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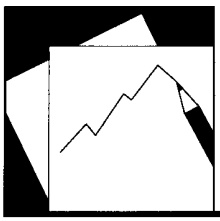

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The Problem that Wasn't: Coordination Failures in Sovereign Debt Restructurings

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Abstract

Contrary to widespread expectation, debt renegotiations in the era of bond finance have generally been quick and involved little litigation. We present a model that rationalizes the initial fears and offers interpretations for why they did not materialize. When the exchange offer is sufficiently attractive vis-à-vis holding out, full participation can be an equilibrium. Legal innovations such as minimum participation thresholds and defensive exit consents helped coordinate creditors and avoid litigation. Unlike CACs, exit consents can be exploited to force high haircuts on creditors, but the ability of creditors to coordinate to block exit consents can limit overly aggressive use.

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Contents

I. INTRODUCTION

This paper addresses a puzzle in the history of sovereign debt crises. After bonds replaced bank loans as the main sovereign debt instrument of Emerging Market countries in the early 1990s, there was a widespread expectation that debt renegotiation would become far more difficult compared to the bank-led process of preceding decades. Surprisingly, that has not been the case. When a number of emerging market issuers lost access to capital markets in the late 1990s and 2000s and were forced to restructure their debts, these restructurings were for the most part undertaken relatively quickly, and with high creditor participation (above 90 percent, except for Argentina's 2005 external debt exchange).

The purpose of this paper is two-fold. First, using a simple debt renegotiation model, we ask whether, and under which conditions, it is possible to rationalize the initial fear that the presence of many uncoordinated creditors would make debt renegotiations intractable. Specifically, we give a formal interpretation to two types of collective actions problems that have been extensively discussed in the literature, namely, the holdout problem and what we call pure coordination failures. The "holdout problem" (see, for example, Sturzenegger and Zettelmeyer, 2007, Chapter 3), is interpreted as a situation in which there is a unique low participation equilibrium (or possibly multiple equilibria that all involve low participation). Pure coordination failures, in contrast, are cases in which no participation (or low participation) in the exchange is an equilibrium, but an equilibrium with high participation also exists. The problem is then how to coordinate on this "good" equilibrium.

Second, we explore the extent to which these collective action problems can be overcome without requiring either new institutions or changes in bond contracts. In particular, we study two mechanisms that have been observed in the recent exchanges: minimum participation thresholds, which condition the exchange to a critical level of creditor participation, and defensive "exit consents" or "exit amendments", which refer to changes in the non-payment terms of the bonds, such as cross-default, listing, and acceleration clauses, which can typically be undertaken with a simple majority of bondholders. These changes destroy value by impairing the liquidity and litigation prospects associated with a particular bond, and hence make it less attractive for creditors to hold out.

We show that minimum participation thresholds function as a coordination device, removing the low participation equilibrium from the game in which both high participation and low participation equilibria exist. In contrast, exit consents are interpreted as changing the payoffs in ways that make litigation unattractive. As a result, with both minimum participation thresholds and exit consents, high participation can become a unique equilibrium in the modified game even when the game previously had a unique low participation equilibrium. These results are fairly robust, in the sense that in virtually any setting where the only reason for not participating is a coordination failure, a minimum participation threshold will coordinate creditors in the good equilibrium. Similarly, in virtually any setting where exit consents are sufficiently destructive of litigation prospects, high participation becomes achievable.

Based on these results, the generally positive experience with debt exchanges since the late 1990s is interpreted as follows. First, our model suggests that collective action problems, although a possibility, are not inevitable (even in the absence of minimum participation thresholds and exit consents). In particular, if either the haircut offered is sufficiently low for a given probability that holdouts will be successful or vice versa, full participation will be an equilibrium. This explains why the presence of a minimum participation threshold alone may be enough to deal with the collective action problem. Exit consents are needed only in response to "holdout problems" that arise when the exchange offer is low and/or the probability of holding out successfully is sufficiently high.

The central prediction of the model is that a debt exchange should be expected to "fail" only in two types of situations (i) there are no participation thresholds, which means that the full participation equilibrium might not get picked even if it exists; or (ii) when the offer implies a high haircut and there are no exit consents, which makes holding out a comparatively attractive option. The only debt exchange offer during the 1998-2010 period to be rejected by many creditors, Argentina (2005), arguably combined all of these features: no participation threshold; no exit consents; and a haircut that was high compared to most other exchanges during the period. However, the model would also predict failure of an exchange offer which involves a low haircut (by historical comparison) if the likelihood that a single investors will be able to recover in full is sufficiently high. "Voluntary" exchange offers, in which the government promises to honour its obligations to holdouts would always fail in our model, unless they involve a zero haircut.

It is important to stress that while exit consents do improve the debtor country's bargaining position, there are limits to how aggressively they can be pursued. If the country uses them to seek too aggressive a haircut, it will give small creditors an incentive to coordinate and bargain as a large creditor, since a 50 percent stake in any bond series can block the exit consents. Moreover, to the extent that in practice a country's debt involves several bond series, even a relatively small creditor may be able to take a controlling stake in a particular series and block the exit consents. We show that these practical problems can revert the bargaining back to the original setting holding out can be attractive.

Finally, we compare the debt renegotiation process under exit consents and minimum participation thresholds, with the process under Collective Action Clauses (CACs). We show that CACs can also achieve full participation. Unlike exit consents, CACs cannot sustain a haircut that makes creditors collectively worse-off. CACs are a stronger coordination tool than exit consents that have a modest litigation-impairement effect, but a weaker tool than exit consents that are strongly destructive of litigation prospects. However, that extra strength will only matter if the country is trying to coerce creditors into accepting a haircut that is higher than the one required to restore solvency.

This paper relates to a rapidly growing theoretical and empirical literature on the outcomes of sovereign debt restructurings and the role of institutions and legal frameworks in shaping these outcomes. Key contributions on the theoretical side include Kletzer (2003),

Eichengreen, Kletzer, and Mody (2003), Haldane et al. (2005), Jeanne (2004), Bolton and Jeanne (2007), Bi (2008), Lanau (2008), Jeanne (2009), Engelen and Lambsdorff (2009), Benjamin and Wright (2009) and Pitchford and Wright (2011); and on the empirical side, Sturzenegger and Zettelmeyer (2008), Enderlein, Trebesch and von Daniels (2010), Trebesch (2010) and Cruces and Trebesch (2011).

Pitchford and Wright (2011) study the holdout problem in sovereign debt restructuring using a dynamic bargaining model involving one debtor and multiple creditors. In contrast, the present paper considers a much simpler static model, and as such does not model delay. Instead, it focuses on the "success" or "failure" of exchange offers, which are identified with full or low participation. We analyze the collective action problems that can arise, focusing on the potential role for minimum participation thresholds and exit consents, the two legal and institutional features most commonly used in actual sovereign debt restructurings since the late 1990s. Engelen and Lambsdorff (2009) also model the effects of exit consents and CACs in debt renegotiation in a static setting. In their model, creditors as a whole are always better-off rejecting the offer, and holdouts do not affect the payoff of participants. In contrast, in our model holdouts adversely affect participants (as is the case in practice), and widespread rejection of an offer can actually make creditors worse-off depending on how the haircut offered compares with the country's ability to repay. Moreover, we also endogenize the haircut offered by the country, as well as how the use of exit consents and minimum participation thresholds affects that choice of haircut.

II. Experiences With Sovereign Bond Restructurings, 1998-2010

As the new era of bond finance to emerging markets began to unfold in the early 1990s, and particularly after the 1994-95 Mexican crisis, there were widespread fears that collective action problems would make future debt crises more difficult to resolve, even compared to the long and difficult crisis of the 1980s. Several developments motivated and seemed to justify this expectation.

First, collective action problems had been an issue even during the 1980s negotiations, despite of the fact that creditors were relatively well organized and coordinated during this period. This was due to the fact that debt reschedulings agreed in the early 1980s typically required unanimity for a change in payment terms. This created problems in subsequent renegotiations, as initial acceptance typically fell short of unanimity (Buchheit, 1991, 1998). In light of this experience, renegotiation of New York law bonds was expected to be extremely difficult, since these bonds also required unanimity for changes in payment terms but typically involved a much larger, more dispersed and less coordinated group of creditors compared to the bank loans of the 1980s.

Second, a series of high profile litigation cases had demonstrated the potential power of holdout creditors (see Sturzenegger and Zettelmeyer, 2007, Chapter 3, for details). While such cases were very rare in the 1980s, they became more common in the 1990s, as defaulted debt began to be traded in secondary market, and "distressed debt funds" began to buy such

debt in order to litigate and ultimately settle with the sovereign. In a famous 1996 case, CIBC Bank and Trust Co. v. Banco Central do Brasil, a holdout creditor managed to extract almost full repayment on a fairly large claim (about $1.3bn), a much better deal than the creditors that had negotiated and agreed to the 1994 Brady agreement with Brazil's. If holdouts could achieve such deals, more creditors may consider holding out. And even if holding out and litigating require specific skills or a specific business model, and hence was not attractive to mainstream creditors, the presence of holdouts can still weaken or interfere with the debtor's debt servicing capacity, and hence complicate negotiations between mainstream creditors and debtors.

Finally, the experience of the 1994-95 Mexican crisis seemed to demonstrate the disruptive power of collective action problems associated with dispersed sovereign debt first hand, even though these problems occurred not in the context of a restructuring negotiation, but in the form of a flight from short term debt that became the trigger of a currency and banking crisis. If lack of creditor coordination could trigger a crisis, then coordination could also reasonably be expected to be an issue in the aftermath of a crisis that required a debt restructuring (as opposed to just liquidity that might be provided by an official lender such as the IMF).

The consequence of these fears was a large number of policy proposals to reform the "international financial architecture" in order to deal with creditor coordination problems in general, and specifically in the context of debt restructuring negotiations (see Rogoff and Zettelmeyer, 2002, for a survey). Broadly, they can be divided into two sets. First, proposals to create a bankruptcy court-type institution at the international level which would oversee debt restructuring negotiations and declare agreements between the debtor and creditors to be legally binding for all creditors, including holdouts (Sachs, 1995; IMF, 1995; Chun, 1996; Schwarcz, 2000; Krueger, 2001; IMF, 2002; Hagan, 2005). Second, proposals to change bond contracts–and, possibly, national laws–to encourage collective representation of bond holders, again, with the objective that changes in payment terms agreed to by a qualified majority of creditors (or at least of the holders of a particular bond) would become binding for all bondholders (Eichengreen and Portes, 1995; Macmillan, 1995; G-10, 1996; Eichengreen, 2000; Taylor, 2002).

In the event, none of these proposals were realized in time for the next generation (1998-2005) of large debt crises. The idea of creating an "International Bankruptcy Agency" was discussed at the June 1995 G-7 summit in Halifax, but not pursued further until IMF First Deputy Managing Director Anne Krueger revived it in a speech in 2001. A period of frantic paper-writing and discussions both within the IMF and in the public ensued, but the proposal was ultimately shelved after the 2003 IMF Spring Meetings, when it became clear that the United States would not support it. The idea of improving creditor representation through changes in bond contracts had a bit more success, arguably because it was viewed by creditors and some debtor countries as a more market-friendly and hence preferable alternative to an international bankruptcy regime. After being ignored by emerging market issuers for many years, majority restructuring clauses began to be incorporated in New York law bonds in the

first half of 2003, beginning with a Mexican international bond issue, and followed by similar issues by Brazil, South Africa, Korea, and other countries (IMF, 2003c). [1]

Hence, as several large emerging market issuers began to default or experience debt servicing problems in the late 1990s (Russia, Ukraine, Pakistan, Ecuador, and eventually Argentina), debt market participants faced a series of potentially daunting restructuring challenges without the benefit of virtually any of the institutional improvements that the literature and official policy community had been urging for years. Amazingly, however, with only one exception (Argentina's external debt restructuring, completed in 2005) all major bond restructurings in the last decade achieved very high levels of creditor participation (over 90 percent) and did not laed to significant litigation (Panizza, Sturzenegger and Zettelmeyer, 2009).[2,3] In addition, they were completed relatively quickly (with an average delay of only 13 months, against 31 months during the era of bank debt restructurings, Trebesch, 2010), and on average were no more "coercive" than the earlier restructurings (Cruces and Trebesch, 2010; Enderlein, Trebesch and von Daniels, 2010).[4]

What happened? The model developed in the next section allows two interpretations:

First, even with uncoordinated atomistic creditors and the possibility of successful holdout litigation, countries may still achieve a successful debt exchange by making the exchange offer sufficiently attractive to discourage litigation.

Second, debt exchange offers were accompanied by institutional and legal mechanisms designed to discourage litigation and mitigate possible coordination failures. Most offers were conditional on sufficiently high creditor participation through "minimum participation thresholds", which automatically canceled the offer if the specified threshold was not met. This eliminated pure coordination failures, that is, the potential failure of individual creditors to accept the exchange offer for fear that they would be alone in doing so. In addition, a few exchanges (Ecuador, 2000; Uruguay, 2003; and Dominican Republic, 2006) used exit consents, which made the old bonds harder to trade and removed legal protections (Buchheit,

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[1]Majority restructuring clauses and similar collective action clauses had traditionally been incorporated in bonds issued under U.K. law. However, with only one exception (Ukraine's 2000 restructuring) these clauses played no role in the major 1998-2010 restructurings.

[2]Namely, Ukraine (1998-2000), Pakistan (1999), Russia (1999, 2000), Ecuador (2000), Argentina's "Phase 1" restructuring (2001), Uruguay (2003), Dominican Republic (2005), Belize (2006), Seychelles (2008) and Jamaica (2010).

[3]In 2010, Argentina offered to restructure the debt held by holdouts from its 2005 bond exchange. That offer was accepted by 66 percent of the holdouts, bringing total creditor participation (from the combined 2005 and 2010 restructurings) to 93 percent.

[4]In late 2008 Ecuador suspended payments on its 2012 and 2030 Global bond issues, which the administration claimed were illegitimate. The price of the bonds collapsed, and Ecuador offered to buy back the debt paying cash (rather than going through a bond exchange). At that time, risk aversion was very high, and liquidity scarce in global financial markets, so over 90 percent of bondholders agreed to sell. Ecuador bought back the debt for about 35 cents on the dollar (which was high enough to deter most "vulture funds").

2000; Buchheit and Gulati, 2000; IMF, 2003b,c). [5] In the case of Ecuador, exit consents removed a prohibition on the further restructuring of Brady bonds tendered at the exchange, cross-default clauses (which define default on other instruments as an event triggering acceleration on the present instrument), negative pledge clauses (which limits debt dilution by prohibiting the issuance of collateralized debt without consent of incumbent debt holders) and the requirement to list the bonds at a major stock exchange. In the cases of Uruguay and the Dominican Republic, cross-default, cross-acceleration, and listing requirements clauses were also removed, and the sovereign immunity waiver was amended in a way that protected payments on new bonds issued by these countries from attachment by holders of the old bonds. We argue below that these changes can be interpreted as changing the payoffs of incumbent bond holders in a way that makes litigation unattractive. In our model, this removes the incentive to hold out, and hence any remaining collective action problem.

To summarize, the fact that most debt exchanges since the late 1990s have gone smoothly could indicate either that the coordination problem was overstated to begin with–in the sense that it was in the power of a debtor country to avoid it, by making a reasonable exchange offer–or it could reflect successful legal design.[6]

The model presented in the next section is consistent with both of these views.

III. Model

A. Baseline Set-Up

Consider the problem of a country that has defaulted or is about to default on its debt, and is offering creditors new bonds in exchange for the defaulted ones. If creditors act collectively as a single entity, then this problem can be solved as a standard bargaining game, with the outcome depending on the particular bargaining solution used (e.g. Nash, Rubinstein or other bargaining solutions). However, if creditors do not act collectively, the problem becomes far more complex, creating scope for holdout and coordination problems. We abstract from the bargaining game between creditors and debtors in order to focus on the collective action problems among creditors. We illustrate these problems in a simple static set-up in which a

[5]Exit consents have been common in U.S.corporate debt restructurings. Daniels and Ramirez (2007) show that exit consents were used in over 50 percent of bond exchange offers during 1986-1997, with use being associated with variables that proxy for holdout problems. While exit consents were used in Brady exchanges to remove negative pledge clauses and standardize debt contract, they were not used strategically in the sovereign context prior to Ecuador's 2000 exchange.

[6]Of course, there are additional factors that may have contributed to differences in the speed of settlements relative to the 1980s. For example, accounting conventions gave incentives for banks to delay recognizing losses on sovereign loans in the 1980s (whereas such concerns did not affect bonded debt). Trebesch (2010) argues that political instability and government behavior are important factors in explaining restructuring delays. Benjamin and Wright (2009) argue that creditor bargaining power increase in the 1990s a result of legal successes by holdouts in the context of the Brady restructurings. According to their model, this leads to shorter delays and lower haircuts. This is consistent with our model (see Figure 2 below) in which a high probability p of litigation success leads to a lower proposed haircut by the debtor country.

homogeneous group of creditors face the choice of accepting or rejecting an offer. A richer setting could distinguish between creditors that are litigation-prone (e.g. "vulture funds" that have a comparative advantage to litigate) from those that are not. Most observers perceive the majority of creditors to have limited interest in litigation, but they may still reject an offer in the hope that a more generous settlement can be achieved, or indeed that the government may decide to repay them in full. While creditors are homogeneous in our model, their behavior can span the entire range of how prone to holding out they are by varying the parameters related to the probability of success. The value of the offer is initially taken as given; later, we show how the outcome of the game is affected if we allow the offer to be set optimally by the debtor country ahead of the creditor coordination game.

Each creditor holds a bond with face-value 1, but the country is able to repay them at most $1 - \underline{h}$, where $\underline{h} < 1$ denotes the minimum haircut that needs to be imposed on average given the country's available resources. The country offers creditors $1 - h$, where $h > \underline{h}$ is the haircut.

Creditors can accept the offer ("participate") or reject it ("hold out"). Denote the share of participating creditors by s. We assume that there is a minimum share of creditor participation, denoted $s_{\min}$ which is necessary for the offer to succeed in the sense of restoring capital market access to the debtor country (this may be, for example, because a sufficiently large group of holdouts are capable of blocking new debt issues of the debtor). If the exchange fails in the sense that $s < s_{\min}$, a "disorderly restructuring" is assumed to take place, in which the country incurs the maximum loss $1 - \underline{h}$ but creditors are only able to extract $\delta(1 - \underline{h})$, which is divided pari passu, and where δ¡1. The term δ captures the inefficiency associated with the disorderly restructuring. There are several ways to motivate these deadweight losses: for example, actual litigation costs following the breakdown of an exchange offer, or lower debt service capacity of the debtor stemming from limited access to credit markets and other economic costs of defaults(e.g. for the private sector in the debtor country). For simplicity, we will consider a static setting where this loss δ is taken as given. [7]

If a creditor rejects the exchange offer ("holds out"), he or she will be repaid in full with probability p, provided there are enough resources to do so. One can think of p as reflecting the probability of successful litigation against the sovereign, but also simply as the probability that a sovereign who may have been vague about the treatment of non-participating creditors will end up paying according to the original terms. We assume that all $1 - s$ holdouts succeed or fail together; hence, the condition for successful holdouts to receive full repayment is $s(1 - h) + 1 - s < 1 - \underline{h}$. If there are not enough resources to repay participants and holdouts in full, then we revert to a disorderly exchange where the resources $1 - \underline{h}$ are divided among creditors pari passu, subject to the inefficiency loss δ . By pari passu we mean that each creditor is paid according to the face value of their claim; this implies that creditors who accepted the offer would receive $\delta(1 - h)$ when holdouts are unsuccessful and a share, but

[7] Recent papers on the cost of default, particularly for the private sector, include Fuentes and Saravia (2006), Arteta and Hale (2008), Trebesch (2009) and Borensztein and Panizza (2009).

only a share of that payment when holdouts are successful. Unsuccessful holdouts receive nothing.

This stylized set-up can capture two important features of how different creditors affect each other's payoffs. It creates scope for a pure coordination failure where creditors may be collectively worse-off by rejecting a reasonable offer (however creditors may also be collectively better-off by rejecting a sufficiently low offer). It also allows for holdouts to have negative externalities on other creditors, as they diminish the resources available to participants and may ultimately compromise the success of the exchange. Throughout the paper, we focus on Nash equilibria, unless otherwise indicated. Nash equilibria with everyone rejecting (failure of the exchange), everyone accepting, or intermediate cases can arise depending on parameter values, as discussed below:

* *Everyone rejecting ($s = 0$).* In this case, the offer fails and a disorderly restructuring occurs. Creditors divide $\delta(1 - \underline{h})$ pari passu. A participant's claim has a lower face-value (since she agreed to the haircut), so it would receive $(1 - h)\delta(1 - \underline{h})$, whereas creditors that rejected the offer still have a claim with a face-value of 1 and receive $\delta(1 - \underline{h})$. This is an equilibrium if:

$$(1 - h)\delta(1 - \underline{h}) < \delta(1 - \underline{h}) \tag{1}$$

Since $(1 - h) < 1$, the expression above always holds. Failure of the exchange is always an equilibrium because if everyone expects everyone else to reject, then there is no point in accepting the haircut which will undermine the creditors position in the disorderly restructuring.

* *Everyone accepting (full participation, s=1).* A holdout would get pay-off of 1 with probability p (since everyone else is accepting there are resources to repay that atomistic holdout in full). Participants get $1 - h$. This is an equilibrium if:

$$p < 1 - h \tag{2}$$

**Internal Solution ($s > \underline{h}/h$).* Holdouts get repaid in full with probability p, and there are always enough resources to repay participants $1 - h$. This is an equilibrium if creditors are indifferent between acceptance and litigation:

$$p = 1 - h$$

This equilibrium will only hold for a particular combination of parameters, and the country could eliminate it by an infinitesimal reduction in h. Therefore, we will not consider this equilibrium.

**Internal Solution ($\mathrm{s}_{\min} \leq s < \underline{\mathrm{h}}/h$).* If $p > 1 - h$, then full participation is not an equilibrium. Creditors will have an incentive to holdout , and their success will compromise the country's ability to repay them and the participants leading to a disorderly exchange (we

assume the inefficiency cost δ is incurred regardless of whether or not holdouts succeed). Successful holdouts enter that disorderly restructuring with claims that have a face-value of 1. Participants get $\delta(1-h)$ when the holdouts fail, and their pari passu share in a disorderly exchange when holdouts succeed. In an internal solution, creditors must be indifferent between accepting or rejecting:

$$p\frac{\delta(1-\underline{h})}{(1-h)s+1-s} = (1-p)\delta(1-h) + p\frac{(1-h)\delta(1-\underline{h})}{(1-h)s+1-s} \tag{3}$$

which implies participation

$$s = \frac{1}{h} - \frac{p(1-\underline{h})}{(1-p)(1-h)} \tag{4}$$

The higher participation, the larger the potential benefit from holding-out, so this equilibrium is trembling-hand-perfect. If the expression above cannot be satisfied for $s_{\min} < s < \underline{h}/h$, then this equilibrium set is empty.

Note that in the setting above, creditors can be made worse off by a high p (that is, a reasonable offer being turned down due to the spectre of holdouts and disorderly restructuring).

B. Equilibria in Baseline Set-up

In this model, equilibria depend on 4 parameters: the holdout prospects p, the haircut offered by the country h, the resources available $\underline{h}$,and the efficiency loss from a default δ.

Failure of the exchange is always an equilibrium (because of the pure coordination failure problem described above). If:

$$h < 1-p \tag{5}$$

then the haircut is sufficiently small that (2) is satisfied, and full participation is an equilibrium. If the haircut is raised past $1-p$ then we move to the range where the internal solution is an equilibrium. For the internal solution to be an equilibrium, (4) needs to be satisfied for $s_{\min} < s < \underline{h}/h$. The constraint $s < \underline{h}/h$ is satisfied when $h > 1-p$. Let $h_{s\,\min}$ denote the value of h for which (4) holds for $s = s_{\min}$. Then the range of haircuts for which the internal solution is an equilibrium is given by:

$$1-p < h < h_{s\,\min} < \frac{1-p}{(1-\underline{h})p + (1-p)} \tag{6}$$

If h increases past $h_{s\,\min}$, then the only remaining equilibrium is failure of the exchange . Thus, equilibrium in the baseline set-up can be summarized by the proposition below:

Proposition 1.Failure of the exchange (general rejection of the exchange offer) is always an equilibrium. When the haircut is sufficiently small to satisfy (5) there is multiple equilibria

involving full participation and failure of the exchange. Raising the haircut to (6) leads to multiple equilibria involving the internal solution and failure of the exchange. Finally, if the haircut is further increased to the point that (6) no longer holds, then failure of the exchange is the unique equilibrium.

Note that if p is sufficiently large (in the limiting case we can consider a voluntary exchange where $p = 1$), then general rejection is the unique equilibrium:

Corollary 1 *Given $\underline{h}$¿0, there is a sufficiently large p such that failure of the exchange is the unique equilibrium.*

Figure 1 provides a numerical example that illustrates the possible equilibria for different combinations of p and h, when $\underline{h} = 0.25$, $\delta = 0.5$, and $s_{\min} = 0.5$. As expected, full participation is an equilibrium (with failure of the exchange being the other) when the haircut is small or holdout prospects are limited (low h or p), while failure of the exchange is the unique equilibrium when the opposite is true (high h or p). These two cases occupy most of the $p \times h$ space in this example. For relatively low values of h and moderately high values of p, we have multiple equilibria involving failure of the exchange and the internal solution.

In our set-up, both the haircut h and the distance between the repayment offer $1 - h$ and the ability to pay $1-\underline{h}$ matter for the equilibrium outcomes. More specifically, the haircut itself is important to determine whether a creditor would litigate for full repayment when everyone else accepts, whereas the distance between the offer and the ability to pay determines the offer's pay-off relative to a disorderly restructuring.

C. Endogenizing the Haircut

To solve for the equilibrium h, we need to make an assumption about the country's objective function. We assume the country values the amount of resources it keeps after the restructuring, but also seeks to limit reputational costs which we assume are linked to the size of the haircut offered, and tries to avoid disorderly restructurings:

$$U^{Country} = 1 - \underline{h} - repayments - l(h) - L \tag{7}$$

where $l(h)$ is a general reputational cost from the default, with $l' > 0$, $l'' > 0$, and L captures an additional loss from a disorderly restructuring (when there are not enough resources to repay participants and holdouts).

The country maximizes this function, mindful of the effects of its choice of h on s in the coordination game that follows, which in turn will also depend on the other model parameters. This solution involves simple constrained optimization, albeit notationally burdensome due to different equilibria in different ranges of the parameters. For that reason, we leave the full characterization of that solution to the appendix. But the country's behavior for extreme values of p is useful both to build intuition and for the results in the next section. If $p \to 0$, we are in the range where there is multiple equilibria between failure of the exchange and

acceptance. If equilibrium selection is given by an exogenous sunspot variable, the country's choice of h will weight the benefit of reducing expected repayments with the cost of increasing its reputational loss. If the probability of selection into the bad equilibrium is π, the country will equate $l'(h)$ to $1-\pi$. Depending on $l(h)$ that can lead to a high or a low haircut. If $p \to 1$, then failure of the exchange becomes the unique equilibrium. In that case, the country will offer the minimum haircut $\underline{h}$. Since it ends-up repaying $1-\underline{h}$ in a disorderly exchange anyway, the country might as well offer a low haircut to minimize its reputational loss.

Figure 2 illustrates the optimal haircut choice for given p assuming $\underline{h} = 0.25$, $\delta = 0.5$, and $s_{\min} = 0.5$ (the same values for these parameters that were used in Figure 1). In Figure 2a we assume the functional forms: $l(h) = h^2/2$ and an additional loss of $L = 0.1$ in the event of a disorderly restructuring. [8] In the ranges where multiple equilibria occur, each possible equilibrium is assumed to realize with equal probability. For low levels of p the country offers $h = 0.50$, and there is multiple equilibria involving full participation and rejection. As p increases, the country lowers the haircut in order to continue to sustain full participation as one of the equilibria despite the better litigation prospects. Past a certain value of p, we switch to multiple equilibrium involving the internal solution and failure of the exchange (despite the best possible offer $h = \underline{h}$ being made). For slightly higher values of p, failure of the exchange emerges as the unique equilibrium, despite $h = \underline{h}$ (again, since the country knows the offer will be rejected anyway due to the good holdout prospects, it might as well offer a low haircut in order to minimize its reputational loss).

In Figure 2b we change the reputational function to $l(h) = h^2$. Under this higher reputational loss, the country always offers a low haircut $h = \underline{h}$, but the equilibrium for different ranges of p is the same as in Figure 2a (while a same level of p yields the same equilibrium in both figures, the h which can sustain that equilibrium may be different). Figure 2c is analogous to Figures 2a, except that we now lower the reputational cost of the haircut to $l(h) = h^2/4$. With that lower reputational cost, the country takes advantage of a low p to offer a very high haircut ($h \to 1$ as $p \to 0$). As p increases, the country will lower the haircut so as to be able to sustain full participation as one of the equilibrium. For sufficiently high levels of p, we move to multiple equilibrium involving the internal solution and eventually to failure of the exchange (despite $h = \underline{h}$), just like in the previous figures.

The main conclusion is that the gist of the previous section, which showed that depending on parameter values different equilibria may arise in the game with exogenous haircuts, is preserved in a setting in which countries set haircuts strategically.

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[8] It would be more realistic to assume a fixed cost of imposing even a small haircut (e.g. $l(h)$ =constant+h^2); but since the country must impose at least a haircut $h > \underline{h}$ in order to restore solvency, that additional fixed cost would not change the results (and for simplicity is dropped).

D. Equilibria with exit consents and minimum participation threshold

This section shows that full participation can emerge as the unique equilibrium with the use of minimum participation thresholds, which depending on parameter values may need to be complemented by exit consents.

Consider first the case in which full participation is an equilibrium. Then, introducing a minimum participation threshold is enough to move creditors to the good equilibrium.

Proposition 1.If full participation is an equilibrium ($h < 1 - p$), then a minimum participation threshold $\underline{s} \geq s_{\min}$ ensures that full participation emerges as the unique equilibrium in the modified game.

Proof: Since $s \geq s_{\min}$ ensures that the exchange will not fail, accepting the offer is a best response if $1 - h > p$, which is the case since full participation is one of the equilibria. Rejecting the offer is a best response if $s < s_{\min}$ Therefore, every creditor is willing to accept an offer that is automatically canceled if $s \leq s_{\min}$, and full participation becomes the unique equilibrium.[9] Q.E.D.

The minimum participation threshold can be implemented as a pledge by the country not to proceed if participation is low, provided breaking that pledge is sufficiently costly. Alternatively, the minimum participation can take the form of a legally binding clause in the exchange offer that automatically cancels it if participation falls below the threhsold (which was used in some debt exchanges).[10] Note that in principle, creditors can be made worse-off by minimum participation thresholds. If p is sufficiently small, then we can have a situation where $h < 1 - p$, but $1 - h < \delta(1 - \underline{h})$, in which case creditors are better-off under a disorderly restructuring than under an orderly one where they receive $1 - h$. That is, when holdout prospects are limited to begin with, a creditor does not want to be left out of a successful exchange, and will agree to participating when most other creditors do. However, that creditor (and the others) would be better-off if they had failed to coordinate, and got $\delta(1 - \underline{h})$ through a disorderly restructuring.

The result above takes h as given. However, setting a minimum participation will generally affect the debtor's optimal choice of h. This is illustrated in Figure 3, which is analogous to Figure 2, except that we now assume that whenever multiple equilibria occur, creditors will always coordinate on the higher participation equilibrium. Comparing the two figures, one salient pattern is that the removal of the coordination failure can lead the country to offer a more aggressive haircut. When there is a risk of a coordination failure, it lowers the marginal

[9]Note that it suffices to set the minimum participation to $s_{\min}$ as opposed to $\underline{h}/h$ because the internal solution cannot be an equilibrium for $p < 1 - h$.

[10]In a dynamic setting, most favored creditor clauses could have a similar coordinating effect to minimum participation thresholds. These clauses ensure creditors who accept the offer also benefit from any improvements offered later on to creditors that initially rejected the offer. But it is easier to enforce minimum participation thresholds than most favored creditor clauses.

cost to the country of making a good offer (since with some probability the exchange will fail, and that offer will not affect how much the country keeps). In contrast, when we remove the coordination failure, the country will face that full marginal cost.

If full participation is not one of the original equilibria, it can still be achieved using exit consents. If exit consents reduce the probability of holding-out successfully (by making litigation more difficult, or otherwise reducing the bargaining power vis a vis the debtor country) to the point that full participation becomes an equilibrium in the modified game. Since exit consents need to be approved by a majority of bondholders, they implicitly set a minimum participation threshold of $1/2$. If that is enough for the exchange succeed (i.e., if $s_{\min} < 1/2$) then exit consents place creditors in a prisoner's dilemma type game where acceptance is the dominant strategy. If a higher participation is needed for the exchange to succeed, then full participation can be ensured by complementing exit consents with a minimum participation threshold.

Proposition 1.Given a haircut h, if exit consents lower the probability of success of holdouts to $\widetilde{p} \leq 1 - h$, then full participation still emerges as the unique equilibrium under a minimum participation threshold $s \geq \max(s_{\min}, 1/2)$

Proof: If $\widetilde{p} < 1 - h$, then a creditor whose bonds have been mutilated by the exit consents is better-off accepting the offer when the exchange succeeds. The minimum participation threshold $\max(s_{\min}, 1/2)$ implies either the bonds will be affected by the exit consents, or the offer will fail, making its acceptance a weakly dominant strategy, and the unique trembling hand perfect equilibrium. Q.E.D.

The proposition above focuses on the use of exit consents to achieve full participation. But exit consents and minimum participation thresholds have the additional effect of shifting bargaining power toward the debtor, and hence can lead to a higher haircut. Consider the limiting case where holdouts are completely impaired by exit consents: $\widetilde{p} \to 0$. If that is the case, the only constraint on the country pursuing a very aggressive haircut is the reputational loss $l(h)$.

However, there are likely to be limits to the extent that exit consents can be exploited for the purposes of achieving a tougher restructuring, for two reasons. First, overly aggressive haircuts driven by expropriatory exit consents would probably be easier to challenge in court, hence negating part of the benefit of exit consents, which is precisely to lower the value of litigation. Second, expropriatory exit consents generate a powerful incentive for creditors to coordinate themselves to prevent the exit consents from being used, a point that we return to in Section IV.

E. Equilibria under Collective Action Clauses

Collective action clauses (CACs) extend the principle that bond contracts can be renegotiated with a simple majority of creditors to the payment terms of the bonds (as opposed to just the

non-payment terms). As discussed in Section II, CACs did not play a central role in the renegotiation of sovereign bonds during the last generation of debt crises; in part because New York law bonds did not yet incorporate CACs at that time, and in part because debt exchanges achieved high participation rates without requiring the use of CACs where they existed.

This said, CACs received much attention during this period as a potential tool to reduce bondholder coordination failures (Eichengreen and Portes, 1995; Macmillan, 1995; Eichengreen, 2000; Taylor, 2002; Kletzer, 2003; Eichengreen, Kletzer, and Mody, 2003). It is hence interesting to compare their coordinating effects with those of exit consents and minimum participation thresholds. We consider CACs in our model by assuming that a majority $s^{CAC} > 1/2$ can impose changes in the payment terms of the bond that are binding for all creditors (that is, even if a creditor opposes the CAC, he or she can only collect $1 - h^{CAC}$ if the CAC is approved by the other creditors).[11] Moreover, an exchange that is settled through CACs does not involve the loss δ.

Proposition 1.Collection Action Clauses can always achieve a haircut h^{CAC} that satisfies the resource constraint $h^{CAC} \geq \underline{h}$ and induces full participation..

Proof: For the range of h for which the internal solution is an equilibrium, (3) implies the s participants receive in expectation $(1-p)\delta(1-h) + p\frac{(1-h)\delta(1-\underline{h})}{(1-h)s+1-s} < 1-h$. Holdouts will receive the same amount as participants in expectation, so any creditor collects less than $1-h$ in expectation, in which case they would have been better-off if CACs allowed the exchange to proceed with $h^{CAC} = h$ in an orderly manner.

If the exchange fails, creditors collect $\delta(1-\underline{h})$. Creditors are better-off under an orderly exchange where CACs impose a haircut h^{CAC} provided:

$$1 - h^{CAC} > \delta(1-\underline{h}) \tag{8}$$

which can be satisfied for $h^{CAC} \geq \underline{h}$. Thus, both types of "bad" equilibria can in principle be addressed by CACs Q.E.D.

The proposition above shows that under both types of "bad" equilibria, there is an h^{CAC} under which creditors are better-off under CACs, and would vote for it. Note that this result is based on our static setting. In a dynamic setting, we could have a situation where creditors may turn down an offer in the hopes of a better counter-offer being made (whereas in our static setting, refusal implies creditors get $\delta(1-\underline{h})$ in the disorderly restructuring).

How do CACs compare to exit consents in inducing full participation? The answer depends on the extent to which exit consents are effective in impairing (or eliminating) the prospects $\widetilde{p}$ of holdout creditors. If exit consents are ineffective in the sense that holdout prospects remain

[11] CACs are rejected if the median creditor (or a higher percentile creditor if CACs require a super-majority) is worse-off under the CAC terms than under the baseline setting. But since in our setting all creditors are ex ante equal (and even when they are ex post different, their expected pay-offs are the same), if a CAC makes creditors as a whole worse-off, then it makes a majority of creditors worse-off.

sufficiently good so $\widetilde{p} > 1 - h$, then exit consents cannot induce full participation, whereas CACs can. On the other hand, if exit consents are very effective in impairing holdouts, then they can achieve full participation, and at less favorable terms to creditors than what they would accept under CACs. An important difference between CACs and exit consents is that a creditors refusal to agree to the CAC does not impair his or her prospects for repayment in the same way that refusal of the exit consents could. That is, if a creditor votes against a bond restructuring under a CAC, he or she can still collect $1 - h^{CAC}$ if the restructuring is approved, or hold out for full repayment if the CAC fails. But in the case of exit consents, a creditor that refuses to participate in the exchange may be left with a mutilated bond whose repayment prospects are severely impaired. Thus, unlike CACs, exit consents have a prisoner's dilemma flavor, whereby individual creditors may agree to a haircut that makes them collectively worse-off.[12] In our setting, CACs are a preferable tool from the perspective of investors; and any full participation outcome that is sustained by exit consents but not by CACs benefits the country at the expense of creditors as a whole. However, if the bonds did not include CACs to begin with, then using exit consents can still make both creditors and country better-off vis-a-vis the outcome without exit consents or CACs.

IV. EQUILIBRIA WITH LARGE PLAYERS

So far we have assumed that creditors are atomistic. Suppose now that creditors were represented by a single negotiator, that could bargain over the haircut h with the country. If they could credibly make a take it or leave it offer to the country, they could demand the minimum haircut required to restore solvency $\underline{h}$, since the country's refusal would lead to an equally large transfer to creditors, plus additional reputational losses (more generally, that haircut could be the outcome of a particular bargaining solution such as Nash or Rubinstein bargaining involving the country and that single creditor). Since exit consents need to be approved by a majority of creditors, if a mass greater than 1/2 of creditors coordinated, they could block the exit consents so the offer can be rejected. But even if coordination costs may be relatively small, a free-rider problem may still prevent such coordination from taking place.

A more realistic constraint on the use of exit consents involve an investor assuming control (i.e. buy more than half of the outstanding face value) of a particular bond series (see Sturzenegger and Zettelmeyer, 2007 Chapter 3, for some examples). Since exit consents need to be voted for each bond series, they will be blocked from that particular series. To the extent that bond issues typically tend to be relatively small vis-a-vis a country's overall indebtness, a creditor taking a majority stake in a specific series could be relatively small vis-a-vis creditors as a whole. This can put such a creditor in a position where he or she can holdout and ask for a full repayment.

Suppose that there are several bond series, and that a measure m of creditors consist of these holdouts that are protected from the exit consents. For simplicity, assume that they buy all

[12] This important difference between CACs and exit consents is well known, and is also discussed in Engelen and Lambsdorff (2009).

bonds in their respective series (so other creditors cannot free-ride on them). The remaining share $1-m$ of creditors are still vulnerable to the exit consents (so accepting the offer is still their dominant strategy). The feasibility constraint for enough resources to be available to repay holdouts in full is:

$$m \leq (1-\underline{h}) - (1-m)(1-h) \tag{9}$$

If a larger mass than the one above holds-out, the country cannot repay them in full, which can lead to a disorderly restructuring. As argued in Section III, in the actual world, the successful holdouts have typically been small vis-a-vis the total debt of the country, a pattern consistent with our model.

Note that if a share $m' > m$were to hold out, the holdouts would have incentives to coordinate among themselves. The m' holdouts would be collectively better-off by uniting and accepting the exchange offer for $m'-m$ bonds so that share m would be repaid in full, while the remaining $m'-m$ would be repaid $1-h$. Of course, that does not mean that they would do so as that involves a collective action problem (since everyone would want to be the holdout that is being repaid in full). These results imply:

Proposition 1.If there are several bond series, a share $m < 1/2$ of creditors may be able to block exit consents on their bond holdings. Provided (9) holds, they will be repaid in full. Otherwise, a disorderly restructuring exchange will take place. Holdouts may be collective better-off capping m to (9), but standard collective action problems may prevent them from doing so.

Finally, we consider the possibility that a large number of creditors (or groups of creditors) can coordinate to own majority stakes in each bond series. To take an extreme case, suppose that as a result exit consents are blocked for all bond series. In this case, we are back to a situation where multiple equilibria may arise:

Proposition 1.In the limit where there are several bond series and all creditors are in groups that can block exit consent, if full participation is not an equilibrium in the original setting, then it cannot be achieved with exit consents.

Proof: If full participation is not an equilibrium in the original setting, then $p > 1-h$, and some group of creditors that can block exit consents will be better-off holding-out. Q.E.D.

Thus, while exit consents are a powerful way of inducing creditors to participate, their inability to operate across different bond series can lower the barriers to blocking them to the point that we are back to the original setting. Note that if full participation is an equilibrium in the original setting it can still be achieved through minimum participation thresholds. But if not, exit consents will no longer be able to help achieve full participation.

A similar limitation on the use of exit consents apply to CACs, which also have to be voted separately for each bond series.

V. Conclusion

As emerging market countries began to experience difficulties in servicing their public debt in the late 1990s, there were widespread fears that the dispersed nature of this debt would make sovereign debt restructurings even more difficult than the protracted renegotiations that followed the debt crisis of the 1980s. However, with one major exception – Argentina's restructuring following its 2001 default – the opposite happened, as virtually all bond restructurings between 1998 and 2005 were swift, largely devoid of litigation, and achieved high participation.

This paper has provided a framework that makes three contributions. First, it rationalizes the original fears, by showing that a simple static coordination game in which creditors have to chose whether to accept an exchange offer or holdout does indeed allow for equilibria with low participation and high proportion of holdouts. Second, it provides an interpretation for why these fears did not materialize. One implication of our framework is that even with atomistic creditors, full participation in a debt exchange offer is an equilibrium as long as neither the haircut nor the probability of successfully "holding out" for full repayment (or a better offer) are too high. In this case, the country can eliminate the collective action problem (that is, turn full participation into the only equilibrium of the creditor coordination game) by conditioning its offer on a minimum level of creditor participation. Furthermore, even if full participation is not an equilibrium in the original game, the country may be able to use exit consents to change the nonpayment terms of the existing bonds in a way that lowers the probability of holding out successfully, and makes full participation an equilibrium.

The third insight of the model is that while these innovations expand the range of haircuts compatible with widespread acceptance of the exchange, they can break down if too aggressive a haircut is offered by the country. For example, creditors may seek a controlling stake in a bond series to block exit consents that are used to extract a large a haircut. In practice, this does not seem to have happened, presumably because exit consents were used "defensively" (i.e. in the context of debt exchange offers that were viewed as reasonable).

In addition to offering an interpretation of the history of bond exchanges, and the debate on bondholder coordination, since the mid 1990s, our model has some implications for financial architecture. One immediate implication is that because collective action problems appear relatively easy to deal with ad hoc – through the design of a debt exchange offer – the case for ambitious sovereign insolvency regimes, via new international treaties or institutions, appears less strong than it did a decade ago.

This said, there are two qualifications to this argument. First, as we saw in section IV, if countries require very large haircuts (perhaps because of deep insolvency problems), then even highly effective exit consents and participation constraints might not avoid a disorderly default, because the incentive for bondholders to block exchanges by acquiring a bond series and holding out at the expense of others is just too strong.

Second, avoiding a disorderly outcome may not be the only objective in structuring an exchange – fairness and predictability, for example, may also matter. But in the full participation equilibria studied in this paper, the losses imposed on creditors are shaped quite arbitrarily by preference parameters of the debtor country – how "tough" it turns out to be – as well as the strength of the available legal technology. This state of affairs is not ideal from the perspective of fostering stability and affordability of international capital flows. Hence, there may still be a case for an international bankruptcy regime as a means of achieving fair outcomes and imposing good incentives on debtor countries and investors ex ante, as opposed to merely avoiding a breakdown in collective action ex post.

When choosing the haircut in the baseline model, the country will take into account the different equilibria the offer may imply. Below we characterize that choice. We initially solve the maximization problem when the choice of h is constrained by the ranges of each type of equilibria in Section III. With those results, we can then choose the optimal h for the country to offer. We assume that when multiple equilibria are possible, creditors coordinate based on a sunspot variable, which implies failure of the exchange with probability π.

Let V_1 denote the country's problem when $h < 1 - p$ and full participation and failure of the exchange are equilibria. With probability $1 - \pi$ the exchange is successful, the country keeps the difference between $(1 - \underline{h}) - (1 - h)$, but incurs the reputational loss $l(h)$. With probability π the exchange fails, the country does not keep any resources, and incurs the additional loss L in addition to $l(h)$. The country solves:

$$\begin{aligned} V_1 &= \max_h \{(1-\pi)((1-\underline{h}) - (1-h) - l(h)) + \pi(0 - l(h) - L)\} \\ s.t.\ \underline{h} &< h < 1 - p \end{aligned}$$

If parameters are such that $\underline{h} < h < 1 - p$ cannot be satisfied, then this solution set is empty. Let h_1 denote the internal solution of this problem, which if it exists, is given by:

$$l'(h_1) = (1 - \pi).$$

The optimal h_1^* over this range is thus:[12]

$$h_1^* = \begin{cases} \underline{h} \text{ if } \underline{h} > h_1 \\ h_1 \text{ if } \underline{h} < h_1 < 1 - p \\ (1-p)^- \text{ if } h_1 \geq 1 - p \end{cases}$$

Let V_2 denote the country's problem when $1 - p < h < h_{s\min}$, and the internal solution and failure of the exchange are equilibria. Under the internal solution outcome, the country keeps $(1 - \underline{h}) - (1 - h)s$ with probability p, but keeps nothing with probability $1 - p$. It solves:

$$\begin{aligned} V_2 = \max_h \{&(1-\pi)[(1-p)((1-\underline{h}) - (1-h)s - l(h) - L) + p(0 - l(h) - L)] + \\ &\pi(0 - l(h) - L)\} \\ s.t.\ 1 - p < h &\leq h_{s\min} \end{aligned}$$

Assuming the solution set is non-empty, let h_2 denote the internal solution to this problem, which if it exists is given by:

$$l'(h_2) = (1 - \pi)(1 - p)s$$

[12]Note that in one of the corner solutions, we assume the country offers an amount infinitesimally smaller than $(1 - p)$ so as to ensure we remain within the range for this type of equilibrium.

The optimal h_2^* over this range is thus:

$$h_2^* = \begin{cases} (1-p) \text{ if } h_2 < 1-p \\ h_2 \text{ if } 1-p < h_2 < h_{s\min} \\ h_{s\min} \text{if } h_2 > h_{s\min} \end{cases}$$

Note that while $1-p$ may be a corner solution for V_2, it would never be the global optimal since by offering $(1-p)^-$ the country could move to the previous range where full acceptance was an equilibrium, and improve its welfare.

Finally, let V_3 denote the country's problem when $h > h_{s\min}$ and failure of the exchange is the only equilibrium:

$$\begin{aligned} V_3 &= \max_h -l(h) - L \\ s.t. h &> h_{s\min} \end{aligned}$$

Since the offer will be rejected anyway, the country is better-off offering the minimum haircut to minimize its reputational loss:

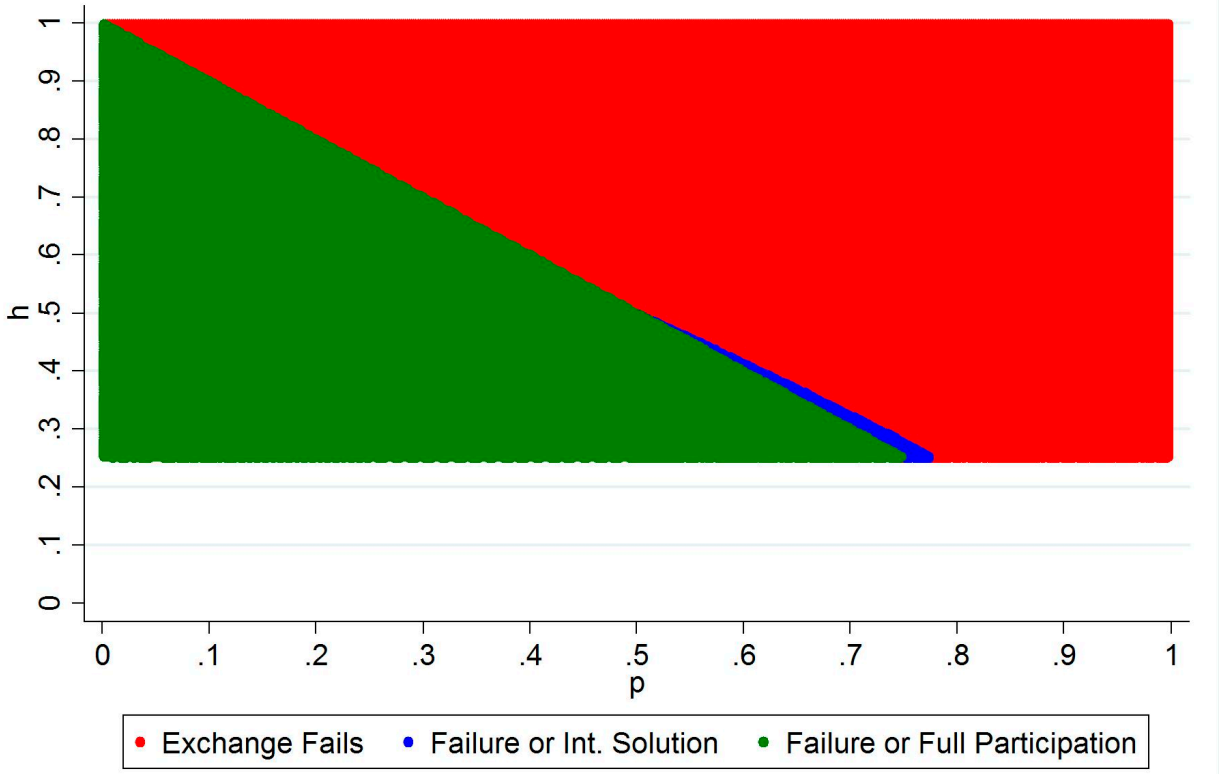
$$h_3^* = \begin{cases} h_{s\min} \text{ if } \underline{h} \leq h_{s\min} \\ \underline{h} \text{ if } \underline{h} > h_{s\min} \end{cases}$$

Note that unless $\underline{h} > h_{s\min}$ binds, the country would be better-off offering $h_{s\min}^-$, and moving to the previous range (where it solves V_2).

Based on the optimal offer for every range, the country will choose the one whose outcome yields the highest welfare, and the equilibrium offer h^* will be:

$$h^* = \begin{cases} h_1^* \text{ if } V_1(h_1^*) = \max(V_1(h_1^*), V_2(h_2^*), V_3(h_3^*)) \\ h_2^* \text{ if } V_2(h_2^*) = \max(V_1(h_1^*), V_2(h_2^*), V_3(h_3^*)) \\ h_3^* \text{ if } V_3(h_3^*) = \max(V_1(h_1^*), V_2(h_2^*), V_3(h_3^*)) \end{cases}$$

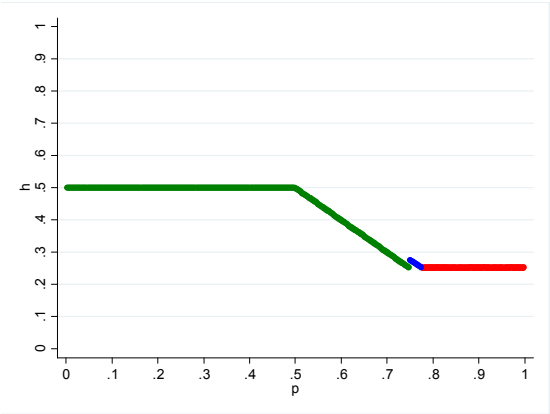
Figure 1. Possible Equilibria as a Function of the haircut and litigation prospects.



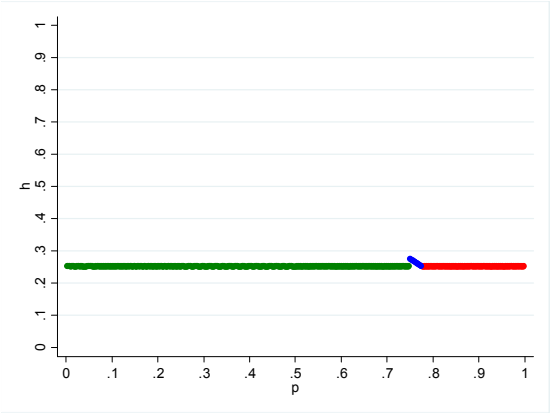
Notes: Example assumes a minimum haircut $\underline{h}$=0.25, s_{min}=0.5 and δ=0.5.

Figure 2. Equilibrium Haircut Offered by the Country.

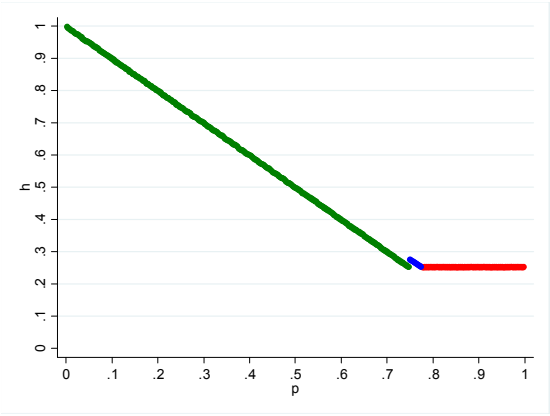
2a. Country maximizes: $U = 1 - \underline{h} - E[repayments] - h^2/2 - L(s)$

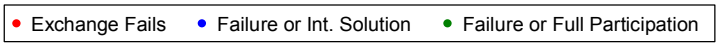


2b. Country maximizes: $U = 1 - \underline{h} - E[repayments] - h^2 - L(s)$



2c. Country maximizes: $U = 1 - \underline{h} - E[repayments] - h^2/4 - L(s)$

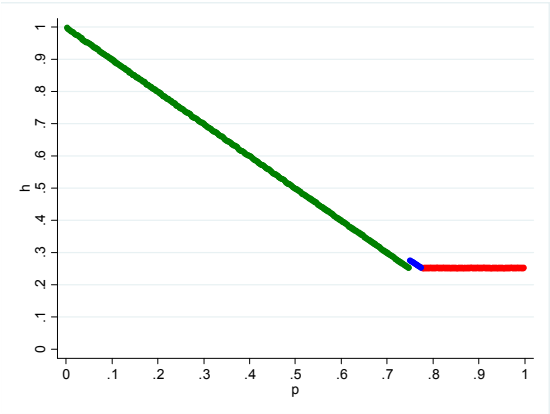




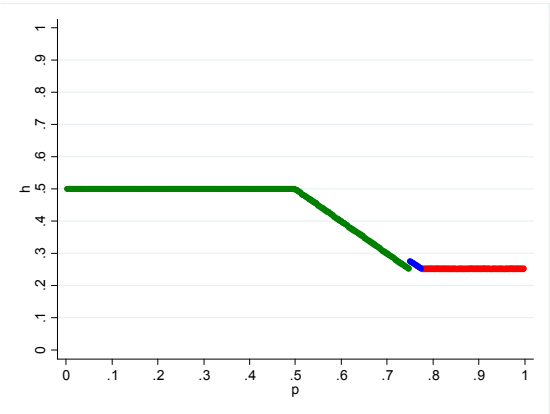
Notes: Example assumes a minimum haircut $\underline{h}$=0.25, s_{min}=0.5 and δ=0.5, as in Figure 1. *L(s)*=0.1 unless there is full participation. We assume that under multiple equilibria each possible equilibrium is selected with equal probability (e.g. if both s=0 and s=1 are equilibria, the probability that either is the outcome is 50 percent).

Figure 3. Equilibrium Haircut Offered by the Country with Coordination in the Higher Participation Equilibrium

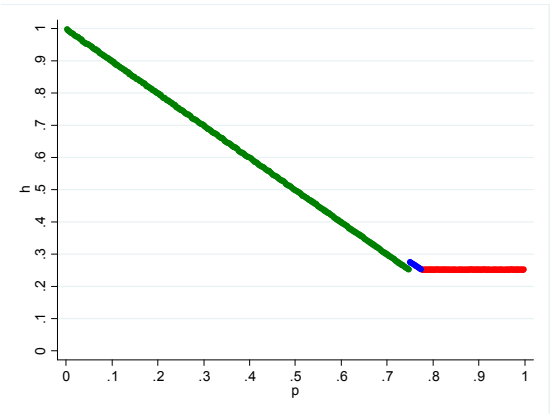
3a. Country maximizes: $U = 1 - \underline{h} - E[repayments] - h^2/2 - L(s)$

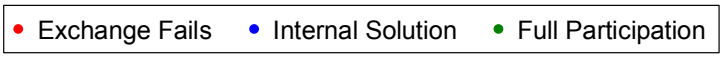


3b. Country maximizes: $U = 1 - \underline{h} - E[repayments] - h^2 - L(s)$



3c. Country maximizes: $U = 1 - \underline{h} - E[repayments] - h^2/4 - L(s)$





Notes: Example assumes a minimum haircut $\underline{h}$=0.25, s_{min}=0.5 and δ=0.5, as in Figure 1. *L(s)*=0.1 unless there is full participation. We assume that under multiple equilibria there is coordination in the higher participation equilibria.

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