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RESEARCH ARTICLE

Sovereign Default, Debt Restructuring, and Recovery Rates: Was the Argentinean "Haircut" Excessive?

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Abstract I use data on 180 sovereign defaults to analyze what determines the recovery rate after a debt restructuring process. Why do creditors recover, in some cases, more than 90 %, while in other cases they recover less than 10 %? I find support for the Grossman and Van Huyk model of "excusable defaults": countries that experience more severe negative shocks tend to have higher "haircuts" than countries that face less severe shocks. I discuss in detail debt restructuring episodes in Argentina, Chile, Uruguay and Greece. The results suggest that the haircut imposed by Argentina in its 2005 restructuring (75 %) was "excessively high." The other episodes' haircuts are consistent with the model.

Keywords Debt · Sovereign · Default · Restructuring · Repudiation · Investors' losses · Haircut · Argentina · Excusable default · Recovery rate · Greece · Chile

JEL Classification F340 · F410 · F650 · G150

1 Introduction

Between 1997 and 2013 there were 24 sovereign bond defaults and debt restructurings in the global economy. The three better known cases are the Russian default of 1998, the Argentine default of 2001, and the Greek default of 2012. But there were many others, including defaults and restructurings in the Ukraine, Cameroon, and Uruguay. In almost every one of these episodes investors incurred considerable losses. According to Moody's (2013, p. 6):

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> "[T]he losses imposed on creditors in sovereign restructurings have frequently been very large… Further, the variation around the average sovereign loss has been extremely high — losses have varied from as low as 5 % to as high as 95 %."

An important question, then, is what explains these large differences in "haircuts." Why, for example, did investors in Uruguayan bonds suffer only a 7 % haircut in 2003, while those that had invested in neighboring Argentina had losses in excess of 75 % in 2005? This question is particularly pertinent since many analysts have argued that the circumstances of the Argentine and Uruguayan defaults were very similar.[1]

In this paper I use data on 180 debt restructurings, for both sovereign bonds and sovereign syndicated bank loans, to analyze the determinants of the magnitude of recovery rates and haircuts. I use the results from the empirical analysis to evaluate whether some well known restructuring events resulted in "excessively high" losses. In particular, I focus on the Argentine restructuring of 2005, an episode that has generated controversy and that resulted in a U.S. Supreme Court decision that is changing the way in which foreign debt contracts are written. In order to present a comparison with Argentina, I also analyze in some detail the cases of two of its neighbors: Uruguay and Chile. Finally, I use the empirical results to investigate some aspects of the Greek restructuring of 2012.

The analysis is in the spirit of the "excusable default" model developed by Grossman and Van Huyck (1989). According to this work, in a world with rational lenders and borrowers, and reputational constraints, sovereign debt is never repudiated. It is restructured when the debtor faces (very) bad states of the world. In this setting, investors may lose some of their money, but (almost) never all of it. The extent of losses depends on the severity of external shocks that hit the sovereign debtor.

The rest of the paper is organized as follows: In Section 2 I provide some background, and I analyze data on 180 bank loans and bond restructurings between 1978 and 2010; these are all the restructurings for which there is enough information. I also present a fairly detailed analysis of the Argentine restructuring of 2005, one of the most controversial episodes in recent memory. In Section 3, I present regressions' estimates for a number of "haircut" equations. The results indicate that, with other things given, losses depend on the state of the world faced by the debtor; the more severe the shocks that hit the sovereign in the period preceding the restructuring, the lower the recovery rate (and the higher the haircut). These results are consistent with the main implications of the Grossman and Van Huyck (1989) model of "excusable defaults," and are robust to the time period, variables' definition, equations' specification, and estimation techniques (least squares or instrumental variables). In this Section I also present a number of extensions, I discuss robustness issues, and I present instrumental variables results. In Section 4 I analyze the regressions' residuals to determine whether some restructuring episodes resulted in "excessively high" or "excessively low" haircuts. This discussion concentrates on the Argentine restructuring of 2005, and on the cases of Chile, Greece and Uruguay. The analysis suggests that, given Argentina's circumstances, the 2005 haircut (approximately 75 %) was "unusually high," in the sense that its residuals are statistically "very large," or outliers. I also find that the recovery

[1] See, for example, the discussion in Edwards (2010).

rate in Chile's restructurings of 1984–1990 were consistent with the model's implications, as was the recovery rate in Uruguay's restructuring of 2003. Finally, in this section I use out of sample forecasts to compute the "appropriate" haircut in Greece's restructuring of 2012. I find that the model's prediction is similar to the actual Greek haircut (64 %). Finally, in Section 5 I present some concluding remarks and I discuss directions for future research. There are two appendixes: in Appendix A I present the model; in Appendix B I present the data sources.

2 Background and Preliminary International Comparisons

The data set includes 162 bank loan restructurings and 18 bond exchanges. [2] The sovereigns involved are from all parts of the world: Africa (60), Asia (8), Europe (25, mostly former communist nations), Latin America (72), and the Middle East (15). In this paper the loss, or "haircut," incurred by an investor as a consequence of a debt restructuring and exchange is defined as follows: [3]

$$Haircut = 1 - \left(\frac{PV\ \ New\ \ Security}{PV\ \ Old\ \ Security} \right) \tag{1}$$

Where "*PV New Security*" and "*PV Old Security*" are the present values of the new and old securities (bank loans or bonds), respectively. The present value of the "old security" is calculated under the assumption that the debtor abides by the terms of the original contract. The "yield at exit," or rate of return of the new security at the date of the exchange, is used to discount the income streams of both securities. In Eq. (1) investor losses are calculated on the date of the exchange.

Using this approach, Cruces and Trebesch (2013) estimated that the average losses (across different bonds) incurred by investors that participated in Argentina's 2005 exchange amounted to 76.8 %. This figure is similar to calculations made by other authors for Argentina: Sturzenegger and Zettelmeyer (2006), estimated a haircut ranging from 71 to 75 %, Bedford and Irwin (2008) calculated investors' losses of 70 %, and according to Díaz-Cassou et al. (2008) the Argentina 2005 haircut ranged between 71 and 75 %, depending on the type of debt exchanged.

A limitation of Eq. (1) is that it ignores the (possible) value of warrants or contingent "kickers" that are triggered after certain variable (export prices, terms of trade, or GDP) surpass a predetermined threshold. [4] Cruces and Trebesch (2013, p 65) justify disregarding the kickers in their computations as follows:

> "[T]he portion of state contingent payments is usually not very large… [Historically,] some clauses paid…and others did not… [A]fter the Bradies the only

[2] The basic data were assembled by Cruces and Trebesch (2013). This is the largest data set on restructurings and haircuts. Benjamin and Wright (2009), for example, used a data set with 90 episodes in their analysis on restructuring delays. For an even more comprehensive list of sovereign defaults, see Beers and Nadeau (2014). This data set, however, dos not have data on recovery rates.

[3] See the discussion in Sturzenegger and Zettelmeyer (2006) on alternative ways of measuring losses.

[4] Twelve of the 180 restructurings included a warrant linked to either the terms of trade or GDP: Honduras 1989, Costa Rica 1990, Mexico 1990, Venezuela 1990, Nigeria 1991, Uruguay 1991, Bolivia 1993, Bulgaria 1994, Ecuador 1995, Bosnia 1997 Cote d'Ivoire 1998, and Argentina 2005.

relevant case is Argentina in 2005… Against this backdrop, and to avoid bias, we decided to disregard state contingencies in our haircut calculations."

Although this is correct for most episodes, it is not so for the Argentine exchange of 2005. In this instance the warrants were detachable from the new bonds 6 months after the exchange, and they could be traded independently of the underlying securities — this was not the case in any of the other restructurings with contingent payments.[5] Starting in late 2004, investment banks developed models to value the Argentine warrants, and by late February 2005, when the exchange was coming to an end, there was generalized agreement that their value was approximately 2 cents on the dollar.[6] In November 2005, when they became detachable, the warrants were traded in the vicinity of 3 cents on the dollar. Eventually, however, and due to high commodity prices and Argentina's fast rate of growth, their price increased significantly. Given these facts, in this paper I adjust the Cruces and Trebesch (2013) estimate of Argentina's 2005 haircut downward by the consensus value of the warrants at the time of the exchange (2 cents on the dollar). Consequently, in the analysis that follows I will use 74.8 % as the basic estimate for Argentina's 2005 haircut. Following Cruces and Trebesch (2013) own line of argument, I have not made adjustments to the other 11 episodes that included contingent payments. In Section 3.3, however, I discuss alternative ways of addressing this issue.

2.1 International Comparisons

In Table 1 I present the list of countries in the data set. I include the date of the restructuring and the magnitude of the "haircut." Episodes with losses in excess of Argentina's 2005 haircut appear in italics. As may be seen, there are 25 such cases; I discuss this subsample below. In Table 2 I provide summary statistics on haircuts for the complete sample, and for a number of subsamples by type of debt and region. I also include the estimate for the Argentina 2005 haircut. As may be seen, losses foisted on Argentine investors were significantly higher than the mean and median across all episodes (37 and 32 % respectively), as well as across any of the subsamples.[7]

In Fig. 1 I present a histogram for the 180 haircuts. The value of the Argentine 2005 haircut (74.6 %) is shown with a vertical black line. An analysis of Fig. 1 and of the data behind it (Table 1) shows the following: (a) the distribution is "bimodal," suggesting that the data may come from two different populations.[8] (b) There are only 25 episodes with haircuts in excess of that imposed by Argentina in 2005. As noted, these countries appear in italics in Table 1. (c) Countries with haircuts in excess of Argentina's 74.8 % are very different from Argentina. Eighteen of them correspond to very poor African countries, another four are among the poorest nations in Central and

[5] See Miyajima (2006).

[6] See, for example, Costa, Chamon et al. (2008), Miyajima (2006), HSBC's "EM Portfolio Strategy" (July 21, 2005), and Sandleris and Wright (2013).

[7] To put things into perspective, analyses of the Greek sovereign restructuring of 2012 based on the same methodology indicate that the aggregate haircut (across all restructured bonds) was of the order of 60 %. See Zettelmeyer et al. (2013).

[8] The Jarque-Bera tests are 13.3 and 7.8 respectively, rejecting the hypothesis of normality at a very high significance level.

Table 1 Sovereign restructurings, 1978–2010: years and estimated "haircuts"

Country	Year	Haircut	Country	Year	Haircut
Albania	*1995*	*0.804*	*Dom. Rep (Bank)*	2005	0.113
Algeria	1992	0.087	Dominica	2004	0.540
Algeria	1996	0.235	Ecuador	1983	0.063
Argentina	1985	0.303	Ecuador	1984	0.057
Argentina	1987	0.217	Ecuador	1985	0.154
Argentina	1993	0.325	Ecuador	1995	0.422
Argentina (Global)	2005	0.748	Ecuador	2000	0.383
Belize	2007	0.237	Ecuador	2009	0.677
Bolivia	*1988*	*0.927*	*Ethiopia*	*1996*	*0.920*
Bolivia	*1993*	*0.765*	Gabon	1987	0.079
Bosnia and Herzegovina	*1997*	*0.896*	Gabon	1994	0.162
Brazil	1983	−0.098	Gambia,The	1988	0.493
Brazil	1984	0.017	Grenada	2005	0.339
Brazil	1986	0.192	Guinea	1988	0.261
Brazil	1988	0.184	*Guinea*	*1998*	*0.870*
Brazil	1992	0.270	*Guyana*	*1992*	*0.892*
Brazil	1994	0.293	*Guyana*	*1999*	*0.910*
Bulgaria	1994	0.563	Honduras	1989	0.732
Cameroon	*2002*	*0.855*	*Honduras*	*2001*	*0.820*
Cameroon	*2003*	*0.855*	*Iraq*	*2006*	*0.894*
Chile	1983	0.007	Jamaica	1978	0.022
Chile	1984	0.084	Jamaica	1979	0.035
Chile	1986	0.317	Jamaica	1981	0.152
Chile	1987	0.143	Jamaica	1984	0.181
Chile	1990	0.170	Jamaica	1985	0.317
Congo, Dem. Rep. (Zaire)	1980	0.296	Jamaica	1987	0.328
Congo, Dem. Rep. (Zaire)	1983	0.382	Jamaica	1990	0.440
Congo, Dem. Rep. (Zaire)	1984	0.301	Jordan	1993	0.546
Congo, Dem. Rep. (Zaire)	1985	0.370	Kenya	1998	0.457
Congo, Dem. Rep. (Zaire)	1986	0.354	Liberia	1982	0.357
Congo, Dem. Rep. (Zaire)	1987	0.268	Macedonia, FYR	1997	0.346
Congo, Dem. Rep. (Zaire)	1989	0.506	Madagascar	1981	0.190
Congo, Rep.	*2007*	*0.908*	Madagascar	1984	0.413
Costa Rica	1983	0.394	Madagascar	1987	0.137
Costa Rica	1985	0.356	Madagascar	1990	0.527
Costa Rica	1990	0.719	Malawi	1983	0.285
Cote d'Ivoire	1998	0.628	Malawi	1988	0.392
Cote d'Ivoire	2010	0.552	*Mauritania*	*1996*	*0.900*
Croatia	1996	0.110	Mexico	1983	−0.002
Cuba	1983	0.429	Mexico	1985	0.022
Cuba	1984	0.442	Mexico	1985	0.054

Table 1 (continued)

Country	Year	Haircut	Country	Year	Haircut
Cuba	1985	0.495	Mexico	1987	0.181
Dom. Rep.	1986	0.499	Mexico	1988	0.563
Dom. Rep.	1994	0.505	Mexico	1990	0.305
Dom. Rep. (Bonds)	2005	0.047	Moldova	2002	0.369
Moldova (Gazprom)	2004	0.563	Russian Federation	1997	0.262
Morocco	1986	0.235	Russia (GKOs.)	1999	0.460
Morocco	1987	0.213	Russia (MinFin3)	2000	0.515
Morocco	1990	0.403	Russia (PRINs & IANs)	2000	0.508
Mozambique	1987	0.486	*Sao Tome and Principe*	*1994*	*0.900*
Mozambique	*1991*	*0.900*	Senegal	1984	0.288
Nicaragua	1980	0.261	Senegal	1985	0.313
Nicaragua	1981	0.485	Senegal	1990	0.357
Nicaragua	1982	0.563	*Senegal*	*1996*	*0.920*
Nicaragua	1984	0.417	Yugoslavia	1983	0.065
Nicaragua	*1995*	*0.920*	Yugoslavia	1984	−0.075
Niger	1984	0.374	Yugoslavia	1985	0.145
Niger	1986	0.458	Yugoslavia	1988	0.197
Niger	*1991*	*0.820*	Serbia and Montenegro	2004	0.709
Nigeria	1983	0.012	Seychelles	2010	0.562
Nigeria	1983	0.021	*Sierra Leone*	*1995*	*0.886*
Nigeria	1984	−0.028	Slovenia	1995	0.033
Nigeria	1987	0.193	South Africa	1987	0.085
Nigeria	1988	0.415	South Africa	1989	0.127
Nigeria	1989	0.301	South Africa	1993	0.220
Nigeria	1991	0.401	Sudan	1985	0.546
Pakistan (Bank)	1999	0.116	*Tanzania*	*2004*	*0.880*
Pakistan (Bond)	1999	0.150	Togo	1988	0.460
Panama	1985	0.120	*Togo*	*1997*	*0.923*
Panama	1994	0.151	Trinidad and Tobago	1989	0.155
Panama	1996	0.349	Turkey	1979	0.222
Paraguay	1993	0.292	Turkey	1979	0.195
Peru	1980	−0.046	Turkey	1981	0.085
Peru	1983	0.063	Turkey	1982	0.170
Peru	1997	0.639	*Uganda*	*1993*	*0.880*
Philippines	1986	0.426	Ukraine (OVDPs)	1998	0.118
Philippines	1987	0.154	Ukraine (Chase)	1998	0.147
Philippines	1990	0.428	Ukraine (ING)	1999	−0.083
Philippines	1992	0.254	Ukraine (Global)	2000	0.180
Poland	1982	0.406	Uruguay	1983	0.007
Poland	1982	0.629	Uruguay	1986	0.243
Poland	1983	0.525	Uruguay	1988	0.203

Table 1 (continued)

Country	Year	Haircut	Country	Year	Haircut
Poland	1984	0.269	Uruguay	1991	0.263
Poland	1986	0.375	Uruguay	2003	0.098
Poland	1988	0.244	Venezuela	1986	0.099
Poland	1989	0.120	Venezuela	1988	0.042
Poland	1994	0.490	Venezuela	1990	0.367
Romania	1982	0.329	Vietnam	1997	0.520
Romania	1983	0.317	*Yemen, Republic of*	*2001*	*0.970*
Romania	1986	0.123	*Zambia*	*1994*	*0.890*

Based on Cruces and Trebesch (2013). Episodes with a haircut higher than 0.748 (Argentina's haircut in 2005) appear in italics

South America – Bolivia, Guyana, Honduras and Nicaragua —, and many of them were subject to wars and/or major civil conflicts (Iraq, Bosnia and Herzegovina).[9]

2.2 The Argentine Default and Restructuring in Historical Perspective

On December 23 2001, Argentina defaulted on its debt. Two weeks later the peso was devalued by 30 %, and a ten-year experiment with a currency board and a fixed exchange rate (one peso equal to one dollar) came to an end. During the years leading to the crisis the Argentine economy was subject to a number of severe external shocks: the terms of trade declined, global interest rates increased, and capital inflows slowed significantly, in part as a result of contagion stemming from the Russian 1998 crisis.[10] The road to devaluation and default was traumatic: throughout 2001 there were massive demonstrations, riots, bank runs, a suspended IMF program, and a deposit freeze. On December 9, 2001, President Fernando de la Rúa resigned, and five months later, Nestor Kirchner, the former Governor of the province of Entre Ríos, was elected president. When he took over, Argentina was facing a severe economic and political crisis: growth was negative, unemployment exceeded 20 %, the public debt was in arrears, relations with the IMF were strained, and the currency had lost 2/3 of its value.[11]

Soon after taking office, Kirchner decided to restructure the external government debt. In September 2003 the Argentine government made an offer to investors to exchange defaulted bonds for new ones. This proposal became known as the "Dubai Guidelines," and implied an average reduction of the face value of the debt of approximately 75 %. Investors balked at the stiff losses, and asked for better conditions. Negotiations ensued, and a new offer was formally made in June 2004 under the moniker of "Dubai Plus." The terms of this proposal were very similar to the original ones, and implied losses (in present value terms) for bondholders of approximately 75 %.[12]

[9] These four countries, plus Haiti, form the "poorest five" group in Latin America and the Caribbean.

[10] For details on the Argentine crisis of 2001–02 see, for example, Edwards (2002), Blustein (2005), and IMF (2004). Most of these shocks were temporary. See Section 4 of this paper for a discussion on the magnitude of these shocks.

[11] See, Blustein (2005).

[12] See IMF (2004) for a detailed timeline of earlier events. See, Sturzenegger and Zettelmeyer (2006) for details on the negotiations.

Table 2 Summary statistics for haircuts: 1978-2010

	Mean	Median	Standard deviation
All episodes	37.0 %	32.1 %	27.3 %
Bank loans	37.1 %	37.6 %	21.6 %
Bond exchanges	36.9 %	31.7 %	27.9 %
Africa	46.5 %	39.5 %	29.4 %
Asia	32.6 %	34.0 %	17.9 %
Europe	30.0 %	19.7 %	26.4 %
Latin America	31.8 %	28.1 %	26.2 %
Argentina 2005	74.8 %	–	–

Investors had until February 28, 2005 to exchange their old securities for new ones. Three new bonds were available: (1) A "Par Bond" with the same face value as the old bonds, but significantly longer maturity (35 years). The coupon would increase gradually through time from 1.33 to 5.25 %. Amortization was expected to begin in 2029.[13] (2) A "Discount Bond" with a significant face value reduction. The coupon was 8.28 % for the USD-denominated bonds and 5.83 % for the (inflation adjusted) peso-denominated bonds.[14] And (3), a "Quasi Par" bond that, for all practical purposes, was a combination of the other two bonds.[15] Under the "Dubai Plus" scheme past due interest (PDI) was only recognized partially. Interest coupons not paid before the default date of December 23, 2001 were included in the exchange offer. However, PDI corresponding to the December 2001-December 2003 period was excluded. All three exchange options were subject to a GDP growth "kicker." Starting in 2006, bond holders could receive an extra payment in the eventuality that GDP growth exceeded a predetermined threshold.[16]

When the exchange window closed on February 28, 2005, 76.2 % of bondholders had tendered their defaulted bonds and had accepted new bonds in exchange. This rate of participation (76.2 %) was low from a comparative perspective; in the seventeen sovereign debt restructurings/exchanges between 1999 and 2010, 96 % of investors had accepted the new terms suggested by the sovereign. At the time of the exchange Argentina's congress passed a law prohibiting the government from making better offers in the future to those investors that had not tendered their defaulted bonds. This

[13] These bonds were available in a number of currencies — US Dollars, Euros, Yen, and Argentine pesos indexed to the local consumer price index (CPI). The initial coupon was very low, but would increase gradually through time (from 1.33 to 5.25 %). Amortization was expected to begin in 2029.

[14] These securities were also available in US Dollars, Euros, Yen, and Argentine pesos indexed to the local consumer price index (CPI). They had 30 years maturity and amortization would begin in 2024. The exchange would take place at 33.7 % of the original face value. This fact led the popular press to report that investors' haircut amounted to 66.3 %. This computation, however, is based in the incorrect methodology for the reasons discussed in the text.

[15] These securities had a 42 year maturity, were exchanged for 69.6 % of the original face value and had a coupon rate of 3.31 % that was capitalized during the first ten years. Amortization was to begin in 2036. These Quasi Par bonds were only available in (inflation adjusted) pesos.

[16] The conditions for this payment to kick were: growth in the preceding year had to exceed 3 % and total payments could not exceed 48 % of the original value of each bond. See, Sturzenegger and Zettelmeyer (2006). According to Cruces and Trebesch (2013), investment banks were not sure how to value this GDP kicker. In November 2005, six months after the exchange had taken place, the GDP-linked warrants were to become detachable.

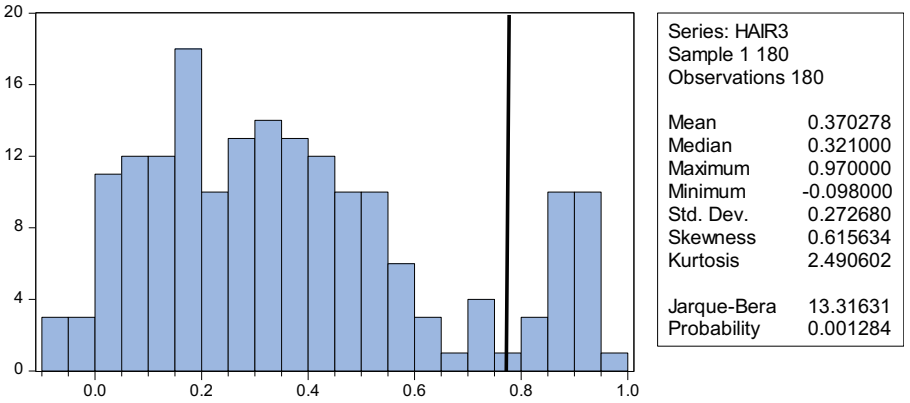

Fig. 1 Haircuts histogram: all episodes

legislation was known as "*ley candado*" (lock-in or clam-down law). The provision forbidding better offers to holdouts was also introduced as a clause in the new bonds — the so called *RUFO* clause. The prohibition for better offers and the RUFO clause was to expire on December 31, 2014.[17]

In 2010, Argentina reopened the bond exchange and offered identical terms as in 2005 to those that had not tendered their defaulted securities. An additional group of investors decided to exchange their bonds. The main reason for accepting the offer five years later was the realization that Argentina's congress was not going to amend the "*ley candado*" that prohibited the government from improving the terms of the exchange. But not everyone came into the fold: bondholders representing approximately 7 % of the original debt decided to hold on to the old securities and to press for better terms. There were two types of holdouts: retail investors and funds specialized in distressed debt that had been buying defaulted bonds in the secondary market. Two of these funds took Argentina to court in the U.S., arguing that the haircut was unusually high, and that the country had the ability to make improved payments. The case slowly made its way through the U.S. Judicial System, and in mid-2014 it reached the Supreme Court. On June 16, 2014 the Supreme Court refused to hear the case, and left in place a lower court ruling mandating Argentina to make a payment to the "holdouts." The argument by the lower court was that the *pari passu* clause required Argentina to treat all (new and old) investors equally: if the holders of exchanged bonds received a coupon payment, those holding old bonds should also be paid. [18] After the Supreme Court decision, frantic negotiations between the holdouts and the Argentine government began. By July 30, 2014, the deadline imposed by the Court, no agreement had been reached, and on August 1, 2014, Argentina was declared by the ISDA to be in default.[19]

[17] Cruces and Trebesch (2013).

[18] A number of news media stories covered, in detail, the Supreme Court decision and the implications of the lower court ruling. See, for example, http://www.bloomberg.com/news/2014-06-16/argentina-rejected-by-u-s-high-court-on-defaulted-bonds.html

[19] The government of Argentina claimed that it had *not* defaulted in late July 2014. The reason, according to Argentina, was that it had made a deposit covering the July 2014 coupon payment to new bondholders in the Bank of New York. Judge Thomas Griesa, however, forbade the bank from paying these investors if Argentina was unwilling to pay the holders of old bonds that had brought the case to court. This ruling has generated significant discussion among economists regarding the future of sovereign restructurings.

Throughout this process Argentina's position was that given the shocks faced by the country in the late 1990s and early 2000s, and the hardship suffered by the Argentine people after the January 2002 devaluation, the Dubai terms were reasonable, and the country would not improve its offer.

For Argentina, the 2001 default was, to use the terminology of Grossman and Van Huyck (1989), "excusable," and the terms of the exchange were fair and in line with the historical experience on debt restructurings under similar conditions. This view became clear on June 22, 2014, when the Presidency of Argentina published a full page ad in the New York Times, titled "Argentina wants to continue paying its debts but they won't let it."

3 Explaining Recovery Rates and "Haircuts": A Regression Analysis

In this Section I use the cross country data set described above to estimate a series of haircut regressions. These estimates are then used, in Section 4, to evaluate whether the Argentine restructuring of 2005 resulted in "unusual" and "excessively high" losses to investors. Within this framework, a haircut would be "excessive" if that episode is an "outlier." On the other hand, a haircut would conform to the historical evidence if fitted values from the regression analysis are not significantly different from the actual haircut. I also rely on these results to analyze the "appropriateness" of the haircuts in the Uruguayan restructuring of 2003, the Chilean restructurings of 1984–1990, and the Greek restructuring of 2012.

3.1 The Empirical Model

In an important paper, Grossman and Van Huyck (1989) argued that in a world where reputation is valuable, sovereign loans should be seen as state contingent claims.[20] Creditors know that under (very) bad states of the world the borrower will have an excuse to restructure its debts, and will act accordingly. Sovereigns, on the other hand, recognize that if they incur in a non-justifiable default they will ruin their reputation and will not be able to borrow in the future. In this setting there is no outright debt repudiation, only restructurings.[21] But not all restructurings are alike; in some cases the losses are very high, while in others the haircuts are relatively low. The actual level of the haircut is the result of a negotiation between creditors and the debtor, and depends on how devastating is the bad state of the world that affected the sovereign. The more severe the negative shocks, the higher will be the fraction of the debt that will be forgiven (in present value) and, thus, the higher will be the haircut. If creditors and debtors agree on the nature and intensity of these negative shocks, negotiations will be short and creditors will accept new terms. If, however, there is disagreement on the nature of the shocks, negotiations may be quite long, until both parties agree on the actual depth of these disturbances. See Appendix A for a discussion of the model.

[20] On the "excusable default" model see, for example, the discussion in Yue (2010). See, also, Alfaro and Kanczuk (2005). For an early study on spreads in sovereign bonds and loans, see Edwards (1986).

[21] Restructurings may be delayed and take some time, but they eventually occur. See Benjamin and Wright (2009) for an analysis on delays.

Consider the following empirical model that captures the key implications of the Grossman and Van Huyck (1989) analysis:

$$haircut_{it} = \alpha + \sum \beta_i x_{it-k} + \sum \delta_i y_{it-j} + \sum \theta_i q_{it-m} + \sum \gamma_i z_{it-l} + u_i. \quad (2)$$

α, the β_is, the θ_is, and the γ_is are regression coefficients to be estimated. The x_i are (one or more) explanatory variables in the spirit of Grossman and Van Huyck (1989) that capture the severity of the shocks that hit country i during a time window $(t-k)$ that precedes the actual exchange; these are the "excusable" shocks related to bad states of the world. The y_is are variables that capture other circumstances of country i in the period immediately preceding the restructuring, such as its debt to GDP ratio. The q_i s are covariates that summarize the conditions of the global economy around the time of each exchange, including whether the global economy is in a recession. The $z_i's$ are characteristics of the debt exchange itself that may affect the magnitude of the haircut. u_i is a (possibly heteroskedatic) error term. An important feature of Eq. (2) is the timing of the different variables: when negotiating the haircut, creditors and sovereign consider the shocks that affected the debtor during a window of time that goes from, approximately, the payments' suspension, to the negotiation. In that sense, $t-k$ refers to a window of time prior to the decision on the actual magnitude of the haircut. Benjamin and Wright (2009) calculated that for their data set restructuring processes took, on average, eight years. For the episodes considered in this paper, the average restructuring took 6 years; in the empirical analysis I consider different lengths for this window. The y_is and the q_is also enter into the regression with a lag. However, this lag needs not be the same as the one for the excusable shocks variable. For more details on the lag structure used in the estimation, see the discussion in Sections 3.2 and 3.3. In every equation I included regional dummy variables.

In order to construct an indicator of "bad states of the world" I inquired if at any time during the six years preceding the debt restructuring the country in question was subject to any of the following shocks[22]: (1) War, civil conflict, coup d'état, or coup attempt. (2) A major GDP contraction of at least 8 %. (3) A major deterioration in its terms of trade, of at least 15 %. And (4) a severe currency crisis that implied a devaluation of, at least, 20 %.[23] The "bad states of the world" indicator x_i was then defined as the sum of the number of shocks suffered by each county. This index is equal to 0 if none of these shocks took place during the six years preceding the restructuring, and takes the value of 4 if all four shocks were present. Its regression coefficient is expected to be positive in Eq. (1): countries that have been subject to a succession of severe (excusable) shocks will tend to receive a more lenient treatment during restructuring negotiations and, thus, there will be a lower recovery rate for investors. In Section 3.3 I

[22] A number of historical analyses, including Reinhart and Rogoff (2009), have concluded that three of the shocks considered here have usually been present during major debt crises. A six year window covers, in the vast majority of cases, the default itself and the restructuring. For 108 episodes with data the mean time elapsed between default and restructurings was 6.2 years. Reinhart and Rogoff (2009) don't include wars and coups in their analysis; they do include banking crises.

[23] More specifically, a devaluation crisis is defined as an abrupt increase in the value of foreign currency (the U.S. dollar) of at least 20 % that takes place after a period of relative exchange rate stability That is, large annual devaluations stemming from the adoption of a crawling peg or other type of managed currency regime are not considered to be a crisis.

discuss the results obtained when other windows for the excusable shocks are used, and when alternative measures for these shocks are considered.

I included the following y_is variables that capture each country's circumstances at the time of the period immediately prior to the restructuring negotiations:

- Debt to GDP ratio: This variable is defined as the ratio of debt to the country's GDP subject to restructuring, and is measured the year prior to the exchange. Its coefficient is expected to be positive: with other things given, countries with a higher debt burden will require large debt relieve to move to a sustainable situation. Thus, they will be able to be treated more leniently.
- Poor: This variable takes the value of 1 if the country in question is among the poorest in the world. These include countries in South Saharan Africa, the four poorest nations in Central and South America – Bolivia, Honduras, Guyana, and Nicaragua –, Pakistan and Vietnam.[24] Its coefficient is expected to be positive. Payment difficulties in poor counties are easier to qualify as "excusable."

The following variables (q_i) that capture the state of the global economy at the time of each negotiation were also included in the estimation[25]:

- Recession: This variable takes a value of 1 if during the year of the sovereign restructuring the U.S. economy was in recession. The timing of recessions comes from the National Bureau of Economic Research.
- Global interest rates: The yield on the 10 year U.S. Treasury note six months prior to the restructuring was included. A higher yield implies tighter global financial conditions. It is expected that the coefficient of this variable will be negative, as creditors will tend to be less "generous" if financial conditions are tight. I also considered alternative lags; this didn't affect the results in any significant way.
- Nineties: This is a dummy that takes the value of 1 after the year 1990. This is meant to capture the fall of the Berlin Wall, and the fact that in the years that followed a number of former Warsaw Pact countries began to reform their economies, sought global financing, and restructured their old debts.

In some of the regressions I included two binary z_i variables that summarize some aspects the debt exchange/restructuring:

- Brady deal: This variable takes the value of 1 if the exchange in question was part of the Brady deal from the early 1990s. Its coefficient is expected to be positive, since at the time of the Brady agreements the official and private sectors were committed to make significant concessions in order to solve the debt problem that had paralyzed many poor and middle income countries for up to a decade.
- Donor funded: Takes a value of 1 if the international donor community — IMF, World Bank, regional development banks, and/or bilateral aid agencies — provided

[24] The cutoff point is a GDP per capita in PPP dollars of 4000 in 2010. Most of these nations, however, have a GDP per capita below 2000 PPP dollars. Many of these countries — but not all of them — eventually became eligible for the IMF and World Bank's *HIPC* debt relief program.

[25] These variables were dated three months prior to the restructuring.

funds to facilitate the exchange. Its coefficient is expected to be positive, as the aid community only provides financial assistance to countries that are restructuring their debts if they deem them to be in significant difficulties (more on this below).

3.2 Basic Results

In Table 3 I present the basic regression results; White heteroskedasticity-consistent standard errors are reported.[26] Equations (3.1) and (3.2) are for 1978–2010. Equations (3.3) and (3.4), on the other hand, are for 1988–2010, a period with more reliable data.[27]

Overall, these results are satisfactory. First, the coefficient for the "bad state of the world" variable is always significantly positive, as expected. This is consistent with the Grossman and Van Huyck (1989) view that countries subject to a larger number of (very) negative shocks have a greater "excuse" for not paying their debts fully, and will tend to obtain better terms when restructuring them. The coefficients of the "debt to GDP" and "poor" variables are also positive, as expected, and in all but one of the regressions they are significant. With other things given, poorer countries get higher debt forgiveness (and creditors get a stiffer haircut), as do countries with a higher debt burden. The coefficients of the global economy variables suggest that haircuts are lower when global liquidity is tighter. Also, and after controlling for other factors, haircuts have tended to be higher if the restructuring takes place during a global recession. The "nineties" variable, which appears in two regressions, is significant in one of them. Most of the regional dummies are significant. Whether a particular restructuring was part of the Brady Deal makes no difference; episodes where donors provided additional funds were characterized, with other things given, by lower recovery rates and higher haircuts. An interesting result is that the point estimates for the coefficients of the "bad states of the world" indicator and the "poor" variable are always smaller when the "donor funded" variable is included. A possible explanation for this is that the "donor funded" variable captures the official aid organizations' assessment of whether a particular country had been subject to major "excusable" shocks and, thus, is deserving of better treatment (I return to the "donor funded" variable in Section 3.3 when I present instrumental variable results). As may be seen, the R-squared is quite high, and in most equations it is in the neighborhood of 0.6; only in one of the estimates it is below 0.5.

The results in Table 3 include data for bank loans' restructurings and bonds' restructurings. An interesting question is whether there are differences in the determinants of recovery rates across these two types of securities. Unfortunately, given the low number of bond exchanges during the period (only 18) it is not possible to estimate separate regressions for bonds and bank loans. As an alternative I ran a number of equations with a "bond exchange" dummy variable. This was included both on its own as well as interacted with some of the main covariates. The results obtained are reported in Table 4. As

[26] Jarque-Bera tests on the residuals from OLS estimates reject the null of homoskedastic errors. The same test indicates that the use of White-corrected estimates solve the problem.

[27] Notice that in equations (3.1)–(3.2) there are 153 observations. The reason for this for some episodes there are no data for all the covariates. This is particularly so during the early years. See Cruces and Trebesch (2013) for a discussion on data quality and reliability.

Table 3 Haircut equations: white-corrected standard errors

Eq name:	(3.1)	(3.2)	(3.3)	(3.4)
Period	1978–2010	1978–2010	1988–2010	1988–2010
BAD STATES	0.050	0.037	0.074	0.069
	[2.600]**	[1.995]**	[2.469]**	[2.638]**
DEBT_GDP	0.334	0.242	0.428	0.257
	[2.828]***	[1.695]*	[2.883]***	[1.330]
POOR	0.360	0.234	0.419	0.231
	[5.856]***	[3.316]***	[5.655]***	[2.872]***
TEN_YR	−0.021	−0.023	−0.044	−0.013
	[−2.065]**	[−2.503]**	[−2.722]***	[−0.864]
NINETY	0.202	0.050	–	–
	[4.091]***	[0.871]		
RECESSION	0.031	0.083	0.129	0.129
	[0.601]	[1.705]*	[1.726]*	[1.996]**
C	0.325	0.432	0.541	0.348
	[3.067]***	[4.148]***	[4.003]***	[2.636]**
AFRICA	−0.195	−0.195	−0.158	−0.179
	[−2.436]**	[−2.211]**	[−1.559]	[−1.715]*
ASIA	−0.165	−0.132	−0.127	−0.120
	[−2.192]**	[−1.797]*	[−1.611]*	[−1.517]
EUROPE	−0.156	−0.117	−0.128	−0.112
	[−2.286]**	[−1.480]	[−1.458]	[−1.120]
LATAM	−0.089	−0.111	−0.066	−0.076
	[−1.624]*	[−1.723]*	[−0.880]	[−0.953]
BRADY DEAL	–	0.066	–	0.068
		[1.016]		[1.161]
DONOR FUNDED	–	0.392	–	0.405
		[7.330]***		[7.663]***
Observations:	153	153	90	90
R-squared:	0.541	0.668	0.462	0.655
F-statistic:	16.730	23.525	7.633	13.482

t-statistics in brackets. * denotes significant at 10 %; ** at 5 %; and *** at 1 %

may be seen, the bond dummies are insignificant, and the previous results regarding the main determinants of the haircut rates are maintained.

In the regressions reported in Tables 3 and 4 the indicator for bad sates of the world is defined as the sum of four major shocks. An interesting question refers to the individual contribution of each of these shocks to the explanation of haircuts. Regressions with each "excusable" shock entered separately confirm the results reported above: countries that experience major negative shocks tend to impose more severe haircuts. As may be seen from Table 5, the most important "bad state of the world" shock is *Wars and civil conflicts*. Its coefficient is the highest and it

is always significant at the 5 or 1 % levels. Interestingly, the coefficient for "currency crises" is not significant in the two regressions where it is included. A possible explanation is that large devaluations have been quite common among developing countries, and that on their own — that is, when not accompanied by major output collapses or an armed conflict —, currency crises are not considered to be an "excusable" shock by creditors.

3.3 Robustness, Extensions, and Possible Endogeneity

In this section I deal with some robustness issues, and I discuss whether the results are sensitive to the definition of certain variables, time periods, and equation specification. I also deal with possible endogeneity problems and I present results obtained when instrumental instruments are used. Due to space consideration some of the estimates discussed in this section are not reported in tables; they are, however, available on request.

Alternative Measures of Investors' Losses The analysis presented above relied on Eq. (1) to compute investors' losses. An alternative measure of haircuts compares the *face value* of the old debt to the *market value* of the new debt. In the literature, this alternative approach to computing investors' losses has received the name of "market haircut," and is equivalent to discounting the old debt flows by the coupon interest rate, and the new debt by the "yield at exit." In many instances the differences between the two measures are small; in others, however, they can be quite significant. For the complete sample the difference between both measures is −3.0 %, and the median is 0. When the haircut regressions in Tables 3 through 5 are re-estimated using the market haircut as a dependent variable the results don't change in any significant way. In particular, it is still the case that there is a positive association between the severity of the shocks and the magnitude of the haircuts. (Results available on request).

Different Windows for the Covariates I re-estimated the equations reported above using larger windows for defining the "bad states of the world" indicator. More specifically, I considered 8, 10 and 12 years windows. I also considered different lags (longer) for the other regressors. The results obtained confirmed the main findings in Tables 3 through 5, and provided support to the main implications of the "excusable defaults" model. Results available on request.

Alternative Definition of "Bad States of the World" The "bad states of the world" variable used in Tables 3, 4 and 5 above was defined as an additive index. This means that having two negative shocks is twice as bad as having one, and facing four shocks is twice as bad as facing two. It is possible to argue, however, that the effect of major shocks is more than additive, and that countries that experience many of these shocks simultaneously go through significant hardship. In order to explore whether the definition of this variable affects the results I constructed an exponential "bad states of the world indicator" as follows: $Bad\ \ Exp=e^n$. Where n is the number of shocks that affected this particular country in the six year window prior to the restructuring. The results obtained when this definition of "bad states" is used are presented in Table 6. As may be seen, they confirm those reported above, and provide support to the "excusable" default model.

Table 4 Haircut equations with bond dummies: white-corrected standard errors

Eq name:	(4.1)	(4.2)	(4.3)	(4.2)
Period	1988–2010	1988–2010	1978–2010	1978–2010
BAD STATES	0.081	0.080	0.048	0.048
	[2.723]***	[2.673]***	[2.499]**	[2.491]**
DEBT_GDP	0.432	0.434	0.327	0.327
	[2.752]***	[2.748]***	[2.644]***	[2.635]***
POOR	0.421	0.423	0.343	0.343
	[5.150]***	[5.101]***	[5.720]***	[5.689]***
TEN_YR	−0.022	−0.022	−0.028	−0.027
	[−0.960]	[−0.964]	[−2.815]***	[−2.793]***
NINETY	0.207	0.206	0.201	0.201
	[2.647]***	[2.617]**	[4.153]***	[4.131]***
RECESSION	0.060	0.059	0.042	0.042
	[0.784]	[0.773]	[0.850]	[0.854]
C	0.286	0.288	0.395	0.395
	[1.416]	[1.414]	[3.917]***	[3.908]***
AFRICA	−0.206	−0.204	−0.191	−0.191
	[−2.202]**	[−2.157]**	[−2.572]**	[−2.555]**
ASIA	−0.207	−0.209	−0.167	−0.167
	[−2.566]**	[−2.525]**	[−2.265]**	[−2.243]**
EUROPE	−0.200	−0.199	−0.145	−0.145
	[−2.125]**	[−2.097]**	[−1.932]*	[−1.923*]
LATAM	−0.091	−0.091	−0.083	−0.083
	[−1.413]	[−1.397]	[−1.741]*	[−1.731]*
BOND	−0.043	−0.030	−0.121	−0.123
	[−0.304]	[−0.183]	[−0.879]	[−0.761]
BOND*BAD3	0.001	−0.004	0.012	0.013
	[0.018]	[−0.050]	[0.160]	[0.151]
BOND *DEBT	−0.282	−0.300	−0.128	−0.127
	[−0.594]	[−0.598]	[−0.285]	[−0.268]
BOND *POOR	–	−0.062	–	0.006
		[−0.481]		[0.053]
Observations:	90	90	153	153
R-squared:	0.520	0.520	0.557	0.557
F-statistic:	6.328	5.808	13.440	12.391

t-statistics in brackets. * denotes significant at 10 %; ** at 5 %; and *** at 1 %

Nonlinearities and Interactive Terms In an effort to understand better the determinants of investors' losses in debt restructurings I explored whether higher order terms of the bad state of the world variables were significant, and whether interactive terms played a role. In particular, I investigated if interactions between a number of the regressors and other covariates were important — in Table 4 I present the interaction

Table 5 Haircut equations with separate bad states of the world: white-corrected standard errors, 1988-2010

Eq name	(5.1)	(5.2)	(5.3)	(5.4)	(5.5)
COUP_WAR	0.195	–	–	–	0.204
	[2.904]***				[2.639]**
COLLAPSE	–	0.111	–	–	0.052
		[2.093]**			[0.932]
TOT	–	–	0.189	–	0.170
			[2.296]**		[2.311]**
CRISIS	–	–	–	−0.007	−0.017
				[−0.142]	[−0.394]
DEBT_GDP	0.207	0.267	0.348	0.238	0.156
	[1.925]*	[1.269]	[1.826]*	[1.094]	[0.796]
POOR	0.234	0.296	0.195	0.283	0.160
	[3.879]***	[3.352]***	[3.173]***	[2.874]***	[2.338]**
TEN_YR	−0.018	−0.013	−0.019	−0.013	−0.015
	[−1.300]	[−0.902]	[−1.320]	[−0.843]	[−1.103]
RECESSION	0.097	0.120	0.124	0.115	0.121
	[1.498]	[1.833]*	[1.902]*	[1.791]*	[1.856]*
BRADY_DEAL	0.070	0.066	0.030	0.058	0.091
	[1.342]	[1.093]	[0.497]	[0.905]	[1.614]
DONOR_FUNDED	0.317	0.397	0.434	0.407	0.342
	[5.062]***	[7.486]***	[8.586]***	[7.725]***	[5.110]***
C	0.433	0.339	0.450	0.424	0.383
	[3.659]***	[2.479]**	[3.215]***	[2.893]***	[3.206]***
AFRICA	−0.149	−0.170	−0.171	−0.225	−0.073
	[−1.919]*	[−1.506]	[−1.753]*	[−1.767]*	[−0.870]
ASIA	−0.083	−0.101	−0.126	−0.157	−0.127
	[−0.983]	[−1.188]	[−1.280]	[−1.623]	[−1.521]
EUROPE	−0.020	−0.047	−0.054	−0.021	−0.037
	[−0.247]	[−0.458]	[−0.525]	[−0.182]	[−0.411]
LATAM	−0.055	−0.041	−0.103	−0.091	−0.053
	[−0.776]	[−0.459]	[−1.145]	[−0.978]	[−0.720]
Observations:	98	92	94	92	90
R-squared:	0.657	0.622	0.643	0.602	0.690
F-statistic:	14.956	11.981	13.427	10.991	11.929

t-statistics in brackets. * denotes significant at 10 %; ** at 5 %; and *** at 1 %

between a "bond exchange" dummy and several covariates. The answers to both of these questions are negative; I found no role for interactions or nonlinearities.

Face Value Reduction Some debt restructurings include a reduction in the face value of the debt — or face value haircut —, while others are confined to extending maturity, reducing coupon rates, and/or establishing a grace period with no payments of

principal. Fifty seven of the 180 episodes in this paper included face value reductions. Argentina 2005 is one of them, with an average (across bonds) face value reduction of 29.4 %. For the complete sample the mean face value reduction is 16.1 %, and the median is zero. I estimated a number of probit regressions to investigate whether the bad states of the world index(es) help explain if, in a particular restructuring, there was face value reduction. These regressions indicate that countries with more severe shocks, a higher debt burden and poor have a higher probability of having a reduction in the face value of the debt. The results are available on request.

Warrants and Kickers As noted above, most authors have ignored the value of GDP and terms of trade-contingent kickers in their calculations of haircut rates. Some authors, such as Cruces and Trebesch (2013), have made the (correct) point that in the vast majority of cases these claims had a very low (or zero) value at the moment of the exchange; other authors have ignored them without much explanation. In this paper, in contrast, I explicitly subtracted the value of the Argentina 2005 GDP-linked warrant when calculating the haircut magnitude for that episode. However, I assigned a value of zero to kickers in the other 11 cases that included them in the restructuring agreement. In order to explore the robustness of the results, I considered two alternative approaches: (1) I followed Cruces and Trebesch (2013) and others, and ignored contingent components in all cases[28]; and (2) I made an effort to assign values to kickers in the other 11 episodes that included them — for Argentina I still used 2 cents on the dollar.[29] The results obtained, confirm those discussed above: haircuts tend to be higher in countries that are subject to more severe "bad state of the world," have higher debt burdens, and are poorer (results available on request).

Possible Endogeneity Issues The results in Tables 3 through 6 were obtained using White-corrected least squares. An important question, however, is whether these estimates may be subject to some endogeneity problems. Inspection of the equations indicates that almost every regressor is either an exogenous variable or, given, the lags structure, a predetermined variable. The clearly exogenous variables are: terms of trade changes, U.S. interest rates, "coups and wars," and recessions in the United States. The predetermined covariates include "GDP collapse" and "currency crises." Both are defined within a window that begins one year *before* the restructuring, and extends to 6, 8 or 10 years into the past. This is also de case with the "debt to GDP ratio" and the "poor" indicator, both defined with a one year lag.

However, there is a (slight) possibility that through some forward looking expectations mechanism there is an endogeneity issue related to the output collapse and the currency crises components of the "bad states of the world" index. In order to deal with this potential problem I estimated a number of equations using instrumental variables. The following instruments were used: A "natural disasters" index that takes the value of one if the country was hit by one of more natural disasters in the six years lagged window. The raw data come from the data set kept by the Center for Research on the Epidemiology of Disasters (CRED). In building this indicator I considered the following disasters: droughts, earthquakes, volcanic activity, flood, landslides, and storms.

[28] See, Chamon et al. (2008), and Sandleris and Wright (2013).
[29] See, for example, Miyajima (2006).

This instrument is clearly exogenous. A second instrument is given by a binary variable that takes the value of 1 if the country was included n the *original* 1996 list of countries for the HIPC program. Naturally, this variable can only take the value 1 after 1996. The third instruments is an indicator that takes the value of 1 if the country had been approved by the IMF for a Poverty Reduction and Growth Facility loan in the window comprised from one year prior to the debt restructuring to 6 years prior to this event.[30] The fourth instrument is an index that measures the number of coups and wars in the country's region during the ten years prior to each restructuring.

The results obtained under instrumental variables are in Table 7. In order to have a base for comparison, the equation specifications in Table 7 are the same as in Table 3. As may be seen, the results confirm the main conclusions from Tables 3, 4, 5 and 6: there is support for the implications for the "excusable default" model: countries with more severe bad states of the world shocks have larger haircuts. In addition, the other covariates continue to have the expected signs and are significant. The point estimates for the Bad States variable is higher than in Table 3; the point estimates for the other covariates are similar and significant at conventional levels.

4 Was Argentina's 2005 Haircut Excessive? A Residuals' Analysis

In the preceding section I reported twenty one haircut equations. These estimates showed that the results are robust to variables' definitions, periods considered, specifications, and estimation methods (White-corrected least squares or instrumental variables). These estimates may be used to inquire whether haircuts in particular episodes conformed to the predictions of the model or if, on the contrary, they were excessively high or low. This is what I do in this Section for the Argentine exchange of 2005, the Chilean restructurings of 1984–1990, and the Uruguayan exchange of 2003. I also use these results to investigate, using an out of sample forecast, the Greek sovereign debt restructuring of 2012.

A good starting point is the analysis of fitted values for the Argentina 2005 haircut. These fitted values range from a minimum of 36.0 % to a maximum of 60.1 %. As may be seen this range doesn't include the actual haircut resulting from the Argentina 2005 restructuring: 74.6 %. The mean for the 20 fitted values is 47.1 %, and the median is 45.7 %; the standard deviation is 7.3 %. Although these numbers are significantly higher than the mean and median for all episodes reported in Table 2 (37 % and 32 %), they are still much smaller than the actual haircut imposed by Argentina to investors in 2005.

Another way of saying this is that the residuals for the Argentina 2005 episode are positive and very large in every regression. In what follows I rely on two "influence statistics" to investigate formally whether Argentina 2005 is an outlier in the empirical analysis: I use the R-student standardized test, and the DFFITS test. In order to provide some context I also analyze the residuals from debt restructuring episodes in two of

[30] The data are from Dreher (2006) and from the IMF website. The data on wars and civil conflicts are from the Integrated Network for Social Conflict Research. The data on natural disasters are from the Center for Research on Epidemiology and Disasters. The data on coups and coups attempts are from the Peace Research Institute of Oslo. For further details on data sources, see Appendix B.

Table 6 Haircut equations with exponential bad states of the world: white-corrected standard errors, 1988–2010

Eq name:	(6.1)	(6.2)	(6.3)	(6.4)
Period	1978–2010	1988–2010	1988–2010	1988–2010
BAD_EXP	0.0066	0.0055	0.0085	0.0091
	[2.933]***	[2.124]**	[2.801]***	[4.506]***
DEBT_GDP	0.2322	0.1666	0.4213	0.2844
	[1.976]**	[1.915]*	[3.078]***	[1.732]*
POOR	0.3579	0.2112	0.4311	0.2042
	[8.482]***	[4.638]***	[7.867]***	[3.492]***
TEN_YR	−0.0207	−0.0233	−0.0496	−0.0232
	[−2.075]**	[−2.521]**	[−3.256]***	[−1.672]*
NINETY	0.1956	0.0440	–	–
	[4.137]***	[0.827]		
RECESSION	0.0146	0.0750	0.1213	0.1215
	[0.307]	[1.663]*	[1.692]*	[1.949]*
C	0.3754	0.4675	0.6265	0.4526
	[3.496]***	[4.480]***	[4.706]***	[3.483]***
AFRICA	−0.2090	−0.1858	−0.1713	−0.1496
	[−3.080]***	[−2.441]**	[−1.969]*	[−1.721]*
ASIA	−0.1531	−0.1087	−0.1282	−0.0883
	[−1.948]*	[−1.354]	[−1.544]	[−1.000]
EUROPE	−0.1280	−0.0926	−0.0828	−0.0738
	[−1.783]*	[−1.123]	[−0.932]	[−0.772]
LATAM	−0.0683	−0.0888	−0.0710	−0.0802
	[−1.164]	[−1.293]	[−0.931]	[−1.011]
BRADY_DEAL	–	0.0651	–	0.0666
		[1.104]		[1.232]
DONOR_FUNDED	–	0.3952	–	0.3962
		[8.011]***		[8.147]***
Observations:	168	168	98	98
R-squared:	0.512	0.640	0.483	0.664
F-statistic:	16.478	22.953	9.140	15.457

t-statistics in brackets. * denotes significant at 10 %; ** at 5 %; and *** at 1 %

Argentina's neighbors: (1) Chile in 1984–1990, and (2) Uruguay in 2003; I also discuss briefly, and in light of these results, the Greek restructuring of 2012.

Residuals' Analysis for Argentina The R-student standardized residual test for episode *i* is defined as follows:

$$e_i^S = \frac{e_i}{S(i)\sqrt{1-h_i}}.$$

Table 7 Haircut equations: instrumental variables

Eq name:	(7.1)	(7.2)	(7.3)	(7.4)
Period:	1978–2010	1978–2010	1988–2010	1988–2010
BAD3	0.116	0.072	0.147	0.132
	[3.806]***	[2.246]**	[3.417]***	[3.838]***
DEBT_GDP	0.341	0.239	0.453	0.261
	[2.958]***	[1.658]*	[3.228]***	[1.745]*
POOR	0.322	0.217	0.354	0.180
	[5.167]***	[3.317]***	[3.910]***	[2.301]**
TEN_YR	−0.019	−0.023	−0.045	−0.015
	[−1.783]*	[−2.417]**	[−2.588]**	[−0.942]
NINETY	0.237	0.068	–	–
	[4.675]***	[1.180]		
RECESSION	0.022	0.078	0.138	0.139
	[0.414]	[1.552]	[1.791]*	[2.018]**
C	0.221	0.379	0.469	0.293
	[1.980]**	[3.656]***	[3.186]***	[2.229]**
AFRICA	−0.162	−0.176	−0.099	−0.127
	[−2.110]**	[−2.238]**	[−0.894]	[−1.329]
ASIA	−0.158	−0.130	−0.083	−0.089
	[−2.506]**	[−1.968]**	[−1.187]	[−1.290]
EUROPE	−0.223	−0.150	−0.201	−0.172
	[−3.247]***	[−1.838]*	[−2.417]**	[−1.775]
LATAM	−0.074	−0.101	−0.040	−0.055
	[−1.522]	[−1.781]*	[−0.590]	[−0.796]
BRADY_DEAL	–	0.075	–	0.086
		[1.199]		[1.479]
DONOR_FUNDED	–	0.381	–	0.398
		[6.916]***		[6.727]***
Observations:	153	153	90	90
R-squared:	0.501	0.657	0.420	0.625
F-statistic:	16.040	22.926	7.643	12.868

t-statistics in brackets. * denotes significant at 10 %; ** at 5 %; and *** at 1 %

For a discussion on the instruments, see the text

The DFFITS test, on the other hand, is defined as:

$$DFFITS_i = \left(\frac{e_i}{S(i)\sqrt{1-h_i}}\right)\left(\frac{h_i}{1-h_i}\right)^{1/2},$$

where, e_i is the original residual for episode i, $S(i)$ is the variance of the residuals if the observation corresponding to episode i is excluded from the analysis, and h_i is the i-th diagonal element of the $x_i(X'X)^{-1}x_i$ matrix. In order to have a broad view I used the

residuals from the equations reported in Tables 3 through 5. That is, the analysis includes 13 estimates. This means that there are a total of 26 residual tests (13 for the R-student and 13 for the DFFITS).

The results obtained from this analysis are quite revealing. In 21 out of the 26 tests the Argentine 2005 debt restructuring is a statistical outlier. [31] In Fig. 2 I present, as an illustration, the two residual tests — including the critical 95 % bands — for equation (5.5) in Table 5.[32] According to the R-student standardized test, only three episodes are outliers: Argentina 2005, Bosnia and Herzegovina, and the Ukraine 1998. Only the latter has negative residuals and, thus, had an "unusually low" haircut. The DFFIT test, on the other hand, identifies four outliers: Argentina 2005, Bosnia and Herzegovina, Cote d'Ivoire 1998, and Iraq 2006. As may be seen, Argentina appears in both lists, indicating that the haircut imposed on investors in 2005 was "excessively high" from a comparative perspective.

An interesting question is what makes Argentina 2005 an outlier observation. The answer is in three parts: (1) Argentina was hit by two of the four bad states of the world shocks: output collapse, and currency devaluation. Even though the crisis and the default were surrounded by considerable political instability, the country maintained constitutional rule and the institutions of the state continued to function. In addition, in the years preceding the crisis the terms of trade declined by only 9 %. While this is clearly a negative shock, it is not large enough to qualify as a "bad state of the world." Indeed, in Argentina's modern history there have been numerous occasions where the terms of trade have declined significantly more than 9 %.[33] As a consequence, in the regression analysis the "Bad States" index takes a value of "2" for Argentina, while in a number of countries it was greater. (2) Argentina is not a poor country. It is true that this crisis was severe and resulted in a significant increase in the poverty headcount and unemployment, but even in 2002 Argentina was not a "poor country," as are many of the nations that were able to obtain significant debt relief when restructuring their debts. And (3), the amount of debt exchanged was not high enough as to justify a 75 % haircut. The issue here is not whether this was a large and massive exchange — which, of course, it was —, but whether the debt to GDP ratio was *high enough* as to justified the magnitude of the haircut. At USD 65 billion, Argentina's 2005 sovereign restructuring was the second highest ever in absolute terms, and as a proportion of GDP it was the tenth highest in the modern history of sovereign restructuring. And yet, this was not enough as to explain, according to the model, such a massive haircut. As noted, in the equations reported above the fitted values for the Argentina 2005 episode ranged from 36 to 60 %. These figures are significantly lower than the 74.8 % actual haircut.

[31] In some of these tests the Argentina's 2005 residuals were exactly on the outlier bands.

[32] The tests in Fig. 2 show some gaps, due to two facts: (1) Not every episode has data for all covariates; (2) the estimates in equation (5.5) refer to the 1980–2010 period.

[33] Argentina's terms of trade have historically been quite volatile, and a 9 % decline is well within what is normal. Indeed, an analysis of Argentina's recent past provides strong support for the notion that declines in terms of trade are common, cyclical and temporary. For example, in 1974, Argentina's terms of trade deteriorated by 14 %, and in 1975 they dropped further by 11 %. In the next three years, however, the terms of trade improved by 23, 15 and 8 %, respectively. This terms-of-trade cycle repeated itself in the mid-1980s: in 1986, the price of Argentine exports relative to its imports declined by 21 %, and in 1987 they dropped by an additional 11 %. In each of the next three years they improved by 29, 8 and 10 %, respectively.

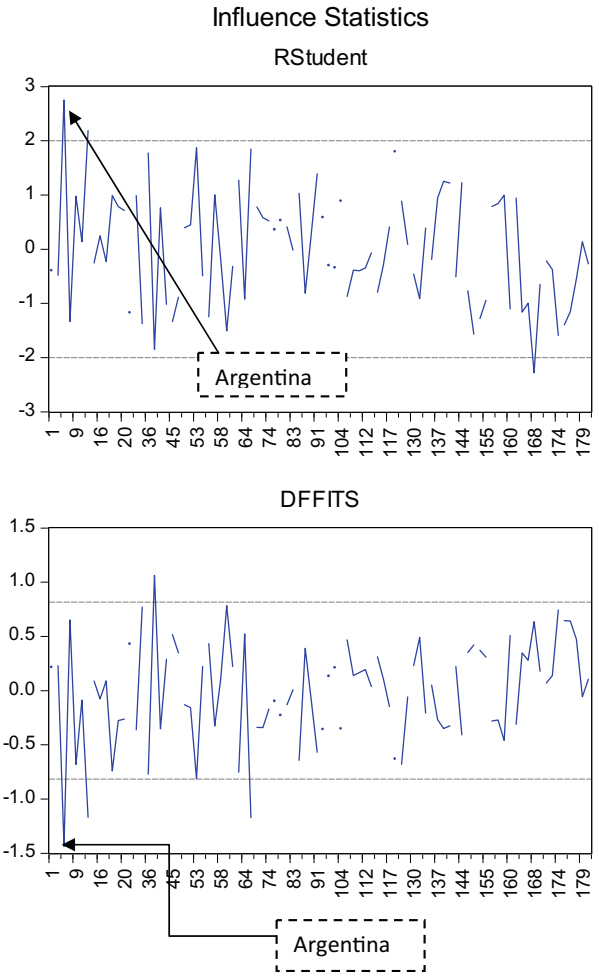

Fig. 2 Influence statistics and outliers

Chile and Uruguay In order to provide context, I compare Argentina's episode to restructurings in two of its neighbors: Chile and Uruguay.

In 1982, and after an experiment with fixed exchange rates (the value of the U.S. dollar was rigidly fixed at 39 pesos), Chile faced a major crisis. Most banks went under, the currency lost two thirds of its value, output collapsed by 15 %, and unemployment skyrocketed to 25 %. In 1983 Chile defaulted on its sovereign debt, and long and protracted negotiations with the banks began. The restructuring was in stages and agreements with creditors were signed in 1984, 1986, 1987 and 1990. The haircuts were 8.4, 31.7, 14.7 and 17 % respectively, and the weighted average for the complete episode was 27.3 %.[34] During this long process, debt equivalent to 95 % of GDP was renegotiated. This was significantly higher than in Argentina 2005.[35] The influence

[34] The weighted average is from the four episodes when the equation corresponds to 1978–2010. It is for 1990 only when the estimate is restricted to 1988–2010.
[35] See Edwards and Edwards (1991) for details.

statistics indicate that Chile is not an outlier; indeed, the (the weighted average of the) fitted value(s) for its haircut is remarkably similar to the actual haircut: 26.9 vs. 27.3 %. The Chilean haircut was neither unusually high, nor unusually low.

During the late 1990s and early 2000s, Uruguay was affected by a number of negative shocks similar to those that hit Argentina. In late 2002, and in the face of a run on the currency, output collapse, and severe contagion form Argentina, Uruguay declared a five days bank holiday. In April 2003, a restructuring proposal was presented to creditors. At the end of the process 93 % of bondholders exchanged their bonds. In this operation, and in contrast with Argentina's restructuring two years later, there was no face value reduction. Due to its timing, to Uruguay's proximity to Argentina, and to the structural similarity of both countries, this episode has often been used as a comparison to the Argentine exchange. Some analysts have even argued that in the case of Uruguay the "haircut was excessively low." [36] The influence statistics calculated from the equations reported in this paper provide evidence suggesting that in the case of Uruguay the haircut imposed on investors was neither low nor high; it was "appropriate."

Greece An interesting question is what does this analysis, which relies on data up to mid-2010, has to say about the Greek restructuring of April 2012. Using the same present value methodology used in this paper, Zettelmeyer et al. (2013) calculated that the haircut in this episode was 64 %; other estimates, including Moody's (2013), put the Greek haircut closer to 75 %. For Greece the key covariates have the following values: the "Bad States" indicator is equal to 1 (output collapse only), "Poor" is 0, "Debt to GDP" is 0.966, "Ten Year" is equal to 2 %, and "Europe" is equal to 1. I used the nine equations in Tables 4 and 5 to obtain estimates for the "appropriate" Greek haircut, from the perspective of this analysis. These estimates ranged from 81 to 52 %. The mean of the nine estimates is 62.9; the median is 60.8 %, and the standard deviation is 9.2 %. This estimate is quite high, but somewhat lower than the actual estimated range for the haircut in this episode (64–75 %).[37]

5 Concluding Remarks

Most studies on debt restructurings and haircuts rely on the concept of "debt sustainability." The idea is that a restructuring process should reduce the debt to the point where the debt to GDP ratio is "sustainable." Roubini and Setser (2004, p. 171), for example, state that in order to achieve sustainability, "the overall debt burden has to be consistent with the country's overall capacity to

[36] In fact, Uruguay suffered more severe terms of trade shock than Argentina. It experienced a currency crisis, and a GDP collapse similar to that of Argentina. See Edwards (2010).

[37] At the time of this writing Greece is once again facing debt problems and there is talk of a new restructuring. For a discussion and some estimates see, for example, Philippon (2015). I thabks George Tavlas for helping me clarify this point.

make payments."[38] Even though these sustainability-based models are useful and are used profusely — indeed I constructed one for assessing Nicaragua's HIPC debt reduction program, Edwards (2003) —, they have some limitations. The two most important ones are: (a) It is not easy to determining the "capacity to make payments," to quote Roubini and Sester (2004, p.171). Is it the same for all countries? Does it change through time? What does it depend on? And (b), calculating the observed ratio of debt to GDP is not trivial. The basic problem is that this implies comparing a number expressed in foreign currency (foreign debt) to a number expressed in domestic currency (GDP). In most cases the current exchange rate is used to convert GDP in domestic currency into GDP in foreign currency (U.S. dollars). However, it is easy to see the problem with this approach: after a large devaluation — say from 1 peso equal to 1 dollar, to 3 pesos to 1 dollar —, GDP denominated in dollars shrinks to one third of the value it had immediately prior to the currency event. There are number of possible ways for dealing with these issues. For example, GDP in PPP dollars may be used. This is a significantly more stable figure that GDP converted using spot exchange rates. Another alternative is to use an estimate of the long run "equilibrium" real exchange rate to make the GDP conversion.

In this paper, however, I have used a different approach for evaluating the "appropriateness" of haircuts after a debt restructuring. I used a data set that includes every sovereign restructuring between 1978 and 2010 to explain the extent of investors' losses. The regression results are broadly in agreement with the "excusable default" approach to restructurings: countries that have suffered very severe shocks — including wars, armed conflicts, coup d'état, output collapses, and major declines in the terms of trade — end up having larger haircuts than countries that have not faced these major disturbances. Very poor countries and nations with larger debt burdens also have larger haircuts. The residuals from these regressions are then used to investigate whether the haircut in a particular episode conforms to the predictions from the empirical model. An analysis of the residuals from 26 regressions indicates, consistently, that the haircut imposed by Argentina in its 2005 restructuring was unusual and excessively high (in most regressions the residuals exceeded two times the standard error of the regression). The analysis presented here suggests that an "appropriate" haircut in the Argentine exchange of 2005 would have been in the vicinity of 47 %, significantly lower than the actual "haircut" of 74.8 %. The empirical analysis also indicates that the haircuts in Chile's (1984–1990) restructurings were "appropriate," as was the haircut in Uruguay's exchange of 2003. In addition, and out of sample forecast suggests that for Greece a haircut in the vicinity of the actual figure was consistent with the historical evidence.

There are a number of possible directions for future research. First, it would be interesting to analyze the length of time that elapses between default and restructuring. Benjamin and Wright (2009) documented that during early restructurings — almost all of which were for syndicated bank loans — this time period was very long, exceeding, on average, 8 years. More recent bond restructurings, however, have been very quick.

[38] A simple version of this methodology may be described as follows: First, the analyst determines the country's "capacity to make payments." Say, interest payments should not exceed X% of GDP per year. Second, the debt to GDP ratio that is consistent with payments not exceeding X% of GDP is calculated. This is called the "sustainable" debt to GDP ratio. The "appropriate haircut" is then computed as the amount by which the current debt needs to be reduced in order to make the actual debt to GDP ratio equal to the "sustainable" ratio.

The Uruguay exchange of 2003, for example, took 63 days (in contrast, the Argentine exchange of 2005 took almost 1300 days). A second direction for future research has to do with the potential role played by international reserves in the restructuring process. Defaults take place when international reserves are very low, but still positive.[39] For example, the Argentine default of December 23, 2001, took place when the country still had approximately USD 20 billion in reserves (equivalent to 7 % of GDP at the pre-devaluation exchange rate and almost 20 % of GDP at the post evaluation exchange rate). An interesting question is how the reserves position of a country affects the haircut losses incurred by investors. In principle, one would expect that the higher the reserves at hand, the lower the haircut and, thus the higher the recovery rate. A third promising avenue of research would be to estimate jointly a probability model on whether countries do restructure their debts and a model of the magnitude of the haircut, in case the answer to the first question is positive. A class of models that could be fruitfully used in this analysis would include "treatment models."

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Appendix A

Sovereign Borrowing and Excusable Default: A Conceptual Framework

In this Appendix I discuss the Grossman and Van Huyck (1989) model of sovereign borrowing and default, which provides the conceptual bases for the empirical analysis in this paper. In this model there is no money and, thus, currency crises are ruled out. There is a risk free security with a rate of return ρ, and loans are for one period. There are no capital controls. Sovereign borrowers can invest in a risk free technology, or can purchase the risk free security. Lenders, on the other hand, face a competitive market and are risk neutral.

Borrowers maximize the present value of consumption. Their objective function is:

$$\Omega = U(c_t) + \sum\nolimits_{i=1}^{\infty} \frac{E(U(c_{t+i}))}{(1+\delta)^i} \tag{A.1}$$

Conventional notation is used. δ is the consumer's discount rate, and E(…) is the expectations operator, conditional on all available information. Consumption is given by the sum of three elements:

$$c_t = F(b_{t-1}) + z_t - s_t. \tag{A.2}$$

Where $F(b_{t-1})$ is a function that captures the return from last period's borrowing (b_{t-1}); z_t is the stochastic component of income, and depends on the state of the world (see below for details); and s_t is debt service in period t. It is assumed that $s_t \geq 0$; that is, the

[39] See Aizenman and Lee (2007) for an analysis of the role of international reserves in debt crises. See, also, Reinhart and Rogoff (2010).

borrower cannot buy insurance that will cover them if there is a very bad state of the world. Also, for simplicity, it is assumed that borrowing cannot be used for consumption; a relaxation of this assumption would not affect the results in a fundamental way. The F function has the following properties:

$F'>(1+\rho)$, and $F''<0$, if $b \leq B$.
$F'=(1+\rho)$, and $F''=0$, if $b>B$.

That is. the return from investing in the local technology exceed the opportunity cost up to a point B; from that point on the marginal productivity of output is equal to the world risk free rate of return ρ.

The z_t are drawn from a stationary probability distribution $p(z)$, with mean $\bar{z}$. The discreet z realizations range from a "good" state of the world Z to the worst possible state of the world ξ. Naturally, $p(Z) \gg p(\xi)$.

In equilibrium, creditors' expected income across all states of the world — each of them with a probability $p(z)$ — is equal to the risk-free return. Assuming that an amount b_t is lent in period t, this implies:

$$\sum p(z)\{E\,[S_{t+1}(z_{t+1})]\} = (1+\ \rho)b_t \tag{A.3}$$

$E[s_{t+1}(z_{t+1})]$ plays a key role in the model. It is the creditor's expectation of the sovereign's debt servicing decision for period t+1. It is assumed that in forming this expectation creditors know borrowers preferences and utility function — that is they know Ω —, and that they know the sovereign's payment plans into the future. Thus, lenders know sovereign's debt servicing plan R_t (z_{t+1}), which is generally contingent on the state of the world. The actual solution of the model will depend on this $R_t(\ z_{t+1})$ plan. Below I consider three cases for $R_t(z_{t+1})$.

To summarize, a utility maximizing sovereign will have to make three simultaneous decisions: how much to borrow today (b_t), how much debt to service today (s_t), and what type of plan to adopt for future debt service payments. This payments plan R_t is contingent on the states of the world z_{t+1}. This payment decision will determine the nature of the equilibrium. In the rest of this appendix I consider three cases:

Case1: Precommitment Assume that the sovereign can credibly precommit to follow a payment strategy that is strictly depending on the realization of the state of the world z_{t+1}. This plan is denoted as $\widetilde{R}_t(z_{t+1})$, which is equal to $\sum p(z)\{E\,[S_{t+1}(z_{t+1})]\}$. In this case there will be full risk shifting from the sovereign to the lender. Both the amount borrowed and the payment plan will be time invariant:

$$\widetilde{b} = \max\left(B,\ \frac{\bar{z}-\xi}{1+\rho}\right), \tag{A.4}$$

$$\widetilde{R}(z_{T+1}) = z_{t+1}-\bar{z} + (1+\rho)\widetilde{b}. \tag{A.5}$$

Actual debt service will depend on the sign of $(z_{t+1}-\bar{z})$. In the bad state of world $(\xi-\bar{z}) < 0$, and payment will be less than debt plus interest. This is the "excusable

default" solution. In this case, the haircut will depend on the severity of the negative shocks, and will be equal to $(\bar{z}-\xi)$, the difference between the mean of the stochastic component of income and the bad state of the world realization.

Case 2: Repudiation Assume now that instead of precommitting, the sovereign maximizes utility without any concern regarding its reputation or ability to borrow in the future.[40] The simple and myopic maximization of (A.1) implies, for all states of the world, that $s_t=0$. If the creditor anticipates this plan, then $b_t=0$, for all states of the world. This is a suboptimal outcome with no borrowing; if borrowing does happen, the debt would be fully repudiated.

Case 3: Reputation Assume, finally, that although the sovereign cannot strictly precommit, it does care about its reputation. The creditor, in turn, takes into account the borrower's past behavior to elucidate its payment intentions in the future; creditors have rational expectations, and use information about the past to form its expectations about the future. In this case, it never pays for the borrower to mislead the creditor; that is, in every period $t+1$, the sovereign validates the expectations that the creditor formed about the contingent payment plan $R^*(z_{t+1})$. This plan, then, is the best plan within the class of incentive compatible payment plans. Under most values of δ, and sovereign's degree of risk aversion (curvature of the ultilty function), the reputational equilibrium implies an amount of borrowing lower than in the precommittment case, and incomplete risk shifting from the borrower to the lender. The payment function $R^*(z_{t+1})$ will be state contingent, and under bad states of the world (when $z_{t+1}=\xi$) debt service will fall short of the debt plus interest. That is, in a bad state of the world there is an "excusable" partial default. The magnitude of the default, or haircut, will depend on $(\bar{z}-\xi)$. That is, the haircut will be larger, the more severe are the negative shocks that affect the sovereign.

Appendix B

Data Sources

Wars and civil conflicts: Integrated Network for Social Conflict Research (http://www.systemicpeace.org/inscr/inscr.htm).

Coups and coups attempts: *Peace Research Institute of Oslo* (PRIO), Norway (http://www.prio.no/).

Output collapse: Constructed from raw data form the World Development Indicators.

Currency Crises: Constructed from raw data form the World Development Indicators.

Poor: Constructed from data from the World Development Indicators.

[40] Whether sovereigns can actually precommit is an open question. Indeed, in the absence of international bankruptcy courts (or equivalent institutions), it is not possible.

Recessions: Constructed from data on recessions from the National Bureau of Economic Research.

Ten year Treasury yield: Federal Reserve of St. Louis, FRED data base.

Haircuts: Basic data from Cruces and Trebesch (2013).

Characteristics of restructuring deals: Basic data from Cruces and Trebesch (2013).

Natural Disasters: Center for Research on the Epidemiology of Disasters (CRED) (http://www.emdat.be/database)

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