

Credit Derivatives and Sovereign Debt Crises*

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Abstract

The new markets for credit derivatives allow for buying protection on sovereign debt. This paper considers the implications for sovereign debt crises. We show that the availability of credit protection lowers ex-ante debtor moral hazard by allowing a bondholder to improve his bargaining position in negotiations with the sovereign, thus forcing the sovereign to internalize more of the costs of a crisis. Moreover, we find that equilibrium protection does not hinder an efficient resolution of crises. We even identify situations where crisis resolution is improved by facilitating conditionality.

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Nevertheless, we show that a bondholder's choice of protection is not always socially optimal. In these cases, *increasing* the level of protection makes crisis resolution more efficient.

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1 Introduction

The recent wave of defaults in countries such as Argentina, Mexico and Russia has led to a renewed interest in sovereign debt crises. Their resolution is often difficult because in the absence of supranational bankruptcy procedures, there is no clear and orderly mechanism on how to deal with them. In principal, this absence could be compensated for by writing appropriate contracts ex-ante. However, countries only seem to be able to raise funds through debt, which is rather inflexible. Because of these, and other issues, many observers consider the current arrangements for resolving sovereign crises as inefficient.¹

The arrival of *credit derivatives* has added a new element to sovereign debt financing. Broadly speaking, credit derivatives are financial instruments that allow creditors to insure against losses on their debt.² Their use is growing rapidly: only introduced ten years ago, the total outstanding volume of credit derivatives had reached US\$ 17 trillion by the end of 2005. While most protection is traded for corporates, a significant part of the market covers sovereign debt, allowing, among others, to buy protection on countries such as Brazil, Mexico, Russia, Colombia, Venezuela, South Africa and the Philippines.³

¹Several proposals for their improvement are currently under discussion. For an overview, see Eichengreen (2003).

²In their most common form, the *credit default swap*, they work as follows: a bondholder makes periodic insurance payments to a protection seller; in return, when a default occurs, the protection seller makes a compensation payment to the bondholder. For a detailed overview of the various forms of credit derivatives, see Kiff, Michaud and Mitchell (2003).

³See BIS (2004), BBA (2004) and Fitch (2005). This development has received widespread attention among policymakers. In the sovereign context, see for example Ranciere (2001), Packer and Suthiphongchai

Credit derivatives matter for sovereign debt crises because they change a bondholder's incentives to participate in a debt restructuring. A widespread concern is that they make restructuring more difficult since "credit derivatives may provide investors with incentives to hold out in the hope of forcing a default, thereby triggering a repayment under the terms of the derivative contract"⁴ and are thus harmful for the resolution of crises. An alternative view would be that credit derivatives are beneficial for crisis resolution since they provide a new tool to structure debt relationships. In particular, credit derivatives have been praised for their flexibility since they allow a bondholder to choose the extent and duration of protection he buys. Which of these views is likely to prevail, of course, ultimately depends on how a bondholder will use protection.

This paper tries to understand the consequences of the availability of credit protection for sovereign debt crises. We present a simple model of sovereign debt financing. In this model, the optimal ex-post resolution of a crisis depends on a country's productivity. While for sufficiently high productivity it is efficient to restructure debt, a default is preferable when countries are unproductive in order to avoid a continued inefficient use of resources. The equilibrium crisis resolution which arises in the absence of protection is efficient, except for private costs which a country suffers in a default. These costs create a bias towards default, i.e., there are situations where a default occurs although restructuring would be efficient. From an ex-ante point of view, however, crisis resolution is always inefficient. This is because due to sovereign immunity the sovereign can renegotiate down the debt claim in a crisis. This reduces the crisis costs borne by the country and causes ex-ante debtor moral hazard in crisis avoidance.

We then study the impact of credit protection chosen by a bondholder for strategic reasons, that is in order to influence his position in a potential crisis.⁵ Contrary to the (2003), Verdier (2004) and Federal Reserve Bank of New York (2005).

⁴Anne Krueger, the deputy managing director of the IMF, in a recent speech (Krueger, 2002).

⁵For dispersed debt, this requires the existence of bondholders that have potential influence over the

voiced concern, we find that credit protection does not undermine the ability to achieve restructuring. It is true that if the bondholder would sufficiently insure his bonds, restructuring would indeed be impossible as the bondholder then always prefers default in order to trigger the protection. However, choosing such protection is not in the bondholder's interest. The reason is that the bondholder would then exercise protection in every crisis, making the purchase of protection expensive.⁶ Still, there are welfare ramifications as the bondholder insures partially in order to improve the restructuring offer the sovereign has to make. This has the effect of reducing ex-ante debtor moral hazard by making crises more costly for the country.⁷

We further study situations in which the bondholder has inferior knowledge about the overall restructuring process. For instance, for restructuring through the London Club (which deals with commercial bank debt) these may be members of the *steering committee* which handles negotiations with the sovereign. For non-commercial private debt, large creditors have an influence over the restructuring process through the consultation period which typically precedes the public exchange offer (this may be either formally, as notably in Uruguay and the Dominican Republic in recent years, or informally).

⁶The seller of protection is assumed to remain passive in the process, i.e., he does not renegotiate his position. There are a variety of reasons for why this seems plausible. For one, protection sellers are typically large financial institutions not protected by sovereign immunity, hence contractual features can be used to prevent renegotiation. More importantly, these institutions make frequent interactions in financial markets, thus reputation concerns are likely to deter them from renegotiating. Furthermore, protection sellers will be typically widely dispersed. This makes coordination for them difficult, in particular so since protection is traded in decentralized and anonymous markets.

⁷This argument is related to studies that argue against policy interventions that make restructuring less costly for sovereigns. Dooley (2000) and Shleifer (2003), for example, have shown that such interventions increase sovereigns' incentives to repudiate their debt. Given that creditors have little enforcement power, they will be more reluctant to lend. This then leads to higher costs of borrowing for sovereigns and a reduction in lending to emerging market countries (see also Eichengreen, 2003, and Bolton and Jeanne, 2005).

repayment ability of the country. In the absence of protection, this has the consequence that crisis resolution cannot be conditional on the country's productivity, as the sovereign always has an incentive to pretend to have high productivity. We show that there is a role for credit protection in restoring conditionality, which arises because it can alter the bondholder's incentives to litigate against the sovereign in a default.

Our results hence broadly suggest that credit derivatives are beneficial for sovereign debt financing, once taking into account the bondholder's strategic incentives to buy protection. Besides potentially improving crisis resolution ex-post, this is because protection allows a bondholder to improve his outside option in a crisis. The increased outside option neutralizes the renegotiation problem which arises from sovereign immunity and reduces debtor moral hazard. It should be emphasized that potential adverse effects of credit derivatives are only avoided precisely because protection is chosen with strategic awareness. If this is not the case, a case for government intervention arises.

However, we show that the bondholder's strategic choice of protection is not always socially optimal in terms of crisis resolution. In particular, the excessive defaults that arise from countries' private costs could be fully avoided by buying protection with a sufficiently long maturity. Intuitively, this is because under such protection the bondholder is *more* inclined to accept a restructuring offer, as he is then also protected against situations where the country cannot make the repayments on the restructured bond in the future. This suggests that if debtor countries and/or supranational institutions believe that the current restructuring procedure exhibits a bias towards delivering defaults, they can correct this bias through the appropriate use of credit derivatives. This may for example take the form of protection that is attached to the initial bond and guaranteed by a third party.

Credit derivatives may thus have a role to play in the ongoing discussion on how to improve the sovereign restructuring process. In fact, by increasing the negotiation power of creditors in a crisis, they work in a similar way as proposals that aim at enhancing

creditor power, such as a bankruptcy court for sovereign debt (Krueger, 2002, and Bolton and Jeanne, 2005) or measures to increase the contractibility of debtor's pay-offs (Tirole, 2002, and Ghosal and Miller, 2003). Moreover, their ability to reduce informational problems between lenders and borrowers may reduce the need for institutions that aggregate information, such as the IMF (as analyzed in Spiegel, 2005). Furthermore, because they allow for a private sector solution for inefficient defaults, they may be an alternative to IMF-bailouts or insurance funds (as suggested by Jeanne, 2001).

The remainder of this paper is organized as follows. The next section briefly reviews related literature on credit derivatives. Section 3 presents the basic model in the absence of protection. Section 4 studies the impact of protection. Section 5 extends the analysis to situations where the bondholder is not fully informed about the repayment ability of the country. The final section concludes.

2 Credit Derivatives in the Literature

Many contributions to the burgeoning literature on credit derivatives have focused on their impact on the borrower-lender relationship. Duffee and Zhou (2001), for example, show how the flexibility of credit derivative instruments can be used to mitigate adverse selection problems. Morrison (2005) has shown that credit derivative markets can reduce banks' incentives to monitor, which can erode the certification value of bank loans.

The point of departure for our paper is Arping (2005), who has shown in the context of corporate debt that credit protection can improve lenders' outside option and thus exercise a disciplining effect on borrowers. Our paper deviates from Arping's as follows. For one, we additionally consider the impact of credit protection on the resolution of a crisis and how this trades off with the bondholder's desire to increase his outside option. While in Arping's model default is always inefficient and never occurs in equilibrium, in our model

the efficiency of crisis resolution varies with the country's productivity and equilibrium credit protection may alter crisis resolution.⁸

Furthermore, we allow for situations in which lenders are imperfectly informed about the borrower's repayment abilities. We also acknowledge that it is relatively costly for lenders to legally enforce any claims when a sovereign defaults. This friction turns out to play an important role for the impact of credit protection, in particular it allows protection to reduce inefficiencies in crisis resolution stemming from lender's inferior information. Moreover, consistent with the nature of credit derivatives markets we analyze protection that is chosen anonymously, while Arping's paper mostly focuses on protection that is part of the contract between lenders and borrowers. As a consequence, the equilibrium level of protection is not necessarily socially efficient in our paper, and we consider the role for policy to improve efficiency.⁹

Few papers have so far focused on sovereign debt markets. General overviews are provided in Ranciere (2001), Packer and Suthiphongchai (2003), and Federal Reserve Bank of New York (2005). Verdier (2004) provides an extensive analysis of the legal aspects, which played a large role in recent settlements of protection. Pan and Singleton (2005) and Cossin and Jung (2005) use sovereign credit derivatives to extract market expectations about sovereign risk.

⁸One consequence of this, for example, is that (in contrast to Arping) debtor moral hazard may actually increase after the introduction of credit protection because credit protection is used to improve crisis resolution (see, for example, Proposition 6).

⁹For most parts our analysis also applies to corporate debt. However, we have chosen to focus our exposition on sovereigns because due to sovereign immunity the renegotiation problem is presumably more severe in this context.

3 A Simple Model of Sovereign Debt Restructuring in the Absence of Credit Protection

Consider a sovereign country and a bondholder, who are both risk-neutral and maximize their expected payoffs. There are three periods and there is no discounting. In period 0, the sovereign borrows funds from the bondholder. Repayment takes place in period 1 and in period 2, where total repayment is normalized to one. At the beginning of period 1 a ‘debt crisis’ occurs because the country’s funds are zero and thus debt payment cannot be met (below we endogenize the occurrence of debt crises as a consequence of debtor moral hazard). The country has an ongoing project at this time (possibly financed by the funds raised in period 0), generating output f in period 2.

In order to avoid default, the sovereign can make a *take-it-or-leave-it* restructuring offer to the bondholder.^{10 11} A restructuring offer promises a period 2 return in exchange for the total outstanding debt. If the bondholder accepts (i.e., the offer is successful), production in the project continues, yielding output in period 2. If the bondholder rejects, the country is in default (equivalently, in such cases the sovereign could default outright rather than making a restructuring offer).¹² The project can then no longer be continued (for example, because it requires foreign resources which are unavailable in a default). The bondholder then obtains the liquidation value of the project k , with $k < 1$ (in Section 5.1 we consider

¹⁰Such *pre-default* restructuring has become common since the mid 1990s.

¹¹Thus, we focus here on the extreme case where the sovereign has all the bargaining power. For our arguments to hold, however, it is only needed that the sovereign has some bargaining power.

¹²Our model abstracts from strategic ‘holdouts’. In a world of multiple creditors, this presumes that there is some form of creditor coordination such as through collection action clauses (CAC), creditor committees, or restructuring via the London or the Paris Club (recent restructuring experiences also suggest that the holdout problem is perhaps overstated; see for example De Brun and Della Mea (2003) who show that in the Uruguay case restructuring was implemented within a short time on debt which did not include CACs).

that the bondholder has to litigate in order to obtain k).¹³ The disruption of the project causes additional private default costs $c > 0$ to the country, such as from lower domestic consumption.¹⁴

Appendix 1 shows that welfare in this economy is determined by two aspects: the efficiency of crisis resolution (ex-post efficiency) and debtor moral hazard in avoiding crises (ex-ante efficiency). An efficient resolution requires that the joint payoffs of bondholder and sovereign in a crisis are maximized (the distribution of the payoffs between sovereign and bondholder does not affect ex-post efficiency as in competitive bond markets the sovereign participates fully in the bondholder's losses in a crisis through a higher interest rate). Hence, from an ex-post perspective, there should be restructuring whenever the output of the project is at least its liquidation value net of default costs (i.e., $f \geq k - c$), and default otherwise.¹⁵ As to ex-ante efficiency, Appendix 1 endogenizes the occurrence of crises as being the result of insufficient incentives for the sovereign to avoid them. These incentives depend on the sovereign's payoff in a crisis. Welfare, *ceteris paribus*, therefore decreases with the sovereign's payoff in a crisis, as higher payoffs increase moral hazard in crisis avoidance.¹⁶

¹³The assumption that the bondholder fully obtains the liquidation value may seem extreme; however, our main results hold also when the bondholder can only secure a fraction of the country's funds. Furthermore, it should be noted that the possibilities for creditors to enforce their claims against sovereigns have improved substantially recently as bondholders can now threaten to disrupt future financing: in 2000 Elliott Associates succeeded in stopping the distribution of Peru's payments to new bondholders, forcing Peru to pay Elliott's pre-Brady loans in full.

¹⁴More broadly, these costs can also be interpreted as being due to reputational losses (e.g., Eaton and Gersovitz, 1981) or sanctions (e.g., Bulow and Rogoff, 1989).

¹⁵An alternative interpretation of the optimality of default when output is low is that the country can carry out a reform which increases the productivity of the project but may choose not to do so under restructuring because of the outstanding debt (debt overhang problem).

¹⁶The potential friction between ex-post efficiency of crisis resolution and ex-ante incentives is now central to the sovereign restructuring debate. See Bolton and Jeanne (2005) for a recent example.

3.1 Equilibrium Crisis Resolution

Table 1, column ‘No protection’, summarizes for a restructuring offer of r the payoffs for the sovereign and the bondholder. Because there is no discounting, we can ignore whether payments are received in period 1 or 2. When the offer is accepted, the bondholder’s payoff is r , or f whenever the project’s output falls short of r . The sovereign obtains whatever there may be left of output after having paid the bondholder: $\max(f - r, 0)$. When the offer is rejected, the bondholder obtains the liquidation value k and the sovereign suffers default costs $-c$.

Table 1: Payoffs for a Restructuring Offer r

		No protection	Short protection q	Long protection q
Sovereign	Accept	$\max(f - r, 0)$	$\max(f - r, 0)$	$\max(f - r, 0)$
	Reject	$-c$	$-c$	$-c$
Bondholder	Accept	$\min(r, f)$	$\min(r, f)$	if $r \leq f : r$ if $r > f : q + (1 - q)f$
	Reject	k	$q + (1 - q)k$	$q + (1 - q)k$

Proposition 1 derives the equilibrium outcome of the restructuring process, which is also summarized in Table 2 (column ‘No protection’).

Proposition 1 *In the absence of protection there is restructuring with $r = k$ whenever $f \geq k$ and default otherwise.*

Proof. *Note first that the sovereign’s payoff under restructuring ($\max(f - r, 0) \geq 0$) is larger than under default ($-c < 0$). Thus the sovereign always prefers restructuring. Given that the bondholder’s payoff under default is k , the sovereign needs to credibly promise a return of k to obtain restructuring. When $f \geq k$, this is feasible by offering $r = k$ and hence*

there is restructuring with $r = k$. When $f < k$, the sovereign cannot credibly promise a return which is at least equal to the bondholder's payoff under default (in particular, $r > f$ is not credible; the bondholder realizes then that his pay-off will only be f). Any restructuring offer is hence rejected and there is default. ■

Table 2: Equilibrium Crisis Resolution (R=Restructuring, D=Default)

	No protection		Protection	
	$f \geq k$	$f < k$	$f \geq k$	$f < k$
Resolution of Crisis	R with $r = k$	D	R with $r = f$	D
Sovereign's Payoff	$f - k$	$-c$	0	$-c$
Bondholder's Payoff	k	k	f	k

Crisis resolution is thus efficient, except when we have $k > f > k - c$. In this case, there is default (as $f < k$) but the sovereign's and bondholder's joint payoff would be higher under restructuring (as $f > k - c$). The reason why the sovereign cannot achieve restructuring in this case (even though he would like to because of private costs c) is that he cannot credibly promise a return at least equal to the bondholder's outside option k . The proposition also shows that moral hazard in crisis avoidance is not minimized because the sovereign can keep $f - r = f - k \geq 0$ when there is restructuring, even though the bondholder is not fully repaid ($r = k < 1$).¹⁷ This is because, once in a crisis, the sovereign renegotiates down the bondholder's claim according to the bondholder's outside option k (in contrast, when there is no crisis, the sovereign does not find it optimal to renegotiate because of the costs of doing so, see Appendix 1).

¹⁷Our analysis focuses on the *moral hazard* aspect of sovereign debt crisis and thus ignores liquidity crises. These can be avoided in our setup because the sovereign can promise future output to bondholders (for a recent synthesis of both views, see Powell and Arozamena, 2003).

4 Credit Protection

We now allow the bondholder to buy protection on his debt. As with standard credit derivatives (such as credit default swaps), this protection insures the bondholder against a so-called *credit event*. A credit event is defined as a situation where the debtor no longer makes the agreed repayments to the bondholder and where the bondholder has not voluntarily accepted a change in the repayment terms. Since the restructuring offer in our model is accepted on a voluntary basis, it does not qualify as a credit event.¹⁸ However, when the debtor does not deliver on the restructured debt, a credit event may still be triggered, if the non-delivery falls within the period for which protection has been bought.

When a credit event occurs, the bondholder is paid $q \cdot 1 = q$ by the protection seller, where q ($0 \leq q \leq 1$) is the fraction of debt on which the bondholder buys protection. Interpreting the debt as consisting of a (large) number of bonds, we can also refer to q as the fraction of insured bonds. In return, the bondholder delivers the insured bonds to the protection seller (such *physical settlement* is predominant for sovereign credit derivatives, see Ranciere, 2001). We consider two different maturities of credit protection. Under *short (maturity) protection*, the bondholder is only insured throughout period 1, while under *long (maturity) protection* the bondholder is also insured throughout period 2. Thus, in contrast to short protection, long protection also insures the bondholder against non-delivery on the restructured bonds.¹⁹

We consider protection that is bought once the crisis has materialized (although, as will

¹⁸This is consistent with the ruling of the Southern District of New York that Argentina's 2001 voluntary exchange offer did not constitute a credit event (Verdier, 2004).

¹⁹Such differences in maturities proved relevant during the Argentinian default: on November 1, 2001, Argentina made a voluntary exchange offer, which was announced as successful on November 19. On December 24, Argentina suspended payments on its debt, which triggered many default swaps. However, some protection had expired between those dates (Verdier, 2004).

become clear later, this assumption is inessential). We assume that the protection seller is a risk neutral agent who behaves competitively. This implies that the price of protection, $p(q)$, equals the expected payments the protection seller has to make to the bondholder, net of the value of the restructured bonds he may obtain. Note, furthermore, that the protection seller can be ignored in the welfare analysis, as he breaks even on average.

We assume that the protection seller does not renegotiate with either the sovereign or the bondholder (for example, the protection seller could offer payments to the bondholder in order to make him accept a restructuring offer). We believe this to be a plausible assumption for several reasons. First, protection sellers are not protected by sovereign immunity, thus disallowing renegotiation can be part of the derivative contract. Second, and more importantly, even though there are no explicit contractual features, reputation concerns are likely to deter renegotiation by protection sellers, who are typically large financial intermediaries that make interactions in financial markets at high frequency (few market participants would engage in transactions with an institution that is known for its tendency to renegotiate!). Finally, there are serious practical impediments to renegotiation. Credit derivatives are traded in decentralized markets and diversification considerations imply that there is a large number of protection sellers. A successful renegotiation for protection sellers (i.e., a renegotiation that avoids default) would require for their actions to be coordinated, as a single protection seller would lack the incentives (and the means) to compensate the sovereign or the bondholder in order to avoid default. Coupled with the anonymity of derivatives markets, such coordination seems hard to achieve.²⁰

Columns 2 and 3 in Table 1 summarize the payoffs for a level q of either short or long protection. For comparability with the no protection case, the table presents *gross* payoffs for the bondholder, which do not include the price of protection p (the protection price,

²⁰In addition, a renegotiation by the protection seller is even less likely since such a renegotiation would have to take place before the sovereign defaults and the protection is exercised.

however, does not affect the resolution process as it is sunk at the time of the restructuring offer). There are two changes relative to the situation without protection. First, under both short and long protection the bondholder's payoff in a default is now $q + (1 - q)k$, which is larger than k when $q > 0$. This is because default constitutes a credit event, allowing the bondholder to secure fully the nominal repayment on his uninsured bonds ($q \cdot 1$). On the uninsured bonds, the bondholder receives their share in the liquidation value $((1 - q)k)$ (the remainder of the liquidation value (qk) is received by the protection seller as he obtains the insured bonds from the bondholder). Second, under long protection the bondholder's payoff if the sovereign does not deliver on the restructured bond is $q + (1 - q)f$, as he can then still exercise protection in period 2.

Proposition 2 derives the equilibrium crisis resolution which arises from the bondholder's optimal choice of protection (also summarized in Table 2). Note that since the bondholder is risk neutral, he only buys protection for strategic reasons, that is in order to improve his outside option in negotiations with the sovereign.

Proposition 2 *The introduction of protection does not change crisis resolution but reduces moral hazard in crisis avoidance; in particular there is restructuring with $r = f$ whenever $f \geq k$ and default otherwise.*

Proof. *Suppose that the bondholder buys an amount of short protection q^* such that his payoff under default becomes $q^* + (1 - q^*)k = f$ (i.e., $q^* = (f - k)/(1 - k)$) when $f \geq k$ and buys no protection ($q^* = 0$) otherwise. When $f \geq k$, there is thus acceptance with $r = q^* + (1 - q^*)k = f$, as the sovereign still always prefers acceptance and has to promise at least the bondholder's default payoff to obtain restructuring. The bondholder's net payoff (net of the price of protection) is then f since the price of protection is zero as protection is not exercised. When $f < k$, Proposition 1 can be readily applied as $q^* = 0$, implying that there is rejection and the bondholder's payoff is then k . It follows that for each f the*

bondholder obtains the maximum available payoff: f when $f \geq k$ and k when $f < k$. q^ is therefore the bondholder's optimal protection (other forms of protection may at most give the same payoff). Since for q^* there is restructuring when $f \geq k$ and default otherwise, we have that equilibrium crisis resolution is unchanged. However, the sovereign's payoff when $f \geq k$ is now zero (when $f < k$ it is still $-c$). Hence, for $f > k$ moral hazard is lowered.*

■

Thus, even though credit protection can potentially reduce the efficiency of restructuring (as protection may raise the bondholder's outside option, $q + (1 - q)k$, beyond f even when $f > k$ and thus lead to inefficient defaults), it is not in the bondholder's interest to choose such levels of protection. This is because, since the protection seller breaks even, the bondholder's *net* payoff (i.e., net of the price of protection) always equals the *payout* of the sovereign to both bondholder and protection seller in a crisis. In particular, the bondholder fully internalizes a lower payoff for the protection seller via a higher price of protection ex-ante. Obtaining protection which causes default when $f > k$ is therefore not optimal, as the total payout the sovereign makes in a default is only k , while the bondholder through protection which does not lead to default can extract up to f from the sovereign. Hence, even though the bondholder's gross payoff in a default may be larger than under restructuring (for $q = 1$ the bondholder could even fully recover his debt), the bondholder's net payoff is smaller.

As the proposition has shown, the availability of protection is even beneficial for welfare because it improves ex-ante debtor incentives. This is because it allows the bondholder to increase his outside option in restructuring negotiations and thus reduces the sovereign's payoff in a crisis.²¹ The question arises as to whether the bondholder's choice of protection

²¹We have assumed that the bondholder can fully obtain the liquidation value of the project. If this were not the case, the renegotiation problem in the absence of protection would be more pronounced, making the effect of credit derivatives in terms of improving the bondholder's outside option even stronger. Note

is even welfare optimal. As the next proposition shows, this is not the case from the perspective of ex-post crisis resolution.

Proposition 3 *The bondholder's choice of protection is not always socially optimal in terms of crisis resolution. Crisis resolution can then be improved through appropriate short and long protection; however, this comes at the cost of increased moral hazard.*

Proof. *Suppose that when $f < 1$ the bondholder holds long protection with $q_{LP} = c/(1 - f)$ and short protection with $q_{SP} = -c/(1 - f)$ (note that although $q_{SP} < 0$, $q_{SP} + q_{LP} \geq 0$ is still fulfilled). As $q_{LP} = -q_{SP}$, the bondholder is not protected in period 1 (effectively, there is now protection which only starts in period 2). Compared to the case of no protection, the bondholder's payoff has only changed in that under restructuring he now obtains $q_{LP} + (1 - q_{LP})f = f + c$ when $r > f$. Analogous to Proposition 1, it follows that there is restructuring with $r = k$ whenever $f + c \geq k$ and default otherwise, implying that crisis resolution is now efficient (when $f \geq 1$ crisis resolution has already been efficient in the absence of protection). However, the sovereign's payoff (and thus moral hazard) increases compared to the bondholder's optimal protection. This is because the joint payoffs for the sovereign and the bondholder have increased (as crisis resolution becomes more efficient and recalling that the protection seller breaks even) but the bondholder's payoff has not increased (otherwise, the bondholder's optimal protection q^* from Proposition 2 would not maximize his payoffs). ■*

Thus, there is a potential case for intervention. The reason why the bondholder does not choose protection which achieves optimal resolution is that when $k > f > k - c$ the payout the sovereign makes to the bondholder and the protection seller under default (k) is larger than the maximum attainable payout under restructuring (f).²²

also that while reducing renegotiation is unambiguously beneficial in our model, there are also arguments for why this may be costly (see, for example, Weinschelbaum and Wynne, 2005).

²²Proposition 3 also suggests that credit protection can overcome the inefficiencies which arise because

4.1 Protection That is not Chosen Strategically

That credit protection does not reduce the efficiency of the restructuring process relies on the bondholder being aware of the potential impact of his protection on the resolution process. If this were not the case, he might ‘overprotect’ by purchasing a level of protection that could lead to inefficient defaults. For the current market situation, such strategic awareness seems a plausible presumption as sovereign credit derivative markets are dominated by few large institutional investors (e.g., Ranciere, 2001), who should rationally anticipate any potential implications of their protection choice. However, participation may increase as the credit derivatives markets continue to grow and thus also the influence of small investors who take the resolution process as given and buy protection purely for hedging reasons. Still, the experience with other mature derivatives markets shows that participation ratios are typically small,²³ suggesting that the overall influence of protection which is chosen without strategic awareness may remain limited.

Nevertheless, the presence of players who choose protection for other than strategic reasons has interesting implications for the design of bonds with collective action clauses (CACs). Setting participation thresholds in bonds with CACs higher than the share of investors in the market who do not have strategic incentives would give the strategic investors full control over the restructuring process (beyond their role in the pre-offer consultation process), presuming that small investors alone are unlikely to overprotect and thus make a restructuring offer fail. As our analysis suggests, this would help to avoid potential adverse effects of credit derivatives.

the sovereign’s default costs are private. Thus, credit derivatives may be a substitute for policies which aim at increasing the pledgeable income of sovereigns (e.g., Tirole, 2002, and Ghosal and Miller, 2003).

²³For example, Faulkender (2005) finds that firms hedge only 6.5% of their (fixed rate) bond issuances (and zero percent of their bank loans) through interest rate swaps.

5 Informational Problems

An efficient resolution of crises is likely to be complicated in practice because a sovereign may have superior information about its repayment ability, that is the productivity of the project. The bondholder does not then know whether the sovereign will be able to deliver on the restructuring offer, which the sovereign may use to his advantage.

We assume now that there are two states of nature, high and low, occurring with positive probabilities π and $1 - \pi$, respectively. These states materialize at the time of the crisis in period 1. Output of the project in the high state is $f^H > k$, while in the low state output is $f^L < k - c$. An efficient crisis resolution would thus require restructuring in the high state and default in the low state. The sovereign's informational advantage arises because he is assumed to have full knowledge of the states in a crisis, while the bondholder only knows their prior probabilities.

Lemma 1 *Equilibrium crisis resolution cannot be conditional on the state of the project (no separating equilibria).*

Proof. *Suppose that there were a separating equilibrium, where without loss of generality the sovereign offers r^L in the low state and r^H in the high state with $r^L \neq r^H$. The bondholder then learns about the state of the project from the offer, implying that there are no informational problems. It follows from Proposition 1 that in the low state there is default and the sovereign's payoff is $-c < 0$, while in the high state there is restructuring and the sovereign's payoff is at least zero. The sovereign could then strictly improve his payoff by offering r^H in the low state and thus achieve restructuring. Therefore, a separating equilibrium cannot exist. ■*

Lemma 1 holds because in a separating equilibrium the sovereign always has an incentive to pretend to be in the high state. Therefore, there can only be pooling equilibria, in which the sovereign makes a restructuring offer which is independent of the state. Proposition 4

derives the equilibrium crisis resolution in the absence of protection, where for convenience we define with $\tilde{f} := \pi f^H + (1 - \pi)f^L$ the (prior) expected value of output and with $\widetilde{\min}(r, f) := \pi \min(r, f^H) + (1 - \pi) \min(r, f^L)$ the expected repayment on a restructuring offer r .

Proposition 4 *In the absence of protection there is restructuring with r such that $\widetilde{\min}(r, f) = k$ whenever $\tilde{f} \geq k$ and default otherwise.*

Proof. *Analogous to Proposition 1: the sovereign still always prefers restructuring, while the bondholder needs a repayment fulfilling $\widetilde{\min}(r, f) = k$ to accept. For $\tilde{f} \geq k$ a restructuring offer that guarantees such a repayment is feasible as then for $r = f^H$ we have that $\widetilde{\min}(f^H, f) = \tilde{f} \geq k$, while for $\tilde{f} < k$ it is not. ■*

Note that there are now two types of inefficiencies in the crisis resolution. First, there are only pooling equilibria, while an efficient outcome requires conditional crisis resolution (i.e., restructuring in the high state and default in the low state). Second, the equilibrium crisis resolution is inefficient even within the class of pooling equilibria. This inefficiency is similar to the one obtained when informational problems are absent: when $k > \tilde{f} > k - c$ there is default (since $\tilde{f} < k$) although the joint expected payoff under restructuring is higher (since $\tilde{f} > k - c$).

The next proposition shows that the impact of credit protection is as in the absence of informational problems:

Proposition 5 *The introduction of protection does not change crisis resolution but reduces moral hazard; in particular there is restructuring with $r = f^H$ whenever $\tilde{f} \geq k$ and default otherwise.*

Proof. *See Appendix 2. ■*

Similar to the previous section, the inefficient default equilibrium which arises for $k > \tilde{f} > k - c$ can be avoided through a different choice of protection:

Proposition 6 *The bondholder's choice of protection is not always socially optimal in terms of crisis resolution. Crisis resolution can then be improved through appropriate short and long protection; however, this comes at the cost of increased moral hazard.*

Proof. See Appendix 2. ■

5.1 Costly Litigation

In the following we show that there is also a role for credit protection in overcoming the first inefficiency, that is to achieve conditionality in crisis resolution. This role arises when there are imperfections which make obtaining the liquidation value costly for the bondholder, for example because of legal fees.²⁴ To this end we assume that in order to force the government to pay out the liquidation value in a default, the bondholder would need to engage in litigation which incurs costs $l > 0$. Consequently, the bondholder finds it optimal to litigate only if $(1 - q)k \geq l$, that is if his share in the liquidation value (arising from the unprotected bonds) exceeds the litigation costs. We assume that in the absence of protection the bondholder would litigate, i.e., $k \geq l$. We also assume that litigation merely acts as a threat: whenever $(1 - q)k \geq l$ (i.e., the bondholder finds it optimal to litigate), the sovereign prefers to avoid being litigated by paying right away. However, when this condition is not fulfilled the sovereign can keep the liquidation value, as he knows that the bondholder will not litigate. We presume that the protection seller remains passive in that he does not litigate for his share in the liquidation value, which may be because his claim is not large enough to justify incurring the legal fees (at the end of this section we discuss the case for when the protection seller litigates).

The next lemma shows that there are now situations in which credit protection can

²⁴Such litigation costs have, for example, been emphasized in Haldane et. al. (2005). Interestingly, in our analysis, litigation costs can be welfare improving, as in their absence crisis resolution may not be conditional.

achieve conditional crisis resolution. The reason is that credit protection reduces the bondholder's benefits from litigation and thus may render the litigation threat not credible. As a consequence, the sovereign may keep the liquidation value in a default, which reduces his incentives to pretend to be in the high state in order to obtain restructuring.

Lemma 2 *When litigation is costly, credit protection may lead to conditional crisis resolution.*

Proof. Consider short protection q that fulfills (i) $(1 - q)k < l$ and (ii) $f^L \leq q \leq f^H - (k - c)$ and assume moreover (iii) $k - c > 0$ ((i)-(ii) are, for instance, fulfilled for $q = 1$ and $f^H \geq 1 + (k - c)$). From (i) we know that litigation is not credible. The sovereign can therefore keep the capital stock in a default, making his default payoff $k - c$. In order to obtain acceptance in a separating equilibrium the sovereign has to credibly offer $r = q$ as the bondholder's gross payoff under default is now only q (since he no longer obtains a share in the liquidation value). The sovereign's payoff from restructuring is hence $\max(f^L - q, 0) = 0$ in the low state and $\max(f^H - q, 0) = f^H - q \geq k - c$ in the high state (from (ii)). It follows that the sovereign prefers to default in the low state but to have restructuring in the high state. ■

We show next that there are also situations in which the bondholder does indeed find it optimal to choose a level of protection which achieves conditionality.

Proposition 7 *The introduction of protection may lead to conditional crisis resolution in the presence of litigation costs.*

Proof. See Appendix 2. ■

However, as the next proposition shows, there are also situations where the bondholder does not choose protection that leads to conditionality, even if this is feasible and also socially desirable in terms of crisis resolution. Intuitively, this is because conditional crisis

resolution only arises for levels of protection that render the litigation threat uncredible. The resulting loss of the liquidation value for the bondholder may outweigh the additional payoffs the bondholder may achieve due to the improved crisis resolution. The bondholder's choice of protection is therefore not necessarily efficient, creating a role for intervention.

Proposition 8 *The bondholder may not choose a level of protection that leads to conditional crisis resolution even when this is socially desirable in terms of crisis resolution.*

Proof. See Appendix 2. ■

Throughout this section we have assumed that the protection seller does not litigate himself. This seems plausible as long as the degree of protection is not very high: the protection seller's incentives to litigate are then limited as he only receives the insured part of the bonds in a default. Nevertheless, for large levels of protection he may find it optimal to litigate. This may be particularly relevant for protection sellers that have low litigation costs, which presumably is the case for *vulture funds*. Such funds are specialized in litigation and may also be less concerned about reputational issues, such as adverse implications for the relationship with sovereign lenders.²⁵ However, while complicating the analysis, this does not change the role of protection in achieving conditionality. This is because regardless of whether or not the protection seller litigates, the sovereign can keep the bondholder's share in the liquidation value in a default when bondholder litigation becomes uncredible (i.e., for $(1 - q)k < l$). Therefore, sovereign's incentives to seek restructuring are reduced compared to the situation without protection.

²⁵Low litigation costs for protection sellers suggest another role for protection: when litigation costs are so high that the bondholder's litigation threat is not credible in the absence of protection ($k < l$), protection may be used to make the litigation threat credible by transferring litigation to a more effective party (the protection seller). Credit derivatives, viewed in this way, can be efficiency improving by allowing for the sharing of tasks between the bondholder (with a comparative advantage in investing in bonds) and the protection seller (with an advantage in litigation).

6 Summary and Conclusions

This paper has analyzed the implications of credit derivatives for sovereign debt crises. We find that in most cases they reduce debtor moral hazard by allowing a bondholder to increase his outside option. Furthermore, credit derivatives do not reduce the efficiency of crisis resolution, as the bondholder internalizes potential inefficiencies through a higher price for protection. When the bondholder is not fully informed about the future repayment abilities of the sovereign, they may even facilitate conditionality in crisis resolution. Hence, our analysis broadly suggests that credit derivatives are beneficial for sovereign debt financing.

However, there is a potential role for government policy. First, a bondholder's optimal strategic choice of protection is not always socially efficient. This is, in particular, because he does not internalize the country's private benefits from not having to go through a default. Interestingly, the role for policy arises because the bondholder does not buy 'enough' protection, either in terms of the extent or in the duration of protection. As credit derivatives markets are decentralized, direct regulation is unlikely to be effective. However, sovereigns (or supranational organizations) may sponsor certain forms of protection (for example by subsidizing protection sellers). Alternatively, they may issue bonds with protection attached to it which is guaranteed by a third party.

Second, private incentives for providing optimal protection for strategic reasons may be insufficient. This may be, for instance, because of transaction costs or because there are not enough strategic bondholders. Sovereigns may then subsidize protection in order to encourage levels which are optimal for bondholders. This may ultimately be to their countries' benefit as higher protection reduces the renegotiation problem (and hence moral hazard) and should thus reduce the financing costs.

Appendix 1: Endogenous Crises and Welfare

Assume that the funds borrowed in period 0 have been fully used up in period 1, for example to finance the project. Assume, furthermore, that the sovereign has to incur costs $a > 0$ if he wants to raise the funds that would allow him to make the repayment in period 1 and thus to avoid a crisis. These costs could arise, for instance, because of an increased domestic tax burden. If the sovereign does not incur the costs, funds remain zero. Avoiding the crisis brings benefits of $b > 0$ to the country. These benefits are unrelated to the potential default costs c and are due to inefficiencies which would otherwise arise from a crisis, such as from going through a restructuring and/or negotiating with the bondholder (e.g. exclusion from capital markets during negotiations).

Given this setup, the sovereign chooses to incur costs a and thus to avoid the crisis iff

$$P_S^{NC} + b - a > P_S^C$$

where P_S^{NC} and P_S^C are the sovereign's payoffs (gross of b and a) in the absence of a crisis and in a crisis, respectively. Hence, for appropriately defined a_{\min} and a_{\max} ($a_{\min} < a_{\max}$), there is a cut-off value $\bar{a} \in [a_{\min}, a_{\max}]$ such that for $a \in [a_{\min}, \bar{a})$ the sovereign incurs the costs, while for $a \in [\bar{a}, a_{\max}]$ he does not, where \bar{a} is given by

$$\bar{a} := P_S^{NC} - P_S^C + b$$

Note that for any a the crisis is fully under the control of the sovereign. However, this could be easily modified by assuming an upper limit on the size of the costs a the sovereign can incur (for example, because of limited domestic tax capacity).

Assume next that the costs a are distributed on $[a_{\min}, a_{\max}]$ with a density $\phi(a)$ that has full support (i.e., $\phi(a) > 0$ for $a \in [a_{\min}, a_{\max}]$). Denoting with D the amount of funds raised in period 0, we have that the bondholder's expected return is D . This is because debt markets are competitive and because there is no discounting (note that the agreed

repayment will generally differ from D since it also has to compensate the bondholder for expected losses in crises). This condition can be written as

$$\int_{a_{\min}}^{\bar{a}} P_B^{NC} \phi(a) da + \int_{\bar{a}}^{a_{\max}} P_B^C \phi(a) da = D$$

where P_B^{NC} and P_B^C denote the bondholder's payoffs when there is no crisis and when there is a crisis, respectively. It follows that

$$dP_B^{NC}/dP_B^C < 0$$

implying that a lower payoff for the bondholder in a crisis has to be compensated by a higher payoff when there is no crisis.

Define, furthermore, with $P^{NC} := P_B^{NC} + P_S^{NC}$ ($= f$) and $P^C := P_B^C + P_S^C$ the joint payoffs for the sovereign and the bondholder. Since the bondholder breaks even on average we can ignore him in the welfare analysis. Welfare, W , is hence solely characterized by the sovereign's expected utility, which consists of the sum of the joint payoffs plus net benefits $b - a$ when there is no crisis ($a < \bar{a}$) and the joint payoffs when there is a crisis ($a \geq \bar{a}$), minus the bondholder's required return D

$$W = \int_{a_{\min}}^{\bar{a}} (P^{NC} + b - a) \phi(a) da + \int_{\bar{a}}^{a_{\max}} P^C \phi(a) da - D$$

We show next that welfare in the economy is increasing in the joint payoff in a crisis P^C but decreasing in the sovereign's payoff in a crisis P_S^C . Totally differentiating $W(P^C, \bar{P}_S^C)$ wrt. to P^C (i.e., holding P_S^C constant) gives

$$\begin{aligned} \frac{dW(P^C, \bar{P}_S^C)}{dP^C} &= \frac{\partial W}{\partial P^C} + \frac{\partial W}{\partial \bar{a}} \frac{d\bar{a}}{dP^C} = \frac{\partial W}{\partial P^C} + \frac{\partial W}{\partial \bar{a}} \frac{\partial \bar{a}}{\partial P_S^{NC}} \frac{dP_S^{NC}}{dP^C} \\ &= \int_{\bar{a}}^{a_{\max}} \phi(a) da + (P_B^{NC} - P_B^C) \phi(\bar{a}) \frac{\partial \bar{a}}{\partial P_S^{NC}} \frac{dP_S^{NC}}{dP^C} \end{aligned}$$

Since $dP_B^C/dP^C = 1$ for $P_S^C = \bar{P}_S^C$ we have thus $dP_S^{NC}/dP^C = d(P^{NC} - P_B^{NC})/dP_B^C = -dP_B^{NC}/dP_B^C > 0$. From $\partial \bar{a}/\partial P_S^{NC} = 1$ and $P_B^{NC} - P_B^C \geq 0$ (i.e., in expectation, the

bondholder's payoff when there is no crisis is at least as high as when there is a crisis), it follows that $dW(P^C, \bar{P}_S^C)/dP^C > 0$.

Totally differentiating $W(\bar{P}^C, P_S^C)$ wrt. to P_S^C gives

$$\begin{aligned} \frac{dW(\bar{P}^C, P_S^C)}{dP_S^C} &= \frac{\partial W}{\partial P_S^C} + \frac{\partial W}{\partial \bar{a}} \frac{d\bar{a}}{dP_S^C} = \frac{\partial W}{\partial P_S^C} + \frac{\partial W}{\partial \bar{a}} \left(\frac{\partial \bar{a}}{\partial P_S^{NC}} \frac{dP_S^{NC}}{dP_S^C} + \frac{\partial \bar{a}}{\partial P_S^C} \right) \\ &= 0 + (P_B^{NC} - P_B^C) \phi(\bar{a}) \left(\frac{dP_S^{NC}}{dP_S^C} - 1 \right) < 0 \end{aligned}$$

where the inequality follows because of $dP_B^C/dP_S^C = -1$ for $P^C = \bar{P}^C$ we have $dP_S^{NC}/dP_S^C = d(P^{NC} - P_B^{NC})/d(-P_S^B) = dP_B^{NC}/dP_B^C < 0$. Hence, welfare is increasing in P^C and decreasing in P_S^C .

Appendix 2: Proofs

Proof. Proof of Proposition 5] Note first that in the presence of protection there are only pooling equilibria (the proof of Lemma 1 can be readily applied by replacing reference to Proposition 1 with Proposition 2). Suppose that the bondholder buys an amount of short protection q^* such that his payoff under default becomes $q^* + (1 - q^*)k = \tilde{f}$ (i.e., $q^* = (\tilde{f} - k)/(1 - k)$) when $\tilde{f} \geq k$ and buys no protection ($q^* = 0$) otherwise. When $\tilde{f} \geq k$ there is then acceptance with $r = f^H$ as this r makes the bondholder's expected payoff from acceptance just equal to his outside option: $\widetilde{\min}(r, f) = \widetilde{\min}(f^H, f) = \pi f^H + (1 - \pi)f^L = \tilde{f}$. The bondholder's net payoff is then \tilde{f} as protection is not exercised. When $\tilde{f} < k$ there is rejection as $q = 0$ (from Proposition 4) and the bondholder's net payoff is k . Thus, in each case the bondholder obtains the maximum available payoff available in a pooling equilibrium: \tilde{f} when $\tilde{f} \geq k$ and k when $\tilde{f} < k$. q^* is therefore the bondholder's optimal protection. From the above we have then that equilibrium crisis resolution is unchanged. However, the sovereign's payoff when $\tilde{f} \geq k$ is now only zero (for $\tilde{f} < k$ it is still $-c$). Thus, when $\tilde{f} > k$ moral hazard is lowered. ■

Proof. Proof of Proposition 6] Suppose that the bondholder holds long protection with $q_{LP} = c/[(1 - \pi)(1 - f^L)] > 0$ and short protection with $q_{SP} = -q_{LP}$. Since $q_{SP} = -q_{LP}$, the bondholder is not protected in period 1. The bondholder's payoff from default is thus k under default. A restructuring offer of $r = f^H$ gives the bondholder a return of f^H in the high state and $\max(f^L, q_{LP} + (1 - q_{LP})f^L) = q_{LP} + (1 - q_{LP})f^L$ in the low state (as then $r > f^L$ and he can exercise his protection). Hence his expected return is $\pi f^H + (1 - \pi)(q_{LP} + (1 - q_{LP})f^L) = \tilde{f} + c$. Analogous to Proposition 4 it follows that there is restructuring whenever $\tilde{f} + c \geq k$ and default otherwise, implying that crisis resolution is improved whenever $k > \tilde{f} \geq k - c$. However, the sovereign's payoff (and thus moral hazard) increases compared to the bondholder's optimal protection. This is because the joint payoffs of the sovereign and the bondholder have increased (as crisis resolution becomes more efficient) but the bondholder's payoff has not increased (otherwise, the bondholder's optimal protection would not maximize his payoffs). ■

Proof. Proof of Proposition 7] Assume (i) $k = l$, (ii) $f^L \leq f^H - (k - c)$ and (iii) $k - c > 0$. Note that (i) implies that litigation is credible for $q = 0$ but not for $q > 0$. Consider short protection with $q = f^H - (k - c)$, which is larger than zero by (ii). Hence the litigation threat is uncredible. The conditions (i)-(iii) from Lemma 2 are then fulfilled. Therefore, we have a separating equilibrium with $r = q = f^H - (k - c)$ in the high state and default in the low state. The bondholder's net expected payoff is $\pi q = \pi(f^H - (k - c))$ as $q = f^H - (k - c)$ is the payout that the sovereign makes in the high state, while there is no payout in the low state (note that this is also the maximum expected payoff the bondholder can achieve in a separating equilibrium as he has to guarantee the sovereign at least $k - c$ in the high state in order not to make the sovereign default).

Pooling equilibria can only obtain for levels of protection which do not fulfill condition (i) or (ii) in Lemma 2. There are three cases to consider: a) $q > f^H - (k - c)$, b) $0 < q < f^L$ and c) $q = 0$. Under a) litigation is uncredible. In order to achieve restructuring in a

pooling, the sovereign would have to promise an expected return of q to the bondholder, thus making the sovereign's payoff under restructuring $\min(f^H - q, 0) < k - c$ in the high state and $\min(f^L - q, 0) = 0$ in the low state. These pay-offs are smaller than the payoff under rejection $k - c > 0$. Thus, the sovereign prefers rejection, making the bondholder's net payoff zero as then there is no payout at all. Under b) litigation is also uncredible. If there is rejection, the bondholder's payoff is still zero, while if there is (pooling) acceptance, the bondholder's net payoff is q . Hence the bondholder's payoff is at most f^L as $q < f^L$. Under c) litigation costs play no role and we can use Proposition 4 to obtain that the bondholder's net payoff is k . Hence, since $0 < f^L < k$, the bondholder would choose case c) ($q = 0$) in a pooling. As shown above, a bondholder can secure himself $\pi(f^H - (k - c))$ in a separating equilibrium. Thus, the bondholder chooses a separating equilibrium whenever $\pi(f^H - (k - c)) \geq k$, which can be fulfilled, for example, for sufficiently large f^H . ■

Proof. Proof of Proposition 8] Assume that conditions (i)-(iii) in the proof of Proposition 7 hold and that $\pi(f^H - (k - c)) < k$, i.e., the bondholder's net payoff in a separating equilibrium is less than in a pooling equilibrium (from Proposition 7). The bondholder hence chooses pooling. Assume furthermore that $\tilde{f} < k$. Recalling that the bondholder chooses $q = 0$ under pooling, it follows from Proposition 4 that there is default under pooling; hence the joint net payoffs of the bondholder and the sovereign are $k - c$. By contrast, the joint payoff in a separating equilibrium is $\pi f^H + (1 - \pi)(k - c)$, which is larger than $k - c$ by $f^H > k$. Thus, although the bondholder chooses a pooling equilibrium, crisis resolution is more efficient in a separating equilibrium. ■

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