Discussion Paper No. 14-126

Haircut Size, Haircut Type and the Probability of Serial Sovereign Debt Restructurings

Christoph Schröder

ZEW
Zentrum für Europäische Wirtschaftsforschung GmbH
Centre for European Economic Research

Discussion Paper No. 14-126

Haircut Size, Haircut Type and the Probability of Serial Sovereign Debt Restructurings

Christoph Schröder

Download this ZEW Discussion Paper from our ftp server:

http://ftp.zew.de/pub/zew-docs/dp/dp14126.pdf

Die Discussion Papers dienen einer möglichst schnellen Verbreitung von neueren Forschungsarbeiten des ZEW. Die Beiträge liegen in alleiniger Verantwortung der Autoren und stellen nicht notwendigerweise die Meinung des ZEW dar.

Discussion Papers are intended to make results of ZEW research promptly available to other economists in order to encourage discussion and suggestions for revisions. The authors are solely responsible for the contents which do not necessarily represent the opinion of the ZEW.

Haircut Size, Haircut Type and the Probability of Serial Sovereign Debt Restructurings

Christoph Schröder* (ZEW Mannheim)

December 2014

Abstract:

This paper complements the empirical literature on sovereign debt restructurings by analyzing potential determinants of (near-term) follow-up restructurings after a restructuring has taken place. The probability of follow-up restructurings is estimated by means of survival models using a unique dataset provided by Cruces and Trebesch (2013). I find that more comprehensive debt remissions decrease the probability of serial restructurings significantly. Moreover, reductions in net present value due to outright face value haircuts reduce the probability of serial restructurings more strongly than equally sized reductions in net present value due to maturity extensions and/or interest rate reductions. One possible explanation may be found in the timing of debt remissions: While a cut in face value provides direct and instant relief, maturity extensions and/or lower interest rates only unburden a country slowly over time.

JEL Classification Code: F34, H63, N20

Keywords: serial restructurings, sovereign debt restructuring, sovereign debt haircuts

* Corresponding author:

Christoph Schröder, Department of Corporate Taxation and Public Finance, Centre for European Economic Research (ZEW), L7, 1, 68161 Mannheim, Germany, +49 (0)621 1235-390, christoph.schroeder@zew.de.

Acknowledgements: I thank Eckhard Janeba, Friedrich Heinemann and participants of the 2014 ZEW Public Finance Conference, the CESifo Venice Summer Institute 2014, the 70th Annual Congress of the International Institute of Public Finance 2014, and the 29th Annual Congress of the European Economic Association 2014 for helpful comments and discussions. All remaining errors and inconsistencies are solely in my own responsibility.

1. Introduction

Even though Reinhart and Rogoff (2004, p. 53) acknowledge that "'serial default' is the rule, not the exception", there is still no systematic empirical analysis examining this phenomenon. Thus, to complement the literature on sovereign debt restructurings, this paper provides an analysis of potential determinants of serial sovereign debt restructurings. Most importantly, I look for these determinants in sovereign restructurings themselves, asking whether there are certain features to debt renegotiations that are correlated with the probability of (near-term) follow-up restructurings. The results are important for answering the question of which measures could be taken to reduce the probability of a country's debt burden to become unsustainable again (shortly) after the implementation of a debt restructuring. The paper's findings also contribute to the discussion of a sovereign debt restructuring mechanism for emerging markets (Krueger, 2000) or for European countries (Gianviti, Krueger, Pisani-Ferry, Sapir, and von Hagen, 2010; European Economic Advisory Group, 2011; Committee on International Economic Policy Reform, 2013; Fuest, Heinemann and Schröder, 2014).

The empirical literature on serial sovereign debt restructurings is very scarce. There are merely a few studies relying on basic descriptive observations and case studies. One study by Moody's (2012) suggests that an initial debt exchange was followed by further exchanges when the initial debt exchange was not large enough in relation to a country's total debt (even when the haircut of the initial exchange was large). Das et al. (2012, p. 33) speculate on a similar reason. They argue that debt relief in restructurings with official creditors (i.e. within the so-called Paris Club[1]) has been too low before the 1990s, thus triggering serial defaults more often during the 1970s/1980s. The IMF (2013, p. 1) highlights that debt restructurings "have often been too little and too late, thus failing to re-establish debt sustainability and market access in a durable way". It further makes a case for the avoidance of outright default[2] and promotes pre-emptive debt restructurings in the view of serious liquidity or solvency problems because pre-emptive restructurings entail predictable cash flows (as opposed to defaults) which make the consequences for the economy more predictable, too. The IMF (2013) further argues that ma-

[1] "The Paris Club is an informal group of official creditors whose role is to find coordinated and sustainable solutions to the payment difficulties experienced by debtor countries." See http://www.clubdeparis.org/

[2] I distinguish between the terms "sovereign debt restructuring" and "sovereign default" because a default occurs when a country misses out on any interest or principal payment on the due date or beyond a pre-specified grace period while a restructuring can take place even in the absence of an outright default, i.e. pre-emptively, in order to prevent a probable default.

terialized defaults may undermine a country's capacity to re-access international private capital markets in the medium term.

I test these partly intuitive statements descriptively and econometrically by estimating so-called survival models. Additionally, I explore whether outright cuts in face value have the same impeding effect on the probability of serial restructurings as equally sized cuts in net present value due to maturity lengthening and the lowering of interest payments. Economic intuition suggests that any reduction in net present value, no matter whether it is effectuated by cuts in face value, maturity extension or a lower interest rate, should have the same impact on a country's debt sustainability. I also investigate which characteristics of the affected debt and the outcomes of the negotiations are correlated with the probability of a follow-up restructuring.

The main findings suggest that higher overall haircuts in net present value are indeed associated with a lower probability of serial restructurings. Interestingly, cuts in face value have a stronger negative impact on this probability than reductions in net present value by the means of maturity extensions and/or interest rate reductions. This puzzling finding challenges the intuitive expectations that it is the overall reduction in net present value which may impact a country's debt sustainability, no matter how this reduction comes about. It could be explained, however, by the fact that the timing of relief may play a role. While cuts in face value provide instant and direct relief in terms of liquidity, maturity extensions and/or interest rate reductions unburden the country only over time.

The sovereign debt literature has traditionally been concerned with the costs of defaults and/or restructurings because these costs are often viewed to be the main reason why sovereigns repay their debt. The idea is that, in the factual absence of legal enforcement mechanisms, creditors of sovereigns generally cannot count ex ante on a debtor country to repay its debt, if default or restructuring were non-costly alternatives (seminal paper by Eaton and Gersovitz, 1981). The literature[3] specifically discusses (i) direct credit market costs like capital market exclusion or higher borrowing costs[4], (ii) costs in the

[3] For a thorough review of the literature and an overview of stylized facts about sovereign debt restructurings in general, please see Das, Papaioannou and Trebesch (2012) as well as Panizza et al. (2009), Sturzenegger and Zettelmeyer (2006), as well as Tomz and Wright (2013).

[4] Eaton and Gersovitz (1981), Gelos, Sandleris, and Sahay (2011), Aguiar and Gopinath (2006), Mendoza and Yue (2008), Borensztein and Panizza (2009), Richmond and Diaz (2009), Asonuma (2010), Yue (2010), Cruces and Trebesch (2013).

form of a trade decline or trade sanctions[5], (iii) a decline in economic output[6], (iv) adverse effects on the financial and banking sector[7], (v) negative spill-overs on the private credit sector[8], (vi) adverse effects on FDI inflows[9], and (vii) administrative and negotiation costs[10].

Even though many studies provide evidence for the general existence of negative consequences of sovereign defaults and debt restructurings, the empirical literature is not completely at one when it comes to the magnitude, the timing, and the duration of the different costs considered. For example, some studies find that credit markets have a rather short time memory with respect to direct credit market costs like higher borrowing costs and capital market exclusion (see e.g. Borensztein and Panizza, 2009, Gelos et al., 2004). Nevertheless, at least for "final restructurings"[11] Cruces and Trebesch (2013) find that, when controlling for the sizes of haircuts, capital market exclusion can take a long time and borrowing costs can be significantly higher following a restructuring. Also Richmond and Diaz (2009) estimate the average duration of capital market exclusion to be non-negligible, taking approximately six to eight years. However, these authors do not control for the restructuring history: They do not explicitly take into account whether a country had been a serial defaulter or not, which potentially influences their reputation as good debtors and the resulting capital market sanctions significantly.

In spite of all potential costs mentioned above, debt restructuring can be a well justified measure for a country facing an unmanageable debt burden in order to regain long-term debt sustainability. However, the lack of a reliable sovereign debt restructuring mechanism creates uncertainty for both debtors and creditors and may hamper the enforcement of necessary debt exchanges that could in fact restore debt sustainability. The IMF (2013, p. 15) argues that "unsustainable debt situations often fester before they are resolved and, when restructurings do occur, they do not always restore sustainability and market access in a durable manner, leading to repeated restructurings." Generally, noth-

[5] Rose (2005), Martinez and Sandleris (2011).
[6] Tomz and Wright (2007), Arellano, (2008), Mendoza and Yue (2008), De Paoli, Hoggarth, and Saporta (2009), Levy-Yeyati and Panizza (2011).
[7] Borensztein and Panizza (2009), Levy-Yeyati, Martinez Peria, and Schmukler (2010), Gennaioli, Martin, and Rossi (Forthcoming).
[8] Arteta and Hale (2008), Das, Papaioannou, and Trebesch (2012).
[9] Fuentes and Saravia (2010).
[10] Das, Papaioannou, and Trebesch (2012).
[11] Cruces and Trebesch (2013) define final restructurings as restructurings that were not succeeded by another restructuring with commercial creditors within four years.

ing is gained if a country restructures its debt too late and to an extent that is insufficient for regaining long(er) term debt sustainability. "[T]oo little and too late" (IMF, 2013, p. 7) restructurings likely have negative consequences for debtors, creditors and, depending on the relative importance of the country in question, for the international financial system. Persistent unsustainable debt levels impede investment and growth in the debtor country, thereby reducing the value of creditors' claims even further.

One important assumption in this paper is that serial and apparently insufficient restructurings are in sum more costly than a single deemed-to-satisfy restructuring. Serial restructurings do not raise a country's reputation of being a good borrower but likely destroy the reputation even more. Additionally, the administrative costs as well as the economic costs due to the uncertain outcome of debt renegotiations (in terms of debt sustainability) have to be incurred over and over again. Fuentes and Saravia (2010) find that the decrease of FDI inflows is even stronger for serial defaulters than for single defaulters. The IMF (2013, pp. 23-24) states that "[s]ince a restructuring process is disruptive and costly to the debtor's perceived creditworthiness, it is not desirable to repeat it." Throughout this paper, I neglect the possibility that a country might restructure its debt serially for completely strategic reasons. Even if single restructurings were strategic in nature, an entire series over many years is likely not to be. Such a strategy is highly precarious, bears high risks and uncertainty, and is thus quite likely to be an exception to the rule.[12]

The remainder of the paper is structured as follows. Section 2 describes the dataset used and provides some stylized facts. Section 3 descriptively analyzes correlations between restructuring characteristics and the probability of (near-term) follow-up restructurings. Section 4 presents the estimation results of Cox (1972) proportional hazard models and section 5 concludes.

[12] See also "Ivory Coast debt: serial default?" in Financial Times (13 July 2011; http://blogs.ft.com/beyond-brics/2011/07/13/ivory-coast-debt-serial-default/) for an example of potential strategic default.

2. Data

2.1. Data Source for Restructurings with Commercial Creditors

The main dataset I use covers all 180 sovereign debt restructurings with foreign commercial creditors in 68 countries since 1970 and has kindly been provided by Cruces and Trebesch (2013)[13]. They report sovereign debt restructurings of public or publicly guaranteed debt with foreign private creditors. The authors focus on distressed debt exchanges, which they define as restructurings of bonds or bank loans at less favorable conditions than the original bond or bank loan. They restrict the sample to medium and long-term debt restructurings. Short-term agreements like 90-day debt rollovers or the upkeep of short-term credit lines (e.g. trade credit) are disregarded and agreements with maturity extension of less than one year are excluded. Cases where short-term debt is exchanged for debt with a maturity of more than one year are, in turn, included. Finally, the dataset covers only restructurings that have actually been implemented.

The value of the dataset does not only lie in the mere listing of all these restructurings but especially in the provision of information on the characteristics of the restructurings. Most importantly, Cruces and Trebesch (2013, p. 87) estimate the "wealth loss of the average creditor participating in the exchange", i.e. they estimate what is generally called a haircut in net present value. The authors use two different haircut measures: the "market haircut" and the, in their view better suited, "SZ haircut" according to the methodology of Sturzenegger and Zettelmeyer (2006, 2008)[14]. The dataset also includes the magnitude of the cut in the nominal value of the debt, which is zero in 123 of the 180 cases.

Furthermore, Cruces and Trebesch (2013) provide information on the absolute amount of debt (in current US dollars) that had been affected as well as other important features of debt contracts, the debt affected and negotiation outcomes. The features of the debt contracts and the debt affected include information on whether the debt was in the form of bonds or bank loans, whether all of the debt affected had already fallen due at the time of debt renegotiations, whether the debt affected included previously restructured

[13] The dataset is freely accessible online: https://sites.google.com/site/christophtrebesch/data

[14] The traditional "market haircut" compares the present value of new debt contracts to the face value of the old debt contracts, whereas the "SZ haircut" is computed according to the methodology by Sturzenegger and Zettelmeyer (2008) who evaluate old debt contracts in present value terms and discount both new and old debt instruments at the same interest rate. See Sturzenegger and Zettelmeyer (2008) as well as Cruces and Trebesch (2013) for a discussion of the advantages and disadvantages of the two haircut concepts.

debt, and whether short-term debt with a maturity of less than one year had also been restructured such that the new maturity exceeded one year. The features of negotiation outcomes include information on whether the restructuring deal was a buy-back deal (i.e. a country buys back its debt at large discount), whether the restructuring deal was a so-called Brady deal[15] (i.e. loosely speaking an exchange of bank loans for partly collateralized tradable bonds), whether the deal was "donor-funded or supported by bilateral or multilateral money, e.g. via funds by International Development Association Debt Reduction Facility", and whether the deal "include[d] the provision of new money or concerted lending" (Cruces and Trebesch, 2013, online Appendix A5, p. 39).

2.2. Data Source for Paris Club Debt Restructurings

Although I focus on debt restructurings with commercial creditors in the descriptive and econometric sections 3 and 4, I include the restructurings with official creditors (Paris Club) in the subsection 2.3 on the stylized facts. This helps the reader to get a more complete picture of the problem.

I gathered the available data on all Paris Club restructurings since 1950 from the Paris Club's website[16] and double-checked this list of restructurings with that of Das et al. (2012). Surprisingly, there are ten Paris Club Restructurings in their list which I cannot find on the official Paris Club's website. I work with those 421 restructurings of 86 countries since 1970 that I could find on the Paris Club's website.

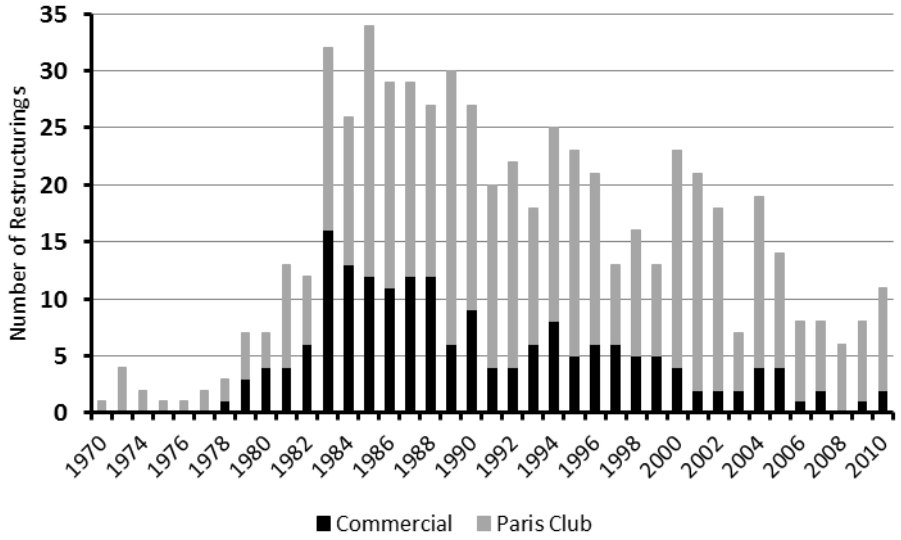
2.3. Some Stylized Facts about Serial Restructurings

When simply looking at the timing of sovereign debt restructurings, one can easily make out restructuring clusters. Figure 1[17] shows a sharp increase in the number of restructurings worldwide in the beginning of the 1980s and an overall peak in 1983. Especially the number of commercial restructurings was highest during this decade and also

[15] Brady deals featured the conversion of bank loans to a variety of new tradable bonds for mostly Latin American countries. The new bonds were partly collateralized by U.S. Treasury 30-year zero-coupon bonds. The main advantage was the possibility for commercial banks to exchange their claims on developing countries into tradable debt instruments, which greatly reduced the concentration of risk on their balance sheets. Argentina, Brazil, Bulgaria, Costa Rica, Côte d'Ivoire, Dominican Republic, Ecuador, Jordan, Mexico, Morocco, Nigeria, Panama, Peru, Philippines, Poland, Uruguay, Venezuela and Vietnam deployed the Brady program, named after the U.S. Treasury Secretary Nicholas Brady.
[16] http://www.clubdeparis.org/
[17] A similar figure can be found in Das et al. (2012).

peaked in 1983. While there were only four commercial restructurings in the 1970s (all of them in the late 1970s) their number declined significantly starting in the late 1980s until 2010. The trend looks similar for Paris Club restructurings, even though the volatility of the number of restructurings per year was much higher. Das et al. (2012, p. 33) explain the higher number and frequency of Paris Club restructurings (as opposed to commercial restructurings) by the "Paris Club's reluctance to grant debt relief" before the 1990s. They hypothesize that "[t]his likely triggered a pattern of serial rescheduling with some debtors."

Figure 1: Number of sovereign debt restructurings by year and creditor



The phenomenon of serial restructurings as stated by Reinhart and Rogoff (2004) as well as Das et al. (2012) can indeed be confirmed: 13% (29%, 41%) of all commercial restructurings are followed by another commercial restructuring within one (two, three) year(s). The share of follow-up restructurings for Paris Club debt is not as high in the first year (5%) but is even higher for the second and third year: 36% (55%) of all Paris Club restructurings are succeeded by another Paris Club restructuring within two (three) years. When taking into consideration all restructurings, the numbers are even more striking. 35% (60%, 70%) of all commercial restructurings are followed by another commercial or Paris Club restructuring within one (two, three) year(s) while 24% (54%, 69%) of all Paris Club restructurings are followed by another commercial or Paris Club restructuring within one (two, three) year(s). Overall, 28% (57%, 70%) of all restructurings are followed by another restructuring within one (two, three) year(s). The picture looks just as impressive when inspecting the time differences between any two

consecutive restructurings of any country (see Figures 2 through 4). Both for commercial as well as for Paris Club cases, about 67% of all debt restructurings that were preceded at some point in the dataset take place within the first three years after an antedated restructuring. Considering all commercial and Paris Club cases together, over 80% of restructurings that were preceded at some point in the dataset take place within three years.

Figure 2: Time between two subsequent sovereign debt restructurings

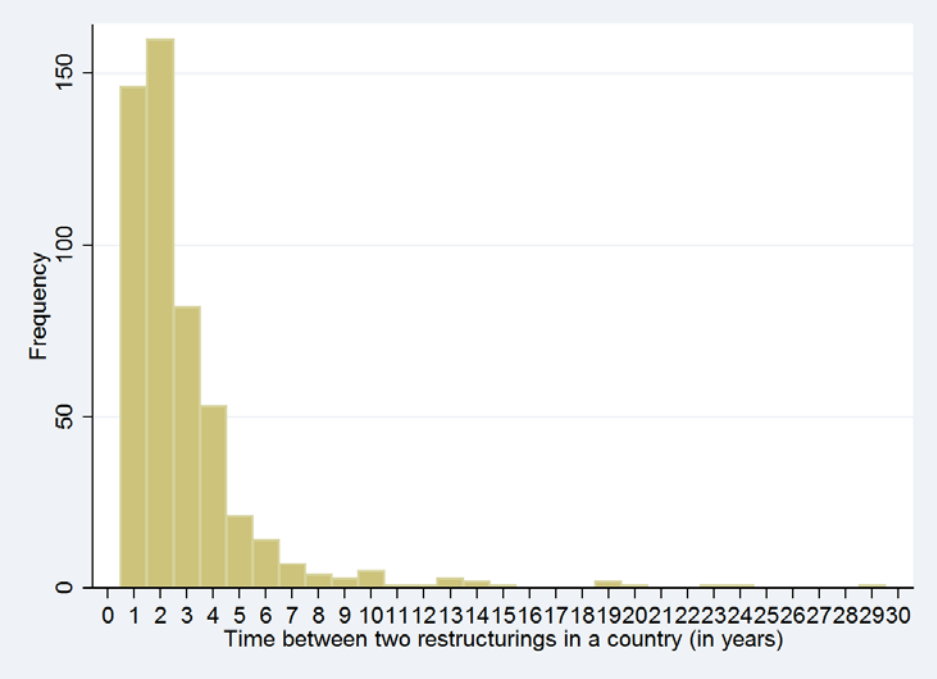


Figure 3: Time between two subsequent restructurings with commercial creditors

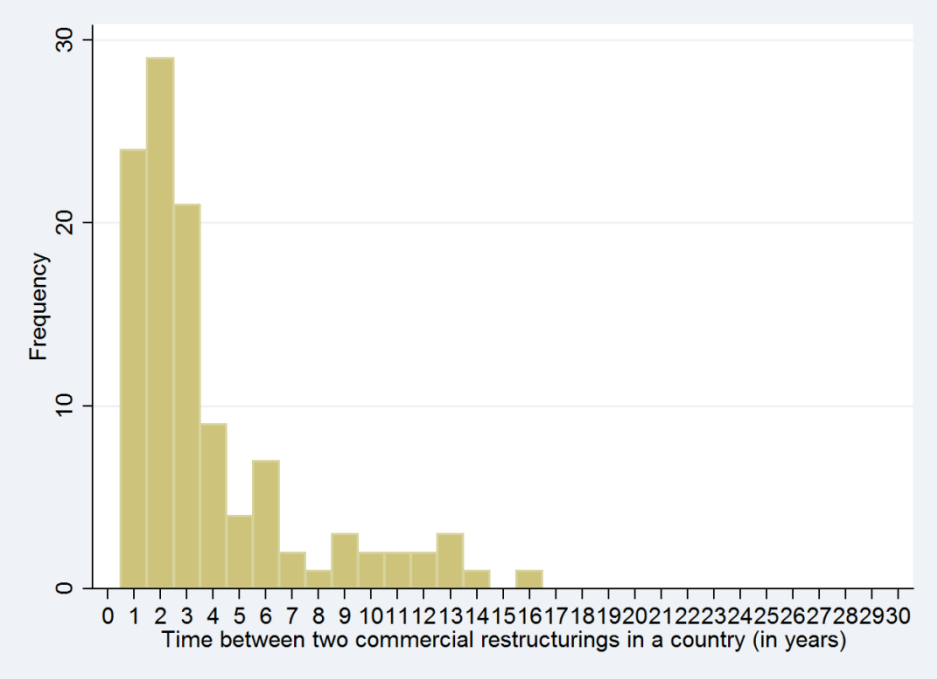
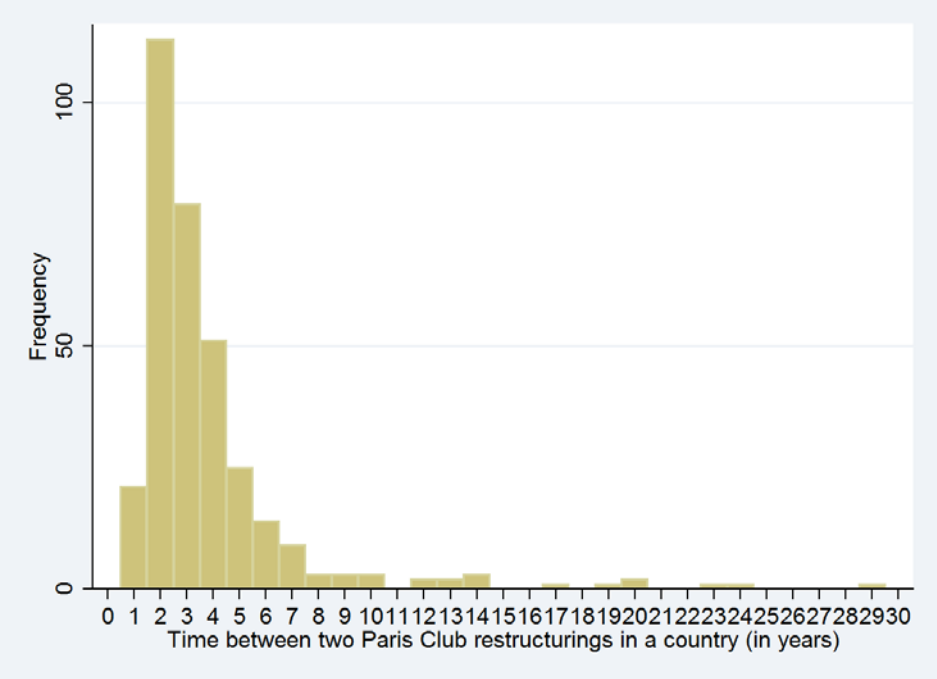


Figure 4: Time between two subsequent Paris Club restructurings



3. Descriptive Analysis

3.1. The Size and Type of Haircuts

One of the central features of any debt restructuring is the size of the haircut, i.e. the reduction of the debt contract's net present value. The size of a haircut is the result of a combination of a direct cut in the nominal value of a debt contract, an extension of maturity, and/or a lowering of interest rates.

As explained in section 1 above, I examine whether cuts in face value have a stronger negative impact on the yearly compound probability of follow-up restructurings than lower interest rates or maturity extensions that lead to an equal reduction in net present value. Economic intuition suggests that face value reductions should not differ in their impact. In fact, any modality leading to a reduction in net present value should be observationally equivalent to any other such modality leading to an equally high cut in net present value. However, the timing may also play an important role. While a cut in face value provides direct and instant relief, maturity extensions and/or lower interest rates only unburden a country over time.

Before I take a closer look into face value cuts and other restructuring modalities, however, I first analyze how the size of the total haircut is correlated with the probability to incur near-term follow-up restructurings. Table 1 presents two different haircut measures as calculated by Cruces and Trebesch (2013).

No matter which of the two haircut measures are used, restructurings that were followed by at least one other restructuring within one to three years exhibited on average statistically significantly lower haircuts (by about one half) than those restructurings that did not entail follow-up restructurings within this time window. This is a first indication that the size of the haircut is highly correlated with the probability of near-term follow-up restructurings.

Table 1: Two-sample t-tests for equal means – Haircuts

The table reports the mean haircuts/ cuts in face value in % of net present value. Using two-sample t-tests for equal means, the table compares those restructurings with a near-term follow-up restructuring to those without a near-term follow-up restructuring. *, **, *** indicate statistical significance at the 10%, 5%, 1% level, respectively.

Mean Haircuts of restructuring cases…				
	obs	SZ Haircut	Market Haircut	Cut in Face Value
… that *were* followed by another commercial restructuring **within one year.**	24	18.4	18.5	1.1
… that *were not* followed by another commercial restructuring **within one year.**	156	39.9	43.3	19.2
Significance		***	***	***
… that *were* followed by another commercial restructuring **within two years.**	53	25.5	27.2	2.7
… that *were not* followed by another commercial restructuring **within two years.**	127	41.8	45.4	22.6
Significance		***	***	***
… that *were* followed by another commercial restructuring **within three years.**	74	24.0	26.3	2.2
… that *were not* followed by another commercial restructuring **within three years.**	106	46.1	49.6	26.9
Significance		***	***	***

A different descriptive way of analyzing the correlation between the size of the haircut and the time until a follow-up restructuring is to plot (unconditional) survival functions and conduct nonparametric hypothesis tests for the equality of these survival functions. Figure 5 shows Kaplan-Meier survival functions[18] to differentiate between very high (above 67%), medium (between 33% and 67%), and very low (below 33%) – panel (a) – as well as between high (above 50%) and low (below 50%) haircuts – panel (b). The nonparametric Kaplan-Meier estimator is especially suitable for the task at hand because it can cope with censored data: Since the dataset used ends in 2010 and some follow-up restructurings may still be to come after that date, the data should be treated as right-censored. The Kaplan-Meier curves as well as the hypothesis tests conducted also

[18] The graphs show the probability of *not* incurring another restructuring (following a restructuring) over time. The compound probability for each point in time is calculated as follows: $\hat{S}(t) = \prod_{t_{(i)} \leq t}(1 - \frac{d_i}{n_i})$, where d_i is the number of follow-up restructurings already materialized at $t_{(i)}$ and n_i is the number of subjects that were at risk of incurring another restructuring at time $t_{(i)}$. Note also that: $\hat{S}(0) = 1$.

provide a first indication whether the proportional hazards assumption is valid, which is important for the estimation of the Cox proportional hazard model in section 4. In order for proportionality to hold, the Kaplan-Meier curves should exhibit approximately the same shape and the separation between the curves should approximately remain constant.

As can be seen in Figure 5, those restructuring cases with high (above 50%) and very high (above 67%) haircuts have a significantly lower compound probability to be followed-up upon by another restructuring than those restructurings with lower cuts in net present value. All tests reject the equality of survival functions at the one percent significance level and the curves are approximately parallel.

Not all haircuts include an outright cut in face value (FV). Indeed, only 32% of all 180 commercial debt restructurings in the sample featured a reduction of the nominal amount of the debt. When conducting the same exercises as for total haircuts (Table 1 and Figure 6), I find that restructurings with at least one follow-up within one to three years have in the mean significantly lower cuts in face value by as much as 88-94% than those restructurings without subsequent restructurings in the near term. Importantly, the extent of the cut in face value is also highly correlated to the overall size of the haircut[19], which is not surprising since the haircut is indeed a function of, inter alia, the size of the reduction in face value. Figure 6 shows Kaplan-Meier curves for restructurings with and without reductions in face value and confirms the findings from Table 1. Those restructurings with a (high) cut in face value have a significantly lower compound probability of being followed-up upon by another restructuring at each point in time.

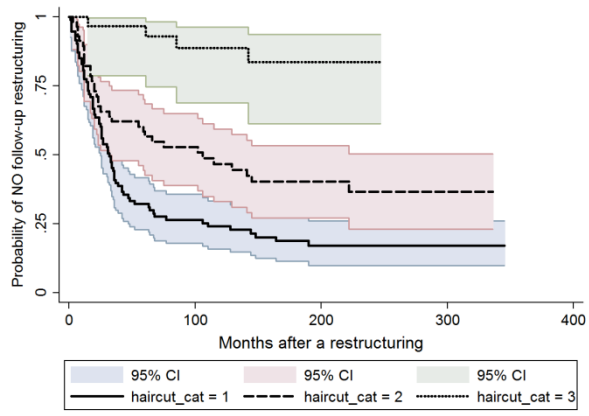
One problem of looking merely at reductions in net present value is that the total amount of the debt affected by the restructuring relative to a country's total debt stock is not taken into account. Of course, the amount of debt cancelled relative to total debt is of crucial importance for debt sustainability. The haircut alone can be very large and have almost no impact if the amount of debt affected is tiny compared to a country's total debt burden (Moody's 2012). In order to control for this fact, I include the amount of debt affected by the restructuring relative to a country's total debt stock as a control variable in the estimations in section 5.

[19] Correlation coefficient is 0.81 for "Market Haircuts" and 0.84 for "SZ Haircuts"

Figure 5: Kaplan-Meier survival estimates – Size of haircuts

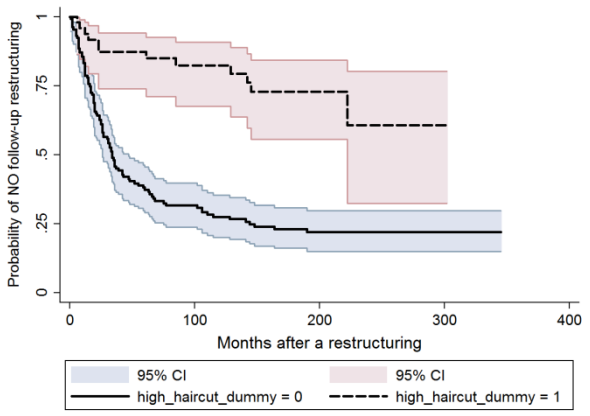
The figure shows Kaplan-Meier curves (see also footnote 9). Shaded regions around the curves mark 95% confidence bands.

(a) Haircut categories[20]



Tests for equality of survival functions:
H_0: Risk of follow-up restructurings is equal across groups
- Log-rank test: p=0.0000
- Wilcoxon (Breslow) test: p=0.0000
- Tarone-Ware test: p=0.0000
- Peto-Peto test: p=0.0000

(b) High (>50%) vs. low (<50%) haircuts

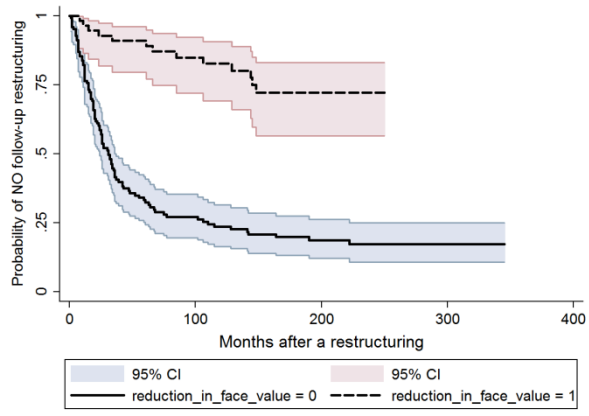


Tests for equality of survival functions:
H_0: Risk of follow-up restructurings is equal across groups
- Log-rank test: p=0.0000
- Wilcoxon (Breslow) test: p=0.0000
- Tarone-Ware test: p=0.0000
- Peto-Peto test: p=0.0000

Figure 6: Kaplan-Meier survival estimates – Cuts in face value

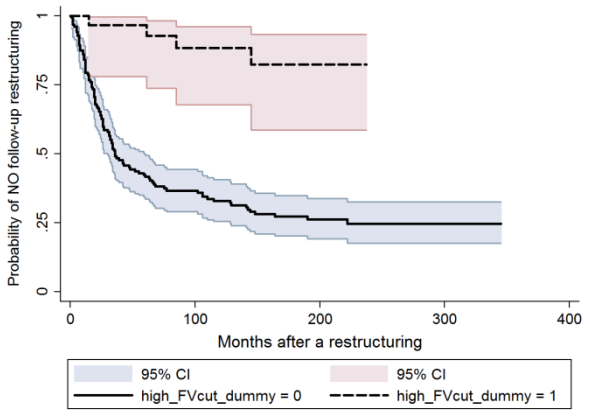
The figure shows Kaplan-Meier curves (see also footnote 9). Shaded regions around the curves mark 95% confidence bands.

(a) Reduction in face value – yes or no



Tests for equality of survival functions:
H_0: Risk of follow-up restructurings is equal across groups
- Log-rank test: p=0.0000
- Wilcoxon (Breslow) test: p=0.0000
- Tarone-Ware test: p=0.0000
- Peto-Peto test: p=0.0000

(b) High (>50%) vs. low (<50%) cuts in FV



Tests for equality of survival functions:
H_0: Risk of follow-up restructurings is equal across groups
- Log-rank test: p=0.0000
- Wilcoxon (Breslow) test: p=0.0000
- Tarone-Ware test: p=0.0000
- Peto-Peto test: p=0.0000

[20] Category 1: Haircut<33%; category 2: 33%<Haircut<67%; category 3: Haircut>67%.

3.2. Other Modalities of Debt Restructurings

Of course, the size of a restructuring and the type of haircut is not the only outcome of debt renegotiations that is potentially correlated with the probability of follow-up restructurings. Cruces and Trebesch (2013) also provide information on whether a restructuring has been donor funded, whether it comprised a buy-back of debt contracts, whether the restructuring was a Brady deal (i.e. loosely speaking an exchange of bank loans for partly collateralized tradable bonds) or whether it included the provision of new money or concerted lending. Indeed, all of these features, except for the provision of new money, are negatively and significantly correlated with the compound probability of observing at least one follow-up restructuring (see Figure 7).

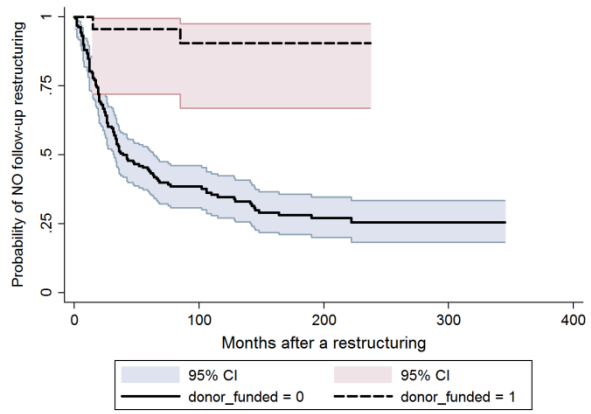
Donor funded restructurings (panel a) generally seem not to entail (many) near-term follow-up restructurings but the causality is not clear at all. It might well be that donors only provide funds to debtors, if they expect them to have a low probability of their debt stock becoming unsustainable and having to restructure again in the future. Thus, we cannot know whether donor funding just works well with respect to a lower probability of serial restructurings or whether these restructuring cases were characterized by a lower probability of serial default, to begin with.

The argument for buy-back deals (panel b) and restructurings that included the provision of new money (panel c) is similar. Countries which can afford to buy back their debt contracts (even if they do so at a large discount) may anticipate a higher probability of being sustainable afterwards. Oftentimes, donor funding and buying back debt even coincide, which makes the exogeniety assumption for these dummy variables with respect to the probability of serial restructurings even more difficult to defend. Due to these potential reverse causality problems, the baseline estimations in the econometric section 4.2 will not include these variables. Furthermore, I will check for robustness of overall results by excluding these restructurings in section 4.3. This way, I can circumvent any potential omission of variables that should actually necessarily be included in order to control for particularities of these restructurings.

Figure 7: Kaplan-Meier survival estimates – Restructuring modalities

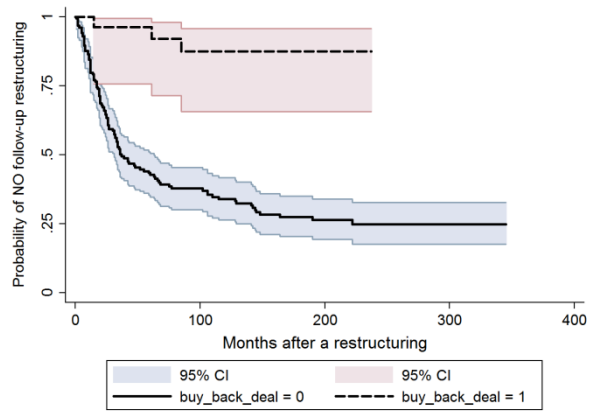
The figure shows Kaplan-Meier curves (see also footnote 9). Shaded regions around the curves mark 95% confidence bands.

(a) Donor-funded Restructurings



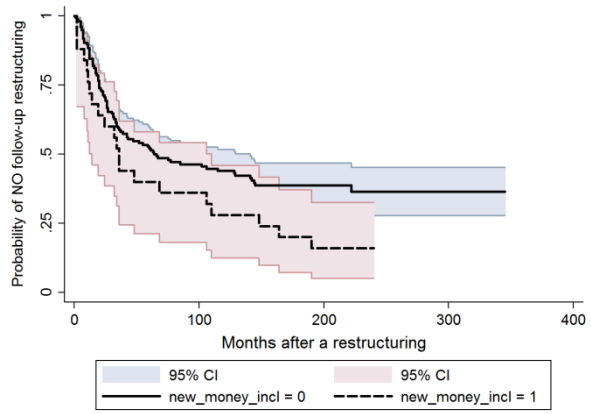
Tests for equality of survival functions:
H_0: Risk of follow-up restructurings is equal across groups
- Log-rank test: p=0.0000
- Wilcoxon (Breslow) test: p=0.0000
- Tarone-Ware test: p=0.0000
- Peto-Peto test: p=0.0000

(b) Buy-back deals



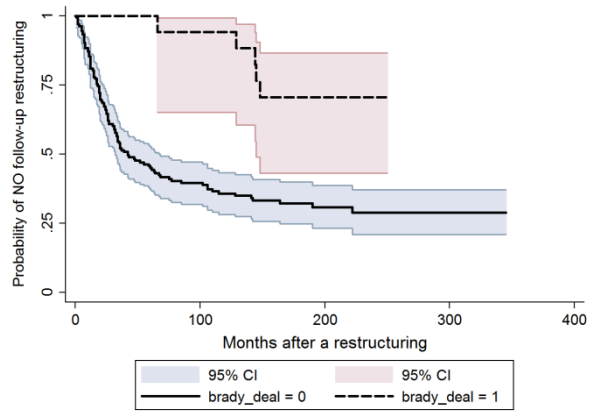
Tests for equality of survival functions:
H_0: Risk of follow-up restructurings is equal across groups
- Log-rank test: p=0.0000
- Wilcoxon (Breslow) test: p=0.0000
- Tarone-Ware test: p=0.0000
- Peto-Peto test: p=0.0000

(c) New money included



Tests for equality of survival functions:
H_0: Risk of follow-up restructurings is equal across groups
- Log-rank test: p=0.0468
- Wilcoxon (Breslow) test: p=0.0921
- Tarone-Ware test: p=0.0711
- Peto-Peto test: p=0.0740

(d) Brady deals



Tests for equality of survival functions:
H_0: Risk of follow-up restructurings is equal across groups
- Log-rank test: p=0.0011
- Wilcoxon (Breslow) test: p=0.0004
- Tarone-Ware test: p=0.0005
- Peto-Peto test: p=0.0004

The exchange of bank loans for tradable Brady bonds in the 1980s also seems to have worked quite well, when it comes to preventing near-term follow-up restructurings. However, some of the countries had to restructure again 6 to 13 years later.

3.3. The Type of Debt Affected

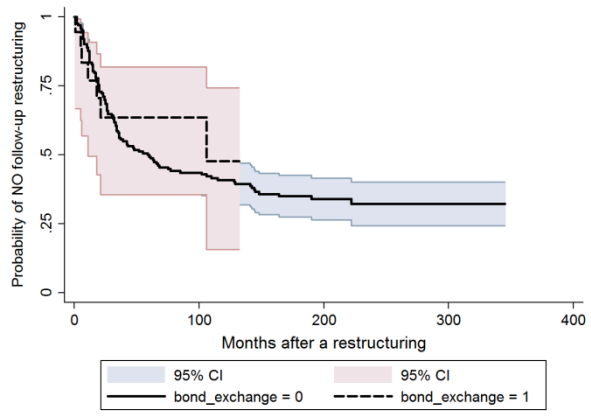
It is important to keep in mind that there are also different types of debt being affected by the restructurings. First, the contracts can be in the form of bank loans or bonds. Second, one has to differentiate between cases where all of the renegotiated debt had already fallen due at the time of the restructuring or not. Third, it might be the case that the very debt being restructured has already been restructured before. Finally, some debt renegotiations included the exchange of short-term debt contracts with an original maturity of at most one year for new debt instruments with a longer-term maturity exceeding one year. When looking at the survival functions (Figure 8), only the facts that previously restructured debt (PRD) has been renegotiated again (panel c) and that short-term debt has been exchanged for longer-term debt (panel c) seem to be correlated with the compound probability of follow-up restructurings. Those cases where previously restructured debt has been restructured again, exhibit a statistically significant lower probability of being followed by another restructuring at each point in time. This may be the case because in these restructurings it was clear that the previous restructuring had not been sufficient for the country to regain medium to long term debt sustainability. These restructurings are by definition follow-up restructurings themselves.

Those restructurings where originally short-term debt was exchanged for longer-term debt exhibit a higher compound probability of follow-up restructurings at each point in time, which may initially be surprising. However, short-term debt being affected is a sign of perceived liquidity problems (rather than real solvency problems). Exchanging short to longer term debt is an attempt to reduce any acute liquidity pressure. Therefore it is also not surprising that only two out of a total of 54 cases, where short-term debt had been included, featured a (low) reduction in face value. The other 52 cases only comprised maturity lengthening and at best interest rate reductions. These cases may well have developed to become real solvency problems, though. Thus, they are followed by further restructurings with higher probability.

Figure 8: Kaplan-Meier survival estimates – Type of debt

The figure shows Kaplan-Meier curves (see also footnote 9). Shaded regions around the curves mark 95% confidence bands.

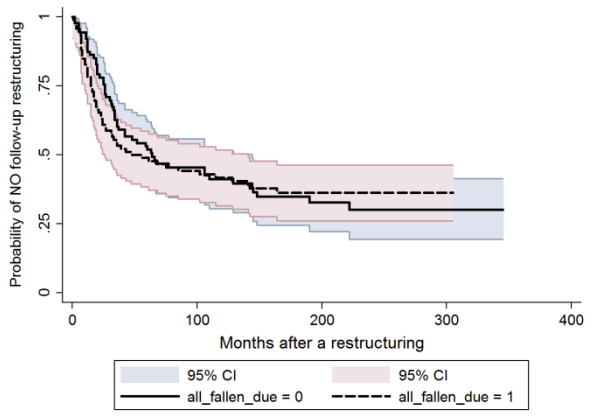
(a) Bond exchange



Tests for equality of survival functions:
H_0: Risk of follow-up restructurings is equal across groups

- Log-rank test: p=0.6019
- Wilcoxon (Breslow) test: p=0.8524
- Tarone-Ware test: p=0.7176
- Peto-Peto test: p=0.8633

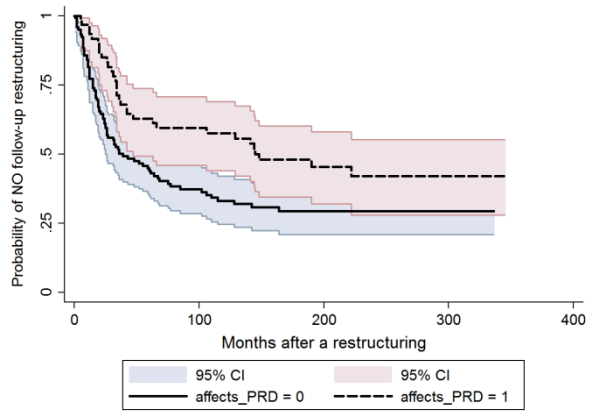
(b) All debt fallen due at time of restruct.



Tests for equality of survival functions:
H_0: Risk of follow-up restructurings is equal across groups

- Log-rank test: p=0.7403
- Wilcoxon (Breslow) test: p=0.2747
- Tarone-Ware test: p=0.4419
- Peto-Peto test: p=0.3208

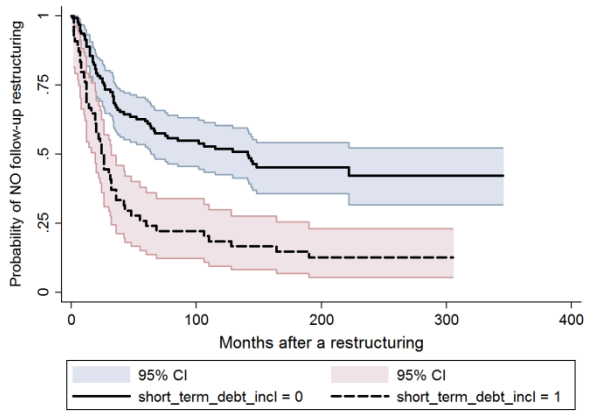
(c) Affects previously restructured debt



Tests for equality of survival functions:
H_0: Risk of follow-up restructurings is equal across groups

- Log-rank test: p=0.0063
- Wilcoxon (Breslow) test: p=0.0015
- Tarone-Ware test: p=0.0026
- Peto-Peto test: p=0.0018

(d) Short term debt included in restruct.



Tests for equality of survival functions:
H_0: Risk of follow-up restructurings is equal across groups

- Log-rank test: p=0.0000
- Wilcoxon (Breslow) test: p=0.0000
- Tarone-Ware test: p=0.0000
- Peto-Peto test: p=0.0000

4. Econometric Investigation

4.1. The Cox Proportional Hazard Model

The above graphs and tests merely provide a first rough picture of the way certain features of debt restructurings may be correlated with the probability of serial restructurings. To complete the picture and check for the general validity of some of the above findings I run semi-parametric Cox proportional hazard regressions (Cox, 1972) in order to model the simultaneous impact of certain debt renegotiation outcomes and debt characteristics on the probability of a follow-up restructuring taking place at any point in time. The main variables of interest are the overall size of the haircut as well as the reduction in face value and the residual haircut due to maturity extensions or/and interest rate reductions.

The Cox proportional hazard model allows estimating the hazard rate $h(t)$ (i.e. the risk of a follow-up restructuring to occur at a time t) and can be written as follows:

$$h(t) = h_0(t) * \exp(\beta_1 X_1 + \beta_2 X_2 + \cdots + \beta_n X_n) ,$$

where $X_1, \dots, X_n$ denote the covariates and $\beta_1, \dots, \beta_n$ are the corresponding coefficients. The term $h_0(t)$ is the baseline hazard rate at time t for all covariates being equal to zero (similar to the constant term in simple linear regressions). The baseline hazard rate is then shifted up or down by an order of proportionality when one of the covariates changes.

The main advantage of the Cox proportional hazard model is the fact that the baseline hazard function is left unparameterized, meaning that one does not have to assume a specific functional form. This of course, can also be a disadvantage, since the proportionality assumption must hold for the reduced form model to be correct. In addition to the Kaplan-Meyer plots and the hypotheses tests for the equality of survival functions in section 3 above, I also conduct post-estimation tests on the basis of Schoenfeld residuals to check for the validity of the crucial proportional hazard assumption.

Another big advantage of the Cox model is that it can cope with left truncation and right censoring, which is the case for the data at hand. Countries enter the dataset at different points in time and some potential future follow-up restructurings cannot be observed because the dataset ends after 2010.

The Cox proportional hazard model is estimated using pseudo maximum likelihood and I use the Efron (1977) method to handle ties (i.e. if two observations have the same survival time).[21] Each regression includes country dummies to control for time invariant particularities. Standard errors are clustered at the country level.

As control variables I use most of the ten macroeconomic variables suggested by Manasse and Roubini (2005) plus a polity indicator to control for the political system. Manasse and Roubini (2005) identified these ten variables to be suitable – and apparently sufficiently so – to predict debt crises. Unfortunately, data for the computation of the public external debt to fiscal revenue ratio, the number of years to the next presidential election as well as external financial requirements are not sufficiently available for the countries and time span at hand.

This also makes it difficult to clearly and unchallengeably identify potential causal relationships econometrically. The number of observations is arguably low, ranging between 144 and 157 for the baseline case, depending on which covariates are included. Nevertheless, some of the found, robust correlations contribute to a better understanding of what kind of restructurings entail serial restructurings with high probability.

4.2. Baseline Estimation Results

Table 2 shows baseline estimation results for the full sample. The haircut measure used here is computed according to the method by Sturzenegger and Zettelmeyer (2008) as explained in section 2.1 above. Moreover, the estimations contain only those restructuring characteristics that have been shown to be suitable for inclusion into the Cox proportional hazard regressions in section 3. Specifically, the variables included have been tested for significantly different and approximately parallel Kaplan-Meier functions. The dummy variables indicating donor-funding, buy-back deals, Brady deals and new money being included are disregarded in the estimations due to potential endogeniety issues. All variables are described in more detail in Table A1 in the Appendix. Table A2 provides some descriptive statistics.

Each regression is estimated twice: first, with the overall haircut as a regressor and, second, with separate regressors for the cut in face value and the residual reduction in net present value due to maturity extensions and/or interest rate cuts. Control variables are

[21] When using the exact method overall results do not change (see column (2) of Table 3 in section 4.3).

included subsequently in table 2. Column 1 comprises only the haircuts, column 2 includes debt characteristics, countries' economic and political fundamentals as suggested by Manasse and Roubini (2005) are included in column 3, and the U.S. treasury bill rate (see also Manasse and Roubini, 2005) as a proxy for international capital market conditions is added in column 4. The estimation results are tested for robustness in tables 3 and 4 in section 2.3.

The regression output confirms the descriptive findings as well as the IMF's (2013) claim that higher haircuts lead to a lower compound probability of follow-up restructurings. A higher overall haircut in net present value of 1 percentage point is on average associated with a $(\exp(-0.04) - 1) * 100 = -3.9$ % lower compound probability of observing a follow-up restructuring. The IMF's (2013) call for higher haircuts thus seems to be justified, if – as explained in the introductory section 1 – one assumes that a single haircut is less expensive than serial restructurings (with the same aggregate haircut).

When discriminating between the effects of a haircut in face value and the residual haircut due to maturity prolongation or/and interest rate reductions, only the coefficient for the cut in face value is significantly different from zero. Still, the coefficient on the residual haircut is negative as expected. Surprisingly, we can reject the null hypothesis that the two coefficients are equal on the 1-3% significance levels, depending on the specification. This implies that a reduction in face value has a stronger negative impact on the probability of serial restructurings than a reduction of net present value due to maturity extension and/or an interest rate reduction. While a one percentage point increase in the face value haircut reduces the probability of a follow-up restructuring by roughly 6.7%, an equally sized haircut due to maturity extension and/or interest rate reduction reduces the probability of serial default by only about 2.0%. The intuitive expectation that it should not matter how the cut in net present value is achieved cannot be confirmed on the basis of these findings. One possible explanation for this finding might be that a cut in face value provides outright debt relief, whereas interest rate cuts and especially maturity extensions merely buy an insolvent country some time until it becomes illiquid or insolvent again.

The amount of debt affected itself also has a significant impact on the probability of serial restructurings. It is an important control variable for the true size of the haircut with respect to the overall debt burden. The higher the amount of debt affected relative to

GDP, the lower the probability of incurring a follow-up restructuring because even a low haircut erases a large part of a country's debt relative to GDP. Estimations where this variable is omitted nevertheless generate very similar results (not shown here).

The covariates describing the type of debt affected and fulfilling the statistical requirements for inclusion into the Cox proportional hazard model are the two dummy variables indicating whether the restructuring affected previously restructured debt and whether short-term debt was exchanged for debt contracts with longer-term maturities. The coefficient to the dummy for short term debt being included is not significantly different from zero in most specifications. The coefficient to the dummy indicating whether previously restructured debt had been affected is significantly negative in all specifications, though. Those cases, where previously restructured debt was restructured again have, on average, a 65-75% lower compound probability of being followed-up by another restructuring. One possibility would be that these restructurings complement the previous restructuring in such a way, that the country finally becomes or at least comes far closer towards medium- to long-term debt sustainability.

A country's real GDP growth around the time of restructuring does not enter significantly. However, a country's debt ratio after the considered debt restructuring is statistically highly significant. Economically speaking, a one percentage point higher debt-to-GDP ratio is associated with a 1.8% higher probability of having to restructure again.

Finally, I include the three month U.S. treasury bill rate to control for the overall international credit market environment. As expected, the sign is positive, implying that the more tense the situation on international capital markets (i.e. the higher the treasury bill rate), the higher the probability of observing follow-up restructurings. However, the coefficients are not significantly different from zero in this specification.

Generally, the coefficients to the haircut variables are left almost unchanged by the successive inclusion of all the controls. The validity of the proportionality assumption is tested on the basis of Schoenfeld (1982) residuals for each covariate individually as well as for the full specifications and can be confirmed. The null hypothesis that the proportionality assumption holds cannot be rejected for any of the specifications. Furthermore, Figures A1 to A3 in the Appendix seem to confirm the time-independence (i.e. zero slopes against time) of the Schoenfeld residuals for the three main variables in the base-

line specification presented in column (4) of Table 2: the overall SZ-Haircut (left column) as well as the reduction in face value and the residual haircut (right column).

Table 2: Semi-Parametric Cox Proportional Hazard Model – Baseline

The table reports coefficient estimates. Standard errors [in brackets] are clustered at the country level. *, **, *** indicate statistical significance at the 10%, 5%, 1% level, respectively.
The residual haircut is the difference of the overall Haircut and the reduction in face value. The test of the proportional hazards assumption is based on Schoenfeld residuals.

Independent Variables	Only Haircut (1)		+ Type of debt affected (2)		+ country characteristics (3)		+ U.S. treasury bill rate (4)	
Haircut size and type:								
Haircut (%)	-0.048***		-0.038***		-0.042***		-0.042***	
	[0.009]		[0.009]		[0.010]		[0.011]	
Reduction in face value (%)		-0.069***		-0.054***		-0.071***		-0.072***
		[0.012]		[0.011]		[0.019]		[0.019]
Residual haircut (%)		-0.028*		-0.013		-0.019		-0.020
		[0.015]		[0.012]		[0.012]		[0.012]
Amount of debt affected	-3.086***	-2.987***	-2.529***	-2.502**	-2.582**	-2.787**	-2.521**	-2.780**
(% of GDP)	[1.084]	[1.010]	[0.934]	[0.997]	[1.108]	[1.130]	[1.145]	[1.113]
Type of debt affected:								
Affects previously			-1.065***	-1.287***	-1.277***	-1.372***	-1.249***	-1.347***
restructured debt (0/1)			[0.243]	[0.314]	[0.347]	[0.414]	[0.341]	[0.415]
Short-term debt			0.152	-0.041	-0.031	-0.191	-0.036	-0.192
included (0/1)			[0.482]	[0.441]	[0.594]	[0.564]	[0.616]	[0.579]
Country characteristics:								
Central government					0.018**	0.017**	0.019**	0.018**
debt (% of GDP)					[0.007]	[0.007]	[0.009]	[0.009]
Short term debt					0.002	0.002	0.002	0.002
(% of reserves)					[0.001]	[0.001]	[0.001]	[0.001]
Real GDP growth (%)					-0.018	-0.021	-0.014	-0.018
					[0.044]	[0.043]	[0.050]	[0.051]
CPI inflation (%)					-0.001	-0.001	-0.001	-0.001
					[0.001]	[0.001]	[0.001]	[0.001]
Exchange rate volatility					0.000	0.000**	0.000	0.000**
([0,1])					[0.000]	[0.000]	[0.000]	[0.000]
Real effective exchange rate					0.000***	0.000	0.000***	0.000
(index where 100 = PPP)					[0.000]	[0.000]	[0.000]	[0.000]
Polity index (-10 to +10)					0.042	0.049	0.050	0.055
					[0.052]	[0.050]	[0.068]	[0.064]
International credit market environment:								
U.S. treasury bill rate (%)							0.044	0.029
							[0.142]	[0.134]
Fixed effects	Country	Country	Country	Country	Country	Country	Country	Country
Number of observations	157	157	157	157	144	144	144	144
Number of months at risk	13892	13892	13892	13892	12309	12309	12309	12309
Number of "failures"	98	98	98	98	95	95	95	95
Number of countries	60	60	60	60	51	51	51	51
Pseudo R^2	0.140	0.150	0.155	0.166	0.165	0.176	0.165	0.176
P-value for global test of proportional hazards assumption	1.000	1.000	1.000	1.000	0.999	0.913	0.999	0.852
	(H_0: Proportional hazards assumption is correct)							
P-value for Wald test		0.018		0.005		0.023		0.026
	(H_0: Coefficients of "reduction in face value" and "residual haircut" are equal)							

4.3. Robustness of Results

The main results presented in section 4.2 are very robust to using a different haircut measure in column 1 of table 3 (the "market" haircut, see Cruces and Trebesch, 2013), a different estimation method to handle tied observations with equal survival times (column 2), or to including region[22] or no fixed effects at all instead of country dummies. Table 4 documents estimation results for the baseline model including all covariates for important subsamples, to check whether not controlling for other restructuring features affects the results in any significant way because any variable omissions may lead to biased coefficients. Table 3 confirms all findings presented in section 4.2. Most importantly, higher haircuts lead to a lower probability of serial restructurings and the impact of cuts in face value is significantly stronger than that of maturity extensions and/or interest rate reductions. These effects are a bit less pronounced in the specification including region dummies instead of country dummies (column 3).

The estimation results for different subsamples in table 4 further substantiate the main results. The overall haircut as well as the cut in face value and the residual haircut all enter negatively and (mostly) statistically significantly. The coefficients' sizes are extremely similar to all previous estimations, too. Tests for the equality of the effects of a cut in face value and the residual haircut largely confirm the above finding: The coefficient to a cut in face value is significantly larger in absolute value than the coefficient to the residual haircut in the first two columns. Even though this significance is lost in columns 3 and 4, the magnitudes of the coefficients remain very stable.

When running all the regressions using the full sample with a dummy variable controlling for a Brady deal, a donor-funded deal, a buy-back deal and/or a debt exchange including the provision of new money (not shown here), results are still robust. The coefficient to this dummy variable is generally significantly negative.

Finally, tests for the validity of the proportional hazard assumption imply that specifications in tables 3 and 4 fulfill this critical assumption.

[22] UN-subregions: Caribbean, Central America, South America, Eastern Africa, Middle Africa, Northern Africa, Southern Africa, Western Africa, South-Eastern Asia, Southern Asia, Western Asia, Eastern Europe, Southern Europe.

Table 3: Semi-Parametric Cox Proportional Hazard Model – Robustness Checks 1

The table reports coefficient estimates. Standard errors [in brackets] are clustered at the country level (except for column 2).
*, **, *** indicate statistical significance at the 10%, 5%, 1% level, respectively.
The residual haircut is the difference of the overall Haircut and the reduction in face value. Region dummies are based on the United Nations' definition of 13 geographical sub-regions. The test of the proportional hazards assumption is based on Schoenfeld residuals.

Independent Variables	"Market" haircut measure (1)		Exact method for ties (2)		Region fixed effects (3)		No fixed effects (4)	
Haircut size and type:								
Haircut (%)	-0.052***		-0.057***		-0.029***		-0.030***	
	[0.012]		[0.014]		[0.006]		[0.005]	
Reduction in face value (%)		-0.074***		-0.078***		-0.039***		-0.038***
		[0.017]		[0.021]		[0.010]		[0.008]
Residual haircut (%)		-0.034**		-0.040**		-0.016**		-0.018***
		[0.016]		[0.016]		[0.008]		[0.007]
Amount of debt affected	-1.825	-2.231*	-3.311**	-3.430**	-0.381	-0.388	-0.631	-0.587
(% of GDP)	[1.159]	[1.152]	[1.578]	[1.554]	[0.655]	[0.704]	[0.544]	[0.579]
Type of debt affected:								
Affects previously	-0.793**	-1.018**	-1.601***	-1.713***	-0.500***	-0.542**	-0.485***	-0.521**
restructured debt (0/1)	[0.336]	[0.426]	[0.497]	[0.490]	[0.187]	[0.213]	[0.185]	[0.206]
Short-term debt	-0.023	-0.145	-0.730	-0.862	0.343	0.321	0.276	0.309
included (0/1)	[0.608]	[0.596]	[0.625]	[0.611]	[0.355]	[0.356]	[0.259]	[0.246]
Country characteristics:								
Central government	0.022**	0.020**	0.027***	0.025**	0.003***	0.004***	0.003***	0.004***
debt (% of GDP)	[0.010]	[0.009]	[0.010]	[0.010]	[0.001]	[0.002]	[0.001]	[0.001]
Short term debt	0.002	0.002	0.003*	0.003*	-0.000	-0.000	0.000	-0.000
(% of reserves)	[0.001]	[0.001]	[0.002]	[0.002]	[0.000]	[0.000]	[0.000]	[0.000]
Real GDP growth (%)	-0.014	-0.014	-0.029	-0.032	0.006	-0.003	0.011	0.005
	[0.049]	[0.049]	[0.042]	[0.041]	[0.024]	[0.024]	[0.022]	[0.022]
CPI inflation (%)	-0.001	-0.001	-0.001	-0.002	-0.000	-0.000	-0.000	-0.000
	[0.001]	[0.001]	[0.002]	[0.002]	[0.000]	[0.000]	[0.000]	[0.000]
Exchange rate volatility	0.000*	0.000**	0.000	0.000	0.000***	0.000***	0.000***	0.000***
([0,1])	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Real effective exchange rate	0.000***	0.000*	-0.002	-0.003	0.000***	0.000	0.000***	0.000**
(index where 100 = PPP)	[0.000]	[0.000]	[0.003]	[0.003]	[0.000]	[0.000]	[0.000]	[0.000]
Polity index (-10 to +10)	0.046	0.053	0.147***	0.153***	-0.009	-0.015	0.004	0.006
	[0.067]	[0.066]	[0.056]	[0.055]	[0.031]	[0.029]	[0.019]	[0.018]
International credit market environment:								
U.S. treasury bill rate (%)	0.046	0.033	0.095	0.062	0.096*	0.080	0.086**	0.075*
	[0.139]	[0.137]	[0.108]	[0.107]	[0.052]	[0.052]	[0.041]	[0.042]
Fixed effects	Country	Country	Country	Country	Region	Region	none	none
Number of observations	144	144	144	144	144	144	144	144
Number of months at risk	12309	12309	12309	12309	12309	12309	12309	12309
Number of "failures"	95	95	95	95	95	95	95	95
Number of countries	51	51	51	51	51	51	51	51
Pseudo R^2	0.174	0.181	0.180	0.192	0.095	0.102	0.083	0.089
P-value for global test of pro-portional hazards assumption	1.000	0.923	n.a.	n.a.	0.845	0.914	0.869	0.889
			(H_0: Proportional hazards assumption is correct)					
P-value for Wald test		0.069		0.009		0.032		0.034
		(H_0: Coefficients of "reduction in face value" and "residual haircut" are equal)						

Table 4: Semi-Parametric Cox Proportional Hazard Model – Robustness Checks 2

The table reports coefficient estimates. Standard errors [in brackets] are clustered at the country level. *, **, *** indicate statistical significance at the 10%, 5%, 1% level, respectively.
The residual haircut is the difference of the overall Haircut and the reduction in face value. Region dummies are based on the United Nations' definition of 13 geographical sub-regions. The test of the proportional hazards assumption is based on Schoenfeld residuals.

Independent Variables	All 18 bond exchanges excluded (1)		All 17 Brady deals excluded (2)		All 28 donor funded and/or buy-back deals excluded[23] (3)		All 25 restructurings with provision of new money excluded (4)	
Haircut size and type:								
Haircut (%)	-0.044***		-0.041***		-0.030***		-0.054***	
	[0.014]		[0.013]		[0.010]		[0.013]	
Reduction in face value (%)		-0.086**		-0.086***		-0.059***		-0.087***
		[0.041]		[0.025]		[0.022]		[0.031]
Residual haircut (%)		-0.021*		-0.017		-0.017		-0.033*
		[0.013]		[0.015]		[0.012]		[0.019]
Amount of debt affected	-2.396	-2.463	-3.143*	-3.927**	-3.067**	-3.203***	-1.425	-1.177
(% of GDP)	[1.625]	[2.054]	[1.634]	[1.618]	[1.238]	[1.195]	[3.874]	[3.859]
Type of debt affected:								
Affects previously	-1.508***	-1.739***	-1.177***	-1.269***	-1.516***	-1.488***	-1.649***	-1.738***
restructured debt (0/1)	[0.373]	[0.471]	[0.417]	[0.455]	[0.375]	[0.411]	[0.495]	[0.557]
Short-term debt	-0.019	-0.337	0.102	-0.017	-0.052	-0.200	0.792	0.472
included (0/1)	[0.734]	[0.730]	[0.690]	[0.652]	[0.523]	[0.543]	[1.256]	[1.245]
Country characteristics:								
Central government	0.022**	0.020*	0.021	0.019*	0.018**	0.017**	0.029***	0.028***
debt (% of GDP)	[0.011]	[0.011]	[0.013]	[0.010]	[0.008]	[0.008]	[0.011]	[0.010]
Short term debt	0.004**	0.004*	0.001	0.001	0.002	0.002	0.002	0.002
(% of reserves)	[0.002]	[0.002]	[0.001]	[0.001]	[0.002]	[0.001]	[0.001]	[0.001]
Real GDP growth (%)	0.028	0.015	-0.024	-0.025	-0.025	-0.032	-0.012	-0.005
	[0.053]	[0.056]	[0.063]	[0.062]	[0.050]	[0.052]	[0.059]	[0.064]
CPI inflation (%)	-0.001	-0.002	-0.001	-0.001	-0.001*	-0.002	-0.000	-0.000
	[0.001]	[0.001]	[0.002]	[0.002]	[0.001]	[0.001]	[0.001]	[0.001]
Exchange rate volatility	0.044***	0.046***	0.000	0.001**	0.000	0.000**	0.000	0.000
([0,1])	[0.017]	[0.016]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Real effective exchange rate	0.000***	0.000	0.000***	0.000	0.000	-0.000	0.000**	0.000
(index where 100 = PPP)	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Polity index (-10 to +10)	0.052	0.068	0.055	0.073	0.048	0.049	-0.003	0.040
	[0.082]	[0.078]	[0.071]	[0.068]	[0.066]	[0.064]	[0.145]	[0.154]
International credit market environment:								
U.S. treasury bill rate (%)	0.065	0.016	0.031	0.036	-0.022	-0.024	0.173	0.132
	[0.148]	[0.141]	[0.156]	[0.160]	[0.144]	[0.137]	[0.196]	[0.209]
Fixed effects	Country	Country	Country	Country	Country	Country	Country	Country
Number of observations	131	131	127	127	121	121	121	121
Number of months at risk	11590	11590	9204	9204	9061	9061	10541	10541
Number of "failures"	88	88	90	90	92	92	76	76
Number of countries	51	51	48	48	38	38	51	51
Pseudo R^2	0.204	0.214	0.158	0.172	0.137	0.142	0.204	0.213
P-value for global test of proportional hazards assumption	1.000	0.192	0.958	0.925	0.997	0.709	1.000	0.770
			(H_0: Proportional hazards assumption is correct)					
P-value for Wald test		0.143		0.014		0.129		0.198
		(H_0: Coefficients of "reduction in face value" and "residual haircut" are equal)						

[23] Many buy back deals are also donor funded, which is why these two categories largely overlap. Results are almost identical, if only one of the categories is excluded.

5. Conclusion

This paper complements the existing empirical literature on sovereign debt restructurings by analyzing whether the often stated claims that higher haircuts reduce the probability of (near-term) follow-up restructurings are valid. I further distinguish between reductions in net present value of the debt in the form of cuts in face value as opposed to reductions in net present value due to maturity extensions or/and reductions in interest rates. Finally, I investigate whether other restructuring features are correlated with the probability of serial restructurings.

The most important finding is that higher total debt remissions are significantly negatively related to the probability of serial restructurings – most likely because higher debt remissions move a country closer to a sustainable debt level than low alleviation. This finding is rather straight-forward and some studies already anticipated it anecdotally (IMF, 2013; Das et al., 2012; Moody's, 2012). An immediate implication for future restructurings would be that debtors and creditors should, whenever possible, dare to accept higher debt remissions in order to prevent the debtor country from having to restructure over and over again. If serial restructurings are indeed more costly than single deemed-to-satisfy restructurings, this strategy would prevent many enduring sovereign liquidity and solvency crises. If uncertainty and administration costs are high, the strategy of accepting one single large restructuring rather than several small restructurings may even be desirable for the creditor.

The estimation results also suggest that haircuts in face value reduce the probability of serial restructurings by about twice as much as haircuts due to maturity extensions or/and reductions in interest rates. This result refutes the intuitive logic that it is the overall reduction in net present value which may impact a country's debt sustainability, no matter how this reduction comes about. One potential explanation for this finding may be that a cut in face value provides immediate and outright debt relief, whereas interest rate cuts and especially maturity extensions merely buy an insolvent country some time until it becomes illiquid or insolvent again.

Finally, the effects of donor funded restructurings, buy-back deals, Brady deals and restructurings including the provision of new money cannot be conclusively resolved because the expectations with respect to a country's future debt sustainability may drive

decisions to provide funding along with granting debt relief. Nevertheless, descriptive statistics suggest that these restructuring features are highly and significantly correlated with a lower probability of serial restructurings.

References

Abbas , S. Ali, Nazim Belhocine, Asmaa ElGanainy, and Mark Horton. 2010. "A Historical Public Debt Database." International Monetary Fund (IMF) Working Paper 10/245.

Aguiar, Mark, and Gita Gopinath. 2006. "Defaultable debt, interest rates and the current account." *Journal of International Economics* 69 (1): 64-83.

Arellano, Cristina. 2008. "Default Risk and Income Fluctuations in Emerging Economies." *American Economic Review*, 98(3): 690-712.

Arteta, Carlos, and Galina Hale. 2008. "Sovereign Debt Crises and Credit to the Private Sector." *Journal of International Economics*, 74 (1): 53-69

Asonuma, Tamon. 2010. "Serial Default and Debt Renegotiation." Unpublished Paper, Banco de Espana.

Borensztein, Eduardo, and Ugo Panizza. 2009. "The Costs of Sovereign Default*."* IMF Staff Papers 56 (4): 683-741

Committee on International Economic Policy and Reform. 2013. "Revisiting Sovereign Bankruptcy.", (Lead Authors: L. C. Buchheit, A. Gelpern, M. Gulati, U. Panizza, B. Weder di Mauro, J. Zettelmeyer), Brookings, October 2013.

Cox, David R. (1972). "Regression Models and Life tables." *Journal of the Royal Statistical Society* 34: 187-220.

Cruces, Juan J., and Christoph Trebesch. 2013. "Sovereign Defaults: The Price of Haircuts." *American Economic Journal: Macroeconomics* 5 (3): 85-117.

Darvas, Zsolt. 2012. Real effective exchange rates for 178 countries: A new database." Bruegel Working Paper 2012/06.

Das, Udaibir S., Michael G. Papaioannou, and Christoph Trebesch. 2010. "Sovereign Default Risk and Private Sector Access to Capital in Emerging Markets." International Monetary Fund (IMF) Working Paper 10/10.

Das, Udaibir S., Michael G. Papaioannou, and Christoph Trebesch. 2012. "Sovereign Debt Restructurings 1950-2012: Literature Survey, Data, and Stylized Facts." International Monetary Fund (IMF) Working Paper 12/203.

De Paoli, Bianca, Glenn Hoggarth, and Victoria Saporta. 2009. "Output costs of sovereign crises: some empirical estimates." Bank of England Working Paper 362.

Eaton, Jonathan, and Mark Gersovitz. 1981. "Debt with Potential Repudiation: Theoretical and Empirical Analysis." *Review of Economic Studies* 48 (2): 289-309.

European Economic Advisory Group. 2011. "A New Crisis Mechanism for the Euro Area.", The EEAG Report on the European Economy, 71-96, CESifo, Munich.

Fuentes, Miguel, and Diego Saravia. 2010. "Sovereign defaulters: Do international capital markets punish them?" *Journal of Development Economics*, 91 (2): 336-347.

Fuest, Clemens, Friedrich Heinemann and Christoph Schröder. 2014. "A Viable Insolvency Procedure for Sovereigns (VIPS) in the Euro Area.", ZEW Discussion Paper No. 14-053, Mannheim.

Gelos, Gaston R., Guido Sandleris, and Ratna Sahay. 2011. "Sovereign borrowing by developing countries: What determines market access?" *Journal of International Economics* 83 (2): 243-254.

Gennaioli, Nicola, Alberto Martin, and Stefano Rossi. Forthcoming "Sovereign Default, Domestic Banks, and Financial Institutions." *Journal of Finance*, forthcoming.

Gianviti, François, Anne O. Krueger, Jean Pisani-Ferry, André Sapir, and Jürgen von Hagen. 2010. "A European mechanism for sovereign debt crisis resolution: a proposal." Bruegel Blueprint Series, Volume X.

IMF. 2013. *Sovereign Debt Restructuring – Recent Developments and Implications for the Fund's Legal and Policy Framework.* International Monetary Fund (IMF). Washington, DC, April 26.

Krueger, Anne O. 2002. *A New Approach To Sovereign Debt Restructuring.* International Monetary Fund (IMF). Washington, DC, April.

Levy-Yeyati, Eduardo, Maria S. Martinez Peria, and Sergio L. Schmukler. 2010. "Depositor Behavior under Macroeconomic Risk: Evidence from Bank Runs in Emerging Economies." *Journal of Money, Credit and Banking* 42 (4): 585-614.

Levy-Yeyati, Eduardo, and Ugo Panizza. 2011. "The elusive costs of sovereign defaults." *Journal of Development Economics* 94 (1): 95-105.

Marshall, Monty G., Keith Jaggers, Ted R. Gurr. 2011. "POLITY™ IV PROJECT – Political Regime Characteristics and Transitions, 1800-2010." Dataset Users' Manual, Center for Systemic Peace.

Martinez, Jose V., and Guido Sandleris. 2011. "Is it punishment? Sovereign defaults and the decline in trade" *Journal of International Money and Finance* 30 (6): 909-930.

Mendoza, Enrique G., and Vivian Z. Yue. 2008. "A Solution to the Default Risk-Business Cycle Disconnect" Board of Governors of the Federal Reserve System: International Finance Discussion Papers 924.

Moody's. 2012. "Investor Losses in Modern-Era Sovereign Bond Restructurings." Soverign Defaults Series, Special Comment, August 7.

Panizza, Ugo, Federico Sturzenegger, and Jeromin Zettelmeyer. 2009. "The Economics and Law of Sovereign Debt and Default." *Journal of Economic Literature* 47 (3): 651-698.

Richmond, Christine, and Daniel A. Diaz. 2009. "Duration of Capital Market Exclusion: An Empirical Investigation." Unpublished Paper, University of Illinois at Urbana-Champaign.

Rose, Andrew K. 2005. "One reason countries pay their debts: renegotiation and international trade." *Journal of Development Economics* 77 (1): 189-206.

Schoenfeld, David 1982. "Residuals for the proportional hazards regression model." *Biometrika* 69(1): 239-241.

Sturzenegger, Frederico, and Jeromin Zettelmeyer. 2006. *Debt Defaults and Lessons from a Decade of Crises*. Cambridge, MA: MIT Press.

Sturzenegger, Frederico, and Jeromin Zettelmeyer. 2008. "Haircuts: Estimating Investor Losses in Sovereign Debt Restructurings, 1998-2005." *Journal of International Money and Finance* 27 (5): 780-805.

Tomz, Michael, and Mark L. J. Wright. 2007. "Do Countries Default in 'Bad Times'?" *Journal of the European Economic Association* 5 (2-3): 352-360.

Tomz, Michael, and Mark L. J. Wright. 2013. "Empirical Research on Sovereign Debt and Default." *Annual Review of Economics* 5(1): 247-272.

World Bank. 2007. *Debt Reduction Facility for IDA-Only Countries: Progress Update and Proposed Extension*. World Bank Board Report 39310. Washington, DC, April.

Yue, Vivian Z. 2010. "Sovereign default and debt renegotiation." *Journal of International Economics* 80 (2): 176-187.

Appendix

Table A1: Variables

Variable	Unit	Explanations and Source
Haircut size and type:		
Haircut ("SZ" or "Market")	% of net present value of debt	Cruces and Trebesch (2013)
Reduction in face value	% of net present value of debt	Cruces and Trebesch (2013)
Residual haircut	% of net present value of debt	Own computation: "Haircut" minus "reduction in face value"
Amount of debt affected	% of GDP	Absolute amounts in US Dollars from Cruces and Trebesch (2013) Own computation of ratios to GDP (GDP from World Bank World Development Indicators)
Other Modalities of debt restructurings:		
Donor-funded restructurings	Dummy=1 if restructuring was donor funded	Cruces and Trebesch (2013)
Buy-back deals	Dummy=1 if country bought back its debt	Cruces and Trebesch (2013)
New money included	Dummy=1 if new money or concerted lending was provided	Cruces and Trebesch (2013)
Brady deals	Dummy=1 if restructuring was a so-called Brady deal	Cruces and Trebesch (2013)
Type of debt affected:		
Affects previously restructured debt	Dummy=1 if previously restructured debt was affected by restructuring	Cruces and Trebesch (2013)
Short term debt included	Dummy=1 if short term debt (with a maturity of less than one year) was exchanged for longer-term debt (with a maturity of more than one year)	Cruces and Trebesch (2013)
Bond exchange	Dummy=1 if the debt affect was in the form of tradable bonds	Cruces and Trebesch (2013)
All debt fallen due at time of restructuring	Dummy=1 if all of the debt being affected had already fallen due at the time of restructuring	Cruces and Trebesch (2013)
Country characteristics:		
Central government debt	% of GDP	Abbas et al. (2010)
Short-term debt to reserves	% of total reserves	World Bank World Development Indicators
Real GDP growth	%	World Bank World Development Indicators
CPI inflation	%	World Bank World Development Indicators
Exchange rate volatility	Between 0 and 1	World Bank World Development Indicators, Own computation of Coefficient of Variation
Real Effective Exchange rate	Index, 100 means that PPP holds	World Bank World Development Indicators and Darvas (2012), where not available
Polity index	-10 to +10, where "autocracies" (-10 to -6), "anocracies" (-5 to +5) and "democracies" (+6 to +10)	Marshall et al. (2011)
International credit market environment:		
U.S. treasury bill rate	%	World Bank World Development Indicators

Table A2: Summary statistics

Variable	Number of observations	Mean	Standard deviation	Min	Max
Haircut size and type:					
Haircut (SZ)	180	37.04	27.28	-9.80	97.00
Haircut (Market)	180	40.01	27.02	-9.80	97.00
Reduction in face value	180	16.77	30.55	0.00	97.00
Residual haircut	180	20.27	16.62	-14.00	73.20
Amount of debt affected	157	0.15	0.17	0.00	0.78
Other Modalities of debt restructurings:					
Donor-funded restructurings	180	0.12	0.33	0	1
Buy-back deals	180	0.14	0.35	0	1
New money included	180	0.14	0.35	0	1
Brady deals	180	0.09	0.29	0	1
Type of debt affected:					
Affects previously restructured debt	180	0.34	0.47	0	1
Short term debt included	180	0.30	0.46	0	1
Bond exchange	180	0.10	0.30	0	1
All debt fallen due at time of restructuring	180	0.51	0.50	0	1
Country characteristics:					
Central government debt	159	85.61	67.94	15.67	711.94
Short-term debt to reserves	158	266.95	948.05	5.21	11235.10
Real GDP growth	175	2.95	5.53	-17.15	34.39
CPI inflation	170	56.15	187.73	-8.48	2075.89
Exchange rate volatility	171	39.38	454.77	0	5948.22
Real Effective Exchange rate	171	2043.99	13412.44	10.41	136987.5 0
Polity index	168	0.77	6.86	-9	10
International credit market environment:					
U.S. treasury bill rate	180	6.44	2.71	0.13	14.08

Figure A1: Schoenfeld residual plot for overall SZ-haircut measure

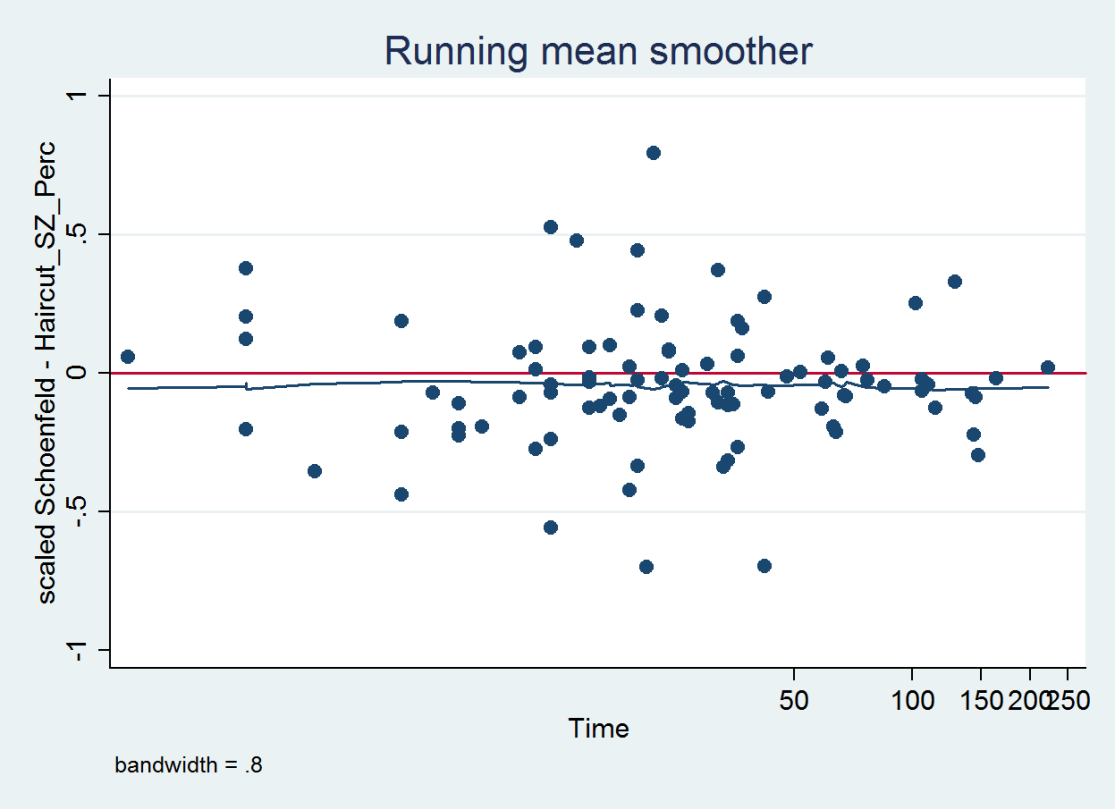


Figure A2: Schoenfeld residual plot for reduction in face value

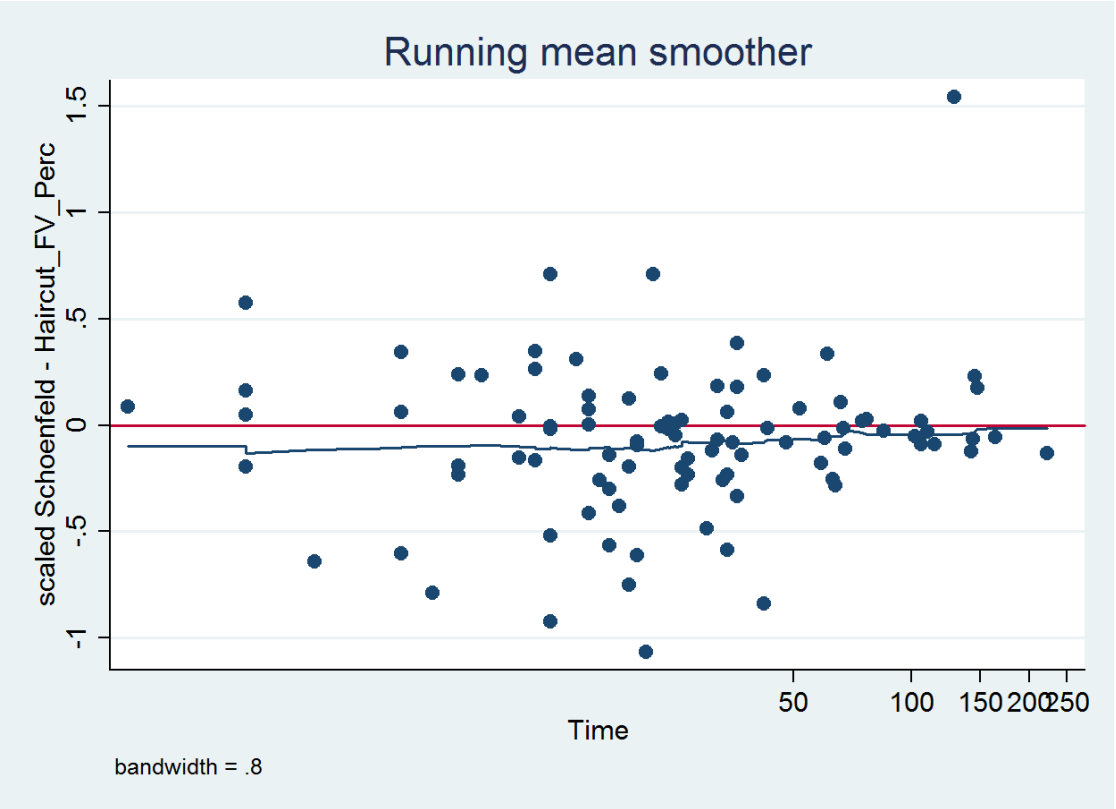


Figure A3: Schoenfeld residual plot for residual haircut

Figure A3: Schoenfeld residual plot for the dummy variable indicating whether previously restructured debt has been affected in a restructuring