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Sovereign Defaults: has the current system resulted in lasting (re)solutions?

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Sovereign Defaults: has the current system resulted in lasting (re)solutions?

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Abstract[1]

The current system of sovereign debt renegotiation has tended to produce restructuring agreements with low haircuts and relatively few events with deeper haircuts. Although this may seem like a successful outcome we uncovered a new empirical fact that throws some doubts on this interpretation, namely that renegotiations that end up in relatively low haircuts are frequently followed by a subsequent renegotiation soon afterwards. Low haircuts and re-renegotiations seems to be the name of the game under the current system. Yet most models of sovereign default consider only a single type of default and ignore multiple renegotiations completely. In this paper, we develop a DSGE model where countries can default in different ways and in which multiple credit events are possible. We solve the model numerically and show how countries may default in different ways and renegotiate debt multiple times. We discuss how recent changes in the international financial architecture may affect the way in which countries default in the future.

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1 Introduction

To paraphrase Tolstoy's Ana Karenina, all repaying sovereigns are alike; each defaulting country defaults in its own way.

When sovereigns decide that they cannot repay debts according to the contracted terms, there is no statutory procedure for a sovereign to follow and there is no bankruptcy court that can force a resolution. The current system has been labeled as ad hoc, although voluntary guiding principles have been developed by creditor groups and by the United Nations. Moreover, the IMF is typically involved in providing advice and there may even be an IMF lending commitment sometimes predicated on a successful debt exchange. The voluntary codes tend to focus on process and emphasize discussion between the various parties to attempt to find a mutually convenient solution that gives the borrower some relief (on interest payments, on the debt stock or both) but which also protects creditors from a greater loss further down the road, as a large debt-overhang may provoke an even greater economic crisis if left unresolved.

However, unfortunate sovereigns in this position face very difficult alternatives. One stark way to characterize the choice set is that the borrower may either seek an agreed solution, typically with a relatively small haircut and most effectively implemented preemptively avoiding difficult legal disputes, or attempt to impose a harsher reduction in debt that might be resisted by creditors and may then be subject to legal actions. In the latter case, courts have frequently judged in favor of a creditor - after all the sovereign has broken the terms of the debt contracts. However, courts have found it very difficult to enforce such judgments, as they typically have no authority to attach or seize assets to repay the creditors. As Buchheit and Daly (2014) have observed sovereign borrowers have been "uniquely vulnerable" but also "uniquely protected".

Arguably, the current system has tended to result in two types of default. In what follows, we will refer to the first type as a debt reprofiling (more consensual, a low present value haircut and often no principal haircut) and the second a debt restructuring - deeper present value haircut, a principal reduction and sometimes accompanied by legal challenges. As discussed below the former is much more common and the latter, at least in the modern era of post Brady bond defaults, has been quite rare. [2]

There has been much discussion in the sovereign debt literature regarding the cost of default [3]. But most models only consider one type of default. And yet the extent of the costs may depend on how the country defaults. For example, there are cases such as Uruguay in 2003 or the Dominican Republic in 2005 where a reprofiling has been effected relatively quickly and with

[2] See IMF (2014) and Asonuma and Trebesch (2014). Given the reinterpretation of the pari passu clause in the context of the Argentina case and innovations in CAC clauses for new bond issues, this characterization may be changing, we discuss prospects for the future in the last section of the paper.

[3] See Sandleris (2011) for a detailed analysis.

apparently relatively little cost. While at the other extreme, there are rare cases such as Argentina where the 2002 default was followed three years later in 2005 with a first restructuring but with a significant amount of "hold-out" creditors, followed by subsequent reopenings of the exchange and much legal action that continues even to this day.

We uncover two empirical facts. First, that most defaults appear to be more akin to reprofilings with relatively low haircuts and resolved fairly quickly (and hence we consider at lower cost) and deeper restructurings with protracted legal problems (and hence higher costs) appear to rare events. But that secondly, reprofilings are often followed by a second reprofiling or restructuring. These multiple renegotiations suggest that while each may have lower costs it may not actually solve the underlying debt problem. Over 40 percent of reprofilings are followed by a second reprofiling or restructuring within 6 years.

Motivated by these findings, we develop a theoretical model that can accommodate them. Our model extends the Arellano (2008) and Aguiar and Gopinath (2006) DSGE models of endogenous default. The model is also related to that of Yue (2008) that incorporates a restructuring decision within a DSGE sovereign default model and to Benjamin and Wright (2009). These latter authors develop a theory of sovereign debt renegotiation in which delay arises from the same commitment problems that lead to default in the first place. Our model is perhaps closest to that of Asonuma and Trebesch (2014) who also consider different ways in which a sovereign may default and calibrate the model on the one hand to Argentina and on the other to Uruguay.

Our model, however, extends these different papers in two ways. First in our case in each period a government can choose between four different possibilities: repay the debt in full, reprofile, restructure or simply miss a payment. The last three options then entail a default but their costs and benefits vary. And secondly our model can incorporate the possibility of multiple default events which we argue is an important and so far overlooked aspect of the recent experience.

Our paper is also related to the more empirical literature on sovereign defaults that considers the duration of the exclusion from credit markets after a default - see for example Gelos et al (2009) and Cruces and Trebesch (2011), (2012). This last paper highlights the importance of haircuts in determinig default outcomes and we employ their database described in the earlier paper to obtain relevant stylized facts regarding sovereign defaults.

The paper is organized as follows. Section 2 presents new stylized facts on sovereign debt restructuring. Section 3 presents the theoretical model. Section 4 presents the main results of our model and Section 5 concludes.

2 New empirical evidence on sovereign restructurings

2.1 The data and defining a final debt renegotiation

In what follows we focus on the size of haircuts of recent debt renegotiations and on multiple debt renegotiations. The data we work with comes from Cruces and Trebesch (2011) which includes all renegotiations with foreign banks and bondholders between 1970 and 2010. This database includes 180 sovereign debt renegotiations that occur in 68 countries. The dataset provides new estimates of haircuts based on the Sturzengger and Zettelmeyer (2008) methodology which calculates the haircut as the percentage difference between the present value of the old and the new debt instruments. This approach differs from market haircut estimations in that the methodology calculates the present value (immediately after the time of the offer) of the old debt and discounts it by using the market interest rates that prevail at that time. The motivation for using the same interest rate for new and old instruments is that it reflects the increase in the capacity to service the debt that results from the exchange itself. The Sturzenegger and Zettelmeyer (SZ) haircuts' measure is then:

$$H_{SZ_t} = 1 - \frac{PresentValueofNewDebt(r_t^i)}{PresentValueofOldDebt(r_t^i)}$$

Information on the timing of sovereign defaults is taken from a Standard and Poor's study. This covers credit events on rated and unrated local and foreign currency instruments, including debt issued by sovereign governments between 1975 and 2006. For the purpose of our paper we focus on defaults on foreign currency debt which largely correlates with bonds that are externally issued. The database was updated to 2010 using data from Standard and Poor's ratings in the case of rated sovereigns, and with Cruces and Trebesch (2011) data on sovereign debt renegotiatons in the case of unrated issuers.

We define any type of debt renegotiaton that allows the borrower to leave a default state for at least two years as a "final renegotiation". In other words if the country only exited a default state for one year and then re-entered default the next year then we do not consider this as a final renegotiation. Following this rule, some 70 final renegotiations are found between 1979 and 2009, which take place in 56 countries. Table A1 in the Appendix presents a list of these 70 final renegotiations including the year in which the sovereign entered default and the year of the final renegotiation. Note that these final renegotiatons may be reprofilings with a low haircut or restructurings with a deeper haircut as per the discussion above.

2.2 Multiple Debt Renegotiations

Given the above definitions, there are a surprising number of cases in which a reprofiling or a restructuring does not imply the end of default for a sovereign and there are many multiple debt

renegotiations within the period of default. Poland is an extreme case with some seven debt renegotiations until the country actually leaves default according to our definition. As Figure 1 illustrates, almost 40% of the 70 final debt renegotiations involved more than one renegotiation before the country was able to leave default.

Figure 1: Multiple debt renegotiations

Interestingly, the haircuts of non-final debt renegotiations tend to be lower than the haircuts of final renegotiations. Table 1 documents the mean SZ haircuts of debt renegotiations for the cases of multiple events. The first column details whether the renegotiations in question are the first, second, third or fourth one, the second column details the mean SZ haircut of debt renegotiatons that are not final ones and the third column the mean SZ haircut if it is a final renegotiation. We stop at the fourth renegotiation as then there are less than 7 observations for the 5th to 7th renegotiations and so we have less confidence in citing statistics - the total number of observations for each type of negotiation (first, second, third fourth) is given in the final column.

Table 1: Statistics on Multiple Debt Renegotiations

Moreover, the probability of there being a multiple debt renegotiation appears to be associated with the size of the haircut of the first negotiation. In other words if the initial debt renegotiation results in a small haircut then the probability of a second debt renegotiation is higher. This is illustrated in table 2.

Table 2: Conditional Probability of there being a Second Debt Renegotiation

As discussed above there appears to be two types of debt renegotiation. The first has now been labelled by IMF (2014) as a "reprofiling". Typically such reneogiations are relatively fast, they may be preemptive (in the sense that they are announced before the country actually enters default) and frequenty have a zero prinicpal haircut. The second type, again following the nomenclatre of IMF (2014) might be called a restructuring and tend to have face value haircuts, have deeper present value haircuts and tend to be ex post. Figure 2 considers instances of multiple renegotiations within a single default period using this breakdown. Specifally, we consider reprofilings as renegotiations that have a zero face value haircut. Figure 2 has three panels and as can be seen there are many cases of multiple reprofilings (a reprofiling followed by a second, third or even further reprofiling - panel A). There are very few cases of multiple restructurings (a restructuring followed by a restructuring - panel B). There are some cases of a restructuring following a reprofiling (panel C) but there are no cases in the data of a reprofiling following a restructuring.

Figure 2: Multiple Reprofilings and Restructurings

2.3 The size of haircuts and the impact of debt renegotiations

In this section, we consider the distribution of the size of haircuts and impact of different types of debt renegotiations on debt ratios. We find that there is a skewed distribution with most debt renegotiations resulting in rather low SZ haircuts and very few with deeper debt relief. Figure 3 plots the distribution of haircuts for all 180 debt renegotiations included in the Cruces and Trebesch (2011) database. As can be seen there are two peaks with the largest at lower haircuts and a second minor peak at a deeper haircut level. Most of the debt negotiations with a low SZ haircut did not have any reduction in the principal of the debt. Indeed, dividing these renegotiations into those with and without face value haircuts, there are some 123 debt renegotiations without a face value haircut and just some 57 with a face value haircut.

If we filter the debt renegotiations taking out those that are donor funded (typically the HIPIC renegotiations) and those that are bank debt renegotiations then the distribution becomes smoother. Now taking this subset of bond renegotiations and considering again the two types (those with and those without face value haircuts), we find that the average haircut of the former is some 50 percent while the average haircut of the latter is some 15 percent. We will use these empirical haricut levels as a guide to parameterize the theoretical model to follow.

Figure 3 The distribution of haircuts

It is also of interest to consider the impact of these different types of debt renegotiations on debt ratios. In Figure 4, the time zero (t=0) is the year in which a debt renegotiation takes place and the lines represent the average debt ratio across countries. The three lines represent a) all countries with a debt renegotiaton, b) reprofilers and c) restructurers. As can be seen, the outcomes for reprofilers and restructurers is quite different with debt tending to rise for the former and falling for the latter. Debt here is public sector external debt or total external debt. It would be nice to do a similar graph for total public debt (external and domestic) and to include domestic debt renegotiations as well. The Cruces-Trebesch database excludes purely domestic debt renegotiations and it remains a challenge to find consistent, homogeneous data on total public sector debt for a wide range of countries going back in time. Still for this sample of countries that include virtually all cases of external debt renegotiations in recent history the differences between reprofilers and restructurers is quite striking.

Figure 4: The Impact of Debt Renegotiation on Debt Ratios

In the next section we develop a theoretical model incorporating the possibility of defaulting in different ways and the possibility of multiple debt renegotiations that may explain many of these empirical findings.

3 The model

3.1 The environment

Consider a small open economy inhabited by a government and a representative consumer. The representative consumer receives a stochastic stream of income, y, that follows a Markov process with transition density $f(y',y)$ over a compact set Y. The representative consumer is risk averse and only derives utility from consumption. She discounts futures payoffs using a discount factor β which reflects her subjective degree of temporal impatience.

The government maximizes the present expected utility flows of the representative consumer. Formally, it maximizes:

$$E_s \sum_{t=s}^{\infty} \beta^t u(c_t)$$

where $u(c)$ denotes the representative consumer's Bernoulli utility function and c_t is consumption at time t. The expectations operator E_s captures the fact that the government uses all available information at the current time period when taking any relevant decision. The resource constrain of the government is the following:

$$c = y + B - q(B',y)\,B'$$

Within the small open economy, the government is the only agent who has access to international credit markets. In each period, the government issues one-period discount bonds in order to smooth the representative agent's consumption path. We denote by B' the amount of debt that the government has issued in the current time period that promises a payment to bond holders of B' units of consumption in the following period. If $B' < 0$ the government is a debtor, otherwise it holds assets. $q(B',y)$ is the market price of the bond (function of the amount issued and the current income).

Sovereign bonds are assumed to be non-collateralized and defaultable, capturing the essential features of sovereign debt contracts. A sovereign default triggers an output loss for the country while in default and the exclusion from international credit markets but as we discuss below, the government may resolve the default in different ways.

The timing of events when the government is current on its payments is as follows. At the beginning of each period, the current aggregate endowment, y, is observed, and, given the amount of sovereign debt, B, the government decides whether to repay in full or one of the following alternatives:

- Debt reprofiling: a voluntary debt exchange with a small present value haircut. Creditors obtain, $\overline{\alpha}$ per unit of promised payment, where $0 < \overline{\alpha} < 1$

- Debt restructuring: an aggressive debt restructuring where creditors obtain $\underline{\alpha}$ per unit of promised payment, where $0 < \underline{\alpha} < \overline{\alpha}$

- Missed payments: in this case the government simply does not pay the debt coming due without reprofiling or restructuring the debt. It does not get rid of its debt, it just carries it over to the following period

Introducing these four alternatives is the main innovation in our model relative to the existing literature. We believe that giving the government these options captures in a much more realistic way the choices faced by governments.

The three non-repaying alternatives mentioned trigger an output loss. The output loss depends on the option chosen by the government. The aggregate endowment in the period of default is $\lambda^{\overline{\alpha}}(y)$ upon reprofiling, $\lambda^{\underline{\alpha}}(y)$ if the sovereign chooses to restructure aggresively and $\lambda^0(y)$ if it chooses to miss payments. We discuss the paramterization of these costs in the next section.

If the government repays or reprofiles its debt, it can access the market to borrow in the current period. If it restructures it has to make the payment in the current period, but it can only borrow the following one. Finally, it cannot access the market while it is in default (without reprofiling or restructuring its debts).

Consumption takes place in each period once all decisions have been taken. When the government repays its current debt, the representative consumer consumes the current aggregate output endowment y net of the expenditures derived from the repayment plus new debt issued.

Foreign lenders are risk neutral and have rational expectations. In addition to the sovereign bond, they have access to a risk-free asset that yields $r > 0$. While the small economy has access to international credit markets, they are willing to lend to the government as long as they break even in discounted expected value terms.

3.2 Value functions and recursive equilibrium

3.2.1 The government's problem

When the government is current on its payments, it has the option to repay, reprofile or to default on its current debt. Let $v(B,y)$ be the value of such an option for a goverment when the amount of debt outstanding is B and current output, y.

The value function $v(B,y)$ is given by:

$$v(B,y) = \max_{\{1,\overline{\alpha},\underline{\alpha},0\}} \left\{ v^1(B,y), v^{\overline{\alpha}}(B,y), v^{\underline{\alpha}}(B,y), v^0(B,y) \right\}$$

where $v^1(B,y)$ is the value for the government of repaying; $v^{\overline{\alpha}}(B,y)$ is the value for the government of reprofiling the debt; $v^{\underline{\alpha}}(B,y)$ is the value of restructuring the debt; and $v^0(B,y)$ is the value of defaulting and remaining in such state until next period.

If the government decides to repay or reprofile, it can choose the amount of debt to be issued, B'. Reprofiling involves a small haircut $(1-\overline{\alpha})$ and a small output loss $\lambda^{\overline{\alpha}}(y)$, the debt is repaid that same period and new debt can be issued to do so. Restructuring involves a larger, non-consensual haircut $(1-\underline{\alpha})$, but, as it is more complex in its implementation, requires the government to stay out of the market in the period in which it occurs. It also involves a larger output loss $\lambda^{\underline{\alpha}}(y)$. The last option that the government has is to remain in default and postpone any settlement to the future. In such a case the output loss in the period of default is given by $\lambda^0(y)$.

The value function of repaying, $v^1(B,y)$, is given by:

$$v^1(B,y) = \max_{B' \in \mathbf{B}} \left\{ u\left(y + B - q\left(B',y\right)B'\right) + \beta \int_Y v\left(B',y'\right) f\left(y',y\right) dy' \right\}$$

If the government reprofiles its debt, the value function is given by:

$$v^{\overline{\alpha}}(B,y) = \max_{B' \in \mathbf{B}} \left\{ u\left(\lambda^{\overline{\alpha}}(y) + \overline{\alpha}B - q\left(B',y\right)B'\right) + \beta \int_Y v\left(B',y'\right) f\left(y',y\right) dy' \right\}$$

If the sovereign defaults and restructures unilaterally, the value function is given by:

$$v^{\underline{\alpha}}(B,y) = \left\{ u\left(\lambda^{\underline{\alpha}}(y) + \underline{\alpha}B\right) + \beta \int_Y v\left(0,y'\right) f\left(y',y\right) dy' \right\}$$

If the goverment defaults and decides to stay in default without restructuring the value function is given by:

$$v^0(B,y) = \left\{ u\left(\lambda^0(y)\right) + \beta \int_Y v\left(B,y'\right) f\left(y',y\right) dy' \right\}$$

Finally, the penalty functions are defined as follows:

$$\lambda^i(y) = \theta_i \lambda_T(y) + (1-\theta_i)\lambda_L(y), \quad \text{for } i = \{\overline{\alpha}, \underline{\alpha}, 0\}$$

Where θ_i is a weighting parameter between a threshold penalty function (λ_T), à la Arellano, and a linear penalty function (λ_L) so that $\theta_i \in [0,1]$ and

$$\begin{aligned} \lambda_T(y) &= \begin{cases} y, & \text{if } y \leq \gamma_i \bar{y} \\ \gamma_i \bar{y}, & \text{if } y \geq \gamma_i \bar{y} \end{cases} \\ \lambda_L(y) &= \gamma_i y \end{aligned}$$

We define $\bar{y}$ as the trend income and $\underline{\alpha}$, $\overline{\alpha}$, γ_i, θ_i are exogenously given in our model.[4]

3.2.2 Foreign creditors' problem

Foreign creditors are risk neutral. They have a risk free asset as their outside option. The sovereign bond price function, $q(B',y)$, indicates the price of the bond B' issued in the current period, given the state (B',y). The sovereign bond price function, $q(B',y)$, then satisfies that:

$$\begin{aligned} q\left(B',y\right) = \tfrac{1}{1+r}\big[\big(1-\delta_{\overline{\alpha}}(B',y)-\delta_{\underline{\alpha}}(B',y)-\delta_0(B',y)\big)+\overline{\alpha}\cdot\delta_{\overline{\alpha}}(B',y)+\underline{\alpha}\cdot\delta_{\underline{\alpha}}(B',y)+ \\ q(B',y)\cdot\delta_0(B',y)\big] \end{aligned}$$

Where r is a constant risk-free international rate; $\delta_{\overline{\alpha}}$ is the probability of *reprofile*; $\delta_{\underline{\alpha}}$ is the probability of *restructure*; and δ_0 is the probability of *missed payment*. We end this section by stating the equilibrium definition in our model:

Definition 1. *A recursive equilibrium in this model is a set of policy functions for (i) household consumption $c(B,y)$; (ii) government asset holdings $B'(B,y)$; (iii) decision sets for each state (B,y) in repayment, reprofile, restructure and missed payment; and (iv) the pricing function $q(B',y)$ such that:*

1. *Given the government policies, household consumption satisfy the resource constrain.*
2. *Given the bond price function $q(B',y)$, the government asset holding function $B'(B,y)$ and the decision sets satisfy the country's optimization problem.*
3. *The sovereign bond price function $q(B',y)$ reflects the government's default probability as well as the expected recovery rate repayments, and satisfies the foreign lenders' break-even condition.*

[4] We calibrate these parameters using data on actual debt restructurings.

4 Numerical Results

In order to solve the model numerically we must first parametrize it. Table 3 summarizes our benchmark parametrization. The discount factor is assumed to be 0.95 which is a standard assumption in the literature. Drawing on the empirical analysis in the second section of the paper above we assume that the haircut of a reprofiling is 15 percent and that of a restructuring is 50 percent. The more controversial parameters in these models are perhaps the penalties in case of default. And in our case there are three types of credit events a) missed payments b) a reprofiling (with a low haircut) and c) a restructuring (with a deeper haircut). Sandleris (2011) provides a detailed discussion of the potential costs of default and drawing on this discussion we posit that the costs of reprofling are significant but relatively low, as this is likely a more consensual process between the borrower and creditors. We also assume that the cost of missing a pyament is relatively lower than that of restructuring as upon missing a payment uncertainty remains upon whether the government will end up reprofiling of restructuring. We assume for the benchmark parameters that the output costs of missing a payment and reprofiling are 3 percent of GDP. However, the cost of a restructuring which involves a deeper haircut and may then be less consensual in nature is assumed to be much higher, in the benchmark we assume this to be 9 percent of GDP.

Table 3: Parametrization of the Model

There is considerable uncertainty regarding the right form of the penalty funcions. So, we follow Arellano (2008) that assumes a non-linear structure such that above a reference level of GDP, costs increase 100 percent with GDP but that below that level the cost is the assumed fraction of GDP, but we combine it with a linear structure using a a weighting parameter between the linear and the non-linear functions which in the benchmark we set at 0.5. The parametrization of the income process follows exactly that of Arellano (2008).

Given this parametrization we are able to solve the model numerically. Figure 3 below depicts the grid in terms of allowable income and asset levels (where negative assets represents debt) and illustrates which option the country would choose between the four alternatives (repaying, reprofiling, restructuring or missed payment) at each income, debt node. As can be seen, the benchmark parameters result in the possibility of each of the four options being chosen and the set of income and debt levels for each choice are well-behaved. For the benchmark parameters we find that for high income and low debt combinations the country would prefer to repay in full, for intermediate income and debt levels the country may reprofile, as income falls or debt rises the country may wish to restructure and the country would miss payments on debt for the lowest income and highest debt combinations. The model is also consistent with standard business cycle facts in emerging markets.

Figure 5: Optimal decisions given the country's income and debt levels

The bond price also reflects the country's income and debt levels at each point in the node. Figure 4 shows the bond price on the vertical axis with the country's debt on the horizontal axis for different levels of income - each colored line represents a different income level. As the income level falls the bond price is lowered - as one of the default choices becomes more likely. And as debt increases (moving to the left in the figure) the bond price also declines as reprofiling and then restructuring and then missed payments becomes more likely, each reducing further the expected payoff to creditors.

Figure 6: The bond pricing function for different income levels

We then simulated the model choosing a set of initial values and then running the model for 10,000 periods. Consistently with the empirical evidende regarding multiple debt re-renegotiations, we find instances of a reprofiling followed in a relatively short period of time by a second reprofiling. Figure 5 illustrates cases of second reprofilings in this simulation of 2,500 years that occur within just 6 years of each other. There is one case of a reprofiling in the same year (year 1), 2 cases within 2 years and 6 cases within 3 years etc.

Figure 5: Re-reprofilings within a 2,500 year simulation of the model

Considering the 2,500 years of the simulation, there are also periods where there are multiple reprofilings. An extract of the simulation is illustrated in figure 6. In this extract some 5 reprofilings take place.

Figure 6: An extract of the model simulation

Naturally, alternative parameterization of the model would give different results. Indeed, given our model is quite general in allowing for four different states (repayment, reprofiling, restructuring and missed payments) varying the default cost parameters can generate different results in terms of the frequency of reprofiling, restructuring and multiple events. We do not wish to push here any particular set of parameters and we do not feel it is particularly useful to show that with some specific parametrization, the model might match a specific country-case. Rather, we would suggest that a more general model of the type we have proposed may be needed to capture the rich heterogeneity and multiple debt renegotiations that we actually witness in practice.

As an example of an alternative parametrization we present further results in Table A2 in the Appendix. In this case we reduce the cost of restructuring to 7.5 percent of GDP from 9 percent of GDP in the example above. This changes the optimal decisions of the country increasing the area in the grid where restructuring would be chosen over say reprofoling. Note that this also

changes other decisions such as the optimal level of debt issuance and the bond pricing function - also illustrated in table A2. In the simulation of the model with these parameters this increases the number of restructurings found and reduces the number of reprofiling - also detailed in table A2.

We conducted other simulations not reported here and in a similar fashion find that the results can change quite significantly for different parameter values. This also suggests that relatively small changes in the international financial architecture that may alter the parameters, for example, the costs of reprofiling or restructuring, may have quite significant impacts on how countries will default in the future. We aim to investigate this more fully in later iterations of the paper discus such developments in a more qualitative way in the next and concluding section.

5 Conclusion and policy discussion

This paper focuses on two novel empirical facts related to sovereign debt renegotiations. First, countries default in different ways and while most debt renegotiations are with low haircuts (and many with no principal reduction), deeper present value haircuts with principal reduction are quite rare. And secondly that instances of multiple debt renegotiations, especially when the haircut of an initial renegotiation is low, are relatively common.

Despite these empirical facts most theoretical models for sovereign debt renegotiation consider only a single way for countries to default and ignore the possibility of multiple renegotiations entirely. Our aim in this paper was then to build a model that was capable of explaining these regularities that are in the data.A key ingredient of the model is that defaulting through a reprofiling (with only a limited present value haircut) is less costly than a renegotiation with a deeper haircut.

Our hypothesis is that these empirical facts are not independent of the system for renegotiating debt that has prevailed to date. In particular, the fact that it has been very easy to get a judgment against a borrower in the case of a default has likely pushed borrowers to accept lower haircuts in an initial renegotiation to find a consensual solution and to avoid any protracted legal difficulties - despite the fact that sovereigns have been protected in the sense that it has been hard for creditors to seize assets.

A broader question is whether this system has worked well or not. Our suspicion is not, at least for unfortunate countries that may be faced with the prospect of default. Given uncertainty regarding country fundamentals creditors may be loathe to give away too much. It is surely better for creditors to push a low haircut (and some creditors prefer a zero reduction in principal for accounting reasons) and then if a second renegotiation is needed so be it. If the costs of the alternatives (say a deeper restructuring) are large then countries will play along. However, this approach tends to be keep the debt on the books and may deter much needed investment and hence lower economic growth, reducing the size of the cake. While these impacts go beyond the modeling in this paper, an implication of our set up may be that countries that renegotiate debt

must either pay the assumed higher cost of a deeper haircut restructuring or face the relatively high probability of a multiple reprofiling with the associated cumulative costs. An interesting question we plan to investigate in the future is whether this situation is ex ante efficient.

At the same time, the international financial architecture has been changing given recent experience with debt renegotiation. As a result of the Argentina case, the New York courts have now provided a new definition of the so-called pari passu clause that surprised many analysts. While the implications of this new interpretation remain somewhat unclear, if it is confirmed that this precedent will be applied in other cases, then sovereigns may be significantly less protected. In other words the courts may have found ways to enforce payment that were not considered viable before. On the other hand, there has also been evolution in contracts and in particular the development of new Collective Action Clauses that have already been adopted in some sovereign bond contracts. Arguably these new CACs make sovereigns significantly less vulnerable to creditors obtaining a judgment against them. It may then not be an exaggeration to say that sovereigns in the future may be, "less vulnerable but also less protected".

We also then plan in future research to employ the model developed here (or variations thereof) to consider how changes in default costs that may be implied by such changes in the international financial architecture may alter the ways in which countries will default in the future.

Figure 1. Incidence of Multiple Debt Renegotiation

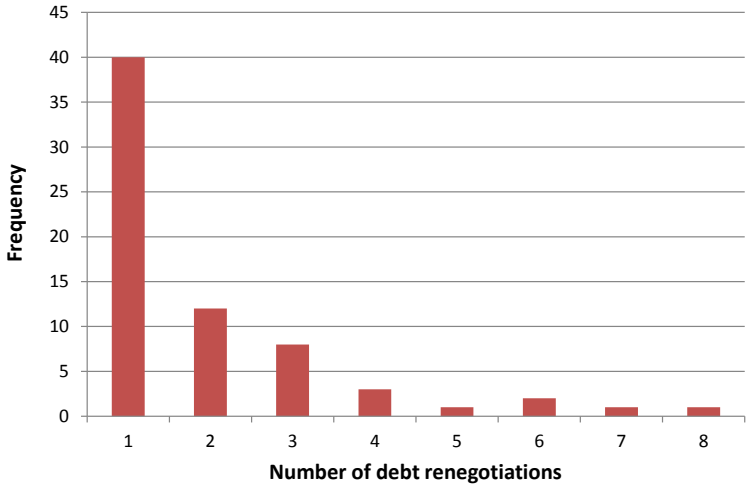
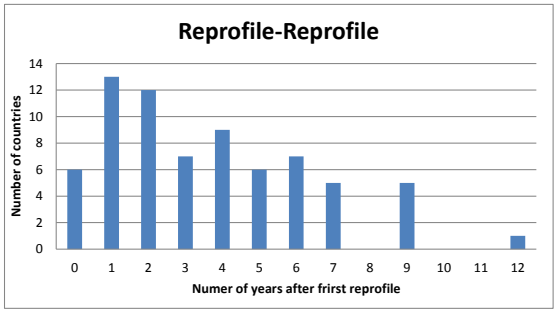
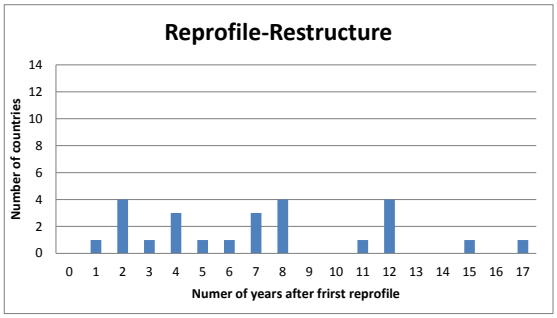


Figure 2. Multiple Renegotiations





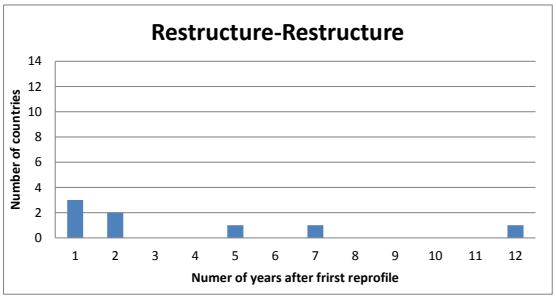


Figure 3. Distribution of Haircuts

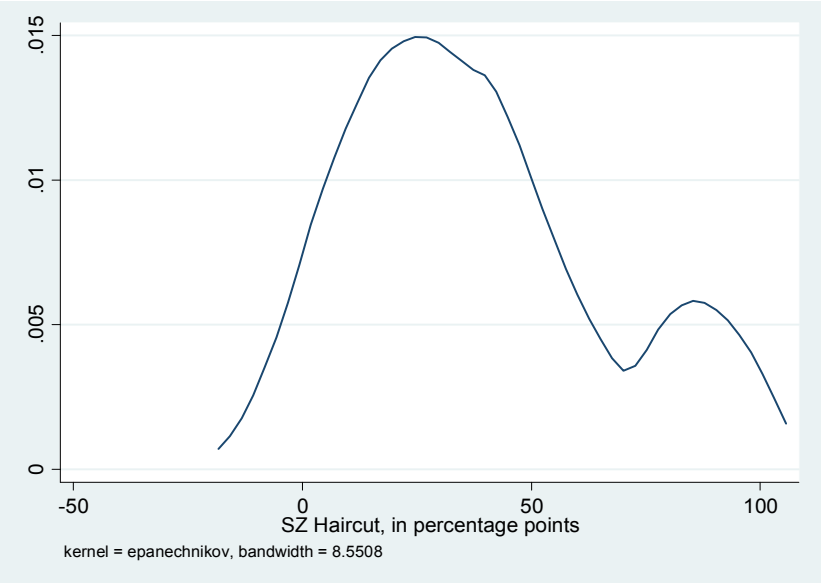


Figure 4. Impact on Debt

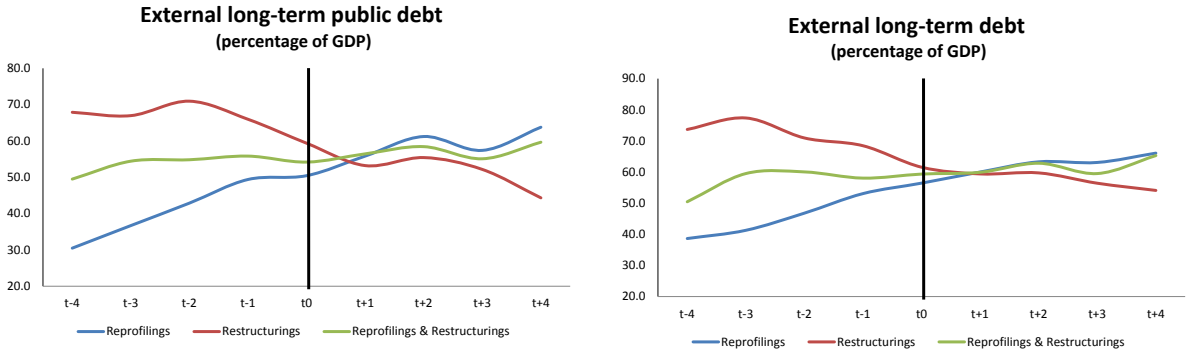


Figure 5. Optimal decisions given country's income and debt levels

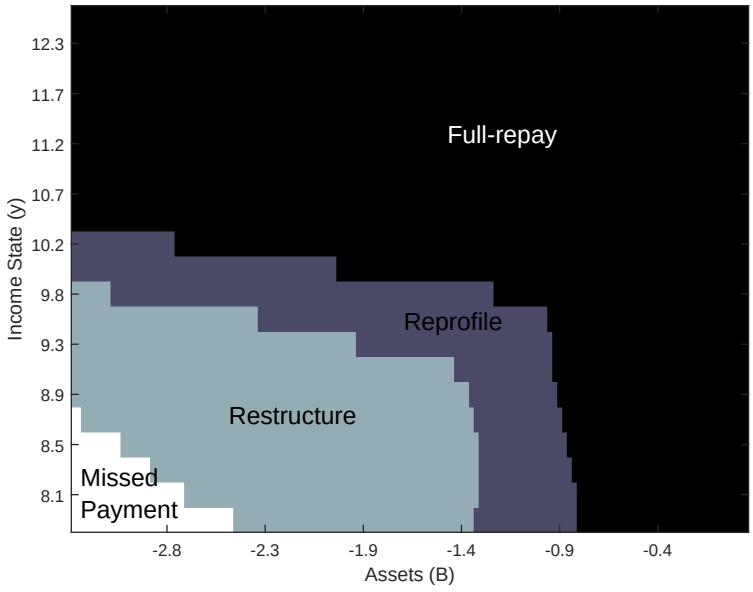


Figure 6. The bond pricing function for different income levels

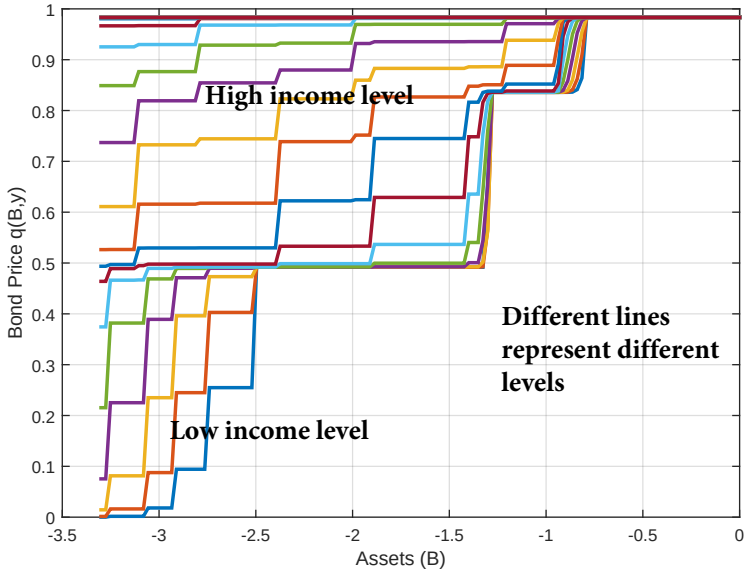


Figure 7. Re-Reprofilings within a 2,500 year simulation of the model

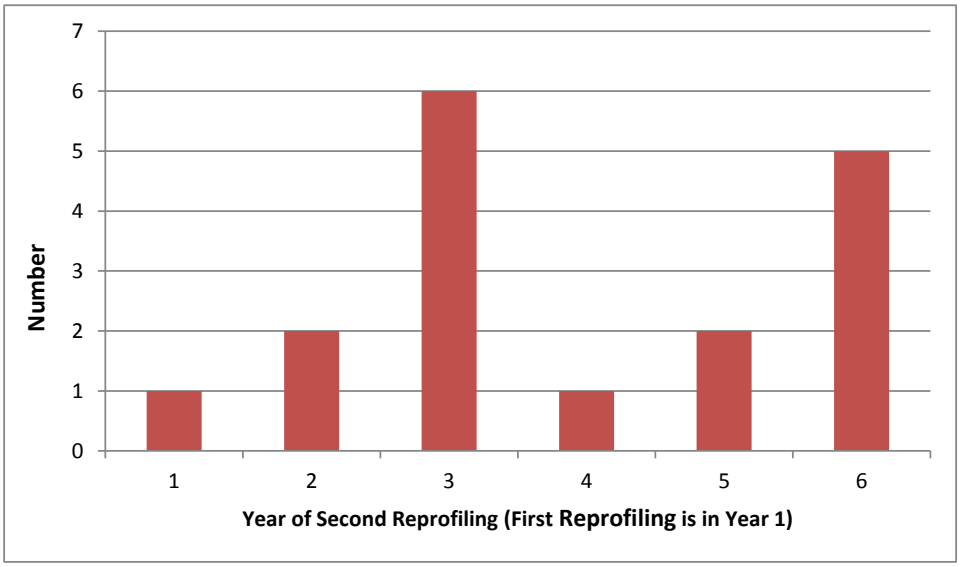


Figure 8. An extract of the model simulation

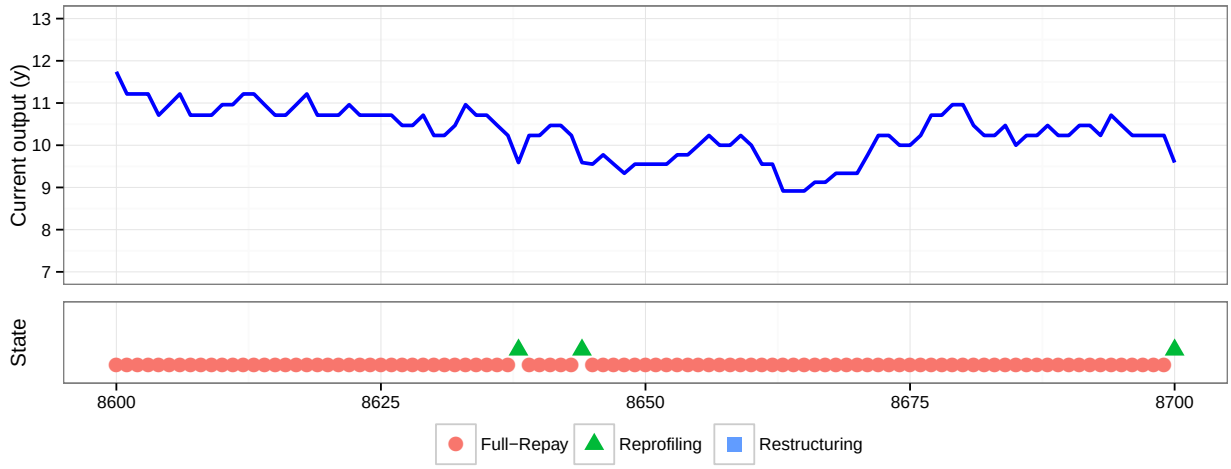


Table 1: Statistics on Multiple Debt Renegotiations				
Debt Renegotiation Number	**Mean If Not Final**	**Mean If Final**	**Median Haircut**	**No of Observations**
First	25.6	49.8	34.3	70
Second	18.1	52.2	23.5	27
Third	24.8	43.0	32.1	16
Fourth	33.6	33.8	37.5	7

Table 2: Conditional Probability of there being a Second Debt Renegotiation	
Haircut of first debt renegotiation smaller than average	**Haircut of first debt renegotiation greater than average**
50%	21%

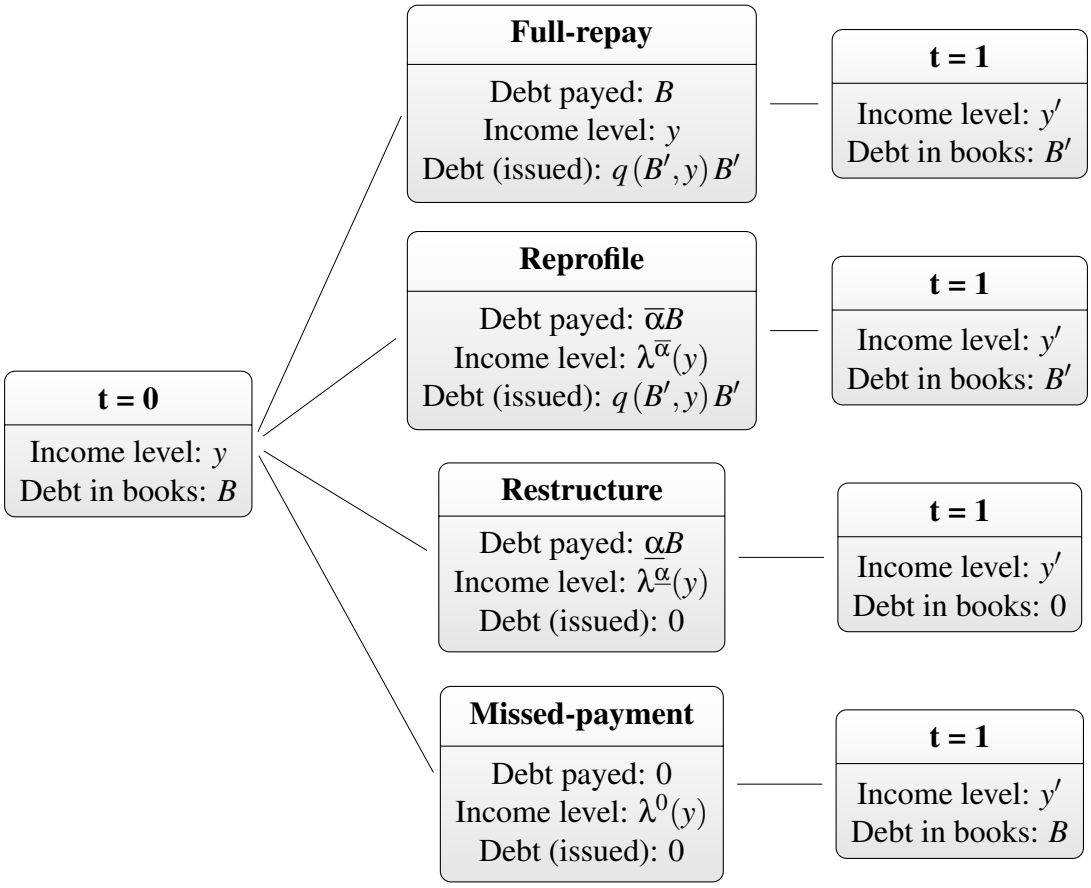
Table 3: Parametrization of the Model		
Risk-free interest rate	r = 1.7%	*US 5-year bond quarterly yield*
Risk aversion	$\sigma = 2$	
Average income level	y = 10	*Arellano (2008)*
Stochastic structure of income	$\rho = 0.945$, $\eta = 0.025$	*Arellano (2008)*
Discount factor	$\beta = 0.953$	*Arellano (2008)*
Haircut for Reprofiling	$(1-\alpha_U) = 15\%$	
Haircut for Restructuring	$(1-\alpha_L) = 50\%$	
Income cost parameters		
Reprofiling	$(1 - \gamma_U) = 3\%$	
Restructuring	$(1 - \gamma_L) = 9\%$	
Missed payment	$(1 - \gamma_0) = 3\%$	
Weight on non-linear costs	$\theta_i = 0.5$	

Table A1: List of Defaults and Final Debt Renegotiations

Case	Country	Start Year of Default	Year of Final Debt Renegotiation
1	Albania	1991	1995
2	Algeria	1991	1996
3	Argentina	1982	1993
4	Argentina	2001	2005
5	Belize	2006	2007
6	Bolivia	1980	1993
7	Bosnia and Herzegovina	1992	1997
8	Brazil	1983	1994
9	Bulgaria	1990	1994
10	Cameroon	1985	2003
11	Chile	1983	1990
12	Congo, Rep.	1983	2007
13	Costa Rica	1981	1990
14	Cote d'Ivoire	1983	1998
15	Croatia	1992	1996
16	Dominica	2003	2004
17	Dominican Republic	1982	1994
18	Dominican Republic	2005	2005
19	Ecuador	1982	1995
20	Ecuador	1999	2000
21	Ecuador	2008	2009
22	Gabon	1986	1994
23	Grenada	2004	2005
24	Guinea	1986	1988
25	Guinea	1991	1998
26	Iraq	1987	2006
27	Jordan	1989	1993
28	Macedonia, FYR	1992	1997
29	Malawi	1982	1983
30	Malawi	1988	1988
31	Mauritania	1992	1996
32	Mexico	1982	1990
33	Moldova	2002	2002
34	Morocco	1986	1990
35	Mozambique	1983	1991
36	Niger	1983	1991
37	Nigeria	1982	1991

38	Pakistan	1998	1999
39	Panama	1983	1996
40	Paraguay	1986	1993
41	Peru	1976	1980
42	Peru	1983	1997
43	Philippines	1983	1992
44	Poland	1981	1994
45	Romania	1981	1983
46	Romania	1986	1986
47	Russian Federation	1991	2000
48	Sao Tome and Principe	1987	1994
49	Senegal	1981	1985
50	Senegal	1990	1996
51	Serbia	1992	2004
52	Sierra Leone	1983	1995
53	Slovenia	1992	1995
54	South Africa	1985	1989
55	South Africa	1993	1993
56	Tanzania	1984	2004
57	Togo	1988	1988
58	Togo	1991	1997
59	Trinidad and Tobago	1988	1989
60	Turkey	1978	1979
61	Turkey	1982	1982
62	Uganda	1980	1993
63	Ukraine	1998	2000
64	Uruguay	1983	1988
65	Uruguay	1990	1991
66	Uruguay	2003	2003
67	Venezuela, RB	1983	1990
68	Vietnam	1985	1997
69	Yemen, Rep.	1985	2001
70	Zambia	1983	1994

Time Scheme


t = 0
Income level: y
Debt in books: B
Full-repay
Debt payed: B
Income level: y
Debt (issued): $q(B',y)B'$
Reprofile
Debt payed: $\overline{\alpha}B$
Income level: $\lambda^{\overline{\alpha}}(y)$
Debt (issued): $q(B',y)B'$
Restructure
Debt payed: $\underline{\alpha}B$
Income level: $\lambda^{\underline{\alpha}}(y)$
Debt (issued): 0
Missed-payment
Debt payed: 0
Income level: $\lambda^{0}(y)$
Debt (issued): 0
t = 1
Income level: y'
Debt in books: B'
t = 1
Income level: y'
Debt in books: B'
t = 1
Income level: y'
Debt in books: 0
t = 1
Income level: y'
Debt in books: B