory and Practice. In *Sovereign Debt and the Financial Crisis: Will This Time Be Different?*, ed. CA Primo Braga, GA Vincelette, pp. 295-315. Washington, D.C.: World Bank

128. Wright MLJ. 2011b. The *Pari Passu* Clause in Sovereign Bond Contracts: Evolution or Intelligent Design? *Hofstra Law Review* 40: 103-14

129. Wright MLJ. 2001. Reputations and Sovereign Debt. *MIT Working Paper*.

130. Yue VZ. 2010. Sovereign default and debt renegotiation. *Journal of International Economics* 80: 176-87

131. Zymek R. 2012. Sovereign Default, International Lending, and Trade. *IMF Economic Review* 60: 265-394

Sidebar

Expropriation of Foreign Direct Investment

In addition to defaulting on their debts, sovereigns also expropriate foreign direct investment (FDI), either directly through nationalization or indirectly by limiting the property rights of foreign investors.

Some theories predict a close relationship between the occurrence of sovereign default and expropriation (collectively referred to as "sovereign theft"). For example, if sovereigns honor contracts in order to maintain a good reputation, and if one form of sovereign theft is informative about the likelihood of the other, sovereigns should default and expropriate together: the information revealed is the same but the benefits to seizing both are larger. A similar prediction arises if sovereign theft is deterred by retaliatory threats of denying international debt and equity market access.

Surprisingly, Tomz and Wright (2010) found no short-run relationship between default and the expropriation of 20th Century US FDI abroad despite a strong long-run relationship: sovereigns rarely expropriated and defaulted at the same time, although many either both defaulted and expropriated, or did neither. Eden, Kraay, and Qian (2012) found similar results in a study of non-US FDI and also find no evidence that debt flows decline after an expropriation, nor that direct investment declines after a default (but contrast Fuentes and Saravia 2010).

Definitions

Debt Relief: A reduction of, or extension of the timing of, payments on a debt.

Default: Narrowly, a violation of the terms of a debt contract such as a failure to pay within the specified grace period. Broadly, also includes voluntary restructurings of debt that reduce the value of that debt to creditors.

Doctrine of Sovereign Immunity: A legal doctrine proscribing suit against a sovereign state, and attachment of a sovereign state's property, without the sovereign's consent.

External Debt: Debt issued in a foreign legal jurisdiction. May be denominated in domestic or foreign currencies, and be held by both domestic and foreign residents.

Face Value of Debt: The undiscounted sum of future principal repayments of a debt.

Haircut: The loss, in percentage terms, experienced by a creditor as a result of a default. It is equal to one minus the recovery rate on the debt.

Sovereign State: A political organization with supreme independent authority over a geographic area. Foreign sovereign immunity is extended to entities that have been recognized as sovereign states by the sovereign state of the relevant legal jurisdiction.

Sovereign Debt: Debt owed or guaranteed by the government of a sovereign state.

Figure 1: The Evolution of Sovereign Indebtedness

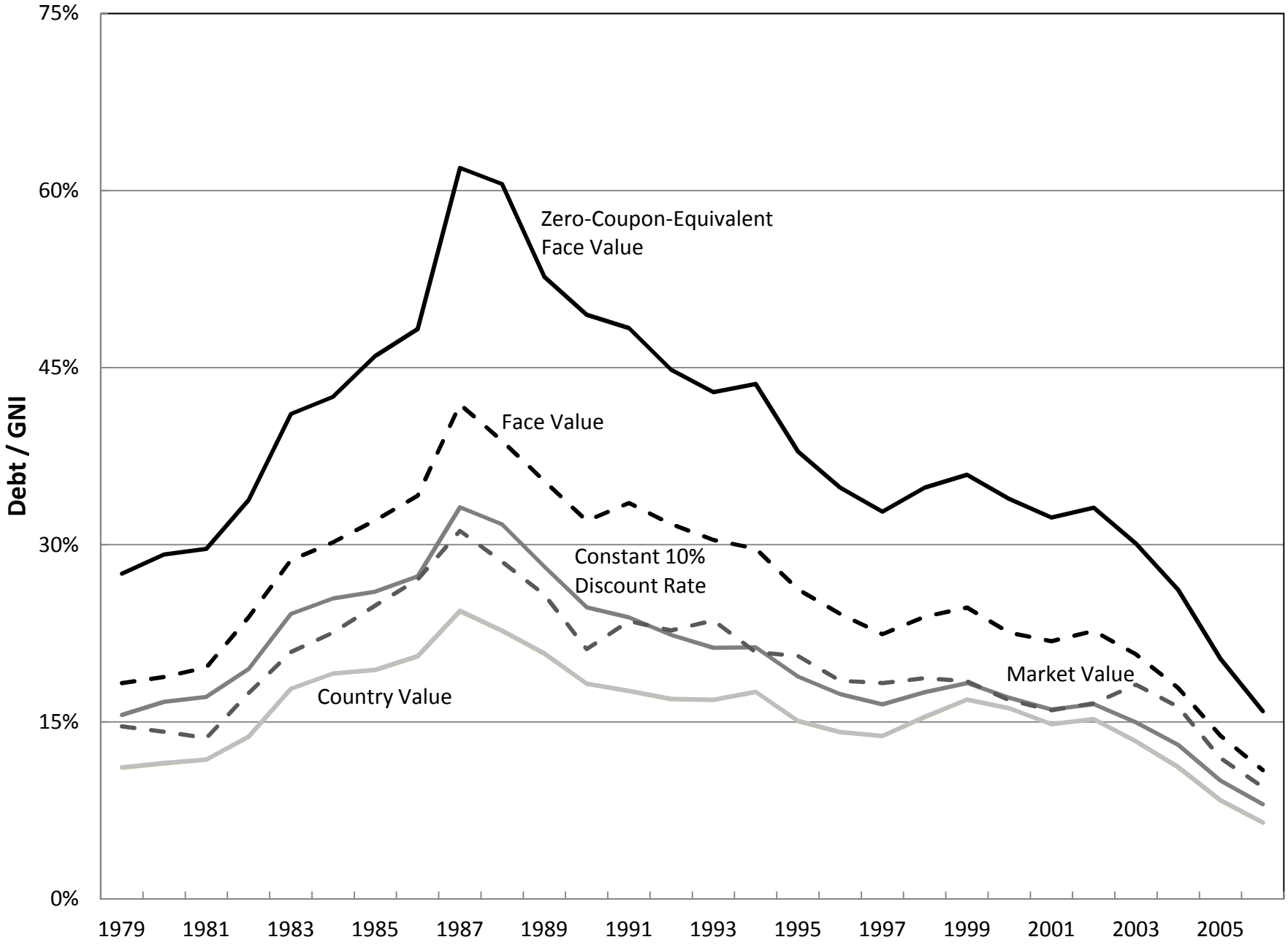
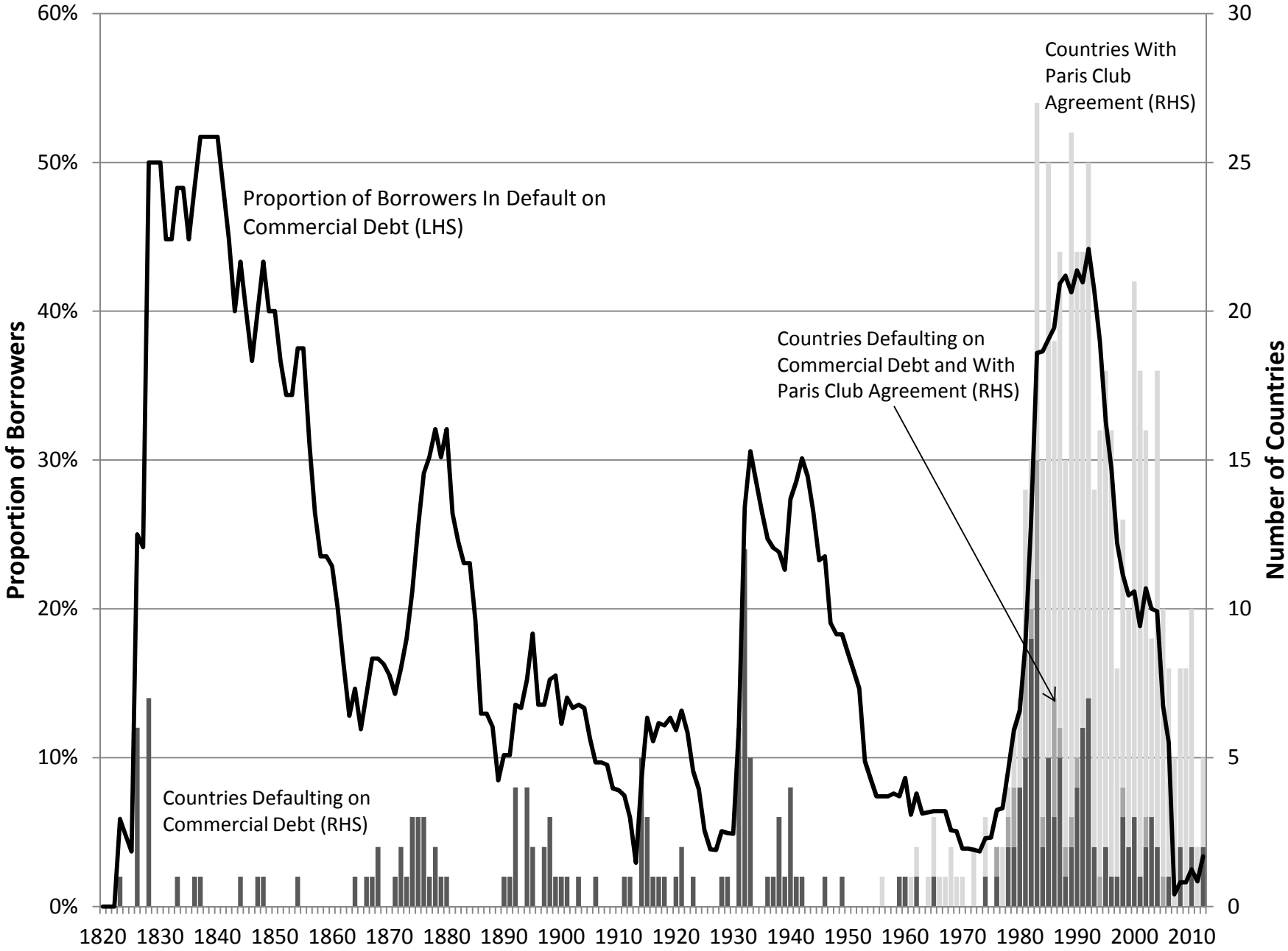


Figure 2: The Frequency of Sovereign Default



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