Waiting for a haircut? A bargaining perspective on sovereign debt restructuring

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Abstract:
Recent investigation of sovereign debt negotiations finds that serious debt restructuring typically involves multi-period delay. We develop an incomplete information bargaining model to account for this, highlighting economic recovery and sustainability considerations as complementary reasons for delay. Evidence relating to settlements, along with the policy implications of our analysis, are discussed.

JEL classifications: F34, C78

1. Introduction

Sovereigns in default are, in practice, faced with a choice between two types of debt renegotiation - reprofiling or restructuring. This is the conclusion of a recent extensive study of foreign currency debt negotiations by Mariscal *et. al.* (2015), hereafter MPST. In the terminology of IMF (2014), *reprofiling*s are relatively fast, they may be pre-emptive (in the sense that they are announced before the country enters default) and frequently have a zero 'haircut' of principal. *Restructuring*s, on the other hand, do have face value haircuts, have deeper reductions of present value and are typically arranged ex post with delay

What light might bargaining theory throw on why some settlements take longer than others and embody greater debt reductions? That is the issue addressed in this paper.

It is, of course, true that prompt agreement is a key feature of the basic single-creditor, complete information bargaining models of sovereign debt restructuring: where preferences and the size of the pie to be divided are known, this is what the 'alternating offers' approach of Rubinstein (1982) delivers. Several reasons for delay have been also been considered in the literature, however. Merlo and Wilson (1995), hereafter MW, show that delay may prove beneficial when it permits the debtor country's economy- or creditor-country banks - to recover from a crisis; and it may act as a signal between participants with asymmetric information, Rubinstein (1985). Problems of creditor coordination and issues of creditor heterogeneity have also been explored, Pitchford and Wright (2012), Ghosal and Miller (2016); and the role of political factors, as in Trebesch (2016).

In this paper, we present an incomplete information model of debt restructuring with a representative private bondholder which incorporates two of these factors: delay occurs along the equilibrium path of play driven by both the prospect of uncertain economic recovery and as a means of signalling sustainability concerns by the debtor state. The length of delay is positively correlated with the size of the haircut: one-period delay permits economic recovery while multi-period delay allows the debtor state to signal the need for a larger 'haircut'.[1]

What this provides is a rationale for the correlation between length of delay and size of write-down noted by MPST and for which we provide further evidence. We discuss some recent

[1] Sullivan (2016) provides experimental evidence that strongly suggests bargaining with asymmetric information drives delay in settlements.

settlements to illustrate the formal analysis - as well as case studies that limit the scope of its application.

As an appropriate indicator of what restructuring might be needed, the Paris Club adopted progress toward the Millennium Development Goals, typically for Heavily Indebted Poor Countries. More generally, transparency has been identified as one of the basic principles for efficient sovereign debt restructuring by the UNCTAD (UN General Assembly, 2015). Potentially, the IMF could resolve uncertainty about future growth or sustainability concerns where these are in dispute. But its position as senior creditor may limit its ability to play that role.

1.1 Related literature

The evidence that sovereign bond restructurings involve costly delay is extensive, see for example Cruces and Trebesch (2013), Roubini and Setser (2004) and the monograph by Sturzenegger and Zettlemeyer (2007).

In a carefully calibrated model of sovereign default, with debt renegotiation modelled along the lines of MW, Bi (2008) finds that delay was beneficial for Argentina as it gave the economy breathing-space to recover from deep recession. While multi-period delay can indeed occur in this framework, delay length may be negatively correlated with haircut size.

Asymmetric information as a cause of delay in sovereign debt restructuring is explored in Bai and Zhang (2012). In this case, it is the creditor's reservation value that is private information, and the debtor government knows only its distribution: delays in reaching agreements arise in equilibrium because the debtor uses costly delay to screen the creditors' reservation value. In contrast, in our paper, it is the debtor's type that is private information. For Bai and Zhang, moreover, the key fact to be explained is that 'sovereign debt renegotiations take an average of five years for bank loans but only one year for bonds' and the explanation advanced is that the secondary market for bonds provides information on creditors reservation value. In this paper, however, the key stylised fact to be explained is why prolonged delay may occur even with bonds.

How lack of commitment may bedevil negotiations is explored in the comprehensive study by Benjamin and Wright (2016), where the rationale for delay in settling is that the creditor's ability to share in the future surplus is threatened by the risk that the debtor will default on what is agreed. The data-set they examine (and use in quantifying their model) includes bank loans as well as bonds; and the data period (since 1970) includes the ‘lost decade’ of the Latin

American debt crisis of the 1980s. It has been argued, however, (by MW amongst others) that a substantial reason for delay at that time was the risk that prompt write-downs of syndicated bank loans would have wiped out the equity of key banks in the US financial system.

By assuming that debt restructuring involves bargaining with a representative private bondholder, we abstract from problems of coordination among multiple private creditors. There is an extensive - and growing - literature on this topic, see, for example, Kletzer (2002), Ghosal and Miller (2003), Weinschelbaum and Wynne (2005), Pitchford and Wright (2012), Ghosal and Thampanishvong (2013), and Ghosal and Miller (2016). As the factors generating multi-period delay examined in this paper do not require, in an essential way, multiple private creditors, such considerations are omitted from the formal model; but the role of specialist hold-out creditors is discussed in considering the case of Argentina.

The remainder of the paper is structured as follows. Section 2 presents a simple three period bargaining model. Section 3 contains a discussion of evidence relating to settlements. Section 4 considers various policy implications. Section 5 concludes. The Online Appendix contains an infinite horizon extension of the three-period incomplete information model studied in Section 2.

2. A model of recovery, sustainability, signalling and delay in bargaining

To highlight the factors on which our analysis is focussed, we first review, in a two-period context, the MW logic for delay– postponing a settlement to allow for economic recovery. Then we look at a two-period case where there is uncertainty about the type of the debtor. While creditor acceptance of sustainability requirements will shift the bargaining position in favour of the debtor, when there is asymmetric information about the debtor's type, we show how this may give rise to a signalling equilibrium with delay.

After these preliminaries, both factors are combined in a stylized three-period model, where we find conditions for longer delay, first to allow for economic recovery and then for signalling.

2.1 Waiting for recovery

Conditional on default, we assume there is bargaining between debtor and creditor over restructuring sovereign debt. Although this restructuring applies to the stock of outstanding debt, from a bargaining perspective it is more natural to focus on the associated flow - namely the fiscal surplus needed to service, in full and on a sustainable basis, the sovereign debt owed

to the creditor[2]. Suppose, for example, the sovereign debtor uses tax revenue for one of the two reasons, either spending on a public good or on servicing debt: then, by seeking a write-down, the debtor seeks, effectively, to divert resources from servicing foreign debt to providing domestic public goods. We will denote the total tax revenue available for bargaining as $\pi > 0$, and refer to it as 'the pie' or 'the bargaining surplus'.

The analysis begins at a point at which the debtor is in default and in a recession, i.e. we assume that the value of π at the initial period, immediately after default, is low and is denoted by π_L. However, we allow the future value to be stochastic so that in the following period π can continue to be low at π_L with probability p or grow to a higher level, π_H, with probability $1-p$, where the probabilities are common knowledge and the growth of π corresponds to an increase in the tax revenue. The bargaining model formalizes the argument that in the initial period, the current surplus, π_L, can be shared between debtor or creditor, but doing so means giving up on the prospect of economic growth, i.e. this is a primitive endogenous growth model.

Assume, for convenience, that creditor and debtor share a common discount factor $\delta < 1$.[3] If no contingent contracts can be written, we find that delay will occur when the expected increase in the pie exceeds the interest rate. Although their infinite horizon analysis makes the analysis much less straightforward, this is the principal feature of the bargaining equilibria in Merlo and Wilson (1998), who cite the delay in restructuring Latin American debt in the 1980s as an illustration of their approach.

The bargaining game is specified as follows. The debtor makes the offer in the first period; but each party has equal probability of making an offer (being the proposer) in the subsequent period. In the second (and final) period, bargaining takes the form of an ultimatum game, where the proposer takes all. Breakdown payoffs are zero for both players. (It is assumed that offers matching breakdown payoffs will be accepted.) Table 1 illustrates, with the debtor's payoff first, depending on the state of the economy and who makes the offer.

Table 1 Final period payoffs

[2] Guzman and Lombardi (2017) provides a clear and persuasive exposition of this perspective.
[3] An assumption that is relaxed when it comes to calibration.

	Depression (p)	Recovery (1-p)
Debtor' s Offer (1/2)	$\pi_L, 0$	$\pi_H, 0$
Creditor's Offer (1/2)	$0, \pi_L$	$0, \pi_H$

Note: Probabilities are shown in parentheses

Moving to the first period, we calculate the continuation values which are the same for each player, namely $\frac{\delta E\pi}{2}$, where $E\pi = p\pi_L + (1-p)\pi_H$ denotes the expected size of the pie.

In the first period, with the debtor as proposer, these continuation values limit the offers that can be made. The current pie can be shared between debtor or creditor, but doing so means abandoning the prospects for economic growth. Figure 1 shows debtor payoffs – current and expected – on the horizontal axis with the creditors' payoff on the vertical axis. Pareto-efficient settlements lie on the downward-sloping line labelled 'current pie', the boundary of the set of feasible current settlements. Discounted future prospects, summarized by the continuation values, lie on the upward-sloping 45 degree line, a reflection of the *ex ante* symmetry of bargaining power in the second period. These continuation values will lie outside the 'current pie' if expected growth of the economy, $\frac{E\pi - \pi_L}{\pi_L} = Eg$, exceeds the discount rate, defined as $r = \frac{1-\delta}{\delta}$; inside, if growth prospects fall short. With high growth prospects, as indicated at G for example, delay dominates current settlement and the creditor will reject R, the best the debtor can offer while matching its own continuation value.

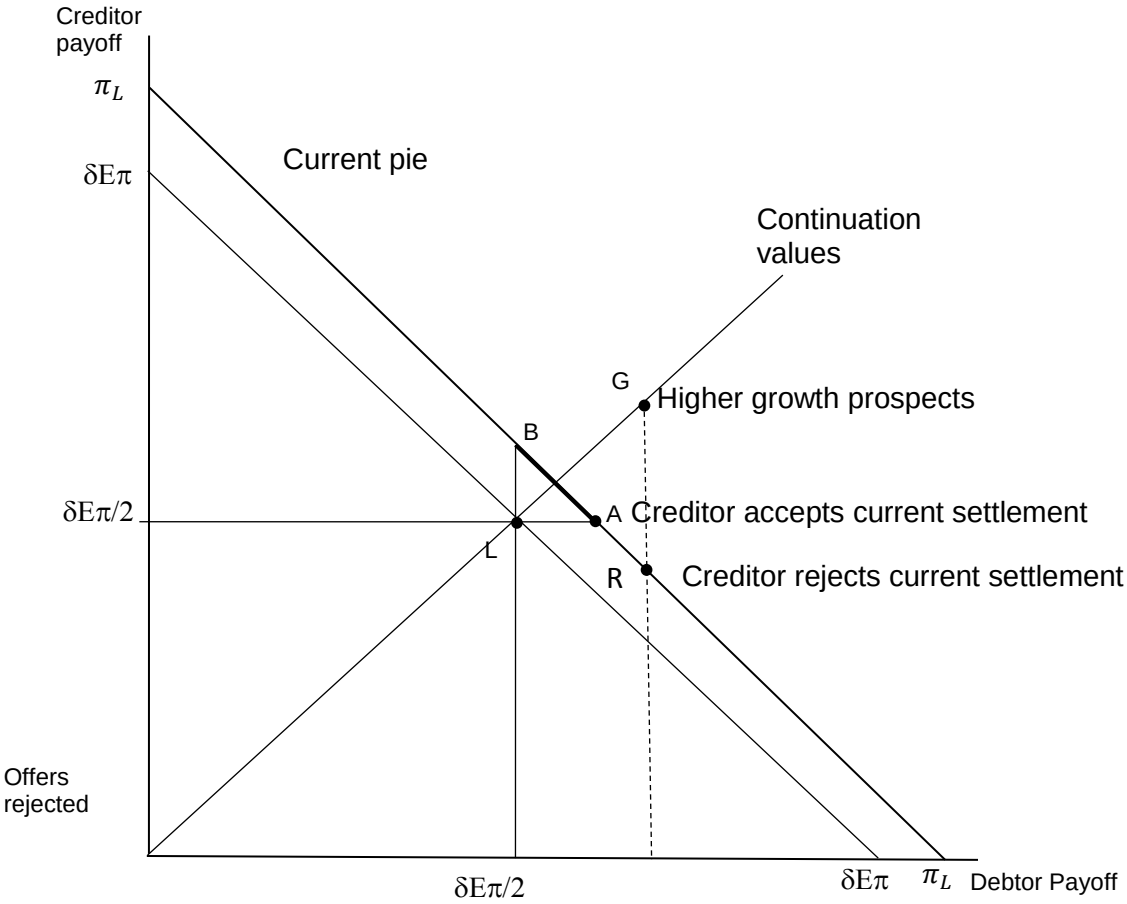

Figure 1 Continuation values and 'efficient' delay

With relatively low growth prospects, however, the bargaining model predicts an immediate settlement. With continuation values at point L, for example, there is scope for current settlement; and the debtor can achieve the payoff of A which improves on continuation.

More formally, we have the following result:

Proposition 1. Efficient delay occurs when $Eg > r$***. The creditor's payoff with efficient delay is*** $\delta \frac{E\pi}{2}$.

Proof. In period 1, the maximum offer the debtor will make is $\pi_L - \delta \frac{E\pi}{2}$. Hence, it follows that whenever $\pi_L - \delta \frac{E\pi}{2} < \delta \frac{E\pi}{2}$ the debtor's offer will be rejected. Re-writing the preceding

inequality as $\pi_L < \delta E\pi \Leftrightarrow \frac{1}{\delta} < \frac{E\pi}{\pi_L}$. Subtracting both sides of the preceding inequality by -1, simplifying and using the definitions of r and Eg yields the desired result. ■

Proposition 1 shows that delay is efficient whenever the expected growth of the size of the bargaining pie implies that the maximum offer the debtor is willing to make to obtain immediate agreement is less than its expected continuation payoff by waiting to settle.

2.2 Signalling concern for sustainability

By allowing information to differ as between creditor and debtor, delay can arise as a costly signal by the debtor concerned with sustainability, designed to secure an improvement in continuation payoffs. Specifically, we assume the debtor may be one of two types - one concerned with sustainability, the other not - where the debtor knows his type but the creditor is not sure.

Consistent with the interpretation of the bargaining surplus in Section 2.1 above, we motivate a concern for sustainability as follows. The sustainability constraint, s, represents the minimum fraction of the tax revenue required by the sovereign debtor for expenditure on the public good consistent with economic and political stability of the debtor country. For simplicity of analysis, we will assume that there are just two debtor types: Optimistic and Cautious. When s is close to 0, the debtor is Optimistic (with a lower sustainability constraint and willing to tolerate more austerity), while when s is close to a level $\bar{s} > 0$, the debtor is Cautious (with a higher sustainability constraint and less willing to tolerate austerity). At the start of the debt restructuring process there is incomplete information about the debtor's sustainability constraint. We assume that the debtor is better informed than the creditor about its own sustainability constraint.

Concern for sustainability can be captured by distinguishing debtor types in the utility they get from consuming their part of a 'pie' of size π. We assume utility is linear in (equal to) the payoff only for payoffs greater than or equal to $s \in \{0, \bar{s}\}$: for the Optimistic debtor $s = 0$ while for the Cautious debtor $s = \bar{s} > 0$. Let $\pi_i, i = O, C,$ denote the share of the surplus obtained by each type. For the Optimistic debtor $u_O = \pi_O$ for any allocation, but for the Cautious debtor $u_C =$

π_C - $\bar{s}$ only if $\pi_C \geq \bar{s}$; for any share strictly less than $\bar{s}$, $u_C < 0$. The implication is that the Cautious Debtor will not accept an offer below $\bar{s}$ as the payoff to each agent is zero if bargaining breaks down.

The debtor knows his type, the creditor does not, but believes that the debtor is Optimistic with probability q_0.

The debtor makes the initial offer in the first period; but each party has equal probability of making an offer in the subsequent period. Breakdown payoffs are zero for both players in period two.

We focus on Perfect Bayesian Equilibrium in mixed and pure strategies that involve delay[4].

We begin with the ultimatum game in the final period, when the belief of the creditor that the debtor is an Optimist has evolved and is denoted q_1. Consider the creditor's offers at extreme values of q_1. As indicated in Table 2a, the offer is zero unless the debtor is thought to be concerned about sustainability; in which case it is $\bar{s}$.

Table 2a Creditor's offers with extreme beliefs

Creditor's Belief as to Debtor's type	Creditor's offer to Debtor	Payoff for Creditor
$q_1 = 1$ (it's an Optimist)	0	π
$q_1 = 0$ (it's not)	$\bar{s}$	$\pi - \bar{s}$

For less extreme beliefs, $0 < q_1 < 1$, the creditor's expected payoff from a high offer (of $\bar{s}$), acceptable to either type, will be $\pi - \bar{s}$; but the expected payoff from a low offer (of zero) , acceptable only to the Optimist, will be $q_1\pi$. If $q_1\pi > \pi - \bar{s}$, the creditor will do better by making

[4] In what follows, we demonstrate the existence of a Perfect Bayesian Equilibrium in mixed strategies in which the two debtor types choose different mixed actions in the first period and hence, signal their types to the uninformed creditor. In CEPR DP 117710 (Ghosal *et al*., 2016) we show how, once inside options are present in our model, a pure strategy Perfect Bayesian Equilibrium exists where the two debtor types choose different pure actions in the first period to signal their types to the uninformed creditor.

a low offer, and conversely for $q_1\pi < \pi - \bar{s}$. When $q_1 = \frac{\pi - \bar{s}}{\pi}$, the two offers have the same expected payoff.

To summarize, the creditor's offers are shown as a function of his priors in Table 2b.

Table 2b Creditor's offers in the ultimatum game for all values of beliefs

Creditor's Belief as to Debtor's type	Creditor's offer to Debtor	Payoff for Creditor
$q_1 > \frac{\pi - \bar{s}}{\pi}$ (it's probably an Optimist)	0	π
$q_1 \leq \frac{\pi - \bar{s}}{\pi}$ (it's probably Cautious)	$\bar{s}$	$\pi - \bar{s}$

As for the debtor, his offer to the creditor is simply zero - which will be accepted by the creditor in this ultimatum game.

From the perspective of the initial period, bearing in mind that each player has a 50% probability of making the next offer, the expected discounted payoffs as a function of the prior are as in Table 3:

Table 3 Continuation values in the initial period of bargaining

Creditor's Belief as to Debtor's type	Expected payoff for debtor (for both types)	Expected Payoff for creditor
$q_1 > \frac{\pi - \bar{s}}{\pi}$ (it's probably an Optimist)	$\frac{\delta\pi}{2}$	$\frac{\delta\pi q_1}{2}$

$q_1 \le \frac{\pi - \bar{s}}{\pi}$ (it's probably Cautious)	$\frac{(\pi + \bar{s})\delta}{2}$	$\frac{(\pi - \bar{s})\delta}{2}$

Assume that the debtor makes the offer in the initial period.

The following proposition demonstrates the existence of a Perfect Bayesian Equilibrium with delay. It shows that, for some parametric configurations, delay arises from both debtor and creditor choosing mixed strategies, with the debtor able to signal, to the uninformed creditor, its sustainability constraint.

Proposition 2. Suppose $q_0 \ge \frac{\pi - \bar{s}}{\pi}$***,*** $\pi \in \{\pi_L, \pi_H\}$***. Then a mixed strategy Perfect Bayesian Equilibrium exists where delay occurs with probability*** $(1 - q_0)\left(\frac{\pi}{\bar{s}}\right)$ ***along the equilibrium path of play. Suppose*** $q_0 < \frac{\pi - \bar{s}}{\pi}$***,*** $\pi \in \{\pi_L, \pi_H\}$***. Then a pure strategy Perfect Bayesian Equilibrium exists where delay occurs with probability one. The creditor's expected payoff is*** $\delta \frac{\left(E\pi - \bar{s}\right)}{2}$***.***

Proof. Our initial focus is on separating equilibria in mixed strategies. Note that for the creditor to randomize at t=2, it must be the case that $q_1 = \left(\frac{\pi - \bar{s}}{\pi}\right)$. Note that the debtor makes the offer at the initial period denoted by $(x_1, \pi - x_1)$. Suppose that $x_1 = \left(\frac{\delta\left(\pi + \bar{s}\right)}{2}\right)$; then, by computation, $\pi - x_1 = \left(\frac{(2-\delta)\pi}{2}\right) - \left(\frac{\delta \bar{s}}{2}\right) > \left(\frac{\delta\left(\pi - \bar{s}\right)}{2}\right)$. Let x'_1 positive number such that $\pi - x'_1 < \left(\frac{\delta\left(\pi - \bar{s}\right)}{2}\right)$. Suppose the Optimistic debtor offers $(x_1, \pi - x_1)$ with a probability $(1-\beta)$ and offers $(x'_1, \pi - x'_1)$ with a probability β, while the Cautious debtor offers $(x'_1, \pi - x'_1)$ with a probability 1. The posterior belief of the creditor at $t = 2$, which is $q_1 = \frac{\pi - \bar{s}}{\pi}$, must be consistent with the Bayesian updating rule so that $q_1 = \left(\frac{\beta q_0}{\beta q_0 + (1 - q_0)}\right) = \frac{\pi - \bar{s}}{\pi}$, and therefore, by computation,

$\beta = \beta^* = \left(\frac{\pi - \bar{s}}{\bar{s}}\right)\left(\frac{1-q_0}{q_0}\right) > 0$. Since we must have that $\beta^* \leq 1$, it follows that the model parameters must satisfy the condition $\left(\frac{\pi - \bar{s}}{\bar{s}}\right)\left(\frac{1-q_0}{q_0}\right) \leq 1 \Leftrightarrow q_0 \geq \frac{\pi - \bar{s}}{\pi}$. Moreover, if the creditor observes the offer $(x'_1, \pi - x'_1)$, the creditor believes with probability one that the debtor is an Optimist. Finally, we specify the posterior beliefs of the creditor in subgames that do not occur along the equilibrium path of play as $q_1 = 0$ if the current offer of the debtor, $(x''_1, \pi - x''_1)$ is such that $(x''_1 > x_1)$ with $q_1 = 1$ if the current offer of the debtor, $(x''_1, \pi - x''_1)$ is such that $(x''_1 < x_1)$. Given these beliefs, the creditor will accept the offer $(x_1, \pi - x_1)$ but reject the offer $(x'_1, \pi - x'_1)$. Clearly, given the preceding computations, both debtor types are choosing a best-response and given the debtor's strategy, the creditor cannot do better either. Hence, delay occurs with probability $q_0\beta^* + (1-q_0) = (1-q_0)\left(\frac{\pi}{\bar{s}}\right)$ along the equilibrium path of play. When $q_0 \leq \frac{\pi - \bar{s}}{\pi}$, then, in equilibrium, at $t = 1$ both debtor types offer $(x'_1, \pi - x'_1)$ with probability one. Posterior beliefs are specified so that $q_1 = 0$ if the current offer of the debtor, $(x''_1, \pi - x''_1)$ is such that $(x''_1 > x_1)$ with $q_1 = q_0$ if the current offer of the debtor, $(x''_1, \pi - x''_1)$ is such that $(x''_1 < x_1)$. Hence, the offer is rejected by the creditor. There is no signalling along the equilibrium path of play so that $q_0 = q_1$ but nevertheless, delay occurs with probability one along the equilibrium path of play. ■

When the creditor attaches a high (prior) probability to the debtor being Optimistic, there is no pure strategy Perfect Bayesian Equilibrium with delay; it is, however, possible to construct a mixed strategy Perfect Bayesian Equilibrium with delay where the debtor signals its type (the value of the sustainability constraint). Along the equilibrium path of play, the probability of delay decreases (and in the limit, goes to zero), the higher the (prior) probability that the debtor is Cautious. When the creditor attaches a high (prior) probability to the debtor being Cautious, then there is a pure strategy equilibrium with delay; as both debtor types want to delay, delay occurs with probability one along the equilibrium path of play but there is no signalling of debtor type.

So much for the technical detail of equilibrium with delay; for an intuitive understanding, consider the behaviour of the assorted players, starting with the Cautious debtor.

Assume the creditor's prior beliefs are such that, without signalling, he is unwilling to grant a substantial write down in the second round of bargaining. For the Cautious debtor, who seeks to gain a substantial write-down by using delay as a signal, the plan is simple - make an offer that will be refused. For the creditor, however, things are not so simple. Only when the creditor's posterior beliefs attach a high enough[5], probability that the debtor is Cautious that he decides to grant a debt write down. As these beliefs evolve in Bayesian fashion along the equilibrium path of play, the mixed strategy of the Optimist here plays a crucial role. With some probability he is tempted to join Cautious in delay. What is this probability? Just enough so that the creditor will come to believe (with a probability just high enough) that he is dealing with a Cautious creditor so that it is optimal to grant a write down! With the residual probability, the Optimist makes an offer sufficient for prompt settlement[6]. So, everyone plays their part in achieving probabilistic delay, with Cautious signalling all the time, Optimist sometimes blocking the signal but sometimes joining in; and the creditor providing relief only where (posterior) beliefs warrant it.

This is how the players behave along the equilibrium path where delay can occur. Out of equilibrium, however, the creditor's beliefs must be configured around a threshold value (the Optimist's offer specified above) such that neither debtor type has an incentive to deviate from what we have just described in the preceding paragraph.

Suppose, next, that the creditor's prior belief is such that the debtor is Cautious with a probability high enough to make it willing to grant a write down in the second round of bargaining even without any signalling. Then both debtor types will want to make an offer that leads to delay and a generous write-down (both debtor types act identically). Here, again, we must specify out-of-equilibrium beliefs so that neither debtor type has an incentive to deviate.

Finally, it is worth noting that, where the sustainability condition is common knowledge, this shifts bargaining power in favour of the Cautious debtor without any need for signalling. This reallocation does not, however, affect the MW condition given in Section 2.1 for delay where there is uncertainty as to the growth of the pie.

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[5] I.e. $q_1 = \dfrac{\pi - \bar{s}}{\pi}$.

[6] For the Optimist to be willing to randomize between the two offers, it must be the case that prompt settlement and delay generate the same expected payoffs.

2.3 The three-period model

This section shows how recovery and sustainability can each contribute to delay bargaining. By extending the bargaining model by an extra period, we find that extended delay can occur, first due to prospects of recovery and second due to signalling of sustainability concern. Therefore, prolonged delay is associated with a larger haircut in the debt swap.

In the three-period case, the timing of moves and events is as follows[7]:

Table 4 The three-period game

	Size of Pie	Proposer	Outcome
t = 1	π_L	debtor makes offer	if offer accepted, game ends; if offer rejected, game continues, and conditional on φ, nature chooses π is $\{\pi_L, \pi_H\}$ with prob. $p, 1-p$; s is $\{0, \bar{s}\}$ with prob. $q_0, 1-q_0$.
t = 2:	π_L or π_H	debtor makes offer	if offer accepted game ends; if offer rejected, game continues to final period (with no intervention by nature)
t= 3	π_L or π_H	with probability ½ debtor makes offer with probability ½ creditor makes offer	if offer accepted game ends; if there is no agreement, there are disagreement payoffs of (0,0).

The following proposition characterizes the conditions under which two-period delay occurs in the three-period bargaining model:

[7] The sequence of moves in the stylized three-period model has the debtor making the offer at the first two-time periods. In the online appendix we consider an infinite horizon version of the bargaining game where, after the first round of bargaining, at each period both the debtor and the creditor make an offer with equal probability. The main results of the three-period model studied in the main text continue to hold in the infinite horizon bargaining model.

Proposition 3 Two-period delay exists whenever $r < Eg\left(\frac{\delta}{1+\delta}\right)$***. The creditor's expected payoff with two period delay is*** $\delta^2 \frac{\left(E\pi - \bar{s}\right)}{2}$***.***

Proof. In any subgame starting at $t = 2$, the analysis of the preceding section applies and, for brevity, isn't repeated. Note that at a Perfect Bayesian equilibrium, the anticipated discounted expected payoffs in each subgame for the creditor and the debtor are, respectively, $\left(\frac{\delta\left(\pi - \bar{s}\right)}{2}\right)$ and $\left(\frac{\delta\left(\pi + \bar{s}\right)}{2}\right)$, $\pi \in \{\pi_L, \pi_H\}$. Hence, at $t = 1$, it follows that the creditor's continuation payoff from rejecting the debtor's current offer is defined as: $a = \delta\left[p\left(\delta\left(\frac{\pi_L - \bar{s}}{2}\right)\right) + (1-p)\delta\left(\frac{\pi_H - \bar{s}}{2}\right)\right] = \delta^2 \frac{\left(E\pi - \bar{s}\right)}{2}$. It follows that whenever $\pi_L - a < \frac{\delta^2\left(E\pi + \bar{s}\right)}{2} \Leftrightarrow r < Eg\left(\frac{\delta}{1+\delta}\right)$, two-period delay occurs along the equilibrium path of play. ■

The above proposition demonstrates the conditions under which, in the three-period game, multi-period delay occurs, along the equilibrium path of play, initially driven by the prospect of uncertain economic recovery followed by an additional period of delay due to signalling of sustainability concerns by the debtor. Intuitively, to obtain two-period delay along the equilibrium path of play, the maximum offer the debtor is willing to secure immediate agreement with the creditor must be less than the continuation payoff it expects to obtain in the subgame with one further period delay. As $\left(\frac{\delta}{1+\delta}\right) < 1$, it is evident that the condition required for two-period delay is more stringent than the condition for one-period delay derived in Section 2.1 above.

A key empirical implication of our formal analysis is that prolonged delay is positively correlated with a larger haircut (corresponding to lower creditor payoff) in all the models formally analysed in this section. Moreover, in the three-period model, with two-period delay, the creditor's expected payoff is less than its payoff both in the model studied in Section 2.1 (where one period delay is driven by the prospect of (uncertain) recovery) and in the model studied in

Section 2.2 (where one period delay is driven by incomplete information about the debtor's sustainability constraint). In the following section, we examine empirical evidence consistent with our formal analysis and as well as case studies that limit the scope of its application.

3. Evidence of haircuts

In this section, we first report on salient features of the MPST data-set which runs for four decades after 1970. We then report summary details of sovereign debt restructurings between 1998 and 2005 to see in broad terms the correlation between write-downs and delay.

As MPST note, the distribution of haircuts in forty years of sovereign debt renegotiations is bi-modal. Using data from Cruces and Trebesch (2011), including all renegotiations with foreign banks and bondholders between 1970 and 2010, the histogram they provide has peaks at haircuts of about 25% and 85%, as shown in Fig. 2.

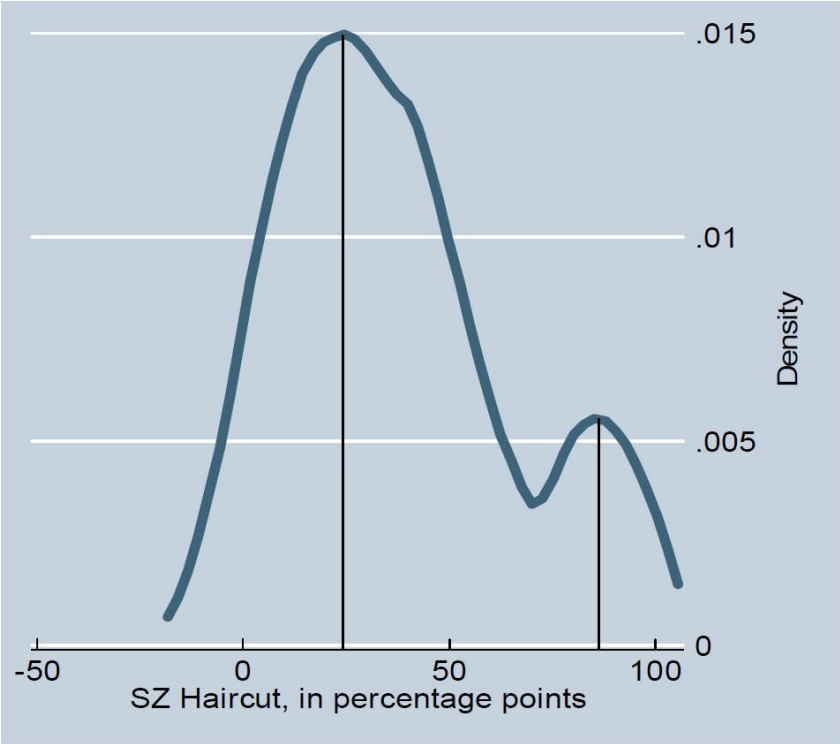

Figure 2 Distribution of haircuts.
Source: Mariscal *et al.* (2015, p.17)

For bonds only, however, haircuts are smaller. When they '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 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'. MPST (p.7)

For bonded debt, Table 5 illustrates the broad correlation between delay and haircuts. It also indicates the heterogeneity of outcomes when sovereigns seek to restructure their debts.

Table 5 Sovereign debt restructurings with haircuts until 2005

Sovereign State	Restructuring Negotiations	Default?	'Delay' - after default	Face Value,	Haircut
Bonds and Bank Loans					
18 countries	08/1982-5/1994		141 months		30-35%
Bonds only					
Argentina	9/2003-4/2005 19 months	Yes 12/2001	40 months	$79.7	67%
Russia	11/1998-7/2000 20 months	Yes 1/1999	18 months	$29.1	69%
Ecuador	8/1999-8/2000 12 months	Yes	12 months	$6.5	60%
Ukraine	1/2000-4/2000 3 months	Yes	3 months	$2.6	40%
Pakistan	2/1999-12/1999 10 months	No	-	$0.6	30%
Uruguay	4/2003-5/2003 1 month	No	-	$3.8	26%

Sources: Table 14 and 15 in Sturzenegger and Zettlemeyer (2005)[8]; Table A.3 in Roubini and Setser (2004); Table 1 in Bi (2008)

[8] The losses that defaults have inflicted on creditors are largely based on the comparison between the (remaining) payment stream that was originally promised to investors and the payment stream associated with the restructured instruments, both discounted at a common interest (Sturzenegger and Zettlemeyer, 2007).

To highlight the contrast between bank loans and bonds when it comes to restructuring, earlier experience reported by Bi (2008) for sovereigns that restructured bank debt as well as bonds is briefly summarized in the top row. The average delay of *more than eleven years* shown there includes the 'lost decade' of Latin American growth, where US banks had to accumulate substantial reserves before writing-down around a third of their loans under the Brady Plan, as discussed by Cline (1995) and Merlo and Wilson (1998).

The sovereign debt restructurings shown in rest of the table, ordered by length of delay after default (if formal default was declared), indicate the positive correlation of delay and write-down. While the average haircut is about 50%, those with above average haircuts (Russia, Argentina, and Ecuador) took the longest to resolve - suggestive evidence that negotiating a bigger haircut involves longer delay.

In his investigation of 'efficient delay' Bi (2008) argues that the entire delay of 40 months shown for Argentina can be accounted for in terms of 'waiting for recovery' as in MW. We would argue, however, that, following default in 2001, there were two separate phases leading up to the debt swap in 2005. First, from the beginning of 2002 to mid-2003, the Argentine economy was recovering strongly from deep recession and there appeared to be a consensus between debtor and creditors to await recovery (a consensus reinforced by the political difficulties faced by the regime in power pending presidential elections). As for the second phase, one could interpret the meagre offer made by Argentina in September 2003 as driven by sustainability concerns. (In terms of our analysis, see Figure 2, this low offer was designed to be rejected - leading to further delay and a reappraisal of the debtor's type - and to a debt exchange in 2005 that acknowledged these sustainability concerns.

Developments after those in Table 5, however, indicate two limitations of our model - namely the absence of creditor heterogeneity and of third party official intervention. In fact, holdout creditors played a played a key role in explaining further delay – and the final out-turn - for Argentina. As the debt exchange achieved in 2005 involved only 76% of the bonds in default, negotiations continued, leading to a second exchange in 2010, raising creditor participation to 93%. The Republic of Argentina effectively treated the second swap as a defeat for the holdouts, and made it clear that the remaining 7% would not receive any payment. But the remaining holdouts included specialist funds[9] determined not to accept any write-down: and, as the debtor appeared to be challenging the authority of the US court handling the case, they

[9] Often referred to as vulture funds.

were able to secure an injunction to *prevent the payment of coupons on the bonds already exchanged* unless the claims of the holdouts were also paid as claimed. Since this so-called 'Pari Passu' injunction threatened to undermine all that had been achieved in earlier restructuring, the Republic of Argentina - after election of a new administration - finally agreed to a settlement with the principal holdouts in early 2016, Guzman (2016). So, our formal analysis can account for part but not all the spectacular delay involved in this complicated case.

In the case of the 2012 Greek debt restructuring, private creditors settled without default, accepting a write-down of 69% on debt with face value of $199b, achieved after only 8 months of negotiation. But this was orchestrated largely by third party official creditors, highlighting the institutional differences between debt problems of a member of a currency union and those of stand-alone nation states. The Eurozone may be incomplete - a currency union without fiscal and banking union - but policy-makers of the so-called Troika (the Commission, the ECB and the IMF) were determined it should not fail (Zettelmeyer *et al.*, 2013; Sapir *et al.*, 2015). This hardly fits the scenario analyzed in our model of a private creditor and a debtor state involved in bargaining with asymmetric information with no third party intervention.

4. Some policy implications

In terms of the analysis provided earlier, sustainability concerns may be signalled by delay; but this will only happen if the benefits to the debtor are sufficient to cover the cost of delay. The fact that MPST have uncovered - that there are so many repeat 'reprofilings' - suggests that the costs of using delay as a signal may be substantial.

If delay is too costly, is there an alternative? The Greek case delivered a prompt restructuring; but it hardly provides a tempting template. By way of *institutional reform*, the experience of the Paris Club provides a more promising precedent. Initially, as Sachs (1995) pointed out, when negotiations were seen simply in terms of debt enforcement, this led to debt reductions which failed to give countries a 'fresh start': so, the same debtor countries frequently reappeared seeking further concessions. A key alternative, that Sachs (2002) discussed, was to use the Millennium Development Goals as a benchmark: so, a restructuring would be judged inadequate if it failed to help the debtor make progress with these goals. The paper by Cheng *et al.* (2016) takes a 60-year view of the operations of the Paris Club and, as the title suggests, charts a significant shift before and after 1980 - a shift 'from debt collector to relief provider';

and attempts to measure the success of this change of focus - in terms of achieving economic growth in particular.

The sovereign debtors involved in the Paris Club negotiations are typically[10] Heavily Indebted Poor Countries (HIPC), however. What of countries with middle or higher incomes? How to signal appropriate restructuring criteria for them? When Argentina went into default at the end of 2001, Anne Krueger took the bull by the horns by advocating a form of sovereign bankruptcy procedure, analogous to what domestic bankruptcy law provides for corporations and municipalities. Her proposal, Krueger (2002), gave a central role to the IMF, which would naturally have a data available on the country[11] and its problems (and has unparalleled experience of providing support – with conditions - to countries in financial trouble). The proposal was not adopted, however, largely because the US Treasury was not convinced: a key issue being that the IMF would face a conflict of interest as both judge and creditor.

While the IMF could potentially resolve uncertainty about future growth or sustainability concerns when these are in dispute, this same conflict of interest may preclude it from acting in this role. Consider a simple extension of the model studied above which differentiates between an official senior creditor (such as the IMF) and private bondholders, whose claims are subordinate. Assume that bargaining surplus over which the debtor and the private bondholder bargain over, π, is the *residual amount available after any payments to IMF are made*. As a senior creditor, the IMF's claim on resources will reduce the bargaining surplus π available. Since this will exaggerate the significance of debtor's sustainability constraint $\bar{s}$ over which the private bondholder and the debtor can bargain, this will tend to make delay more likely. Hence, given its senior creditor status, the IMF may not be able to play the role of disinterested assessor who can reduce delay.

The US Treasury's alternative to institutional reform was *renegotiable contracts* - specifically Collective Action Clauses in sovereign debt instruments so that a supermajority of creditors could, after default, engineer debt restructuring as they judged appropriate. The apparent success of the contractual approach has encouraged further proposals. Thus Brooke *et al.* (2013), a paper from economists at the Bank of Canada and Bank of England, makes the case for 'sovereign CoCos' (Contingent Convertible debt instruments) to ease liquidity crises, where the provision of emergency funding by the IMF would trigger a rollover by private bondholders.

[10] According to the Paris Club, although selected non-HIPC countries are also entitled for assistance under the Evian approach, there is lack of detail on exactly which countries are covered.
[11] Blustein (2005) discusses official sustainability assessments of Argentina made by the IMF but kept confidential.

For issues of solvency, the authors advocate the issuance of GDP linked bonds[12]. State-contingent contracts, as advocated by Robert Shiller, have been positively assessed in a study by Barr *et al.* (2014) at the Bank of England; and similar 'growth-linked securities' have been strongly endorsed by Blanchard *et al.* (2016), who emphasize how they could assist European countries in handling the current sovereign debt overhang.[13]

5. Conclusion

Apart from Greece, recent sovereign debt restructuring involving considerable delay secured substantial haircuts. We develop a bargaining model to account for this. With a stochastic bargaining surplus and asymmetric information about the debtor's sustainability concern, we show that multi-period delay can occur, initially to allow for recovery then for signaling concern about sustainability; so prolonged delay is positively correlated with a large haircut. These are by no means the only factors to be considered, however, as recent experience in Argentina and Greece has shown. Possible institutional development, problems of creditor coordination and prospects for contractual innovation are further issues in sovereign debt restructuring all clearly worth exploring.

So too is the role of domestic politics. In the 'war of attrition' model developed by Alesina and Drazen (1991), for example, different social groups adopt an 'après vous Alphonse' approach as they attempt to shift the burden of stabilization onto others, following a fiscal crisis. More recently, Trebesch (2016) has provided a wealth of empirical evidence on domestic political factors associated with delay in restructuring. Political conflict may be another symptom of domestic concern for achieving a sustainable settlement. Our results on signalling by delay are, we believe, complementary to such studies.

In the absence of an institutional solution for overseeing debt restructuring for higher income countries, contract redesign offers an alternative: Brooke et. al. (2013), for example, make a case for adopting sovereign CoCos and GDP-indexed bonds *ex ante* to help align the debtor's commitments with its capacity to pay. Extending the formal analysis developed here to discuss sovereign CoCos is a topic of future research.

[12] GDP-linked warrants were issued by both Argentina and Greece: but this was *ex post*, and the contracts suffered from a marked novelty premium, estimated at 800 bps.
[13] See Williamson (2017) for further discussion.

Supplementary material

Supplementary material is available on the OUP website. This is the online appendix.

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References

Alesina, A. and A. Drazen (1991) 'Why are Stabilizations Delayed?', *American Economic Review,* **81**, 1170-1188.

Bai, Y. and J. Zhang (2012) 'Duration of sovereign debt renegotiation', *Journal of International Economics*, **86**, 252-268.

Barr, D, O. Bush and A Pienkowski (2014) 'GDP-linked Bonds and Sovereign Default'. In J.E.Stiglitz and D. Heymann (eds) *Life after Debt: The Origins and Resolution of Debt Crises.* Palgrave Macmillan, London, Chapter 4.3.

Benjamin, D. and M.L.J. Wright (2016) 'Recovery before redemption', mimeo. Federal Reserve Bank, Chicago.

Bi, R. (2008) 'Beneficial Delays in Debt Restructuring Negotiations, IMF Working Paper 08:38, International Monetary Fund, Washington, DC.

Blanchard, O., P. Mauro and J. Acalin (2016) 'The Case for Growth-Indexed Bonds in Advanced Economies Today,' Policy Briefs PB16-2, Peterson Institute for International Economics, Washington, DC.

Blustein, P. (2005) *And the Money Kept Rolling In (and Out)* Public Affairs, New York.

Brooke, M., R. Mendes, A. Pienkowski and E. Santor (2013) 'Sovereign Default and State-Contingent Debt', **Bank** of Canada Discussion Paper 2013-3, Bank of Canada.

Cheng, C., J. Diaz-Cassou and A. Erce (2016) 'From Debt Collector to Relief Provider: 60-Year Official Debt Restructuring with the Paris Club', Working Papers 20, European Stability Mechanism, Luxembourg.

Cline, W.R. (1995). International Debt Reexamined, Peterson Institute Press, Peterson Institute for International Economics. Washington DC.

Cruces, J.J. and C. Trebesch (2011). 'Sovereign Defaults: The Price of Haircuts', CESifo Working Paper Series, number 3604.

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

Ghosal, S. and M. Miller (2003) 'Coordination Failure, Moral Hazard and Bankruptcy Procedures', *Economic Journal*, **113**, 276-304.

Ghosal, S. and M. Miller (2016) 'Writing-down debt with heterogeneous creditors: lock laws and late swaps', *Journal of Globalisation and Development,* Special Issue on Sovereign Debt Restructuring, M. Guzman, D. Lombardi, J. Ocampo and J. Stiglitz (eds) DOI 10.1515/jgd-2015-0017.

Ghosal, S., M. Miller and K. Thampanishvong (2016) 'Waiting for a haircut? A bargaining perspective on sovereign debt restructuring', Discussion Paper 117710, CEPR, London.

Ghosal, S. and K. Thampanishvong (2013) 'Does strengthening Collective Action Clauses (CACs) help?' *Journal of International Economics*, **89**, 68-78.

Guzman, M. (2016) 'An Analysis of Argentina's 2001 Default Resolution', CIGI Paper 110, Centre for International Governance Innovation, Waterloo.

Guzman, M. and D. Lombardi (2017) 'Assessing the appropriate size of debt relief'. Paper presented at IEA World Congress, Mexico, April.

IMF (2014) 'The Fund's Lending Framework and Sovereign Debt- Preliminary Considerations', IMF Staff Papers, http://www.imf.org/external/np/pp/eng/2014/052214.pdf (last accessed April 2018)

Kletzer, K. (2002) 'Sovereign Bond Restructuring: Collective Action Clauses and Official Crisis Intervention'. IMF Working Paper, No. 03:134, International Monetary Fund, Washington, DC.

Krueger, A. O. (2002) *A New Approach to Sovereign Debt Restructuring.* International Monetary Fund, Washington, DC.

Mariscal, R, A. Powell, G. Sandleris and P. Tavella (2015) 'Sovereign Defaults: has the current system resulted in lasting (re)solutions?', Business School Working Papers 2015-03, Universidad Torcuato Di Tella, Buenos Aires.

Merlo, A. and C. Wilson (1995) 'A Stochastic Model of Sequential Bargaining with Complete Information'. Econometrica, **63**, 371-399.

Merlo, A. and C. Wilson (1998) 'Efficient delays in a stochastic model of bargaining'. *Economic Theory*, **11**, 39-55.

Pitchford, R. and M. Wright (2012) 'Holdouts in Sovereign Debt Re- structuring: A Theory of Negotiation in a Weak Contractual Environment 'Review *of Economic Studies*, **79**, 812-837.

Roubini N. and B. Setser (2004) *Bailouts or Bail-ins? Responding to Financial Crises in Emerging Economies*. Institute of International Education, Washington, DC.

Rubinstein, N. (1982) 'Perfect Equilibrium in a Bargaining Model', *Econometrica,* **50**, 97 - 110.

Rubinstein, N. (1985) 'A Bargaining Model with Incomplete Information About Time Preferences', Econometrica, **53**, 1151-1172.

Sachs, J. (1995) 'Do we need a Lender of Last Resort'. Presented as Frank D. Graham Lecture, Princeton University, Princeton, NJ, April.

Sachs, J. (2002) 'Resolving the Debt Crisis of Low-Income Countries' *Brookings Papers on Economic Activity*, **1**, 257-286.

Sapir, A, G.B. Wolff, C. de Sousa and A. Terzi (2015) 'The Troika and financial assistance in the euro area: successes and failures'. Study for the Economic and Monetary Affairs Committee, European Parliament, Brussels.

Sturzenegger, F. and J. Zettlemeyer (2005) 'Haircuts: Estimating Investor Losses in Sovereign Debt Restructurings, 1998-2005' IMF Working Paper. WP/05/137, International Monetary Fund, Washington, DC.

Sturzenegger, F. and J. Zettlemeyer (2007) *Debt Defaults and Lessons from a Decade of Crises.* MIT Press, Cambridge, MA.

Sullivan, S.P. (2016) 'Why wait to settle? An experimental test of the asymmetric-information hypothesis', *Journal of Law and Economics*, **59**, 497-525.

Trebesch, C. (2016) 'Delays in Sovereign Debt Restructurings: The Role of Political Risk', mimeo, Kiel Institute of the World Economy, Kiel.

UN General Assembly (2015) Basic Principles on Sovereign Debt Restructuring Processes, A/69/L.84. United Nations, New York.

Weinschelbaum, F. and J. Wynne (2005) 'Renegotiation, collective action clauses and sovereign debt markets'. *Journal of International Economics*, **67**, 47-72.

Williamson, J. (2017) *Growth-linked Securities*. Palgrave-Macmillan, London.

Zettelmeyer, J., C. Trebesch, and M. Gulati (2013) 'The Greek Debt Restructuring: An Autopsy', *Economic Policy,* **28**, 513-63.