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Sovereign Defaults: The Price of Haircuts†

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A main puzzle in the sovereign debt literature is that defaults have only minor effects on subsequent borrowing costs and access to credit. This paper comes to a different conclusion. We construct the first complete database of investor losses ("haircuts") in all restructurings with foreign banks and bondholders from 1970 *until* 2010, *covering* 180 *cases in* 68 *countries. We then show that restructurings involving higher haircuts are associated with significantly higher subsequent bond yield spreads and longer periods of capital market exclusion. The results cast doubt on the widespread belief that credit markets "forgive and forget."* (*JEL* E43, F34, G15, H63)

Leading theories in international finance assume or predict that sovereign defaults result in higher subsequent borrowing costs, up to the government's full exclusion from capital markets.[1] However, empirical support for this proposition is weak at best, as shown by 30 years of research. According to the consensus of empirical studies, defaulting countries do *not* face substantially higher borrowing costs after a debt crisis, and often regain access to credit after just one or two years.[2]

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[1] See Eaton and Gersovitz (1981) or, more recently, Kletzer and Wright (2000), Amador (2003), Aguiar and Gopinath (2006), Kovrijnykh and Szentes (2007), Arellano (2008), Sandleris (2008), and Yue (2010). Alternatively, Grossman and van Huyck (1988) argue that to the extent that defaults are excusable, they should not entail reputational damage. A different branch of the literature suggests that sovereign defaults have costly spillovers beyond sovereign credit markets (see Cole and Kehoe 1998), with adverse effects on trade (Rose 2005), on private sector access to credit (Arteta and Hale 2008; Trebesch 2009), or for the financial sector (Gennaioli, Martin, and Rossi 2010; Acharya and Rajan 2011). Others study the possibility of direct sanctions (e.g., Bulow and Rogoff 1989a; Mitchener and Weidenmier 2005; Tomz 2007).

[2] See the surveys by Eaton and Fernández (1995) and Panizza, Sturzenegger, and Zettelmeyer (2009), as well as the papers by Eichengreen (1989); Jorgensen and Sachs (1989); Lindert and Morton (1989); Özler (1993); Dell'Ariccia, Schnabel, and Zettelmeyer (2006); Borensztein and Panizza (2009); Gelos, Sahay, and Sandleris (2011); and Sandleris (2012).

These findings have led many to conclude that "debts which are forgiven will be forgotten" (Bulow and Rogoff 1989b, 49). In this paper, we build and exploit a comprehensive dataset on creditor losses ("haircuts") in past debt restructurings and come to a different conclusion. We find that sovereign default is an important predictor of subsequent borrowing conditions, once the scope of creditor losses is taken into account.

The paper is organized around its two main contributions. The first part presents a new database of haircut estimates, covering all sovereign debt restructurings with foreign banks and bondholders between 1970 and 2010, the only complete set of estimates so far. To construct this dataset we gathered and synchronized data from nearly 200 different sources, including the International Monetary Fund (IMF) archives, private sector research, offering memoranda and articles from the financial press. The result is the first full archive on sovereign restructuring events since the 1970s, providing not just haircut estimates, but also details on the occurrence and terms of past restructurings, as well as the characteristics of old and new instruments involved in each exchange. Like in Sturzenegger and Zettelmeyer (2008), we use the collected restructuring details to compute haircuts as the percentage difference between the present values of old and new instruments, discounted at market rates prevailing immediately after the exchange.[3] To compute deal-specific "exit yields" for each restructuring since the 1970s, we also develop a new discounting approach, which takes into account both the global price of credit risk and country conditions at each point in time.

We find that the average sovereign haircut is 37 percent, which is significantly lower than for corporate debt restructurings in the United States (see Section II). We also find that there is a large variation in haircut size (one-half of the haircuts are either below 23 percent or above 53 percent), and that average haircuts have increased over the last decades. These data and stylized facts are relevant both from an academic and a policy perspective. On the academic front, they invite us to rethink the influential theoretical models that feature a 100 percent haircut upon default. On the policy front, they enable more informed judgments on debt crises outcomes and private creditor burden sharing in the past decades. In addition, the dataset sheds new light on sovereign debt as an asset class. In particular, it provides, for the first time, representative estimates on sovereign debt recovery rates. These may be used for future academic research, but also as inputs for a wide range of credit risk models in the financial industry, e.g., to back out default probabilities from observable bond prices.[4]

The second part of the paper documents the relationship between restructuring outcomes and subsequent borrowing conditions for debtor governments.[5] Our key hypothesis is that higher haircuts are associated with higher post-restructuring spreads and longer duration of exclusion from capital markets. Econometrically, we analyze sovereign borrowing conditions after debt restructuring events. We start by

[3] For completeness, we also compute alternative measures of investor losses for each deal, which we term as *market haircuts*, *face value haircuts*, and *effective haircuts* (see Section IA for details).

[4] Given the lack of data, even rating agencies continue to base their recovery assumptions for sovereigns on a very small sample of restructurings. The most recent report by Moody's (2011) shows recovery rates for 15 recent cases, while Standard and Poor's (2007) shows estimates of 10 cases only.

[5] A detailed survey of the empirical literature is given in Panizza, Sturzenegger, and Zettelmeyer (2009) and Sandleris (2012). Relatedly, we refer to Das, Papaioannou, and Trebesch (2012) for an overview on sovereign debt restructuring characteristics.

running a fixed effects panel regression with monthly sovereign bond spreads as the dependent variable, using the Emerging Market Bond Index Global (EMBIG) for 47 countries, and then lag our haircut measure for up to 7 years after the restructuring. In a second step, we analyze the duration of exclusion from capital markets by applying semi-parametric survival models. Our exclusion measure captures the number of years from the restructuring until the country reaccesses international capital markets. To improve on previous work on exclusion duration, we construct a yearly dataset of reaccess, which combines data on more than 20,000 loans and bonds at the micro level, with aggregate credit flow data at the country level.

The results can be summarized as follows. The size of haircuts is a significant predictor of spreads for up to seven years after a restructuring. The spread increase is also economically substantial, especially at haircut levels beyond 40 percent. In our most conservative specification, a 1 standard deviation increase in haircut (22 percentage points) is associated with post-restructuring bond spreads that are more than 120 basis points higher in years 4 to 7 after the crisis. These are sizable coefficients, especially when compared to the findings of previous empirical work. In addition, we find that haircut size is highly correlated with the duration of capital market exclusion. Ceteris paribus, a 1 standard deviation increase in haircuts is associated with a 50 percent lower likelihood of reaccessing international capital markets in any year after the restructuring.

We attribute our results to more precise measurement of a country's repayment record. Previous papers attempting to gauge the effects of defaults on subsequent market access have used a binary default indicator, capturing *any* missed payment as explanatory variable for past credit history.[6] But using binary default instead of actual losses ignores the large variation in restructuring outcomes. This may be one reason why past research concluded that the effects of previous defaults in sovereign credit markets are negligible, at least in the medium run. Our analysis indicates that it is crucial to consider the magnitude of past defaults, not only the default event per se.

The rest of the paper is structured as follows. The methodology to compute haircuts and a number of stylized facts from the resulting dataset are summarized in Sections I and II. Section III discusses theoretical considerations and the two testable predictions. Section IV assesses the link between haircuts and subsequent bond yield spreads, while Section V focuses on capital market exclusion. The last section concludes.

I. Estimating Creditor Losses: Methodology and Data

This section summarizes the construction of our haircut database, which is presented in detail in the online Appendix. Our aim is to estimate the wealth loss of the average creditor participating in the exchange. To this end, we provide two main sets of haircut estimates: one following the approach used by most market participants ("market haircut"), and another using the more refined approach of Sturzenegger and Zettelmeyer ("SZ haircut") who estimate haircuts rigorously for 22 recent restructurings (see Sturzenegger and Zettelmeyer 2006 and 2008, SZ hereafter).

[6] This applies to all papers cited in footnote 2. Relatedly, a recent paper by Benczur and Ilut (2009) uses arrears as a continuous measure for repayment history.

Other authors have preceded us in estimating haircuts—albeit with a more limited scope.[7] Our contribution is that we are the first to estimate haircuts based on a present value approach for all 180 sovereign debt restructurings with foreign banks and bondholders between 1970 and 2010. In addition, we collect data on nominal debt reduction, measured as the share of debt written off to face value.

Section IA defines the two main haircut measures, while Section IB summarizes how we compute debt service streams and briefly presents our discounting approach. Section IC discusses case selection and the data sources used.

A. *Defining Investor Losses*

Debt restructuring typically involves swapping old debt in default for a new debt contract. The simplest way to compute the loss involved in such a debt exchange is to measure nominal debt reduction (see e.g., Alesina and Weder 2002). This *face value haircut* captures the share of debt forgiven in nominal terms. While easy to compute, the approach ignores any loss due to a lengthening of maturities, so that a debt rescheduling, which only postpones payments in the future, implies a zero haircut. Since the 1970s, there have been 123 such "pure" debt reschedulings by sovereigns, including most cases of the 1980s and recent debt exchanges in Ukraine 2000 or Uruguay 2003. It is unrealistic to conclude that investor losses were zero in all of these cases. Instead, as we will show below, maturity extensions are a crucial component of overall debt relief, so that face value haircuts will tend to bias the reported investor losses downwards.

Sovereign creditor groups,[8] rating agencies, central banks, and international financial institutions like the IMF all assess the new debts following a restructuring in present value, not face value, terms. The traditional present value loss measure is what we call the *market haircut*, which can be defined as follows. For a country i that exits default at time t and issues new debt in exchange for old debt, and which faces an interest rate of r_t^i at the exit from default, the market haircut (H_M) is

$$H_{M_t^i} = 1 - \frac{\text{Present Value of } New \text{ Debt } (r_t^i)}{\text{Face Value of } Old \text{ Debt}}. \tag{1}$$

This approach thus compares the present value of the new debt instruments (plus possible cash repayments) with the full face value amount of the old outstanding debt. This simple formula is widely used and simple since it does not require detailed

[7] Jorgensen and Sachs (1989) were the first to compute creditor losses in sovereign restructurings covering four cases during the 1930s and 1940s. Benjamin and Wright (2009) provide haircut estimates for 90 cases since 1990, which are not computed in present value terms but rather based on aggregate face value reduction and interest forgiven. Further haircut estimates for several recent cases are provided by Cline (1995); Rieffel (2003); Bedford, Penalver, and Salmon (2005); Finger and Mecagni (2007); and Díaz-Cassou, Erce-Domínguez, and Vázquez-Zamora (2008). In addition, some authors computed the internal rates of return on sovereign bonds historically or over longer periods of time, but without computing recovery values for specific restructurings: e.g., Eichengreen and Portes (1986, 1989); Lindert and Morton (1989); Klingen, Weder, and Zettelmeyer (2004); and Esteves (2007).

[8] Rieffel (2003, chapters 5 and 6) explains that creditor groups, such as the bank steering committees of the 1980s/1990s and the Paris Club of official creditors, use present value as their method to assess the creditor losses and the scope of debt relief.

knowledge of the old debt's characteristics. Another reason for using this measure is that debt payments are contractually accelerated at a default event.[9]

SZ (2008) propose a more sophisticated present value measure, which is now an established approach among academics and also increasingly so among practitioners.[10] The SZ haircut is defined as

$$(2) \qquad H_{SZ}{}_t^i = 1 - \frac{\text{Present Value of } \textit{New} \text{ Debt } (r_t^i)}{\text{Present Value of } \textit{Old} \text{ Debt } (r_t^i)}.$$

The key difference between equations (1) and (2) is that unmatured old debt instruments are not taken at face value but computed in present value terms and discounted at the same rate as the new debt instruments. The rationale for using the same "exit yield" to discount the old and the new debt reflects the increased debt servicing capacity resulting from the exchange itself. More generally, the exit yield is widely regarded as the best available proxy for the debtor's default risk after the exchange. Of course, when the old debt had all fallen due by the time of the restructuring, H_{SZ} uses the face value of that old debt, just like H_M, which happens in 92 of the 180 cases in the sample. Both formulae include past due interest and principal of the old debt at face value.

H_{SZ} is our preferred haircut measure because it accounts for the characteristics of both the old and the new debt, in particular, any change in the maturity and interest structure. The measure is therefore the best available approximation of the wealth loss for participating investors. More specifically, H_{SZ} compares the present value of the new and the old debt in a hypothetical scenario in which the sovereign kept servicing old bonds that are not tendered in the exchange on a pari passu basis with the new bonds (SZ 2008, 783). Another advantage of the H_{SZ} approach is that it better captures the cumulative investor losses in a sequence of restructurings by the same country.[11] This is empirically relevant here, as many debtor countries restructured the same debt two or three times during the 1980s and early 1990s (see Reinhart and Rogoff 2009 for a discussion of "serial defaulters").

The main drawback of H_M is that it treats all outstanding bonds and loans as if they were fully and immediately due on the day of the exchange. This ignores the fact that, in most cases, the old debt would have taken years or even decades to be

[9] Acceleration clauses entitle creditors to immediate and full repayment in case the debtor defaults on interest or principal payments (see Buchheit and Gulati 2002).

[10] Recent investment bank reports refer to the SZ data and method as a benchmark for a possible Greek debt exchange (e.g., Citibank 2010, 2; or Deutsche Bank 2010, 19–20).

[11] The sequence of restructurings could involve repeated restructurings of the same debt, or simply be restructurings of unrelated debts. The superiority of H_{SZ} over H_M is easier to show for two restructurings of the same debt: If a country restructures old debt at time t but the new debt is renegotiated again soon after, say at time $t + N$, then the cumulative H_M will depend on the product $\frac{PV\,New_t}{FV\,Old_t}\frac{PV\,New_{t+N}}{FV\,Old_{t+N}}$, which will tend to overestimate the actual cumulative loss of investors since, in general, $\frac{PV\,New_t}{FV\,Old_{t+N}} < 1$, especially when the debt is long term. Under H_{SZ}, this latter ratio would be $\frac{PV\,New_t}{PV\,Old_{t+N}}$, which, under normal conditions, would be much closer to one. A similar reasoning applies to restructurings of different debts at two different points in time. See online Appendix Section A1 for further discussion of cumulative haircut computations.

fully serviced.[12] Take the example of the recent Greek bond exchange of March 2012, which restructured about 200 billion euro of bonds maturing up to the year 2054. The implicit counterfactual underlying H_M is that this entire stock of debt is paid upon default. It therefore compares the face value of the old bonds or loans to the discounted present value of the new instrument(s). The result is that H_M will tend to exaggerate the actual loss of investors participating in the exchange. Acceleration clauses are not always a valid justification, either. Of the 17 recent debt exchanges in Table 2, 7 were preemptive, meaning that the restructuring was implemented prior to a formal default that could have triggered the acceleration of payments. Therefore, H_M is often conceptually inadequate, including for the preemptive Greek exchange of 2012.

It is important to underline that H_{SZ} captures the wealth loss of participating investors at one point in time, namely at the exit from default. An alternative would be to measure the wealth loss relative to the value of the old bonds before the default, especially when the default and the restructuring terms contain an important element of surprise.[13] Note however, that if the market is informationally efficient, the pre-default market value of the old bond will equal the expected present value of the new bond resulting from the exchange, so that this haircut would be the market's pricing error (i.e., zero on average), which is unsatisfactory.[14] Given these challenges, the post-restructuring old debt prices used by H_{SZ} are a natural benchmark, acknowledging upfront that this measure may overestimate or underestimate the investor's wealth loss relative to old bond values in particular cases.[15] Overall, we conclude that H_{SZ} is the most appropriate measure to capture investor wealth losses for the large sample of cases at hand. Most importantly, it does not suffer from the biases of plain face value losses or of the practitioner's measure H_M.

B. *Discounting Payment Streams*

This subsection briefly summarizes our methodology to compute present values of both the new and the old debt.

Computing Contractual Payment Flows.—We start by computing, in US dollars, the contractual cash flows of the old and the new debt for each year from restructuring to maturity. To do this, we collect detailed data on debt amounts, maturity, repayment schedule, contractual interest/coupon rate, and any further debt

[12] More generally, equation (2) will often, but not always, yield a lower haircut estimate than equation (1). The difference between these two measures arises from the comparison between the face value and the present value of the old debt. When r_t^i is larger than the interest/coupon rate on the old debt, then $H_M > H_{SZ}$ (76 cases in the sample). This discrepancy will tend to increase the longer the remaining maturity of the old debt. When r_t^i is smaller than the interest/coupon rate on the old debt, then the present value of the old debt is greater than par and $H_M < H_{SZ}$ (11 cases in the sample).

[13] Russia's default in August 1998 is one such case, because it was largely unexpected (see the discussion in Dell'Ariccia, Schnabel, and Zettelmeyer 2006). The pre-default bond price, as of June 1998, was *higher* than the value we compute for the old bonds at the exit from default. An opposite example is Uruguay 2003, where bond prices before the start of the debt crisis (e.g., in July 2002) were *lower* than the present value we compute for the old bonds in the month of the restructuring (in May 2003). The deviation can thus go in either direction.

[14] For simplicity, we are assuming here that restructuring occurs immediately upon default.

[15] We thank a referee for pointing this out.

characteristics that might influence an instrument's value (such as the collateralization of interest payments in Brady bonds).

In computing cash flows, we take advantage of the most disaggregated information available. This means that we calculate present values on a loan-by-loan and bond-by-bond level, whenever we could collect such information. For all cases in which detailed terms were unavailable, as often happens in restructurings of the 1970s and 1980s, we simply compute an aggregated discounted cash flow stream and haircut for all of the debt. The online Appendix provides further details, including the scope of data available for each restructuring.

Discounting.—We next discount the cash flow streams to assess their present values. Most importantly, this requires choosing a discount rate for each restructuring. In their analysis of major deals from 1998 until 2005, SZ use the secondary market yield implicit in the price of the new debt instruments on the first trading day after the debt exchange. Unfortunately, such market-based "exit yields" are only available for a very small subsample of recent cases with liquid secondary debt markets. This lack of data has pushed other researchers to use a constant rate across restructurings,[16] despite the fact that countries restructured their debts in very different conditions.[17]

We also provide an original contribution to the literature in this front. We design a procedure to impute voluntary market rates specific to each of the 180 restructurings in our sample, thus covering more than three decades. Our imputed discount rates take into account two main determinants of the cost of capital facing debt issuers at the exit from default: the specific country situation and the level of the credit risk premium at that time. In a nutshell, the procedure can be summarized as follows. We start from secondary market yields on low-grade US corporate bonds which we group by credit rating category. We then convert these corporate yields into discount rates on sovereign debt by first linking corporate and sovereign secondary market yields and then imputing yield levels for each sovereign based on its credit rating at the time of restructuring.[18] In the spirit of SZ, we then use these imputed discount rates at the exit from default to discount the cash flows of the old and new debt.

Overall, the procedure yields monthly discount rates from the late 1970s until 2010 and for up to 140 countries, although we only use a small subset of these for our haircut computations. To our knowledge, no set of discount rate estimates in the literature spans such a large number of countries and years. The discount rates

[16] A popular rule of thumb is to use a flat 10 percent rate, as done, for example, by the Global Development Finance team of the World Bank (Dikhanov 2004), by IMF staff (see Finger and Mecagni 2007), and by researchers, such as Andritzky (2006) and Benjamin and Wright (2009). Others have used risk-free reference rates, such as US Treasury bond yields or Libor (e.g., Claessens, Diwan, and Fernández-Arias 1992).

[17] For example, when Nigeria restructured in 1991, its credit rating was 19.5 points on the *Institutional Investor* scale (a scale that goes from 0 to 100 where larger numbers imply more creditworthiness), while when South Africa restructured in 1993, its credit rating was 38.2. Hence, it is unlikely that the default-exit yield would be the same for these two debtors. It is also well-known that the credit risk premium changes over time. For example, when Russia restructured in August 2000, the secondary market yield on Moody's index of speculative grade US corporate bonds was 11.43 percent, while it was only 8.14 percent when Argentina restructured in 2005. Our procedure takes into account both of these factors and gives different yields for these four cases: 9.81 for South Africa, 10.36 for Argentina, 12.48 for Russia, and 18.28 for Nigeria.

[18] Our idea of exploiting US corporate bond data to price sovereign risk is consistent with a recent paper by Borri and Verdelhan (2012) who show that sovereign bond prices in emerging markets are closely related to the degree of risk aversion in US debt markets.

in the used subset range between 9 and 41.2 percent, with a median of 15. The first quartile of the series is 12.8 and the third quartile is 24.3, so that about one-half of the discount rates are outside of this range (see the online Appendix Sections A4.2 and A4.3 for a detailed methodological description).

C. *Data Sources and Sample*

When starting this project there was no single standardized source providing the degree of detail and reliability necessary to set up a satisfactory database of restructuring terms since the 1970s from which to estimate haircuts. We therefore embarked into an extensive data collection exercise, for which we gathered and cross-checked data from all 29 publicly available lists on restructuring terms and more than 160 further sources, including the IMF archives, books, policy reports, offering memoranda, private sector research, and articles in the financial press. The online Appendix provides an overview of sources used, describes our approach to minimize coding errors, and reports a data quality index for each deal. The detailed list of sources on each restructuring is included in Section A6 of the online Appendix.

The case sample in this paper covers the full universe of sovereign debt restructurings with foreign commercial creditors (banks and bondholders) from 1970 until 2010. To identify relevant events we apply five case selection criteria. First, we focus on sovereign restructurings, defined as restructurings of public or publicly guaranteed debt. We do not take into account private-to-private debt exchanges, even if large-scale workouts of private sector debt were coordinated by the sovereign (e.g., Korea 1997, Indonesia 1998). Second, we follow the definition and data of Standard and Poor's (2006, 2011) and include only distressed debt exchanges. Distressed restructurings occur in crisis times and typically imply new instruments with less favorable terms than the original bonds or loans. We therefore disregard market operations that are part of routine liability management, such as voluntary debt swaps. Third, we focus on sovereign debt restructurings with foreign private creditors, thus excluding debt restructurings that predominantly affected domestic creditors and those affecting official creditors, including those negotiated under the chairmanship of the Paris Club. Foreign creditors include foreign commercial banks ("London Club" creditors) as well as foreign bondholders. For recent deals, we follow the categorization into domestic and external debt exchanges of SZ (2006, 263).[19] Fourth, we restrict the sample to restructurings of medium- and long-term debt, thus disregarding deals involving short-term debt only, such as the maintenance of short-term credit lines, 90-day debt rollovers, or cases with short-term maturity extension of less than a year. Finally, we only include restructurings that were actually finalized. We thus drop cases in which an exchange offer or agreement was never implemented, e.g., due to the failure of an IMF program or for political reasons.

Based on these selection criteria, we identify 182 sovereign debt restructurings by 68 countries since 1978 (no restructurings occurred between 1970 and 1977—a

[19] As a result, we do include two restructurings involving domestic currency debt instruments, but only because they mainly affected external creditors: Russia's July 1998 GKO exchange and Ukraine's August 1998 exchange of OVDP bonds.

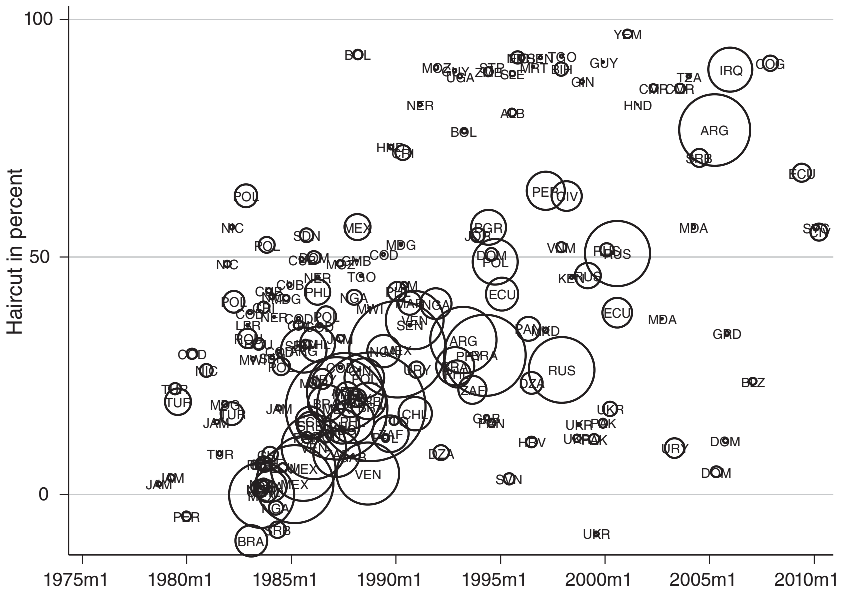

FIGURE 1. HAIRCUTS AND DEAL VOLUMES OVER TIME

Notes: This figure plots the size of H_{SZ} (from equation (2)) expressed in percentage points across countries and time. The circle size reflects the volume of debt restructured in 1980 real US dollars. Haircuts range from almost nil to larger than 95 percent. The maximum haircut shows a secular rise and the cross sectional dispersion of haircuts increases over time. See footnote 20 for a discussion of the negative haircuts.

nonoccurrence that we find informative). We were able to gather sufficient data to compute haircuts on all of these cases, except for the restructurings of Togo 1980 and 1983 (see online Appendix Section A2 for further details). We thus base all summary statistics on a final sample of 180 implemented restructurings by 68 countries.

II. Haircut Estimates: Results and Stylized Facts

The dataset and estimates of the 180 deals in our final sample reveal a series of insights on sovereign debt restructurings.

A first insight is the large variability in haircut size across space and time. Figure 1 plots our estimates of H_{SZ} from equation (2) over time and the respective, inflation-adjusted debt volumes of each restructuring, as represented by the size of the circles.[20] The graph illustrates the dispersion in haircuts, which has increased notably since the late 1970s. Recent years have seen a particularly large variation, with some deals involving haircuts as high as 90 percent and others involving haircuts

[20] We obtain *negative* haircuts for a small subset of cases, most of which happened in the first half of the 1980s. Negative haircuts typically result from a restructuring in which the interest rate on the new debt exceeds the estimated discount rate prevailing at the time. In such cases, any lengthening of maturities will increase the present value of the new debt, instead of decreasing it (note that most deals in the 1980s involved rescheduling only). While these look like bad deals for the government, a successful agreement can buy time and avoid a disorderly default. In severe distress, these benefits can outweigh the drawback of accepting a deal at unfavorable terms.

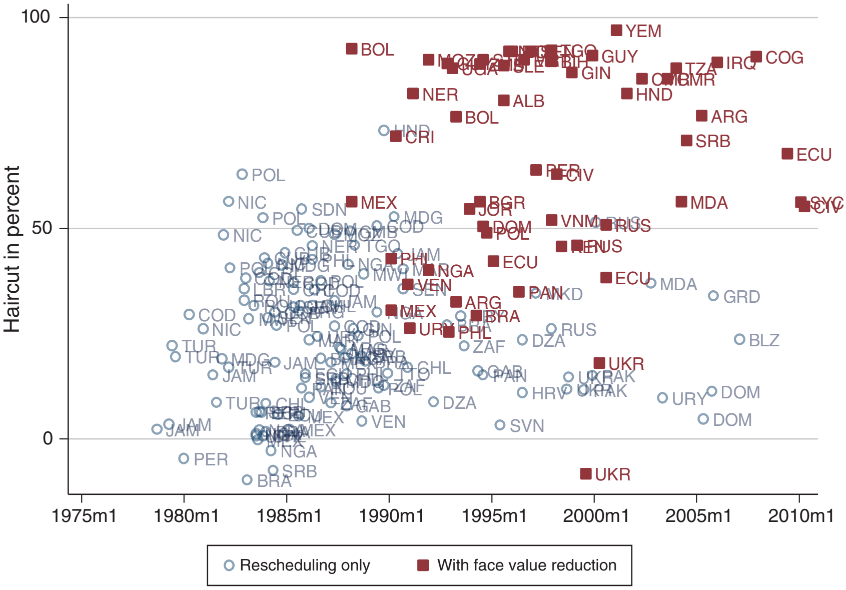

Figure 2. Restructurings With and Without Debt Reduction

Notes: This figure plots the size of haircuts in percentage points across countries and time. The figure differentiates between restructurings that implied debt rescheduling only (i.e., which just lengthened the maturities of old instruments) and restructurings that also implied a reduction in face value. Pure reschedulings were more prevalent during the 1980s, whereas write-offs became more frequent in the 1990s and 2000s. In the full sample, there were 123 pure reschedulings, with a mean H_{SZ} of 24 percent, while the remaining 57 restructurings also involved face value reduction and had a much higher mean H_{SZ} of 65 percent. See footnote 20 for a discussion of the negative haircuts.

as low as 5 percent. Interestingly, we find that the three largest restructurings of recent years (Argentina 2005, Russia 2000, and Iraq 2006) all implied haircuts of more than 50 percent. But also the Brady deals of the mid 1990s show high haircuts and involved large volumes of debt. A related trend is illustrated in Figure 2, which differentiates between restructurings with some degree of face value debt reduction (57 cases) and deals that only involved a lengthening of maturities (123 cases). The figure shows that cuts in face value have become increasingly common and that they tend to imply much higher creditor losses in present value terms. Deals with outright debt write-offs have an average haircut of 65 percent, compared to just 24 percent for pure debt reschedulings.

Table 1 provides further key insights, in the form of summary statistics for the full sample of 180 restructurings. Most notably, we find the average SZ haircut between 1978 and 2010 to be 37 percent (simple mean), while the volume-weighted average haircut is even lower, amounting to about 30 percent. This implies that, on average, investors could preserve almost two-thirds of their asset value in restructurings of the past decades. This degree of losses is surprisingly low, at least when compared to corporate debt exchanges. According to the most comprehensive set of estimates of US corporate bond and loan restructurings (Moody's 2008), the average haircut between 1982 and 2005 was 64 percent. This is nearly twice as high as what we find

Table 1—Haircut Estimates by Type of Restructuring and Era

	Observations	Mean	SD	Min	Max
By type of estimate					
Market haircut (H_M as in equation (1))	180	40.01	27.02	−9.80	97.00
SZ haircut (H_{SZ} as in equation (2), "preferred")	180	37.04	27.28	−9.80	97.00
Face value reduction	180	16.77	30.55	0.00	97.00
By type of creditor					
Bank debt restructuring	162	37.05	27.90	−9.80	97.00
Bond debt restructuring	18	36.97	21.60	4.70	76.80
Rescheduling versus debt reduction					
Rescheduling only	123	24.15	16.67	−9.80	73.20
With reduction in face value	57	64.84	24.94	−8.30	97.00
By era					
1978–1989	99	25.57	18.83	−9.80	92.70
1990–1997	48	51.81	28.48	3.30	92.30
1998–2010	33	49.96	31.30	−8.30	97.00
By type of debtor					
HIPC or donor funded	23	87.03	6.97	62.80	97.00
All other countries	157	29.72	20.61	−9.80	92.70

Notes: This table shows summary statistics for different estimates and subsamples. The figures at the top ("By type of estimate") refer to different haircut computation formulae (Section IA). All other statistics are based on our preferred haircut estimate (H_{SZ} from equation (2)). As expected, H_M tends to be larger than H_{SZ}. Temporary missed payments that are negotiated with creditors, e.g., 90-day debt rollovers, are not coded as outright default. The category of "highly indebted poor countries (HIPC) or donor funded" designates restructurings in poor countries that are supported by the World Bank. See footnote 20 for an explanation of the negative minimum estimated haircuts.

for sovereign debt. This large discrepancy is surprising because US corporate debt, in contrast to sovereign debt, can be enforced in courts and because any corporate restructuring is subject to an orderly bankruptcy regime.

The table also shows notable differences in haircut estimates depending on the formula applied. As expected, the market haircut tends to be larger than the SZ haircut (40 percent versus 37 percent, respectively). The difference between the two measures ranges from 0 (for those 92 deals in which the old debt had fully matured) up to 22 percentage points. More specifically, the average H_{SZ} is 6.5 percentage points lower than the average H_M for those cases in which the old debt had not fully come due. Interestingly, creditor losses appear remarkably lower when looking at the face value reduction measure, with an average haircut of only 17 percent. This low figure suggests that any estimates based on nominal debt write-offs will severely overestimate the actual recovery rates in sovereign restructurings.

Looking at different decades, we find a notable increase in haircut size over time. Average haircuts were about 25 percentage points higher during the 1990s and 2000s as compared to deals implemented during the 1970s and 1980s. One reason is that deals during the 1980s mostly implied maturity extensions only, thus postponing the day of reckoning that many debtor countries had deep-rooted solvency problems. Relatedly, we find that the Brady deals, which ultimately put an end to the 1980s debt crisis for 17 debtor countries, involved a high average haircut of 45 percent. This exceeds the mean investor loss for the more recent subsample of 17 sovereign bond restructurings since 1998 (39 percent).

The type of debtor also matters. In particular, we find average haircuts of 87 percent in restructurings of highly indebted poor countries (HIPCs). To show this, we categorize a subsample of restructurings as donor supported, defined as those co-financed by the World Bank's Debt Reduction Facility (see World Bank 2007).[21] The average haircut in these 23 donor supported restructurings is nearly three times as large as for restructurings in middle income countries.

Table 2 shows our haircut estimates for 17 recent restructurings (panel A) and compares them to results of previous work (panel B). For the overlapping sample, our estimates are very similar to those of SZ. When comparing their average haircut (reported in SZ 2006, 263) to our equivalent of equation (2), we get a mean absolute deviation of 5.8 percentage points.[22] We also find our results to be roughly in line with those of the Bank of Spain (Díaz-Cassou, Erce-Domínguez, and Vázquez-Zamora 2008), the IMF (Finger and Mecagni 2007), as well as the present value recovery rates reported by Moody's (2011) and Standard and Poor's (2007). Both rating agencies rely on estimates from a policy note by the Bank of England (Bedford, Penalver, and Salmon 2005). For each of these set of estimates, the correlation with our preferred measure exceeds 90 percent.

Our results differ markedly from the estimates by Benjamin and Wright (2009), which are based on nominal debt reduction data on principal, interest, and arrears forgiven. For the overlapping sample, the correlation between our H_{SZ} estimate and their haircut measure is only 0.54 and the mean absolute deviation amounts to 21 percentage points. We also find large differences when comparing our data on nominal debt reductions (*face value haircut*), which is the measure that is conceptually closest to theirs; the mean absolute deviation is 26 percentage points, while the correlation is 0.49. There are several likely explanations for these large differences. The first is the data structure, as Benjamin and Wright use data on debt relief flows from the World Bank's GDF database. Our estimates, like those of SZ (2008), are event-based and build on disaggregated restructuring terms, while GDF reports aggregate amounts of debt forgiven for each year in which the relief applies.[23] Second, we focus on haircuts vis-à-vis private banks and bondholders, while the GDF data do not differentiate between debt relief by private creditors and by official creditors (such as the Paris Club). Third, there are differences in how the raw data are collected. As we explain in the online Appendix, we mostly use data assembled by the IMF and the private sector, because these turned out to be the most reliable when cross-checking with further sources, such as the original offering memoranda,

[21] The Debt Reduction Facility grants funds to governments to buy back their debts to external commercial creditors at a deep discount. Typically, the size of haircuts granted by commercial creditors is in the range of those accepted by official creditors in these same countries (World Bank 2007).

[22] Only two estimates differ significantly (by more than 10 percentage points), namely Pakistan 1999 and Ukraine 2000, and this is mostly because our methodology yields significantly lower discount rates for these two cases.

[23] This can make it difficult to link the scope of debt relief to a specific restructuring agreement. To understand this point, consider a hypothetical agreement in the year 1990, which restructures a loan originally due in 1992 into new instruments. GDF does not report the stock of debt forgiven in the year 1990. Instead, their convention is to report debt relief flows for each year following a debt relief agreement. The item "principal forgiven" for the years 1991 and 1992 would thus contain those portions of nominal debt forgiven that would have originally fallen due in 1991 and 1992. Given that GDF shows aggregate data, the item would also capture the debt relief due to any earlier agreement, e.g., in 1988. Benjamin and Wright (2009) address this by discounting future debt relief flows back to the end of each debt crisis spell, using a uniform 10 percent discount rate across time and countries.

Table 2—Haircuts in Selected Recent Restructurings (1999–2010)

Case	Restructuring details				Haircuts: our estimates			
Debtor country | date of exchange | type of debt	Announce-ment of restruct.	Default date	Debt exchanged (in m USD)	Partici-pation rate	Preferred haircut H_{SZ}	Underlying discount rate	Market haircut H_M	Face value reduction
Panel A								
Pakistan | July 1999 | bank debt	Aug-98	Aug-98	777	NA	**11.6**	0.132	12.0	0.0
Pakistan | December 1999 | bonds	Aug-99	Preemptive	610	99%	**15.0**	0.146	14.0	0.0
Ukraine | April 2000 | bonds	Dec-99	Preemptive	1,598	97%	**18.0**	0.163	17.0	0.9
Ecuador | August 2000 | bonds	Jul-98	Aug-99	6,700	98%	**38.3**	0.173	59.8	33.9
Russia | August 2000 | bank/bond debt	Sep-98	Dec-98	31,943	99%	**50.8**	0.125	62.0	36.4
Moldova | October 2002 | bonds	Jun-02	Preemptive	40	100%	**36.9**	0.193	37.0	0.0
Uruguay | May 2003 | bonds	Mar-03	Preemptive	3,127	93%	**9.8**	0.090	9.0	0.0
Serbia & Montenegro | July 2004 | bank debt	Dec-00	since 1990s	2,700	NA	**70.9**	0.097	70.9	59.3
Argentina | April 2005 | bonds	Oct-01	Jan-02	60,572	76%	**76.8**	0.104	79.0	29.4
Dominican Rep. | May 2005 | bonds	Apr-04	Preemptive	1,100	97%	**4.7**	0.095	4.1	0.0
Dominican Rep. | October 2005 | bank debt	Apr-04	Feb-05	180	NA	**11.3**	0.097	16.0	0.0
Grenada | November 2005 | bonds	Oct-04	Preemptive	210	97%	**33.9**	0.097	41.0	0.0
Iraq | January 2006 | bank/com. debt	in 2004	since 2003	17,710	96%	**89.4**	0.123	89.4	81.5
Belize | February 2007 | bank/bond debt	Aug-06	Preemptive	516	98%	**23.7**	0.096	29.0	0.0
Ecuador | June/Nov-09 | bonds (buy-back)	Jan-09	Dec-08	3,190	NA	**67.7**	0.130	68.6	68.6
Seychelles | February 2010 | bonds	Mar-09	Jul-08	320	100%	**55.6**	0.107	56.0	50.0
Cote d'Ivoire | April 2010 | bonds	Aug-09	Mar-00	2,940	99%	**55.2**	0.099	52.0	20.0

Case	Comparison with prior estimates					
Debtor country | date of exchange| type of debt	SZ (2006) average haircut	SZ (2006) haircut DR = 0.10	Finger and Mecagni (2007)	Moody's/ Bedford et al. (2005)	Díaz-Cassou et al. (2008)	Benjamin and Wright (2009)
Panel B						
Pakistan | July 1999 | bank debt						
Pakistan | December 1999 | bonds	31	0.3	9–27	35	30	29
Ukraine | April 2000 | bonds	28.9	2.2	5	40	32	1
Ecuador | August 2000 | bonds	28.6	21	25	40	26	34
Russia | August 2000 | bank/bond debt	52.6	48.2	44	50	48	32
Moldova | October 2002 | bonds	33.5		0–6			42
Uruguay | May 2003 | bonds	12.9	7.8	8-20	15	14	
Serbia & Montenegro | July 2004 | bank debt					62	57
Argentina | April 2005 | bonds	75	77.8	75	70	73	63
Dominican Rep. | May 2005 | bonds	1.5	1.6	1	5	1	
Dominican Rep. | October 2005 | bank debt			2			
Grenada | November 2005 | bonds						
Iraq | January 2006 | bank/com. debt						
Belize | February 2007 | bank/bond debt					28	
Ecuador | June/Nov-09 | bonds (buy-back)						
Seychelles | February 2010 | bonds						
Cote d'Ivoire | April 2010 | bonds						

Notes: This table shows details for 17 main recent restructurings. It also compares our preferred haircut estimates H_{SZ} (column in bold in panel A) to haircut estimates in previous studies (panel B). It is important to underline that the average haircuts by Sturzenegger and Zettelmeyer (2006, 2008) and those by the Bank of England and Bank of Spain staff (Bedford, Penalver, and Salmon 2005, Díaz-Cassou, Erce-Domínguez, and Vázquez-Zamora 2008) are computed in present value terms using country-specific discount rates. In contrast, Finger and Mecagni (2007) mostly use a 10 percent discount rate, while Benjamin and Wright's (2009) estimates are based on World Bank data on nominal interest and principal forgiven, so that the results are not directly comparable. The data on preemptive debt restructurings is from Asonuma and Trebesch (2013).

detailed case studies, or the financial press. In contrast, the GDF data are debtor reported, which can be a problem when measuring haircuts, as highlighted in the debt relief study by Depetris Chauvin and Kraay (2005).[24] These differences in data

[24] On page 25, they state that "given the weak debt management capacity of many low-income countries and the complexity of many debt restructurings, we expect debtor reported data on debt relief to be relatively noisy."

sources and data conventions mean that our estimates are not directly comparable to those of Benjamin and Wright (2009).

III. Theoretical Considerations

This paper reassesses one of the most widespread tenets in the theoretical literature on sovereign debt and default, namely that a government which decides not to repay faces negative consequences in credit markets later on. A main motivation for this reassessment is what appears to be a disconnect between theory and empirics in the field, as summarized by Panizza, Sturzenegger, and Zettelmeyer (2009, 692): "None of the default punishments that the classic theory of sovereign debt has focused on appears to enjoy much empirical backing. Capital market exclusion periods are brief; effects on the cost of borrowing are temporary and small." Our analysis sheds new light on this conclusion by accounting for the size of haircuts in a default. More specifically, our contribution is that we assess the link between present value investor losses and post-crisis borrowing conditions for the defaulting government. In particular, we test two hypotheses: the larger the size of H, the higher the yield spreads after restructurings; and the larger H, the longer the period of exclusion from capital markets. These predictions are not derived from an established theory, among other things because most models simply assume a world with zero recovery rates.[25] Hence, we do not explicitly test a specific theoretical model. Nevertheless, our analysis relates to many of the papers in which defaults have costly consequences and could also be useful to discipline future theoretical work.

As we will show, higher haircuts are correlated with worse subsequent borrowing conditions. This result is consistent with the idea that nonpayment can have adverse credit market consequences for the sovereign, and therefore stands in contrast to the findings of most empirical papers. Our findings are also more consistent with one of the classic channels linking default and borrowing conditions, which is the indirect "punishment" of credit market exclusion. The seminal paper by Eaton and Gersovitz (1981), in particular, assumes that a defaulting government loses access to international credit markets, which is costly because the country will not be able to smooth consumption later on.[26] Beyond this, high haircuts could also be a signal of untrustworthy economic policies, expropriative practices by the incumbent government (similar to the argument in Cole and Kehoe 1998), or of negative private information held by the government about purely economic fundamentals (similar to the argument in Sandleris 2008) with adverse consequences for country spreads and capital access.[27]

[25] Only few theoretical models differentiate by the magnitude of defaults. Recent papers like Benjamin and Wright (2009), Yue (2010), D'Erasmo (2011), or Asonuma (2011) have started to relax the common assumption that haircuts are 100 percent.

[26] Kletzer and Wright (2000) and Wright (2002) allow renegotiation of the threat of credit market exclusion, but in perfect equilibrium, punishments do not occur. If a deviation from equilibrium were to occur, the punishment would entail temporary inability to borrow. However, models in which defaults do occur in equilibrium often assume credit market exclusion, at least temporary exclusion (e.g., Arellano 2008 or Yue 2010).

[27] Another theoretical channel is suggested by Grossman and van Huyck (1988) and analyzed by Kletzer and Wright (2000) in which debt-servicing obligations are implicitly contingent on the realized state of the world. Accordingly, adverse effects could only occur if the size of H is "inexcusable, i.e., not justified by bad exogenous macroeconomic conditions " (Grossman and van Huyck 1988, 1092). In an earlier version of this paper, we follow

While higher borrowing costs and market exclusion could be the result of punishment effects or of information revelation, our findings should not be interpreted as direct evidence for any of the two. In fact, there *could* be other relevant channels explaining the correlation we identify in this paper. For example, it is possible that countries imposing higher haircuts are also in worse shape than those imposing lower haircuts. Country characteristics could influence both the size of H and country access conditions after the restructuring. To address this concern, we include country and time fixed effects and control for a large set of observable, time-varying fundamentals suggested by theory and the previous international finance and asset pricing literatures. This mitigates, but not necessarily completely eliminates, the possibility that the coefficients on H may pick up the effect of a confounding variable which remains omitted.

In addition, there is the channel of debt relief, which goes in the opposite direction. Sovereigns imposing high haircuts will reduce their indebtedness more significantly, lowering the debt to GDP ratio and possibly decreasing the likelihood of future default, at least in the short run. Thus, in an atomistic bond market without creditor collusion lenders could ultimately reward sovereigns for imposing high haircuts. Higher haircuts would then imply lower post-restructuring spreads and quicker reaccess. Empirically, we control for this possibility by controlling for the debt to GDP ratio after the restructuring, as well as for the sovereign credit rating.

To conclude, it should be underlined that we build on the econometric models used in 30 years of previous work on the issue, which tends to reject the claim that sovereign defaults have lasting, substantial effects on credit markets. Here, we reassess this consensus finding, with similar methods but more refined data. The results should nevertheless be interpreted with caution.

IV. Haircuts and Post-Restructuring Spreads: Data and Results

This section assesses the link between debt crisis outcomes and subsequent borrowing costs in the period 1993 to 2010. In order to identify post-crisis episodes, we focus on "final" restructurings only, which we define as those that were not followed by another restructuring vis-à-vis private creditors within the subsequent four years, and that effectively cured the default event, meaning that the country did not remain in ongoing default according to data by Standard and Poor's (2006, 2011). In line with previous work, e.g., by Cline (1995) and Arslanalp and Henry (2005), we therefore focus on the outcome of the most relevant deals, such as the Brady bond exchanges, and pay less attention to intermediate restructurings like most debt operations of the 1980s that only implied short-term relief. One example is Peru's restructuring of 1983, which is not regarded as final, because the country continued to accumulate arrears until it finally resolved its debt crisis with a Brady deal in 1997. Similarly, we do not include Russia's 1997 restructuring of Soviet era debt as a final deal, because the country restructured that same debt only three years

this route and decompose actual H_{SZ} into its "predicted" value and a residual, which we interpret as measuring the "inexcusable" haircut. For reasons of brevity we omit this extension here.

later.[28] For robustness, we also compute a "cumulative haircut" measure, which compounds creditor losses among all restructurings in the same debt crisis spell for each country. The regressions results are broadly similar (see online Appendix Section A1).

A. *Dependent Variable: EMBIG Spreads*

As dependent variable, we use the monthly average secondary market bond stripped yield spread from J.P. Morgan's EMBI Global (EMBIG) for each country. EMBIG spreads have been used extensively in the academic literature to proxy foreign currency borrowing costs of both governments *and* the private sector in emerging market economies.[29] The yields approximate the marginal cost of funding even if the country is not contemporaneously issuing new debt.[30] A further important advantage of using these bond spread data is that they allow constructing a monthly panel dataset for a large number of countries whose bonds satisfy certain minimum liquidity and visibility benchmarks, so that one would expect informationally efficient pricing.

The EMBIG is composed of US-dollar denominated sovereign or quasi-sovereign Eurobonds and Brady Bonds that are actively traded in secondary markets, as well as a small number of traded loans.[31] While the EMBIG was only introduced in January 1998, historical yield spread data are available further back in time.[32] We take all country-month yield observations available, covering 47 countries from January 1993 until December 2010 and resulting in a panel of over 5,000 observations. Among the 47 countries covered by the EMBIG, 23 are defaulters which restructured their debt, while the other 24 countries are "nondefaulters."[33]

[28] An overview of the 67 final restructurings is provided in Table A2 in the online Appendix. Due to a lack of EMBIG coverage, only 27 of these events, from 23 countries, are used in our analysis of bond spreads. In increasing order of haircut, these events are: Dominican Republic (05/2005), Uruguay (05/2003), Croatia (07/1996), Pakistan (12/1999), Ukraine (04/2000), South Africa (09/1993), Algeria (07/1996), Belize (02/2007), Philippines (12/1992), Brazil (04/1994), Mexico (05/1990), Argentina (04/1993), Panama (05/1996), Venezuela (12/1990) –median haircut–, Ecuador (08/2000), Nigeria (12/1991), Ecuador (02/1995), Poland (10/1994), Russia (08/2000), Cote d'Ivoire (04/2010), Bulgaria (06/1994), Cote d'Ivoire (03/1998), Peru (03/1997), Ecuador (06/2009), Serbia and Montenegro (07/2004), Argentina (04/2005), and Iraq (01/2006).

[29] Eichengreen and Mody (2000) underline that sovereign secondary market spreads tend to predict actual government borrowing costs realized in primary markets. Relatedly, Durbin and Ng (2005) show that sovereign spreads determine corporate borrowing costs in emerging markets.

[30] This is analogous to using returns of shares of stock to estimate the corporate cost of capital even when corporations are not issuing new shares, as is widely done in the finance literature.

[31] The stripped yield spread is simply the difference between the weighted average yield to maturity of a given country's bonds included in the index and the yield of a US Treasury bond of similar maturity. In line with most other researchers, we use stripped spreads which focus on the noncollateralized portion of the emerging country bonds (see J.P. Morgan 2004 for details).

[32] Morgan Markets provides EMBIG stripped bond spread data back to 1994. Furthermore, in order to maximize time coverage of our sample, we added data for 1993 from the plain EMBI index for all countries for which stripped bond spread data were available for that year (Argentina, Brazil, Mexico, Nigeria and Venezuela). The results do not change if we omit 1993.

[33] Our counterfactual is the group of 24 "nondefaulters" covered in the EMBIG. This includes countries with no external sovereign debt restructuring in the 1990s/2000s: China, Colombia, Egypt, El Salvador, Georgia, Ghana, Greece, Hungary, Indonesia, Jamaica, Kazakhstan, Lebanon, Lithuania, Malaysia, South Korea, Sri Lanka, Thailand, Trinidad and Tobago, Tunisia, and Turkey. In addition, the "nondefaulter" set includes four countries that did restructure their debt at some point since 1990, but entered the EMBIG more than seven years after that restructuring: Chile, Gabon, Morocco, and Vietnam. Due to our focus on post-restructuring effects, we exclude observations during default.

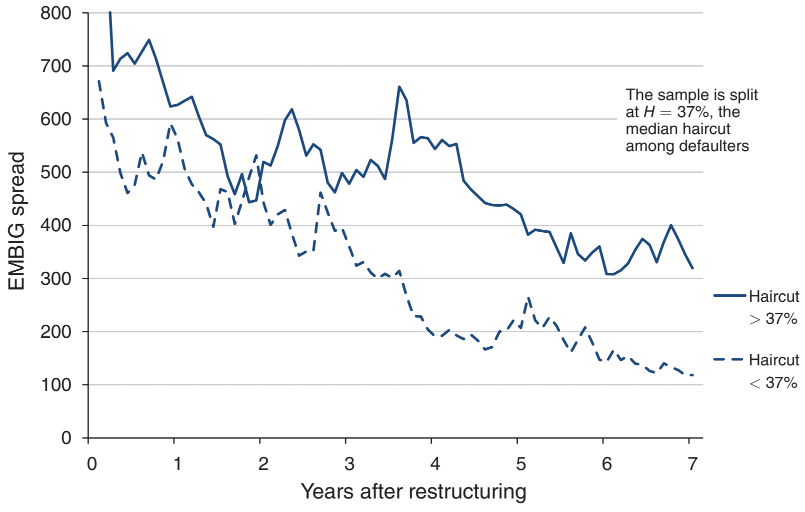

Figure 3. Haircut Size and Post-Restructuring Spreads

Notes: This figure shows that high-haircut countries experience post-restructuring spreads that are about 200 bp higher than low-haircut countries, especially in years three to seven after the restructuring. Specifically, the figure splits the sample in restructurings with higher and lower than median (37 percent) haircuts and plots the respective average post-restructuring EMBIG stripped yield spread (over US Treasury) in event time. The sample goes from 1993 until 2010. To avoid bias, we show the spread differential between defaulters and nondefaulters, as opposed to using the plain spread of defaulters. The differential is constructed by subtracting the average spread of the 23 nondefaulters at each point in time from the spread of the low- and high-haircut group (see text for details). Note, however, that the picture looks very similar when comparing the plain yield spreads of low- and high-haircut defaulters.

B. *Preliminary Data Analysis*

We begin with a preliminary analysis of bond spreads. Figure 3 plots monthly post-restructuring spreads for the 27 debt exchanges in our EMBIG sample from 1993 until 2010. Most importantly, the figure distinguishes between cases with haircuts that are higher and lower than 36.7 percent, which is the median haircut in this sample. Instead of showing plain spreads, the figure plots the spread differential of defaulters over nondefaulters, computed by subtracting the average spread of the nondefaulters in the sample at each point in time from the spread of each defaulter. The advantage of showing the spread differential is that it can mitigate the impact of common shocks, such as the Mexican crisis of 1995 or the Russian default of 1998, and that it addresses the potential endogeneity of restructuring dates.[34] The resulting plot shows a notable difference between low-haircut and high-haircut cases. Restructurings with high haircuts feature much higher average post-restructuring spreads, especially from year three onwards. The differences often surpass 200 basis

[34] We cannot rule out the possibility that low haircut countries may have restructured at times when future yields were expected to be lower than when high haircut countries restructured. Note that the figure looks similar when using nondifferentiated bond spreads of defaulters.

points (bp), which is very large given the average spread level of about 530 bp in the sample of defaulters.

While this univariate plot is illustrative, there are many reasons why the spreads of high haircut countries could be higher than those of low haircut ones. For example, high haircut countries could be more risky. We therefore move on to assess the role of haircuts more systematically.

C. *Estimated Model of Post-Restructuring Spreads*

Since asset markets are forward-looking, we need to control for current and expected future conditions that affect both the prevailing price of credit risk and expected collection. Specifically, we assess the role of credit history for sovereign borrowing costs with a bond spread equation in the vein of those by Dell'Ariccia, Schnabel, and Zettelmeyer (2006); Panizza, Sturzenegger, and Zettelmeyer (2009); or Eichengreen and Mody (2000). Our innovation is that we use a continuous measure of investor outcomes, instead of only focusing on a binary default variable. The empirical model is

$$(3)\quad S_{it} = \{\phi_1 I_1(i,t) + \phi_2 I_2(i,t) + \phi_3 I_3(i,t) + \phi_{4-5} I_{4-5}(i,t) + \phi_{6-7} I_{6-7}(i,t)\}H_i + \boldsymbol{\beta}'\mathbf{X}_{i,t-1} + \omega_i + \eta_t + u_{it} \qquad i = 1,\ldots,N \quad t = 1,\ldots,T,$$

where $I_\tau(i, t)$ is an indicator variable that equals 1 when month t belongs to year τ after country i finalized its last restructuring ($\tau = 1, 2, 3, 4\text{–}5, 6\text{–}7$), and zero otherwise; H_i is the haircut arising from that restructuring; $\mathbf{X}_{i,t-1}$ is a vector of macroeconomic control variables known during month t, ω_i is a country fixed effect, η_t is a time fixed effect; and u_{it} is an error term.[35] The key parameters of interest are ϕ_τ, the coefficients of the lagged haircut variable.

In a second step, we estimate a fully specified model that adds the linear term R_i (that is a dummy for the existence of a restructuring) to equation (3):

$$(4)\quad S_{it} = \{\phi_1 I_1(i,t) + \phi_2 I_2(i,t) + \phi_3 I_3(i,t) + \phi_{4-5} I_{4-5}(i,t) + \phi_{6-7} I_{6-7}(i,t)\}H_i + \{\gamma_1 I_1(i,t) + \gamma_2 I_2(i,t) + \gamma_3 I_3(i,t) + \gamma_{4-5} I_{4-5}(i,t) + \gamma_{6-7} I_{6-7}(i,t)\}R_i + \boldsymbol{\beta}'\mathbf{X}_{i,t-1} + \omega_i + \eta_t + u_{it} \qquad i = 1,\ldots,N \quad t = 1,\ldots,T.$$

The advantage of estimating equation (4) is that it allows us to disentangle the spread increase associated with the default per se from the spread increase associated with the size of haircuts (occurrence versus magnitude). Methodologically, this means that we permit defaulting countries to have a larger post-crisis spread irrespective of their haircut level. This is a more refined approach than equation (3) because the

[35] Due to our focus on post-restructuring effects, we exclude observations during default as declared by Standard and Poor's. Note, also that we cluster standard errors on country-year pairs to account for the fact that some of our control variables are only available on a yearly basis.

lagged haircut coefficients in that model will potentially pick up two effects at the same time: that of the default and that of the haircut. More generally, equation (4) should be understood as an interaction model in which the interacted variables are the lagged haircuts, while the lagged restructuring dummies are the constitutive terms, which should always be included in this kind of econometric setting (see e.g., Brambor, Clark, and Golder 2006).[36]

As control variables, we follow the received literature in including the debtor country's level of public debt to GDP,[37] the ratio of reserves to imports, the country's annual rate of inflation, real GDP growth, the level of the current account to GDP and the government's primary budget balance, which are all lagged by one year. International credit market conditions are controlled for by including the Barclays-Lehman Brothers index of low grade US corporate yields,[38] lagged by one month. We also account for credit ratings as provided by S&P and Moody's. For this purpose, we follow the practice of earlier studies (Eichengreen and Mody 2000 and Dell'Ariccia, Schnabel, and Zettelmeyer 2006) and do not include the ratings themselves, but rather a rating residual from a regression of the ratings on macroeconomic fundamentals and other variables included in the specifications.[39] To capture a country's political situation, we rely on the widely used ICRG political risk index,[40] lagged by one month, and variables capturing government changes. Specifically, we include a variable capturing the number of years in office of the government from the Database of Political Institutions (Beck et al. 2001), and also construct a "new government" dummy that takes the value of one for the first two years after a new administration comes into office. The country fixed effects pick up time constant country characteristics (including unobservables), while year effects account for the potential endogeneity of the timing of restructuring (e.g., as in countries hurrying to settle with creditors when they anticipate favorable future borrowing conditions). The definition and sources of the variables are listed in Table 3.

D. *Results: Haircuts and Subsequent Bond Spreads*

Table 4 shows the main results of our bond spread regressions. We start by replicating the established literature and include a lagged debt crisis dummy as a proxy for sovereign credit history. Like Borensztein and Panizza (2009), we only find significant effects in the first and second year after the restructuring. The coefficient of the lagged R_i drops from 260 bp in year one to about 150 bp in year two, but is small and/or only marginally significant thereafter (column 1). These results are similar in a very demanding specification that controls for all fundamentals discussed above (column 2, akin to the full model in Dell'Ariccia, Schnabel, and Zettelmeyer 2006).

[36] Technically, in both models (3) and (4), H_i is multiplied by R_i. Since all positive H_is have R_i=1, we simply report H_i in the equations to avoid clutter.
[37] Using World Bank GDF data on public debt owed to private creditors (World Bank 2012).
[38] Results are the same when using the 10-year US Treasury yield instead.
[39] The coefficient on this residual picks up any factors that we omit but are used by the agencies in assigning ratings. In addition, the residual could also capture the effect of rating changes per se.
[40] Results are nearly identical when using the ICRG sub-indicator on government stability.

Table 3—Description of Data and Variables Used in Estimations

Variable	Description	Frequency	Source
Dependent variables			
EMBIG stripped spread	Monthly average EMBIG stripped spread	Monthly	J.P. Morgan (2010)
Reaccess	Dummy capturing the first of the following two events: (i) foreign syndicated loan or bond issuance (public or publicly guaranteed) that leads to an increase in indebtedness, (ii) net transfer from private foreign creditors to the public sector	Yearly	Dealogic (2010) Primary market data of individual loans and bonds; GDF (World Bank 2012) (aggregate data, series DT.NTR.PNGB.CD and DT.NTR.PNGC.CD)
Main haircut measures			
Haircut (M)	Market haircut (comparing par value of old debt with present value of new debt, see equation (1))	Monthly/yearly	Own calculations
Haircut (SZ)	Haircuts computed in analogy to Sturzenegger and Zettelmeyer (comparing present value of old and new debt, see equation (2))	Monthly/yearly	Own calculations
Control variables			
US low-grade corporate yield	Yield to Worst on Barclays (formerly Lehman Brothers) US Corporate High Yield Index	Monthly/yearly	Barclays Capital (2011)
US 10-year Treasury yield	Yield on 10-year US Treasury bonds	Monthly/yearly	US Treasury (2011)
Political risk (ICRG)	Political Risk Index (lagged)	Monthly/yearly	ICRG (PRS Group 2010)
New government	Dummy which takes the value of one for the first two years after a new government comes into power	Yearly	Database of Political Institutions 2010 (see Beck et al. 2001), variable "yrsoffc"
Credit rating	Average of available ratings on long-term foreign currency debt	Monthly (S&P, Moody's), yearly (II)	S&P, Moody's (in EMBIG analysis), and *Institutional Investor* magazine (in duration analysis)
Rating residual	Residual from regression of ratings on fundamentals and credit history, lagged	Monthly/yearly	Own calculations, based on ratings data
Public debt/GDP (in percent)	Government debt to GDP (in percent, lagged)	Yearly	GDF (World Bank 2012) and Abbas et al. (2010)
GDP real growth (in percent)	GDP real growth (yoy in percent, lagged)	Yearly	World Development Indicators (World Bank 2011)
Current account to GDP (in percent)	Current account to GDP, four-year moving average (in percent, lagged)	Yearly	World Development Indicators (World Bank 2011)
Primary Balance to GDP (in percent)	Central government primary fiscal balance to GDP (in percent, lagged)	Yearly	Economist Intelligence Unit (2010)
Reserves to Imports (in percent)	Reserves (incl. gold) to imports (in percent, lagged)	Yearly	World Development Indicators (World Bank 2011)
Inflation (in percent)	Consumer price inflation (yoy in percent, lagged)	Yearly	World Development Indicators (World Bank 2011)
Population (log)	Log of population size	Yearly	World Development Indicators (World Bank 2011)
GDP per capita (PPP, log)	Log of per capita GDP in purchasing power parity, lagged	Yearly	World Development Indicators (World Bank 2011)

Thus, with a binary measure of default, we confirm the results of the received literature that default effects appear very short-lived.

The results are notably different when we substitute the restructuring dummy with our continuous haircut measure, expressed in percentage points. Column 3 shows that a 1 percentage point increase in haircut is associated with EMBIG spreads that are about 6.75 bp higher in year 1 after the restructuring and still about 3.16 bp higher in years 4 and 5, after controlling for country and time fixed effects. This means that a restructuring with a haircut of 40 percent, which is roughly the mean for the EMBIG sample used here, can be associated with 270 bp higher spreads in year 1 and 127 basis points higher in years 4 and 5.[41] Accordingly, a 1 standard deviation increase in H_{SZ} (about 22 percentage points in this sample) is associated with spreads that are 149 to 70 basis points higher in years 1 and 4 and 5, respectively. The results are somewhat less pronounced when using the full battery of controls, but the coefficients of the lagged H_i remain economically and statistically significant up to year seven (column 4).

Next, we focus on the results for the fully specified model of equation (4), which includes both the lagged haircut and the lagged restructuring dummies (columns 5–8). We pay more attention to this model for several reasons. First, the results in columns 3 and 4 do not allow differentiating between the spread increase associated with a restructuring and that associated with the size of haircuts. Second, we have mentioned that equation (3) is methodologically problematic because it only includes the interacted variables (the lagged H_is) but not the constitutive terms (the lagged R_is). Third, we find that standard F-tests indicate that both groups of variables (the lagged H_is and R_is) are jointly significant and therefore both belong in the model.[42]

The results of the fully specified model confirm the strong relationship between haircut size and subsequent spreads for years one to seven after the restructuring. To see this, it should be kept in mind that the coefficients shown in columns 5–8 of Table 4 cannot be taken at face value, but have to be interpreted conditionally, as in any interaction model (Brambor, Clark, and Golder 2006, 9). This means that columns 5–8 cannot be directly compared to columns 2 and 4. Adding the lagged R_i transforms the incomplete model of equation (3) into the fully specified model of equation (4). As a result, the coefficients are almost certainly going to change and this should not be seen as the result of multicollinearity.[43]

The best way to interpret the findings is to look at Figure 4, which shows the expected incremental spread of a restructuring conditional on the haircut size, $\hat{\phi}_\tau H_i + \hat{\gamma}_\tau$ from equation (4). The figure is based on the most demanding

[41] The calculation is $40 \times 6.75 = 270$ and $40 \times 3.16 = 127$, respectively. Note that the incremental spread for year 1 at the mean haircut value is similar to the 260 bps associated with the restructuring dummy in column 1.

[42] The F-statistic for joint significance of the lagged H_is in column 5 is 5.46, and it is 4.54 for the joint significance of the lagged R_is (both with a lower than 1 percent p-value). Results are similar for columns 6–8.

[43] Multicollinearity does not bias least squares estimates, but the high correlation between H_i and R_i will tend to increase the estimated standard errors (see Goldberger 1991, chapter 23). The fact that we find significant effects *despite* multicollinearity is reassuring. Relatedly, Kennedy (2003, chapter 11) and Goldberger (1991, 250) argue that multicollinearity can be desirable if one is interested in the joint effect of two highly correlated variables, which is the case here. The high correlation between R and H (about 0.85 in our sample) actually lowers the variance of the estimated effect of interest, $\phi_T H_i + \gamma_T$. We thank a referee for raising concerns about multicollinearity in a previous version.

Table 4—Regression Results: Haircuts and Bond Spreads

	With lagged restructuring dummies (previous literature) (1)	Full model with lagged dummies (Dell'Ariccia et al.) (2)	With lagged haircuts ("preferred" haircut, SZ), fixed effects (3)	Full model with lagged haircuts (4)	With lagged dummies and lagged haircuts (5)	With lagged dummies and lagged haircuts, with rating (6)	With main fundamentals (Eichengreen and Mody) (7)	Full model with lagged dummies and lagged haircuts (8)
Haircut (SZ), 1 year lag			6.75*** (1.47)	5.20*** (1.42)	6.46** (2.91)	2.57 (3.57)	4.77 (2.96)	1.86 (3.48)
Haircut (SZ), 2 year lag			4.73*** (1.13)	3.47*** (1.23)	6.18** (2.47)	1.10 (2.25)	3.07 (2.84)	0.31 (2.55)
Haircut (SZ), 3 year lag			3.89*** (1.17)	2.19** (1.04)	6.25*** (2.18)	4.15* (2.17)	5.42** (2.50)	4.12* (2.11)
Haircut (SZ), 4 and 5 year lag			3.16*** (0.83)	2.52*** (0.80)	7.44*** (1.63)	5.50*** (1.44)	5.82*** (1.88)	5.55*** (1.67)
Haircut (SZ), 6 and 7 year lag			0.80 (0.88)	1.49* (0.80)	9.01*** (1.48)	6.08*** (1.33)	7.02*** (1.80)	6.77*** (1.58)
Restructuring dummy, 1 year lag	262.54*** (76.58)	259.60*** (86.03)			9.00 (147.84)	135.88 (160.13)	16.41 (169.74)	191.96 (187.88)
Restructuring dummy, 2 year lag	151.23** (62.40)	168.40** (66.59)			−80.79 (128.20)	73.30 (121.18)	−30.79 (143.76)	149.44 (137.10)
Restructuring dummy, 3 year lag	103.69* (61.49)	57.67 (51.73)			−124.10 (108.39)	−66.92 (96.07)	−183.26* (111.01)	−90.03 (92.73)
Restructuring dummy, 4 and 5 year lag	51.91 (45.88)	56.19 (43.47)			−217.19** (84.96)	−128.33* (74.75)	−187.64** (94.37)	−138.84 (85.31)
Restructuring dummy, 6 and 7 year lag	−56.24 (40.07)	10.09 (39.09)			−367.05*** (74.43)	−218.41*** (66.53)	−320.47*** (85.24)	−214.58*** (76.67)
Rating (Residual)		−43.71*** (9.87)		−39.37*** (10.27)		−51.67*** (7.39)		−38.54*** (8.89)
Public debt to GDP		8.61*** (2.30)		8.63*** (2.13)			10.18*** (1.12)	7.68*** (2.27)
GDP real growth		−7.51** (3.73)		−7.98** (3.66)			−8.22*** (3.07)	−6.14* (3.59)
Reserves to imports		−0.60 (0.64)		−0.60 (0.66)				−0.64 (0.63)
Inflation		0.02 (0.10)		−0.03 (0.10)				−0.04 (0.09)
Primary balance to GDP		−6.33 (4.95)		−5.88 (5.04)				−6.40 (4.89)
Current account to GDP		−12.32*** (3.30)		−12.85*** (3.08)				−12.77*** (3.06)
Political risk (ICRG)		−4.72* (2.66)		−5.68** (2.63)			−6.31** (2.74)	−4.38* (2.50)
US low-grade corporate yield	60.26*** (4.48)	57.53*** (5.45)	60.19*** (4.48)	57.40*** (5.45)	60.69*** (4.50)	58.55*** (4.65)	60.92*** (5.20)	57.69*** (5.47)
Constant	−128.19 (99.44)	−201.14 (213.67)	−115.54 (86.21)	−64.62 (213.63)	−87.70 (97.94)	−274.90*** (99.63)	326.76 (206.86)	−168.48 (202.76)
Country fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	5,369	3,727	5,369	3,727	5,369	4,969	4,318	3,727
R^2	0.418	0.500	0.422	0.497	0.442	0.472	0.512	0.513
Adjusted R^2	0.415	0.496	0.420	0.493	0.440	0.469	0.509	0.509

Notes: This table shows coefficients of an unbalanced panel data regression with robust, country-year clustered standard errors. The dependent variable is the monthly average country yield spread over US Treasury bonds (EMBIG stripped spread) measured in basis points (bp), while the key explanatory variables are the lagged values of H_{SZ} and R both taken up to seven years after each final restructuring. Note that the coefficients of the lagged restructuring dummies in specifications 5 to 8 cannot be interpreted as unconditional marginal effects, but only conditional on H_{SZ}. The results of column 3 indicate that a 1 standard deviation increase in H_{SZ} (22 percentage points in this sample), is associated with a spread that is 149 basis points larger in year 1, 104 bp in year 2, 85 bp in year 3, and 70 bp larger in years 4 and 5 after the restructuring. See text for further details.

***Significant at the 1 percent level.
**Significant at the 5 percent level.
*Significant at the 10 percent level.

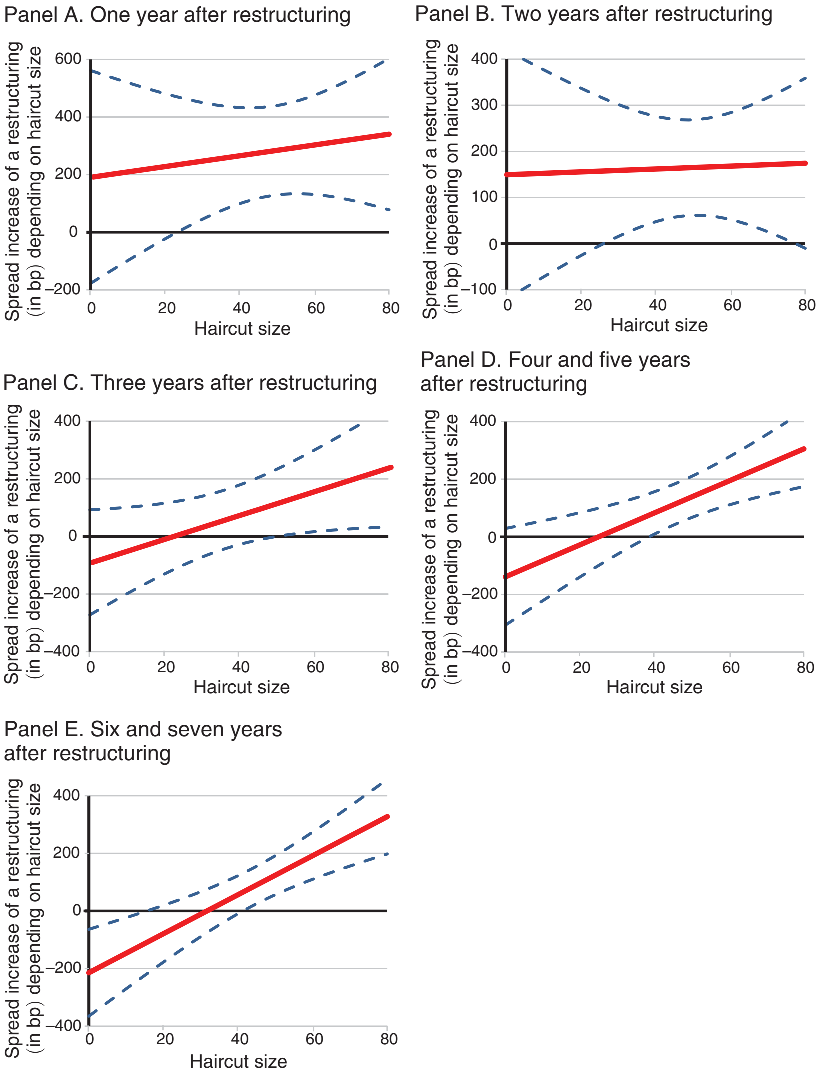

FIGURE 4. EXPECTED SPREAD INCREASE FOR DIFFERENT LEVELS OF HAIRCUTS

Notes: The panels show the mean increase in bond spreads associated with a debt restructuring, for different levels of H and at different lag lengths, and 95 percent confidence bands. The figures are based on the most demanding specification (column 8 in Table 4). The spread increase of a default is statistically significant for haircut levels at which the lower confidence band is above the zero horizontal line. The main message of the figure is that restructurings with haircuts above 40 percent (the mean of this sample) can be associated with significantly higher spreads during the 7 years after a restructuring.

specification (column 8), i.e., controlling for other determinants of spreads. The different panels (A–E) correspond to how many years after the restructuring spreads are being measured (τ), and the dotted lines show 95 percent confidence bands. Besides easier interpretation, this joint estimate and the resulting graphs are important because the high correlation between R and H complicates making inference about their individual effects, but facilitates inference about their sum (Goldberger 1991, 250–51).

The bottom line of Figure 4 is that restructurings are statistically significant for years 1–7, and for haircuts above 40 percent. This can be seen because the lower confidence band is above the 0 horizontal line for values above 40 percent in each panel (lag 3 is the only exception, with significance reached above $H = 55$ percent). The spread increase associated with haircut size is also economically substantial, especially for years four to seven after a restructuring.

For further illustration, suppose that haircuts increase by 1 standard deviation (22 percentage points in this sample). Based on these results this implies spreads that are 122 bp higher in years 4 and 5 after the restructuring, and 149 bp higher in years 6 and 7. These estimates are sizable, especially when compared to the findings of earlier papers. For example, the influential early studies by Lindert and Morton (1989) and Özler (1993), and newer papers like Benczur and Ilut (2009) or Catão, Fostel, and Kapur (2009) suggest that a past default leads to an average increase in post-crisis spreads of, at most, 50 basis points. So while defaults may seem costless when not controlling for investor losses, we find that large haircuts can be associated with substantially higher spreads for up to seven years afterward.

Section A1.1 in the online Appendix provides a large number of robustness checks. Overall, the results are surprisingly robust with alternative model specifications or samples, and when controlling for additional factors, such as government changes or creditor litigation. The results also hold with yearly instead of monthly data, when using alternative haircut measures (including cumulative haircuts), and when dropping the three countries that have repeated final deals in this sample.

V. Haircuts and Duration of Exclusion: Data and Results

To assess the role of haircuts for exclusion duration we construct an annual dataset on access to credit from 1980 until 2010. The decision to use yearly data is in line with related research and driven by data availability because our duration analysis goes further back in time and spans a larger number of defaulting countries, so that monthly data are often unavailable. In line with Eichengreen and Portes (2000) and Richmond and Dias (2009), we study market exclusion after a default is successfully resolved, not exclusion after a default is successfully resolved, not exclusion during default.[44] For this reason, we again focus on final restructurings as defined above, which include the 17 Brady deals as well as all recent external bond restructurings.

A. *Dependent Variable: Years of Exclusion*

The dependent variable on exclusion duration measures the number of years between a restructuring event and the successful reaccess to international credit markets.[45] To avoid lengthy discussions on the benefits and drawbacks of alternative

[44] The duration of default and renegotiation is analyzed in a separate literature, see e.g., Bi (2008), Trebesch (2008), Benjamin and Wright (2009), or Bai and Zhang (2012). Relatedly, it is now a well-established stylized fact that countries are not able to borrow during default (Eichengreen and Portes 2000; Gelos, Sahay, and Sandleris 2011).

[45] If a country restructures and regains market access in the same year, we follow the literature in considering the duration of market exclusion to be one year.

definitions and data sources, we construct a measure of market access that is as comprehensive as possible and builds on the two main contributions on this issue in recent years. Specifically, we combine the approach by Eichengreen and Portes (2000) and Gelos, Sahay, and Sandleris (2011), who focus on individual syndicated loans and bonds issued in international markets, with the definition of market access by Richmond and Dias (2009), who use aggregate capital flows.

Our main measure captures "partial" reaccess. It is defined as the first year with an international loan or bond placement and/or the first year with positive aggregate credit flows to the public sector. More precisely, the measure takes a value of one in case the country places at least one public or publicly guaranteed bond or syndicated bank loan on international markets (gross flows > 0) and/or if the public sector receives net transfers from private foreign creditors (net flows > 0). The first criterion builds on primary market issuance data in international markets from the comprehensive Dealogic database from 1980 until 2010. Specifically, we aggregate information of 8,776 individual public and publicly guaranteed bonds in 95 developing countries and 10,212 public or publicly guaranteed syndicated loans from 136 countries.[46] In line with Gelos, Sahay, and Sandleris we only regard issuances that lead to an increase in public sector indebtedness, using debt stock data to private creditors from the World Bank's GDF dataset. The second criterion is constructed from aggregate credit flow data. The dummy is one for years in which bank or bond transfers from foreign private creditors to the public and publicly guaranteed sector exceed zero.[47] To check the robustness of our findings we also construct a measure of "full reaccess" defined as the first year in which debt flows surpass 1 percent of GDP,[48] a measure that focuses on primary market issuance only (the original Gelos, Sahay, and Sandleris definition), and a measure that takes into account flows to the public and private sector of debtor countries (the Richmond and Dias definition).

B. *Preliminary Data Analysis*

Next, we present descriptive findings on haircut size and the duration of exclusion. Online Appendix Table A2 lists the 67 final restructuring events and the respective year of reaccess using various definitions. The average duration from restructuring to partial reaccess is 5.1 years, while the median is three years. We find that exclusion time increases notably in haircut size. On average, partial reaccess takes just 2.3 years after cases with $H_{SZ} < 30$ percent, while the duration is more than twice as long (6.1 years) for cases with $H_{SZ} > 30$ percent. For the full sample, Figure A1 in the online Appendix plots the relationship between H_{SZ} and

[46] These samples result from a query retrieving all public and publicly guaranteed emerging market loans and bonds of developing countries, excluding issues that are placed and marketed in domestic markets only, according to the Dealogic identifier.

[47] Data are available from GDF using the following series: DT.NTR.PBND.CD (net bond transfers) and DT.NTR.PCBK.CD (net bank transfers). We do not consider arrears as a positive transfer.

[48] Specifically, we define full access when bond or loan issuances in international markets exceed 1 percent of GDP and/or if net bank and bond transfers to the public sector exceed 1 percent of GDP. The 1 percent threshold is chosen in accordance with Richmond and Dias (2009) and represents less than one-half of the annual public sector new borrowing over the entire sample of years and developing countries. GDP data are taken from the World Development Indicators dataset. The annual volume of loan and bond placements is again aggregated from Dealogic, while net transfers are from the GDF dataset.

years until partial reaccess, further pointing to a positive relationship between the two. The overall picture is similar when using alternative measures of exclusion duration, such as the one on full reaccess.

Another way to illustrate the patterns of exclusion is to plot an empirical survival function. We apply the nonparametric Kaplan-Meier estimator, which estimates an unconditional survival function and is very popular in the survival analysis literature, also because it can take into account censored data. This statistic reports the compound probability of not having reaccessed the market for each year after the restructuring. It can be defined as

$$\hat{S}(t) = \prod_{j \mid t_j \leq t} \left(\frac{n_j - d_j}{n_j} \right), \tag{5}$$

where t_j denotes the time at which reaccess occurs for country-case j, d_j are the number of countries that reaccess at time t_j, and n_j is the total number that have not reaccessed just prior to t_j.

Figure 5 shows the estimated survival function for partial reaccess. Unlike previous research, we estimate survival functions depending on haircut size of the restructuring. More specifically, we group cases with $H_{SZ} < 30$ percent, with $H_{SZ} > 60$ percent and those in between. The graph shows that the estimated functions are markedly different depending on the size of haircuts. Countries with $H_{SZ} < 30$ have a 60 percent probability of reaccessing markets within three years compared to just 10 percent for countries with $H_{SZ} > 60$. The figure also shows that exceptionally high haircuts are often followed by exceptionally long periods of exclusion. Countries imposing $H_{SZ} > 60$ percent are likely to remain excluded after 10 years, with an unconditional probability exceeding 50 percent.

C. *Estimated Model on Exclusion Duration*

The univariate analysis shows a correlation between haircut size and exclusion. However, it is likely that the same factors that are causing the exclusion are also causing the large haircut in the first place. To address this, we next estimate a semi-parametric Cox proportional hazard model that allows including constant and time-varying covariates and can deal with the problems of censored observations and multiple events.

For this model, the hazard rate for the ith individual (or ith exclusion episode) can be written as

$$h_i(t) = h_0(t) \exp(\beta' \mathbf{z}_i), \tag{6}$$

where $h_0(t)$ is the baseline hazard function, $\mathbf{z}$ is a set of covariates, and β is a vector of regression coefficients.

The key advantage of the Cox model vis-à-vis other duration models, such as the parametric Weibull model or the log logistic model, is that it is not necessary to specify a functional form of the baseline hazard rate $h_0(t)$. Instead, the shape of

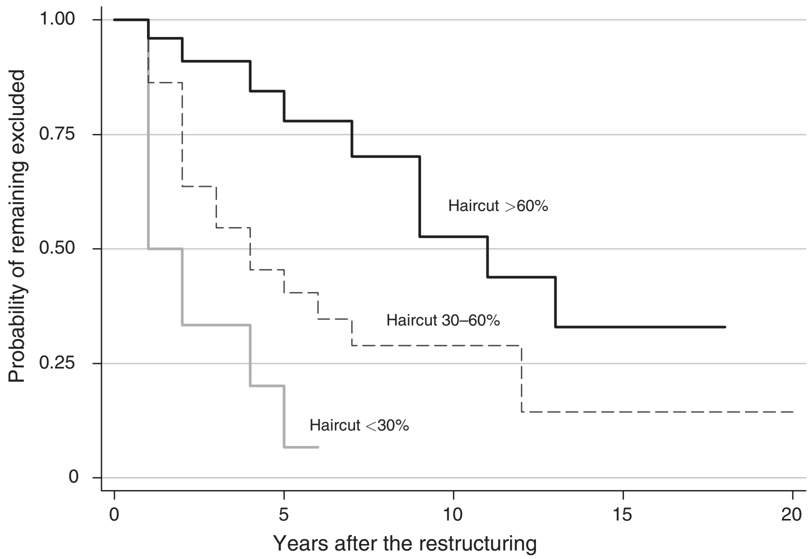

Figure 5. Kaplan-Meier Survival Functions for Duration of Reaccess

Notes: This figure plots three survival functions for the duration of capital market exclusion, differentiating by the size of H_{SZ} (smaller than 30 percent, larger than 60 percent, or in between). The sample consists of 67 final restructurings from 1980 until 2009. The *y*-axis denotes the Kaplan-Meier survival estimate for each function, which represents the unconditional, joint probability that countries remain excluded from capital markets up to each year after the restructuring on the *x*-axis. The figure suggests a positive correlation between haircut size and the probability of remaining excluded for all years considered.

$h_0(t)$ is assumed to be unknown and is left unparameterized. Accordingly, we estimate reduced-form models allowing the functional form of the hazard function to be explained by the data. The model is estimated via a partial likelihood function of the following form:

$$L(\beta) = \prod_{i=1}^{n} \left(\frac{\exp(\beta' \mathbf{z}_i)}{\sum_{j \in W(t_i)} \exp(\beta' \mathbf{z}_j)} \right)^{\delta_i}, \tag{7}$$

where $W(t_i) = (j : t_j \geq t_i)$ denotes the risk set (i.e., the number of cases that are at risk of failure) at time t_i. The model can be extended in a simple manner once time varying covariates are included (see Lancaster 1990).

In estimating the model, we rely on the variance correction method proposed by Lin and Wei (1989). This avoids misleading inference in the case of repeated events and is relevant because some countries in our dataset had multiple restructurings and reaccess episodes since 1980. Thereby potential learning effects are also taken into account.

As before, H_{SZ} is the key explanatory variable of interest, while we build on Dell'Ariccia, Schnabel, and Zettelmeyer (2006); Gelos, Sahay, and Sandleris (2011); and Richmond and Dias (2009) in our choice of model specification and control variables. One difference compared to the above is that we now use country ratings by *Institutional Investor* magazine instead of commercial rating agency ratings, simply because we cover a much larger sample of countries and years than in the monthly EMBIG dataset.[49] We also include dummy variables for world regions as well as year fixed effects.[50]

D. *Estimation Results: Haircuts and the Duration of Market Exclusion*

Table 5 shows the results for various specifications of the Cox proportional hazard model. Here, a positive coefficient indicates that higher values of that variable are associated with quicker reaccess relative to the baseline, while negative coefficients indicate longer exclusion duration.

The main result is that the coefficient on H_{SZ} is negative and robustly significant in all specifications. It also has a sizable quantitative effect. To illustrate this and to allow for a more intuitive interpretation, it is necessary to exponentiate the coefficients shown in Table 5. The coefficient of -0.024 in the full model of column 7 indicates that a 1 unit (percentage point) increase in H_{SZ} lowers the likelihood of reaccessing capital markets in a given year by 2.4 percent.[51] Thus, according to our most conservative estimate, a 1 standard deviation increase (30 percentage points in this sample) is associated with a 51 percent lower likelihood of reaccess in any given year.[52] This is a sizable effect that sheds new light on the finding of earlier studies, which come to the conclusion that reaccess is quick after a debt restructuring (see Eichengreen and Portes 2000; Gelos, Sahay, and Sandleris 2011; Sandleris 2012). We are the first to provide a strong indication that restructuring outcomes play an important role for the speed of reaccess. In previous work, Richmond and Dias (2009) use the Benjamin and Wright (2009) data and do *not* find haircuts to be a significant predictor for partial reaccess (see online Appendix Section A1 for a more detailed discussion).

Column 8 shows that the results are similar when replicating the model in column 7 with a sample that excludes highly indebted poor countries. Regarding the other variables included, we can report only few significant coefficients. We find that population size, GDP per capita, and a good credit rating can be associated with quicker reaccess times. In addition, for some specifications, the debt to GDP ratio and the fiscal balance show significant negative coefficients, suggesting that higher indebtedness and budget surpluses imply longer exclusion duration. All other variables, such as political risk, annual inflation and growth, or the ratio of reserves to imports are clearly insignificant.

Finally, our results are very robust to changes in specification and sample, when using alternative measures of haircuts, when adding additional control variables, or when changing the definition of market access. See Section A1.2 in the online Appendix for details.

[49] For the same reason, we now use public debt to GDP data by Abbas et al. (2010). These data do not differentiate by debt owed to private or to public creditors.

[50] Note that the proportional hazard survival models produce biased estimates with country fixed effects (Allison 2002).

[51] The calculation is $100 \times [\exp(-0.024) - 1] = -2.37$.

[52] The calculation is $100 \times [\exp(-0.024 \times 30) - 1] = -51.32$.

TABLE 5—REGRESSION RESULTS: HAIRCUTS AND YEARS OF EXCLUSION

	Plain (1)	With sovereign rating (2)	With political risk (3)	Population and GDP (4)	External financing conditions (5)	Country fundamentals (6)	Full model (7)	Full model without HIPCs (8)
Haircut (SZ, in percentage)	−0.037*** (0.008)	−0.034*** (0.008)	−0.031*** (0.007)	−0.027*** (0.008)	−0.032*** (0.007)	−0.034*** (0.008)	−0.024*** (0.008)	−0.038*** (0.010)
Credit rating (residual)		0.068*** (0.024)						
Political risk (ICRG)			0.037 (0.028)					
GDP per capita (log)				0.774*** (0.206)			0.826*** (0.281)	0.501 (0.424)
Population (log)				0.414*** (0.102)			0.159 (0.189)	0.326 (0.240)
High-yield bond spread					−0.132* (0.080)			
US Treasury 10-year bond yield					0.136 (0.143)			
Primary balance (in percent to GDP)						−0.094** (0.044)	−0.071* (0.038)	−0.065* (0.038)
Public debt (in percent to GDP)						−0.031*** (0.010)	−0.021* (0.012)	−0.007 (0.015)
Growth (real, p.a.)						−0.064 (0.072)	−0.050 (0.070)	0.017 (0.094)
Inflation (real, p.a.)						0.002 (0.001)	0.002 (0.002)	0.001 (0.001)
Reserves to imports (in percentage)						0.002 (0.005)	−0.003 (0.006)	−0.007 (0.008)
Time fixed effects (year dummies)	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes
Region fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations (time at risk)	322	272	276	322	321	237	237	133
Subjects (episodes)	65	61	54	65	64	52	52	37
log-likelihood	−109.24	−98.12	−87.96	−100.80	−120.71	−75.89	−72.67	−57.84
BIC	339.750	353.202	327.679	334.406	276.057	310.356	309.385	228.162

Notes: This table shows coefficients (not hazard rates) of a Cox proportional hazard model using partial reaccess to credit markets as dependent variable (see text for its definition). The estimated effect of H_{SZ} on exclusion is surprisingly robust across specifications. Here, a negative coefficient sign indicates that higher values of that variable are associated with longer duration of exclusion, but coefficients need to be exponentiated for easier interpretation. For example, the coefficient on H_{SZ} in column 7 suggests that a 1 percentage point increase in haircut is associated with a 2.37 percentage point lower probability of accessing the market in any given year ($100 \times [\exp(-0.024) - 1] = -2.37$). Column 8 excludes highly indebted poor countries from the sample.

***Significant at the 1 percent level.
**Significant at the 5 percent level.
*Significant at the 10 percent level.

VI. Conclusion

Three decades of research find little support for the widespread notion that sovereign defaults lead to higher borrowing costs and exclusion from capital markets. Lindert and Morton (1989, 12) were among the first to conclude that "investors seem to pay little attention to the past repayment record of borrowing governments." Since that influential study, the literature has essentially come to the same conclusion over and over again–sovereign default penalties within credit markets seem to be small or short lived–a finding that stands in contrast to standard theoretical assumptions.

This paper casts doubt on the stylized fact that the financial costs of default are negligible. Instead, our analysis provides indicative evidence that nonpayments can have adverse consequences for governments in the medium run. The paper constructs a new database on haircuts implicit in debt restructurings between sovereigns and private international creditors during 1970–2010. It then documents a close relationship between haircut size in a restructuring and subsequent borrowing conditions for the sovereign. High creditor losses are associated with substantially higher post-restructuring spreads and longer periods of market exclusion. These results are more consistent with theories featuring costly defaults than many previous empirical papers.

Our results should, however, not be misinterpreted. We did not identify a direct channel linking haircuts and sovereign borrowing conditions. Thus, we cannot be sure whether we observe punishment effects, reputational effects or neither of the two. The results also do not imply that countries in default should try to minimize creditor losses. Instead, we provide indicative evidence for the existence of a trade-off; achieving a high degree of debt relief now can have benefits in the short-run, but may also imply worse borrowing conditions in the future.

Further work could complement our findings. In particular, we see the need to study the mechanisms behind our results, both empirically and theoretically. Moreover, it could be insightful to assess the determinants of high or low haircuts. These questions are left for future research.

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