

# Credit Default Swaps

and

## The Empty Creditor Problem\*

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### Abstract

A number of commentators have raised concerns about the *empty creditor* problem that arises when a debtholder has obtained insurance against default but otherwise retains control rights in and outside bankruptcy. We analyze this problem from an ex-ante and ex-post perspective in a formal model of debt with limited commitment, by comparing contracting outcomes with and without credit default swaps (CDS). We show that CDS, and the empty creditors they give rise to, have important ex-ante commitment benefits: By strengthening creditors' bargaining power they raise the debtor's pledgeable income and help reduce the incidence of strategic default. However, we also show that lenders will over-insure in equilibrium, giving rise to an inefficiently high incidence of costly bankruptcy. We discuss a number of remedies that have been proposed to overcome the inefficiency resulting from excess insurance.

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One of the most significant changes in the debtor-creditor relationship in the past few years has been the creation and subsequent exponential growth of the market for credit insurance, in particular credit default swaps (CDS). An important aspect of this development is that credit insurance with CDS does not just involve a risk transfer to the insurance seller. It also significantly alters the debtor-creditor relation in the event of financial distress, as it partially or fully separates the creditor's control rights from his cash-flow rights. Legal scholars (Hu and Black (2008a,b)) and financial analysts (e.g. Yavorsky, Bayer, Gates, and Marshella (2009)) have raised concerns about the possible consequences of such a separation, arguing that CDS may create *empty creditors*—holders of debt and CDS—who no longer have an interest in the efficient continuation of the debtor, and who may push the debtor into inefficient bankruptcy or liquidation:

“Even a creditor with zero, rather than negative, economic ownership may want to push a company into bankruptcy, because the bankruptcy filing will trigger a contractual payoff on its credit default swap position.”, Hu and Black (2008a), pp.19.

We argue in this paper that while a creditor with a CDS contract may indeed be more reluctant to restructure debt of a distressed debtor, it does not necessarily follow that the presence of CDS will inevitably lead to an inefficient outcome. In a situation where the debtor has limited ability to commit to repay his debt, a CDS strengthens the creditor's hand in ex-post debt renegotiation and thus may actually help increase the borrower's debt capacity. The relevant question is thus whether the presence of CDS leads to debt market outcomes in which creditors are excessively tough even after factoring in these ex-ante commitment benefits of CDS.

In a CDS, the protection seller agrees to make a payment to the protection buyer in the event of a default of a prespecified reference asset. In exchange for this promised payment, the protection seller receives a periodic premium payment from the buyer. The default event may be the bankruptcy filing of the debtor, non-payment of the debt, and in some CDS contracts, debt restructuring or a credit-rating downgrade. Unless the swap contract prespecifies a payment equal to a fixed percentage of the face value of the debt, the default payment is given by the difference between the face value of the debt due and the recovery value, which is estimated based on market prices over a prespecified period after default has occurred (typically 30 days). More recently, it has been based on a CDS settlement auction. Settlement of the contract can be a simple cash payment or it may

involve the exchange of the defaulted bond for cash.

We formally analyze the effects of CDS in a limited-commitment model of credit to determine both the ex-ante and ex-post consequences of default insurance on debt outcomes. In our model, a firm has a positive net present value investment project which it seeks to finance by issuing debt. However, similar to Hart and Moore (1994, 1998) and Bolton and Scharfstein (1990, 1996), we assume that the firm faces a limited commitment problem when writing financial contracts: it cannot credibly commit to pay out cash flows in the future, since realized cash flows are not verifiable and thus not enforceable in court. As is standard in these models, non-payment can occur for two reasons: First, when interim cash flows are insufficient to cover contractual payments a lender may be unable to pay for *liquidity* reasons. Second, when cash flows are sufficient to cover contractual payments but the borrower refuses to pay in full to divert cash flows to himself, non-payment occurs for *strategic* reasons.

The central insight of our model is that by raising the creditor's bargaining power, CDS act as a commitment device for borrowers to pay out cash flows. That is, when creditors are insured through CDS they stand to lose less in default and therefore are less forgiving in debt renegotiations. As a result, borrowers have less of an incentive to strategically renegotiate down their debt repayments to their own advantage, and creditors are generally able to extract more in debt renegotiations. However, instances may also arise in which protected creditors are unwilling to renegotiate with the debtor, even though renegotiation would be efficient. This leads to incidence of Chapter 11 even though a debt exchange or workout would be preferable.

There is growing anecdotal evidence for this CDS-induced shift in bargaining power from debtors to creditors.<sup>1</sup> In 2001-02, not long after the creation of CDS markets, Marconi, the British telecoms manufacturer, was unable to renegotiate with a syndicate of banks, some of which had purchased CDS protection. Marconi was eventually forced into a debt-for-equity swap that essentially wiped out equity holders.<sup>2</sup> In 2003, Mirant Corporation, an energy company based in Atlanta, sought Chapter 11 bankruptcy protection when it was unable to work out a deal with its creditors, many of which had bought credit protection. Remarkably, the bankruptcy judge in this case took the unusual step of appointing a committee to represent the interests of equity holders in Chapter 11

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<sup>1</sup>Table 1 provides a selective summary of instances in which empty creditors may have played a role in restructuring.

<sup>2</sup>See, for example, "Liar's Poker," The Economist, May 15th 2003.

(typically, once a company enters Chapter 11 equity holders lose all claims on the firm). In the judge's opinion there was a reasonable chance that the reorganization value would be high enough to allow equity holders to obtain a positive claim after making all creditors whole, suggesting that the reason for the filing was an empty creditor problem, and not an economic insolvency.<sup>3</sup>

More recently, the issue of empty creditors resurfaced in the 2009 bankruptcy negotiations of the US auto companies General Motors and Chrysler, the amusement park operator Six Flags, the Dutch petrochemicals producer Lyondell Basell, the property investor General Growth Properties, and the Canadian paper manufacturer Abitibi Bowater, all of which filed for Chapter 11 protection when they were unable to work out deals with their creditors.<sup>4</sup> In the spring of 2009, Harrah's Entertainment, the casino operator, only barely managed to restructure its debt. Similarly, after two failed exchange offers, the IT provider Unisys had to give its creditors a particularly sweet deal (bonds worth more than par) to reschedule debt coming due in 2010.<sup>5</sup> Most recently, the trucking company YRC only managed to renegotiate its debt at the last minute, when the Teamsters union threatened to protest in front of the offices of hold-out hedge funds, which were alleged to block YRC's debt-for-equity exchange offer so as to trigger a default and cash in on more lucrative CDS payments.<sup>6</sup>

We first highlight the potential ex-ante benefits of CDS protection as a commitment device in renegotiations: A key consequence of the stronger bargaining power of creditors with CDS is that firms can increase their debt capacity. This means that in the presence of CDS more positive net present value projects can receive financing ex ante. Also, projects that can be financed also in the absence of CDS may get more efficient financing, as the presence of CDS lowers the borrower's incentive to inefficiently renegotiate down payments for strategic reasons. Taken together, this implies that under limited commitment CDS can have significant ex-ante benefits.

This insight leads to a more general point about the economic role of CDS markets. In the absence of any contractual incompleteness, introducing a CDS market would not lead to gains from trade in our model, given that both parties involved are risk-neutral. More generally, in any complete market CDS contracts are redundant securities. This raises the question why CDS

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<sup>3</sup>See "Shareholders in Mirant Gain Voice in Reorganization," New York Times, September 20, 2003.

<sup>4</sup>See, for example, "Credit Insurance Hampers GM Restructuring," Financial Times, May 11, 2009; "Burning Down the House," Economist, May 5 2009; "No Empty Threat," Economist, June 18, 2009.

<sup>5</sup>On Harrah's and Unisys see "CDS Investors Hold the Cards," Financial Times, July 22, 2009.

<sup>6</sup>"YRC and the Street's Appetite for Destruction," Wall Street Journal, January 5, 2010.

markets exist in the first place. Our model highlights that, besides reducing the transaction costs of insurance or risk transfer, CDS introduce gains from contracting by allowing the lender to commit not to renegotiate debt unless the renegotiation terms are attractive enough for creditors.

However, despite this beneficial role as a commitment device CDS can lead to inefficiencies. The reason is that when lenders freely choose their level of credit protection, they will generally over-insure: While the socially optimal choice of credit protection trades off the ex-ante commitment benefits that arise from creditors' increased bargaining power against the ex-post costs of inefficient renegotiation, creditors do not fully internalize the cost of foregone renegotiation surplus that arises in the presence of credit insurance. Even when insurance is fairly priced and correctly anticipates the creditors' potential value-destroying behavior after a non-payment for liquidity reasons, creditors have an incentive to over-insure. This gives rise to *inefficient* empty creditors who refuse to renegotiate with lenders in order to collect payment on their CDS positions, even when renegotiation via an out-of-court restructuring would be the socially efficient alternative. This over-insurance is inefficient, both ex post but also—and more importantly—ex ante. In equilibrium, the presence of a CDS market will thus produce excessively tough creditors and an incidence of bankruptcy that is inefficiently high compared to the social optimum.

The legal scholarship (Hu and Black (2008a,b), Lubben (2007)) has exclusively focused on the detrimental *ex-post* consequences of empty creditors for efficient debt restructuring. As a result, the policy proposals regarding the treatment of CDS in and out of bankruptcy risk underestimating some of the potential ex-ante benefits of CDS markets. Thus, a rule that has the effect of eliminating the empty creditor problem altogether, for example by stripping protected creditors of their voting rights, or by requiring the inclusion of restructuring as a credit event in all CDS contracts, would be overinclusive in our analysis. While such a rule would prevent CDS protection from inhibiting debt restructuring when it is efficient, it would also eliminate any positive commitment effects of CDS for borrowers. A similar effect would obtain if CDS were structured like put options, whereby the protection buyer can sell the bond at any time to the protection seller for a prespecified price. Again, this would undo the commitment effect that results from the separation of economic interest and control inherent in most credit default swaps. However, our analysis does suggest that disclosure of CDS positions may mitigate the ex-ante inefficiencies resulting from the empty creditor problem, without undermining the ex-ante commitment effect of CDS. In particular, if public disclosure allows

borrowers and lenders to contract on CDS positions, they may allow the lender to commit not to over-insure once he has acquired the bond. More generally, public disclosure of positions may also be beneficial by giving investors a more complete picture of creditors' incentives in restructuring.

Our paper is part of a growing theoretical literature on CDS and their effect on the debtor-creditor relationship. We add to the existing literature by emphasizing the commitment role of CDS, and the costs and benefits associated with it. Much of the existing literature has focused either on the impact of CDS on banks' incentives to monitor, or on the ability of CDS to improve risk sharing, for example by helping to overcome a lemon's problem in the market for loan sales. In Duffee and Zhou (2001) CDS allow for the decomposition of credit risk into components that are more or less information sensitive, thus potentially helping banks overcome a lemon's problem when hedging credit risk. Thompson (2007) and Parlour and Winton (2008) analyze banks' decision to lay off credit risk via loan sales or by purchasing CDS protection and characterize the efficiency of the resulting equilibria. Arping (2004) argues that CDS can help overcome a moral hazard problem between banks and borrowers, provided that CDS contracts expire before maturity. Parlour and Plantin (2008) analyze under which conditions liquid markets for credit risk transfer can emerge when there is asymmetric information about credit quality. Morrison (2005) argues that since CDS can undermine bank monitoring, borrowers may inefficiently switch to bond finance, thus reducing welfare. Allen and Carletti (2006) show that credit risk transfer can lead to contagion and cause financial crises. Stulz (2009) discusses the role of CDS during the credit crisis of 2007-2009.

Another related literature deals with the decoupling of voting and cash-flow rights in common equity through the judicious use of derivatives to hedge cash-flow risk. Hu and Black (2006, 2007) and Kahan and Rock (2007) argue that such decoupling can give rise to the opposite voting preferences from those of unhedged common equity holders and thus to inefficient outcomes, such as voting for a merger which results in a decline in stock price of the acquirer and profits those who have built up short positions on the firm's stock. More recently Brav and Mathews (2009) have proposed a theory of decoupling in which the hedging of cash-flow risk can facilitate trading and voting by an informed trader, but where it can also give rise to inefficient voting when hedging is cheap. In a related study, Kalay and Pant (2008) show that rather than leading to inefficient acquisition decisions, decoupling allows shareholders to extract more surplus during takeover contests, while still selling the firm to the most efficient bidder.

The emerging empirical literature on the effects of CDS on credit market outcomes support our main findings. Hirtle (2008) shows that greater use of CDS leads to an increase in bank credit supply and an improvement in credit terms, such as maturity and required spreads, for large loans that are likely to be issued by companies that are ‘named credits’ in the CDS market. Ashcraft and Santos (2007) show that the introduction of CDS has led to an improvement in borrowing terms for safe and transparent firms, where banks’ monitoring incentives are not likely to play a major role.

The rest of the paper is structured as follows. We outline our limited commitment model of CDS in Section 1. We then first analyze the model without CDS (Section 2) and then with CDS (Section 3). Section 4 extends the model to analyze the effect of multiple creditors. In Section 5 we discuss the model’s implications for policy and optimal legal treatment of CDS. Section 6 concludes.

## 1 The Model

We consider a two-period investment project that requires an initial investment  $F$  at date 0. The project generates cash flows at dates 1 and 2. At each of those dates cash flows can be either high or low. More specifically, at date 1 the project generates high cash flow  $C_1^H$  with probability  $\theta$ , and low cash flow  $C_1^L < C_1^H$  with probability  $1 - \theta$ . Similarly, at date 2 the project generates high cash flow  $C_2^H$  with probability  $\phi$ , and low cash flow  $C_2^L < C_2^H$  with probability  $1 - \phi$ . The realization of  $C_2$  is revealed to the borrower at time 1. The project can be liquidated after the realization of the first-period cash flow for a liquidation value of  $L < C_2^L$ , meaning that early liquidation is inefficient. The liquidation value at date 2 is normalized to zero.

The project is undertaken by a borrower with no initial wealth, who raises financing by issuing debt. The debt contract specifies a contractual repayment  $R$  at date 1. If the firm makes this contractual payment, it has the right to continue the project and collect the date 2 cash flows. If the firm fails to make the contractual date 1 payment the creditor has the right to discontinue the project and liquidate the firm. One may interpret this as outright liquidation or, more generally, as forcing the firm into bankruptcy; for example by filing an involuntary bankruptcy petition leading to Chapter 11. In the latter interpretation  $L$  denotes the expected payment the creditor receives in

Chapter 11 bankruptcy. We assume that both the firm and the creditor are risk neutral, and that the riskless interest rate is zero.

The main assumption of our model is that the firm (borrower) faces a limited commitment problem when raising financing for the project, similar to Hart and Moore (1994, 1998) and Bolton and Scharfstein (1990, 1996). More specifically, we assume that only the minimum date 1 cash flow  $C_1^L$  is verifiable and that all other cash flows can be diverted by the borrower. In particular, the borrower can divert the amount  $C_1^H - C_1^L$  at date 1 if the project yields the high return  $C_1^H$ . This means that after the date 1 cash flow is realized the firm can always claim to have received a low cash flow, default and pay out  $C_1^L$  instead of  $R$ . We assume that  $C_1^L < F$ , such that the project cannot be financed with risk-free debt that is repaid at date 1. In fact, it turns out that there is no loss from normalizing  $C_1^L$  to zero, such that for the remainder of the paper we take  $C_1^L = 0$  unless we explicitly state otherwise.

We also assume that at date 0 none of the date 2 cash flows can be contracted upon. One interpretation of this assumption is that, seen from date 0, the timing of date 2 cash flows is too uncertain and too complicated to describe to be able to contract on when exactly payment is due. At date 1, however, the firm and its initial creditors can make the date 2 cash flow verifiable by paying a proportional verification cost  $(1 - \lambda)C_2$ , where  $\lambda \in (0, 1)$ .<sup>7</sup> The ability to verify the date 2 cash flow at date 1 opens the way for potential renegotiation between the firm and its creditor following non-payment of the date 1 claim  $R$ . This has the consequence that the firm may want to strategically renegotiate down its repayment at date 1.

The main focus of our analysis is the effect of introducing a market for credit insurance in which lenders can purchase credit default swaps (CDS) to insure against non-payment of the contractual date 1 repayment  $R$ . We model the CDS market as a competitive market involving risk-neutral buyers and sellers, in which CDS contracts are priced fairly. Note that in the absence of any contractual incompleteness there would be no gains from trade in this market given that both parties are risk-neutral. More generally, in any complete efficient market CDS contracts are redundant

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<sup>7</sup>For simplicity, we assume that the date 2 cash flow cannot be made verifiable to a new creditor. In other words, existing creditors have an "informational monopoly", as is assumed in Rajan (1992) for example. Although this is clearly a restrictive and somewhat unrealistic assumption, the main role of this assumption is to simplify the way we model to the distribution of the renegotiation surplus between debtor and creditors. The analysis can be extended to the situation where we drop this assumption. The main change would involve the debtor sometimes rolling over its debts with the initial creditors by borrowing from new creditors at date 1. In this case initial creditors only obtain  $R$  when they could have obtained a higher renegotiation surplus in the event of a liquidity default.



securities. Indeed, in practice an implicit assumption in the pricing of these securities is that they can be costlessly replicated. This, naturally, raises the question why this market exists in the first place. One explanation is that the CDS allows the parties to save on transaction costs. But another explanation is the one we propose in this paper, which is that CDS play another role besides insurance or risk transfer. They also introduce gains from contracting arising from the commitment the lender gains not to renegotiate debt unless the renegotiation terms are attractive enough.

Formally, the CDS is a promise of a payment  $\pi$  by the protection seller to the lender if a ‘credit event’ occurs at date 1, against a fair premium  $f$  to be paid by the protection buyer to the seller. We assume that this credit event occurs when the firm fails to repay  $R$  and if upon non-payment the firm and the creditor fail to renegotiate the debt contract to mutually acceptable terms. With this type of renegotiation we have in mind an out-of-court restructuring, for example through a debt exchange or a debt-for-equity swap. The assumption that CDS contracts do not pay out after successful renegotiation reflects what is now common practice in the CDS market. Since the spring of 2009 the default CDS contract as defined by the International Swaps and Derivatives Association (ISDA) does not recognize restructuring as a credit event. Moreover, even when CDS contracts recognize restructuring as a credit event, in practice there is often significant uncertainty for creditors whether a particular restructuring qualifies.<sup>8</sup> We discuss the implications of specifying restructuring instead of bankruptcy as a credit event in section 5.3.

If the firm misses its contractual date 1 payment  $R$  two outcomes are possible: either the lender liquidates the project, forces the firm into bankruptcy, and collects the liquidation value  $L$  (to be interpreted as the value the lender receives in either Chapter 11 or Chapter 7), or the lender chooses to renegotiate the debt contract in an out-of-court restructuring.

Bankruptcy is a credit event, which triggers the payment  $\pi$  by the protection seller under the CDS contract, so that the insured lender receives a total payoff of  $L + \pi$  under this outcome. Alternatively, if the firm and lender renegotiate the initial contract in an out-of-court restructuring, they avert costly bankruptcy (as  $L < C_2^L$ ) but do not receive the CDS payment  $\pi$ , as out-of-

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<sup>8</sup>When originally introduced some CDS had a restructuring clause, such that a restructuring would count as a credit event. Due to problems with the original restructuring clause, ISDA subsequently updated the restructuring clause, first to "modified restructuring" (or Mod-R) and later to "modified modified restructuring" (or Mod-Mod-R). However, even when restructuring clauses are included in CDS contracts, there can be wide disagreement about what constitutes a restructuring event. For example, on October 5, 2009, ISDA ruled that an ‘Alternative Dispute Resolution’ (ADR) that led to changes in maturity and principal of Aiful Corporation’s debt does not qualify as a bankruptcy event. See [www.isda.org](http://www.isda.org).

court restructurings do not constitute a credit event. A workout also involves costs, as the lender must verify date 2 cash flows and pay the verification cost  $(1 - \lambda)C_2$ , so that the surplus from renegotiation is given by  $\lambda C_2 < C_2$ . However, workouts are less costly than bankruptcy, as we assume that  $\lambda C_2 > L$ . Since for most of our analysis there is not much loss in setting  $L = 0$ , we will make this assumption unless we explicitly state otherwise.

Finally, when renegotiation occurs, the renegotiation surplus is split between the firm and the lender according to their relative bargaining strengths. We assume that absent CDS, the relative bargaining strengths are exogenously given by  $q$  (for the lender) and  $1 - q$  (for the firm). In the presence of CDS, however, the relative bargaining positions in renegotiation can change, as CDS protection increases the lender's outside option. In particular, if the amount the creditor receives by abandoning negotiation and triggering the CDS exceeds what he would receive as part of the bargaining game absent CDS, the firm must compensate the creditor up to his level of credit protection  $\pi$  in order to be able to renegotiate. This means that in the presence of credit protection, the creditor receives  $\max[q \times \text{bargaining surplus}, \pi]$ . Moreover, when  $\pi$  exceeds the available renegotiation surplus  $\lambda C_2$ , the CDS payment exceeds what the creditor can receive in renegotiation, such that renegotiation becomes impossible. Thus, overall CDS protection makes creditors tougher negotiators in out-of-court restructurings.<sup>9</sup>

Our model of debt restructuring, while highly stylized captures the broad elements of debt restructuring in practice. Absent tax and accounting considerations, out-of-court restructuring is generally seen to be cheaper than a formal bankruptcy procedure. Also, the higher the potential gains from continuation the larger are the due diligence costs incurred in restructuring negotiations. This is reflected in our assumption of proportional verification costs. As for the effects of CDS protection on out-of-court restructurings, our model captures in a simple way the empty creditor problem that analysts are concerned about. As Yavorsky, Bayer, Gates, and Marshella (2009) argue: "While individual circumstances may vary, we believe that bondholders that own CDS protection are more likely to take a 'hard-line' in negotiations with issuers."

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<sup>9</sup>Formally, our bargaining protocol is equivalent to a Nash bargaining outcome in which CDS protection raises the creditor's outside option, as outlined in Sutton (1986) (page 714). For the relationship between Nash bargaining and Rubinstain bargaining see also Binmore, Rubinstein, and Wolinsky (1986).

## 2 Optimal Debt Contracts without CDS

We begin by analyzing the model in the absence of a market for credit insurance. The optimal debt contract for this case will later serve as a benchmark to analyze the welfare effects of introducing a CDS market.

Two types of non-payment of debt can occur in our model. At date 1, in the low cash flow state the firm cannot repay  $R$  as it does not have sufficient earnings to do so (since  $F > C_1^L$ ). We refer to this outcome as a liquidity default. In the high cash flow state at date 1, the firm is able to service its debt obligations but may *choose* not to do so. That is, given our incomplete contracting assumption the firm may choose to default strategically and renegotiate with the creditor. In particular, in the high cash flow state the firm will make the contractual repayment  $R$  only if the following incentive constraint is satisfied:

$$C_1^H - R + C_2 \geq C_1^H + (1 - q)\lambda C_2. \quad (1)$$

This constraint says that, when deciding whether to repay  $R$ , the firm compares the payoff from making the contractual payment and collecting the entire date 2 cash flow to defaulting strategically and giving a fraction  $q$  of the renegotiation surplus to the creditor. The constraint shows that the firm has an incentive to make the contractual payment whenever the date 2 cash flow is sufficiently large, while for small expected future cash flows the firm defaults strategically.

We will first establish under which conditions the project can be financed without strategic default occurring in equilibrium. Since strategic default is costly (since  $\lambda < 1$ ), this is the optimal form of financing when it is feasible. From equation (1) we see that the maximum face value that will just satisfy the incentive constraint for both realizations of the date 2 cash flow must satisfy  $R = C_2^L(1 - \lambda(1 - q))$ . We shall assume that  $C_1^H \geq C_2^H(1 - \lambda(1 - q))$  so that the firm can always pay the incentive compatible repayment  $R$  in the high date 1 cash flow state  $C_1^H$ .<sup>10</sup> This maximum value for  $R$  in turn implies a maximum ex-ante setup cost consistent with the no strategic default assumption. We summarize this in the following proposition.

**Proposition 1** *Suppose that there is no strategic default. The maximum face value  $R$  compatible*

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<sup>10</sup>For Proposition 1 it would be sufficient to assume that  $C_1^H \geq C_2^L(1 - \lambda(1 - q))$ . However, we will use the slightly stronger assumption  $C_1^H \geq C_2^H(1 - \lambda(1 - q))$  in Proposition 2.

with this assumption just satisfies the incentive constraint

$$C_1^H + C_2^L - R \geq C_1^H + \lambda C_2^L (1 - q) \quad (2)$$

yielding a maximum face value consistent with no strategic default of

$$R = C_2^L (1 - \lambda(1 - q)). \quad (3)$$

The maximum ex-ante setup cost consistent with no strategic default is given by

$$\hat{F} = \theta C_2^L (1 - \lambda(1 - q)) + (1 - \theta) \lambda q (\phi C_2^H + (1 - \phi) C_2^L). \quad (4)$$

Proposition 1 states that when the ex-ante setup cost of the project is not too high, the project can be financed through a debt contract such that no strategic default will not occur in equilibrium, even in the absence of CDS contracts. The resulting outcome is efficient: When the firm has sufficient resources at date 1 it chooses to repay, such that the firm only enters costly renegotiation in the liquidity default state, where it is unavoidable. Moreover, in the liquidity default state renegotiation, while costly, is efficient and always occurs.

However, inefficiencies arise when the ex-ante setup cost exceeds  $\hat{F}$ . As we show below, in this case the project either cannot be financed at all, or it can only be financed with strategic default occurring in equilibrium. The former is inefficient because it implies underinvestment. The latter is inefficient because renegotiation has a cost, and from an efficiency perspective should only occur when absolutely necessary, i.e. only in the liquidity default state. However, when the ex-ante setup costs exceeds  $\hat{F}$ , the face value required for the project to attract funding makes it optimal for the firm to default strategically when the first-period cash flow is high and the second-period cash flow low. Renegotiation thus occurs even in cases when it is not strictly necessary. This costly strategic renegotiation leads to a deadweight loss. We summarize this in Proposition 2.

**Proposition 2** *When  $\phi \leq \bar{\phi} \equiv \frac{(1-\lambda)C_2^L}{(1-\lambda)C_2^H + \lambda q(C_2^H - C_2^L)}$  the project cannot be financed when the setup cost exceeds  $\hat{F}$ . When  $\phi > \bar{\phi}$  there is an interval  $(\hat{F}, F']$  for which the project can be financed with strategic default arising at date 1 when the date 2 cash flow is low, i.e.  $C_2 = C_2^L$ . This results in*

an expected inefficiency from strategic default of

$$\theta(1-\phi)(1-\lambda)C_2^L. \quad (5)$$

The maximum face value of debt  $R$  consistent with strategic default only in the low cash flow state  $C_2 = C_2^L$  is given by

$$R = C_2^H(1-\lambda(1-q)), \quad (6)$$

and the maximum ex-ante setup cost for which the project can be financed with strategic default only in the low cash flow state is given by

$$F' = \theta[\phi C_2^H(1-\lambda(1-q)) + (1-\phi)\lambda q C_2^L] + (1-\theta)\lambda q[\phi C_2^H + (1-\phi)C_2^L]. \quad (7)$$

Finally, when  $F$  exceeds  $\max[\widehat{F}, F']$ , the project cannot be financed at all. This is because in this case there would be systematic strategic default at date 1. That is, the debt obligation  $R$  is so high that in the high date 1 cash flow state the firm defaults even when the date 2 cash flow is  $C_2^H$ . This, however, implies that the pledgeable income is insufficient to finance the project. We thus obtain:

**Proposition 3** *When  $F > \max[\widehat{F}, F']$  the project cannot be financed. In this case, strategic default would always arise in the high cash flow state  $C_1^H$ . This implies a maximum pledgeable cash flow of*

$$\overline{F} = \lambda q(\phi C_2^H + (1-\phi)C_2^L) < F', \quad (8)$$

*which is insufficient to finance the project.*

Propositions 2 and 3 show that in our model limited commitment causes two types of inefficiencies. First, limited commitment by the firm leads to underinvestment relative to the first best. While it would be efficient to fund any project whose expected cash flows exceed the setup cost,

$$F \leq \theta C_1^H + (1-\theta)C_1^L + \phi C_2^H + (1-\phi)C_2^L, \quad (9)$$

limited commitment reduces the firm's borrowing capacity, such that only projects for which

$$F \leq \max \left[ \widehat{F}, F' \right] < \theta C_1^H + (1 - \theta) C_1^L + \phi C_2^H + (1 - \phi) C_2^L \quad (10)$$

can be financed. Hence limited commitment gives rise to underinvestment relative to the first-best.

**Corollary 1** *The equilibrium without a CDS market exhibits underinvestment relative to first-best.*

Second, when  $F'$  exceeds  $\widehat{F}$ , there is a range for setup costs for which the project can be financed, but only inefficiently. This is because in this range strategic default occurs in equilibrium, leading to a deadweight cost.

**Corollary 2** *When  $\phi > \bar{\phi}$ , there is a range of ex-ante setup costs  $(\widehat{F}, F']$  for which the project can only be financed inefficiently.*

The observation that inefficiencies relative to first best that occur in our model are a direct consequence of limited commitment highlights the potential beneficial effect of commitment devices. In particular, the flip side of Corollaries 1 and 2 is that when financial contracting takes place in the presence of limited commitment, any mechanism that can serve as a commitment device to the firm to pay out at date 1 can be value-enhancing. In Section 3 we show that CDS can serve as exactly such a commitment device.

### 3 Debt, CDS and the Empty Creditor

We now analyze the effect of allowing the lender to purchase credit insurance through fairly priced CDS. As we will see, the main effect of CDS protection is to increase the lender's bargaining position in renegotiation. This is because in order to induce the lender to accept a renegotiation offer, the firm must now compensate the lender for the CDS premium he could collect by forcing the firm into bankruptcy.

The increase in lenders' bargaining power has two effects. On the one hand, when the firm anticipates lenders to be tougher in renegotiation, this reduces the firm's incentive to strategically renegotiate down its repayment at date 1. CDS protection by creditors thus acts as a commitment device for debtors to make contractual repayments. Since in our setup strategic renegotiation is

costly, this effect is welfare-enhancing. Moreover, when creditors are protected, they are generally also able to extract more surplus during renegotiation following a liquidity default. On the other hand, however, when a lender has a CDS position this can also imply that he is not willing to renegotiate when non-payment at date 1 results from insufficient liquidity, even though renegotiation would be efficient in this case (given that there is always positive renegotiation surplus  $\lambda C_2$ ). This happens because credit insurance can turn the lender into what Hu and Black (2008a) have called an inefficient ‘empty creditor.’ While still owning control rights, the creditor with CDS protection is insulated from the potential value destruction that results from bankruptcy. In our model this inefficient ‘empty creditor’ problem emerges when the insurance payout the lender can collect in bankruptcy is larger than the potential surplus from renegotiating with the firm. This results in unrealized renegotiation gains and is clearly ex-post inefficient. When the empty creditor problem leads to foregone renegotiation surplus for projects that could have been financed without sacrificing renegotiation surplus, it also leads to an inefficiency in an ex-ante sense.

We will analyze the CDS market in two steps. First, we analyze as a benchmark the socially optimal level of credit insurance. This is the level of credit protection a social planner would set to maximize overall surplus. In our setting this also coincides with the level of CDS protection the borrower would choose if he could determine a certain level of credit protection for his lenders. After establishing this benchmark, we then analyze the lender’s choice of credit protection. We will show that when the lender is able to freely choose his CDS position, he generally has an incentive to over-insure in the CDS market, leading to socially excessive incidence of bankruptcy and lost renegotiation surplus. This means that our model predicts that a laissez-faire equilibrium in the CDS market leads to inefficiently empty creditors.

To analyze the impact of credit protection, we first have to consider how CDS change the incentive constraint for strategic default. In particular, if the borrower has a CDS position of size  $\pi$ , any out-of-court renegotiation offer must compensate the lender for the outside option of forcing the firm into bankruptcy and collecting the insurance payment. This means that when the amount of credit insurance  $\pi$  exceeds  $q\lambda C_2$ , the incentive constraint (1) becomes

$$C_1^H - R + C_2 \geq C_1^H + \max[\lambda C_2 - \pi, 0]. \quad (11)$$

It is easy to see that by reducing the right hand side of this inequality, credit protection lowers the firm's incentive to default strategically.

### 3.1 Efficient Credit Insurance

What level of credit insurance would a planner choose, or, equivalently, a borrower who can choose a certain level of credit insurance for his creditors? First, it is easy to see that the borrower would choose a level of credit protection of at least  $\lambda C_2^L$ . This is because setting  $\pi = \lambda C_2^L$  increases the lender's bargaining position in renegotiation, while still allowing renegotiation to take place after a liquidity default when the date 2 cash flow is low (a fortiori this implies that renegotiation will also occur after a liquidity default when the date 2 cash flow is high).

Setting  $\pi = \lambda C_2^L$  thus increases the pledgeable cash flow without sacrificing any renegotiation surplus. The only effect of CDS protection is to provide a commitment device for the firm not to default strategically and to allow creditors to extract more in renegotiation. The reduced incentive to default strategically when the lender has credit protection  $\pi = \lambda C_2^L$  means that the highest face value consistent with no strategic default is now given by  $R = C_2^L$ . This follows directly from the incentive constraint (11). This increase in the maximum value of  $R$  consistent with no strategic default and the creditor's increased bargaining power following a liquidity default translate into a higher maximum ex-ante setup cost that is consistent with financing the project without strategic default.

**Proposition 4** *It is efficient to choose a level of credit protection of at least  $\pi = \lambda C_2^L$ . By setting the level of CDS protection to  $\pi = \lambda C_2^L$  the highest face value consistent with no strategic default is given by  $R = C_2^L$ . This translates into a maximum ex-ante setup cost consistent with no strategic default of*

$$\tilde{F} = \theta C_2^L + (1 - \theta) (\phi \lambda \max [C_2^L, qC_2^H] + (1 - \phi) \lambda C_2^L) > \hat{F}. \quad (12)$$

*In addition, when  $\phi > \tilde{\phi} \equiv \frac{(1-\lambda)C_2^L}{C_2^H - \lambda C_2^L}$ , there is an interval  $(\tilde{F}, \tilde{F}')$  on which the project can be financed with strategic default in equilibrium. In this case  $R = C_2^H$ , and the project can be financed up to a maximum ex-ante setup cost of*

$$\tilde{F}' = \theta [\phi C_2^H + (1 - \phi) \lambda C_2^L] + (1 - \theta) (\phi \lambda \max [C_2^L, qC_2^H] + (1 - \phi) \lambda C_2^L) > F'. \quad (13)$$



Proposition 4 illustrates two potential benefits of CDS markets. First, the presence of CDS protection can prevent strategic default. Some projects may be able to attract financing even in the absence of CDS, but only with strategic default in equilibrium. Since  $\tilde{F} > \hat{F}$ , the introduction of CDS eliminates strategic default and the associated deadweight loss of  $\theta(1-\phi)(1-q)C_2^L$ . This is the case whenever  $\hat{F} < F'$ . Second, some positive NPV projects that could not attract financing in the absence of CDS, can be financed when a CDS market becomes available, since  $\max[\tilde{F}, \tilde{F}'] > \max[\hat{F}, F']$ . This means that the introduction of CDS extends the set of projects that can attract financing, thus alleviating the underinvestment inefficiency. Introducing a CDS market can thus make existing projects more efficient and allow for financing of additional projects. As shown in Proposition 4, if the ex-ante setup cost lies below the threshold  $\max[\tilde{F}, \tilde{F}']$  both these efficiency gains are possible without sacrificing any renegotiation surplus.

**Corollary 3** *CDS have two distinct benefits:*

1. *The presence of CDS eliminates strategic defaults for projects that can be financed even in the absence of CDS.*
2. *CDS increase the set of projects that can receive financing in the first place.*

Could it be efficient to raise the level of CDS protection above  $\lambda C_2^L$ ? In this case an additional effect emerges: the presence of CDS protection may prevent socially desirable renegotiation following a liquidity default. More precisely, when the firm renegotiates its debt for liquidity reasons, and when the expected date 2 cash flow is given by  $C_2^L$ , renegotiation will not occur even though it would be efficient. The reason is that the maximum the firm can offer to the lender in renegotiation is  $\lambda C_2^L$ , which means that the lender prefers to collect his insurance payment of  $\pi > \lambda C_2^L$ . Hence when  $\pi > \lambda C_2^L$  the empty creditor problem emerges, leading to suboptimal renegotiation after liquidity defaults. However, even despite this loss renegotiation surplus it may still be efficient to set the level of CDS protection to  $\lambda C_2^H$ . This is the case when this higher level of credit protection allows a project to be financed that could otherwise not be financed, or if the loss of renegotiation surplus generated by the high level of credit protection is more than offset by a reduction in the social cost of strategic default. We will consider these two cases in turn.

First consider the case  $\tilde{F} \geq \tilde{F}'$ . When  $\tilde{F} \geq \tilde{F}'$  the last project that can just be financed with the low level of credit protection  $\pi = \lambda C_2^L$  is financed efficiently, i.e. without strategic default. Raising the level of credit insurance to  $\lambda C_2^H$  can then only be efficient if the project's setup cost exceeds the critical value  $\tilde{F}$ , so that the project cannot be financed at all when  $\pi = \lambda C_2^L$ . If a CDS with  $\pi = \lambda C_2^H$  makes sufficient cash flow pledgeable so that a project with a setup cost higher than  $\tilde{F}$  can be financed, it is ex-ante efficient to get a CDS with  $\pi = \lambda C_2^H$  even though this involves an ex-post inefficiency.

**Proposition 5** *Suppose that  $\tilde{F} \geq \tilde{F}'$ . When the ex-ante setup cost exceeds  $\tilde{F}$  it is efficient to set the level of credit protection to  $\pi = \lambda C_2^H$  if this allows the project to be financed. Raising pledgeable income beyond  $\tilde{F}$  by increasing the level of credit insurance to  $\pi = \lambda C_2^H$  is possible when*

$$C_2^H > \begin{cases} \frac{1-\phi}{(1-q)\phi} C_2^L & \text{when } qC_2^H > C_2^L \\ \frac{1}{\phi} C_2^L & \text{otherwise} \end{cases}. \quad (14)$$

While this results in expected lost renegotiation surplus of  $(1-\theta)(1-\phi)\lambda C_2^L$  it is ex-ante efficient when  $F > \tilde{F}$  since otherwise the project could not be financed. The maximum ex-ante setup cost that can be financed in this case is given by

$$F^\# = \theta \max [C_2^L, \phi C_2^H] + (1-\theta)\phi\lambda C_2^H. \quad (15)$$

Now consider what happens when  $\tilde{F}' > \tilde{F}$ . In this case the marginal project that can be financed with  $\pi = \lambda C_2^L$  involves strategic default. Again it is clearly always efficient to set  $\pi = \lambda C_2^H$  when this allows a project with a setup cost higher than  $\tilde{F}'$  to be financed. However, if the cost of foregone renegotiation surplus is smaller than the cost of strategic default, then it is also optimal to set  $\pi = \lambda C_2^H$  when  $F \in (\tilde{F}, \tilde{F}']$ . As it turns out, the cost of strategic default exceeds the cost of foregone renegotiation whenever  $\theta > \lambda$ .

**Proposition 6** *Suppose that  $\tilde{F}' > \tilde{F}$ . When the ex-ante setup cost exceeds  $\tilde{F}'$  it is efficient to set the level of credit protection to  $\pi = \lambda C_2^H$  if this allows the project to be financed. This allows*

financing up to a maximum ex-ante setup cost of

$$F^\# = \theta \max [C_2^L, \phi C_2^H] + (1 - \theta) \phi \lambda C_2^H$$

In addition, if  $\theta > \lambda$  it is also efficient to set the level of credit protection to  $\pi = \lambda C_2^H$  on the interval  $(\tilde{F}, \tilde{F}']$ , if this allows financing the project without strategic default.

Propositions 5 and 6 show that it can be efficient to raise the level of credit protection to  $\lambda C_2^H$  even though this implies that renegotiation will not take place after a liquidity default when the expected date 2 cash flow is low. However, it is only efficient to do so when certain conditions are met. Either it must be the case that the project cannot be financed when  $\pi = \lambda C_2^L$  and that raising the level of credit protection beyond  $\lambda C_2^L$  allows the project to attract financing. This is possible when  $C_2^H$  is sufficiently large, as stated in condition (14). Or it must be the case that the costs of foregone renegotiation are smaller than the costs of strategic default, in which case it is optimal to choose  $\pi = C_2^H$  also in the region in which financing with  $\pi = C_2^L$  would involve strategic default.

To summarize the results from this section, we have seen that from an efficiency standpoint it is optimal to choose a level of credit protection of at least  $\lambda C_2^L$ . This reduces the incidence of strategic defaults for projects that can be financed in absence of CDS, and it increases the investment opportunity set by increasing pledgeable income. Moreover, for projects that cannot be financed when  $\pi = \lambda C_2^L$ , or when strategic default is particularly costly, it can be optimal to raise the level of protection to  $\lambda C_2^H$ .

### 3.2 The Lender's Choice of Credit Insurance

We now turn to the lender's choice of credit protection and compare it to the efficient benchmark characterized above. We will show that in general lenders will choose to over-insure relative to the efficient benchmark, leading to excessively tough lenders in debt restructuring at date 1.

Consistent with current market practice, we assume that the lender chooses the level of credit protection after the terms of the debt contract have been determined. Moreover, the lender cannot commit ex ante to a specific level of credit protection. This is reasonable, because credit derivatives positions are not disclosed, such that commitment to a certain level of credit protection is not possible. In choosing credit protection, the lender will thus take the face value  $R$  as given and will

then choose a level of credit protection  $\pi$  that maximizes his individual payoff. The fair insurance premium  $f$  in turn correctly anticipates the lender's incentives regarding renegotiation given a level of protection  $\pi$ . Note that this also implies that the value of CDS to the lender comes entirely from strengthening his bargaining power in situations that ultimately do not trigger payment of the CDS. States in which the CDS pays out are priced into the insurance premium  $f$ , which means that in expected terms the creditor pays one for one for potential payouts from his CDS protection.<sup>11</sup>

By the same argument as in Section 3.1, we know that the lender will choose a level of credit protection of at least  $\lambda C_2^L$ . By doing so, the lender improves his position in renegotiation without sacrificing any renegotiation surplus. However, the lender may have an incentive to raise his level of credit protection beyond  $\lambda C_2^L$  to  $\pi = \lambda C_2^H$ . In fact, the lender will do this if the increased level of credit protection raises his expected payoff, notwithstanding any lost renegotiation surplus an increase in credit protection may cause. This means, for example, that in contrast to the efficient benchmark the lender may have the incentive to raise the level of credit protection to  $\lambda C_2^H$  even in cases where the project could be financed efficiently with  $\pi = \lambda C_2^L$ . This is outlined in Proposition 7.

**Proposition 7** *Suppose that  $F \leq \tilde{F}$ , such that the project can be financed without strategic default by setting  $\pi = \lambda C_2^L$ . The lender nevertheless chooses  $\pi = \lambda C_2^H$  when this increases his expected payoff. This occurs when  $C_2^H$  is sufficiently large:*

$$C_2^H > \begin{cases} \frac{1-\phi}{(1-q)\phi} C_2^L & \text{when } qC_2^H > C_2^L \\ \frac{1}{\phi} C_2^L & \text{otherwise} \end{cases}. \quad (16)$$

*This is inefficient because it results in an expected loss of renegotiation surplus of  $(1-\theta)(1-\phi)\lambda C_2^L$ .*

*If in addition there is an interval  $(\tilde{F}, \tilde{F}']$  where financing with  $\pi = \lambda C_2^L$  involves strategic default, the creditor inefficiently chooses  $\pi = \lambda C_2^H$  when (16) holds and in addition  $\lambda > \theta$ .*

Proposition 7 shows that in comparison to the efficient benchmark the lender has an incentive to over-insure. This is because the lender can increase his payoff by raising the level of credit protection to  $\lambda C_2^H$  whenever (16) holds. However, we know from Proposition 5 that it is only efficient to raise

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<sup>11</sup>We use this property to simplify our calculations. In particular, it means that when calculating the creditor's payoff we only need to consider states in which default does not occur, because in expected terms the CDS payment  $\pi$  and the insurance premium  $f$  will exactly offset.

the level of credit protection to  $\lambda C_2^H$  if the project could not be financed otherwise, or if the cost of foregone renegotiation surplus is more than compensated by a gain from eliminating strategic default. The creditor, however, does not fully internalize the loss in renegotiation surplus that results from choosing  $\pi = \lambda C_2^H$  and over-insures in equilibrium. Our model thus predicts and *inefficient* empty creditor problem as an equilibrium outcome of the lender's optimal choice credit protection choice.

**Corollary 4** *Assume that the project can be financed without strategic default by setting  $\pi = \lambda C_2^L$ . The lender will always over-insure (irrespective of the particular values of  $C_2^H$  and  $C_2^L$ ) when*

1. *the probability of the high second period cash flow  $\phi$  tends to one;*
2.  *$qC_2^H > C_2^L$  and  $q \leq \phi$ .*

*There is no overinsurance problem when either  $\phi = 0$  or  $q = 0$ .*

The first part of Corollary 4 shows that inefficient over-insurance by creditors is more likely when there is a high probability that in the event of a liquidity default there is ample renegotiation surplus. In this case, the incentive to appropriate as much as possible when the renegotiation surplus turns out to be high gives creditors an incentive purchase credit insurance up to an amount that inefficiently precludes renegotiation when  $C_2 = C_2^L$ . The second part of Corollary 4 shows that when  $C_2^H$  is large relative to  $C_2^L$ , it suffices that  $\phi$  exceeds  $q$  for the creditor to always over-insure. This illustrates that inefficient over-insurance by creditors is more likely the higher the ‘upside potential’ in renegotiation surplus. Finally, condition (16) shows that there is no over-insurance problem when the creditor receives the entire surplus in renegotiation ( $q = 1$ ), or when the probability of the high date 2 cash flow is zero ( $\phi = 0$ ).

## 4 Multiple Creditors

In this section we explore an individual creditor's incentive to obtain default insurance in situations where the firm raises debt from multiple creditors. Most of our results can be stated in the simplest possible setting with only two creditors. They generalize straightforwardly to situations with an arbitrary number of  $n \geq 2$  creditors.

The firm may raise funds from multiple creditors either through a single debt issue to multiple creditors, or through multiple issues sold to a single creditor each. We mostly focus on the latter situation, in which the firm effectively renegotiates its debts separately with each creditor and can treat creditors with different levels of credit protection differently. In the former situation, the firm will renegotiate with all holders of a particular issue at once, treating all creditors equally, even if they may not all be equally insured.

#### 4.1 Two separate debt issues

Suppose for simplicity that the two debt issues are of equal size and seniority, and that each creditor has purchased  $\pi^i = \lambda C_2^L/2$  in credit protection, such that the aggregate amount of credit protection,  $\pi^1 + \pi^2 = \lambda C_2^L$ , is at the maximum level that allows efficient renegotiation after a liquidity default. Suppose also that the project can attract financing when  $\pi^1 + \pi^2 = \lambda C_2^L$ , such that an increase in credit protection from this level would be inefficient. We will now show that in this situation an individual creditor is more likely to deviate, by getting an inefficiently higher level of insurance, than the lone creditor in the single creditor case analyzed in the previous section. The basic reason is that in a setting with multiple creditors, an individual creditor is seeking to strengthen his bargaining position in renegotiation not just vis-a-vis the debtor but also with respect to the other creditors.

In Proposition 7 we established that when a lone creditor chooses his level of credit protection he will over-insure whenever  $C_2^H$  exceeds the threshold:

$$C_2^H = \begin{cases} \frac{1-\phi}{(1-q)\phi} C_2^L & \text{when } qC_2^H > C_2^L \\ \frac{1}{\phi} C_2^L & \text{otherwise} \end{cases} . \quad (17)$$

We shall now show that the threshold for  $C_2^H$  at which a single creditor deviates in our symmetric two-creditor situation is strictly lower. That is, when comparing a single creditor's expected payoff from choosing protection  $\pi^i = \lambda C_2^L/2$  and from choosing a strictly higher level of protection we show that the latter is strictly higher for a cutoff of  $C_2^H$  strictly lower than (17).

To see this, note that with protection  $\pi^i = \lambda C_2^L/2$  the creditor's expected payoff is given by

$$\frac{1}{2} \{ \theta R + (1 - \theta) (\phi \max [\lambda C_2^L, q \lambda C_2^H] + (1 - \phi) \lambda C_2^L) \}. \quad (18)$$

The most profitable deviation for an individual creditor is to increase protection to  $\lambda C_2^H - \pi^j$  (where  $\pi^j = \lambda C_2^L/2$  is the other creditor's level of protection). In this case he can extract all the bargaining surplus when  $C_2 = C_2^H$  and force both the firm and the other creditor down to their outside options. Increasing protection beyond this level would lead to a breakdown of renegotiation even when  $C_2 = C_2^H$  and would thus not be profitable. Choosing a lower level credit protection would leave money on the table for the firm or the other creditor. The deviation payoff from unilaterally increasing credit protection to  $\lambda C_2^H - \lambda C_2^L/2$  is given by:

$$\frac{1}{2} \theta R + (1 - \theta) \phi \left[ \lambda C_2^H - \lambda \frac{C_2^L}{2} \right]. \quad (19)$$

An individual creditor thus prefers to increase his level of credit protection to  $\lambda C_2^H - \lambda \frac{C_2^L}{2}$  whenever (19) exceeds (18). Proposition (8) shows that the resulting cutoff value for  $C_2^H$  is lower than the one in the single creditor case. Multiple creditors in separate debt issues thus have a tendency to worsen the over-insurance problem.

**Proposition 8** *Suppose that the project can be financed without strategic default with two debt issues of equal size and seniority and CDS insurance:  $\pi^1 = \pi^2 = \frac{\lambda}{2} C_2^L$ . Then an individual lender  $i$  gains by deviating to CDS insurance  $\pi^i = \lambda C_2^H - \frac{\lambda}{2} C_2^L$  when  $C_2^H$  is greater than  $C_2^*$ :*

$$C_2^* = \begin{cases} \frac{1}{\phi(2-q)} C_2^L & \text{when } q C_2^H > C_2^L \\ \frac{1+\phi}{2} \frac{1}{\phi} C_2^L & \text{otherwise} \end{cases}. \quad (20)$$

The cutoff  $C_2^*$  is strictly smaller than the cutoff for  $C_2^H$  at which a sole creditor switches to the higher level of insurance  $\pi = \lambda C_2^H$ . Therefore, there is a greater likelihood of over-insurance under multiple creditor arrangements.

The intuition for the worsening of the over-insurance problem when there are multiple creditors can be seen by considering the costs and benefits of a unilateral increase in credit protection. The

individual creditor who unilaterally raises his level of credit protection extracts all the surplus from the deviation when  $C_2 = C_2^H$ . The cost of the deviation, on the other hand, is split equally among the two creditors: when  $C_2 = C_2^L$  renegotiation fails, and both creditors lose  $\lambda C_2^L/2$  of potential renegotiation surplus.

To compare the multiple creditor case to the single creditor case, it is also instructive to consider the case when  $q = 1$ . In this case creditors receive the entire surplus in renegotiation, and from (16) we see that a lone creditor would have no incentive to over-insure. In the two-creditor case, on the other hand, over-insurance would still emerge even when  $q = 1$ , as shown by condition (20). The reason is that even though creditors receive the entire renegotiation surplus, one creditor can profit at the expense of the other creditor by increasing his CDS position.

## 4.2 One bond issue with multiple creditors

Consider now the situation where the firm has issued a single bond that is held by two creditors,  $i = 1, 2$ , in equal amounts. Unlike in the previous situation, the firm is now required to treat the two creditors equally when it attempts to restructure this bond: It has to offer a debt exchange on the same terms to the two creditors, irrespectively of whether they each have independently purchased the same level of default protection or not. As a result of this constraint on ex post restructuring offers, the incentive for each individual creditor of seeking default protection is unclear. For example, if creditor  $i$  gets protection  $\pi_i$ , which is anticipated to result in an exchange offer to forestall default of  $\pi_i$  for each creditor, then it is redundant for creditor  $j$  to also get default protection. In fact, to the extent that default protection is costly, creditor  $j$  may then choose to simply *free-ride* on creditor  $i$ 's protection. Another complication in this situation is that the two creditors may benefit by trading their claims with each other in anticipation of a debt restructuring. All in all, it is thus not obvious *a priori* whether the presence of multiple holders of the same bond issue results in a greater or smaller level of equilibrium default protection than with a single creditor. We consider in turn the situations where no trade between the two creditors is allowed, and when both bond and CDS trades are possible in a secondary market.



### 4.2.1 No trade among creditors during renegotiation

A first observation that is immediately available is that in equilibrium one of the creditors  $i$  purchases credit protection of at least  $\pi_i = \lambda C_2^L/2$ . To see this, suppose that the two creditors each purchase less than  $\lambda C_2^L/2$  in protection. In that case, it would always be individually profitable for one of the two creditors to increase his level of credit protection to  $\pi_i = \lambda C_2^L/2$ . This increase in credit protection raises the payoffs of both creditors (since they are treated equally in renegotiation) without sacrificing any renegotiation surplus. Accordingly, assuming that credit protection is fairly priced (as we have done so far), a pair  $(\pi_1, \pi_2)$  such that  $\max[\pi_1, \pi_2] = \lambda C_2^L/2$  could be a candidate equilibrium outcome. It is in fact an equilibrium if neither creditor  $i$  has an incentive to deviate by taking strictly higher credit protection.

Thus, consider when it is privately optimal for one of the two creditors to increase his level of credit protection beyond  $\lambda C_2^L/2$ . The most profitable deviation from  $\max[\pi_1, \pi_2] = \lambda C_2^L/2$  for an individual creditor is to raise his level of credit protection up to  $\lambda C_2^H/2$ . This is the maximum level of protection that allows renegotiation when the renegotiation surplus is high, given that both creditors have to be treated equally in renegotiation. Then, assuming that there is no strategic default in equilibrium, the expected payoff from deviating to  $\pi_i = \lambda C_2^H/2$  is given by

$$\theta \frac{R}{2} + (1 - \theta) \phi \frac{\lambda C_2^H}{2}. \quad (21)$$

Equation (21) reflects that under equal treatment a restructuring is possible only if the firm offers  $\lambda C_2^H/2$  to each creditor, which after creditor  $i$ 's deviation is only possible when the renegotiation surplus is high, i.e with probability  $\phi$ . When the surplus is low, renegotiation fails and the creditor receives the CDS payment  $\frac{\lambda C_2^H}{2}$ . However, in expected terms this payment is offset by the cost of purchasing CDS protection, which under fair pricing is given by  $(1 - \theta) (1 - \phi) \frac{\lambda C_2^H}{2}$ .

The deviation is profitable if this exceeds the creditor's payoff when protection is given by  $\max[\pi_1, \pi_2] = \lambda C_2^L/2$ . This payoff is given by

$$\theta \frac{R}{2} + (1 - \theta) \frac{1}{2} [\phi \max[\lambda C_2^L, q \lambda C_2^H] + (1 - \phi) \lambda C_2^L]. \quad (22)$$

Comparing (21) to (22) shows that the deviation is profitable whenever

$$C_2^H > \begin{cases} \frac{1-\phi}{(1-q)\phi} C_2^L & \text{when } qC_2^H > C_2^L \\ \frac{1}{\phi} C_2^L & \text{otherwise} \end{cases}. \quad (23)$$

This condition is equivalent to the condition that must be satisfied for a *single* creditor to benefit by increasing his level of credit protection beyond  $\pi = \lambda C_2^L$ . This means that under a single bond issue, that is held in equal amounts by two creditors, the incentives to over-insure are equivalent to those of a single creditor, when creditors cannot trade amongst themselves in a secondary market. It follows that there is likely to be less inefficient overinsurance under this financial structure than when the firm negotiates two separate debt contracts with the two creditors.

#### 4.2.2 Creditors can trade their CDS and bond positions during renegotiation

Consider now the situation where the two creditors can trade their bond and CDS positions before the firm undertakes debt renegotiations. As we will show, secondary market trade between the two creditors induces the deviating creditor to be more aggressive in seeking high levels of default protection.

We start again from the candidate symmetric equilibrium in which both creditors have purchased  $\pi_1 = \pi_2 = \lambda C_2^L/2$  in credit protection, and ask what an individual creditor's incentives are to deviate by seeking higher credit protection. The most profitable deviation for the deviating creditor is now to raise his level of credit protection to  $\lambda C_2^H - \lambda C_2^L/2$ . Note that absent trade among the creditors, at this level of protection renegotiation would fail even if the renegotiation surplus is high: under equal treatment of both creditors the firm would have to offer  $2(\lambda C_2^H - \lambda C_2^L/2)$  to guarantee that renegotiation succeeds, but this would exceed the available renegotiation surplus of  $\lambda C_2^H$ .

However, when trade is allowed between the two creditors, the deviating creditor can purchase the other creditor's bond and CDS position to ensure that renegotiation will be successful when the renegotiation surplus is high. To be able to purchase the other creditor's bond and CDS positions, the deviating creditor would have to pay the other creditor at least what he would receive if renegotiation were to fail, i.e. his CDS default payment of  $\lambda C_2^L/2$ . After purchasing the other

creditor's bond and CDS positions, the deviating creditor negotiates as a single creditor with the firm and is therefore willing to accept a restructuring offer for the whole bond issue of  $\lambda C_2^H$ . That is, if the firm makes an offer of  $\lambda C_2^H/2$  for each half of the bond issue, the deviating creditor who now owns the entire issue will vote to accept this offer on all the bonds he owns. The deviating creditor can thus generate a payoff of

$$\theta \frac{R}{2} + (1 - \theta) \phi \left[ \lambda C_2^H - \frac{\lambda C_2^L}{2} \right]. \quad (24)$$

Comparing this payoff to

$$\theta \frac{R}{2} + (1 - \theta) \frac{1}{2} \left[ \phi \max [\lambda C_2^L, q \lambda C_2^H] + (1 - \phi) \lambda C_2^L \right], \quad (25)$$

we find that a single creditor is better off deviating to  $\pi_i = \lambda C_2^H - \lambda C_2^L/2$  whenever

$$C_2^H > \begin{cases} \frac{1}{\phi(2-q)} C_2^L & \text{when } q C_2^H > C_2^L \\ \frac{1+\phi}{2} \frac{1}{\phi} C_2^L & \text{otherwise} \end{cases}. \quad (26)$$

This is the same condition as the one we derived for the case which two creditors with two separate bond issues. We thus conclude that the incentives to seek excessive default protection when the firm has issued a single bond held by multiple creditors lie between the incentives for over-insurance under financing with a single creditor, and the incentives for over-insurance when the firm has written multiple debt contracts with multiple creditor

## 5 Policy Implications

Our analysis highlights both the positive role of CDS as a commitment device for borrowers and the negative, socially inefficient 'rent-extraction' they allow lenders to undertake. Hence both the costs and benefits from default protection are flip sides of the same coin: they both arise as a result of the empty creditor's strengthened bargaining power in renegotiation.

In this section we discuss the implications of our analysis for policy and the optimal legal treatment of CDS. The existing law literature on CDS and the empty creditor problem (Hu and Black (2008a,b), Lubben (2007)) has mostly been concerned with the potential ex-post negative

consequences of the empty creditor problem for efficient debt restructuring. The premise of this literature is that the bundling of economic ownership and control rights is efficient, and hence that the introduction of CDS and empty creditors results in distortions, giving rise to inefficient debt restructuring and inefficiencies in the bankruptcy process. Accordingly, the policy proposals arising from this analysis mainly seek to mitigate or undo the effects of CDS, thereby eliminating the empty creditor problem. It is argued, in particular, that courts should require disclosure of CDS positions to be able to uncover potential conflicts of interest between those creditors in a given class that are protected by a CDS and those who are not:

“This disclosure would ensure that the court, other creditors, and shareholders know where a creditor’s economic interest lies. Even if an apparent creditor with negative net economic interest in a class of debt retained voting rights, its views would be discounted. Moreover, courts would likely be readier to override a creditor vote which was tainted by some creditors voting with little, no, or negative economic ownership.”, Hu and Black (2008a), pp.21

Thus, according to Hu and Black (2008a) one effect of disclosure of CDS positions would be the ability to reduce or remove the empty creditor’s control rights and to leave the debt restructuring decisions in the hands of the unprotected creditors:

“Voting rights may need to be limited to creditors with positive economic interest in the debtor as a whole or in a particular debt class. The degree of voting rights may need to be based on net economic ownership instead of gross ownership of a debt class.”, Hu and Black (2008a), pp.21<sup>12</sup>

However, given the form of most CDS contracts, it is not obvious that a conflict between protected and unprotected creditors always remains in bankruptcy, as the CDS payment is a bygone once the firm is in Chapter 11.<sup>13</sup> Thus, the focus on disclosure *in bankruptcy* and on denying

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<sup>12</sup>They suggest further that “it might be feasible to adopt crude rules that block voting with negative overall economic interest – either in the debtor or in a particular class. At least in the U.S., bankruptcy courts may have the power under current law to disregard or limit votes by empty creditors, if disclosure rules made it possible for them to identify these creditors.” That is, “courts can disallow votes that are “not in good faith.” (U.S. Bankruptcy Code § 1126)”.

<sup>13</sup>Clearly, once all CDS are settled, they should not matter in Chapter 11. It is possible, however, that important

voting rights to protected creditors may be misplaced. Our analysis suggests that the critical legal intervention is likely to be *prior* to the filing for bankruptcy protection and should aim at eliminating inefficient obstacles to debt restructuring outside of Chapter 11, while preserving the commitment benefits of CDS.

We divide our policy discussion into five main subsections. The first two cover in turn situations where CDS are likely to be harmless and mostly harmful. The last three subsection cover the issues of: i) whether debt restructuring should constitute a credit event; ii) whether the protection seller should become the debt claimholder following default; and, iii) the benefits of mandating disclosure of CDS positions.

## 5.1 When are CDS harmless?

Given that CDS may have ex-ante commitment benefits by strengthening creditors' ex-post bargaining power, their use should be welcomed as long as they do not give rise to significant ex-post debt restructuring inefficiencies. Thus, as a general principle courts should dismiss any suit brought against a creditor with CDS protection (e.g. seeking to remove the creditor's voting rights in a debt restructuring proposal or exchange offer) unless it can be shown that the CDS protection is likely to lead to a breakdown in a value-enhancing debt restructuring deal. The mere presence of CDS protection should not automatically lead to the denial of voting rights. In particular, if the effect of CDS protection is only to change the terms of the restructuring deal in favor of the creditor then there is no reason to intervene either in the debt contract or the CDS. In fact, denial of voting rights to creditors in this case would erode the ex-ante benefits of CDS that we highlight in this article.

It is also important to note that our model provides no grounds for a general limit on speculation in CDS markets. In particular, since the harmful effects of CDS on renegotiation can only arise through investors who hold both the bond and a CDS, speculation in CDS markets is harmless (at least in terms of a potential inefficient empty creditor problem) as long as the speculators active in these markets do not at the same time own the CDS and the underlying bond. It is thus not

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decisions—in particular whether to grant DIP-financing—have to be made before all CDS contracts are settled. To the extent that the default payment by the protection seller is unaffected, these decisions should not depend on the presence of unsettled CDS. If, however, the default payment is inversely related to the recovery (or continuation) value of the firm in Chapter 11, protected creditors may have a lower incentive to maximize continuation value. From this perspective it is desirable to settle CDS positions as quickly as possible after a Chapter 11 filing.

necessary to sacrifice the role of CDS markets in aggregating market participants' information on credit default probabilities in order to deal with inefficient empty creditors. This also implies that our model provides no grounds for limiting 'naked' CDS positions, as proposed by the Waxman-Markey Bill, which has been passed by the House of Representatives and is now under consideration by the Senate.<sup>14</sup>

On the other hand, our analysis indicates that regulators may want to keep an eye on trading strategies that involve joint positions in bonds and CDS, for example so-called negative basis trades that aim to take advantage of relative price differences between a cash bond and a synthetic bond, comprised of a risk-free bond and a CDS. In fact, Yavorsky, Bayer, Gates, and Marshella (2009) predict that the increasing popularity of negative basis arbitrage trades, which involve positions in a CDS and the underlying bond, may lead to increased and accelerated bankruptcies or restructurings (in cases when restructuring counts a credit event) over the coming years.

## 5.2 When are CDS mostly harmful?

When a firm's debt capacity is sufficiently large that it could secure a loan from an unprotected creditor, or from a creditor protected by a CDS with a low default payment, but instead the creditor takes out a CDS insurance with a default payment  $\pi$  so high that the CDS gives rise to an inefficient breakdown in debt restructuring ( $\pi = \lambda C_2^H$ ), then clearly the CDS is harmful. As stated by Proposition 7, the CDS then gives rise to socially inefficient rent extraction by the creditor at the expense of the overall value of the firm.

More generally, our analysis suggests that when a CDS specifies a default payment that is disproportionately large relative to the creditor's loss in default, for a firm that was perceived to be sufficiently profitable to be able to obtain more loans *ex ante*, then *prima facie* the main purpose of such a CDS is inefficient rent extraction. Intervention to limit such CDS may be desirable, but it is not entirely clear what form this intervention should take.

Should it take the form of disenfranchising holders of CDS contracts of their voting rights in a debt restructuring, as Hu and Black (2008a) suggest? Or should it take the form of limiting the enforcement of excessively large default payments? Clearly, when there is only one creditor

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<sup>14</sup>The Waxman Markey Bill, officially titled H.R. 2454, the American Clean Energy and Security Act of 2009, if passed unaltered, prohibits ownership of a CDS unless the same person also owns the credit referenced by the CDS. It was passed by the House of Representatives on June 26, 2009.

involved, as in our analysis so far, it does not make sense to disenfranchise the creditor. In such situations, intervention must take the form of directly limiting the enforcement of CDS contracts. In this case, a limit on a maximum allowable default payment may be welfare improving. But intervention could also take the form of requiring that the firm rather than the creditor take out default protection. That is, enforcement could be made conditional on the borrower and lender both agreeing to the CDS contract. This would limit unilateral, rent-seeking default protection purchased by the creditor at the expense of the firm.

### 5.3 Should restructuring be a credit event?

One simple way of eliminating the empty creditor problem would be to make debt restructuring itself a credit event under the CDS, for then the default payment  $\pi$  would be made whether or not debt restructuring is successful. When restructuring constitutes a credit event the CDS has no effect on the creditor's incentives in debt restructuring and this would therefore eliminate the empty creditor problem.

We have so far assumed that out-of-court debt restructuring does not constitute a credit event for the CDS contract. This corresponds broadly to current market practice. Indeed, at least since March 20, 2009, standard American CDS do not count restructuring as a credit event (JPMorgan (2009)).<sup>15</sup>

While it is well-known that the different treatment of restructuring events affects the pricing of CDS contracts (Packer and Zhu (2005), Berndt, Jarrow, and Kang (2006)), our model shows that whether restructuring qualifies as a credit event also has important repercussions on creditor behavior and credit market outcomes. In our model the economic value added of CDS stems from their role as a commitment device. That is, a creditor with CDS protection becomes a tougher counterparty in renegotiations when the CDS contract does not trigger a default payment upon

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<sup>15</sup>Some CDS contracts have been written that do include restructuring as a credit event, and restructuring events were originally included as credit events in the 1999 credit derivatives definitions. However problems with restructuring clauses emerged when Consec Finance restructured debt to terms that were advantageous to creditors, yet still the restructuring counted as a credit event. This allowed creditors with protection to exploit the cheapest to deliver option to their advantage. As a consequence, contracts that did not include restructuring as a credit event gained in popularity. Moreover, for investors that wanted restructuring included in their CDS contracts, ISDA introduced modified versions of the restructuring clause. The modified restructuring clause of 2001 (Mod-R) limits the set of securities a lender can deliver in the case of a restructuring credit event. The modified-modified restructuring clause introduced in 2003 (Mod-Mod-R) slightly broadened the set of deliverable obligations after a restructuring event. For more details on the different contractual clauses see JPMorgan (2006).

an out-of-court restructuring agreement, and only triggers a payment when the debtor formally defaults on his debt obligations by, say, filing for Chapter 11 protection. It follows that if restructuring is included as a credit event, the CDS loses its economic role in our model. Hence, while classifying restructuring as a credit event eliminates the empty creditor problem, it also eliminates any economic gains from CDS as a commitment device.

Another way around the inefficient empty creditor problem would be to structure CDS like a put option. Rather than requiring a contractually specified default event, one could imagine a contract according to which the protection buyer can sell (put) the bond to the protection seller for a prespecified price at any time. In this case again, the CDS would have a neutral effect on debt restructuring. However, as with debt restructuring as a credit event, the put option CDS would eliminate the beneficial commitment role of CDS.

In summary, requiring that CDS contracts include restructuring as a credit event, or that CDS be equivalent to put options would in our model destroy the economic value of CDS altogether. A more fruitful intervention would be not to interfere with such key contractual clauses, but to simply cap the size of default payments.

#### **5.4 Who is best placed to renegotiate debt?**

Should the CDS involve a simple default payment  $\pi$ , as we have assumed, or should it also involve a transfer of the debt claim to the protection seller? In our baseline model we have normalized the reorganization value in Chapter 11 to  $L = 0$  and assumed that, according to the absolute priority rule, all the reorganization surplus goes to the lender. In this baseline case it is therefore irrelevant whether the protection seller becomes the owner of the debt in the event of default or not. But, suppose more generally that  $L > 0$  and that the lender is only able to appropriate a share  $q$  of this reorganization surplus. Then, the answer to this question depends on which party is best placed to renegotiate the debt contract with the debtor in Chapter 11. If the protection seller's bargaining power  $q^I$  is higher than the creditor's  $q$  then there are obviously gains from trade in transferring the debt claim to the protection seller, for then the owner of the debt claim can extract a bigger share of the reorganization surplus  $L$ . If this transfer is anticipated at date 0, it is welfare-enhancing since it raises the firm's debt capacity and thus facilitates investment. In the terminology of derivatives markets, in cases where the insurance company that issues CDS has sufficient specialization in



Chapter 11 negotiations, ‘physical settlement,’ in which the bond is transferred to the protection seller when default occurs, may be preferable to ‘cash settlement,’ under which the protection buyer retains the bond in default.

Is there also a gain from transferring ownership of the debt before default occurs? By selling the debt before a default to the protection seller, or another third party with stronger bargaining power (e.g. a vulture fund specialized in distressed debt investments), and retaining only the CDS, the initial lender would undermine the commitment value of the CDS. Indeed, the debtor can then renegotiate the debt with the new debtholder and avoid making the default payment  $\pi$ . Thus it is only if the difference in bargaining strength between the debtholders is large enough to more than compensate for  $\pi$ , that it is attractive for the initial lender to sell his debt claim.

A related, important question for policy, is whether there is an efficiency-improving trade available ex post, in situations where the presence of the CDS leads to a breakdown in renegotiation. Could the protection seller avoid the inefficiency that arises from the failure to renegotiate by purchasing the debt claim from the protection buyer before the firm defaults? In order to examine this in the context of our model, recall that debt renegotiation breaks down when the CDS specifies a high default payment  $\pi = \lambda C_2^H$  and when  $C_2 = C_2^L$ , such that the available renegotiation surplus is given by  $\lambda C_2^L$ . If the protection seller purchases the debt claim from the initial lender there will be efficient debt renegotiation and therefore no default by the firm. This means that the initial lender would be denied the default payment  $\pi = \lambda C_2^H$  under the CDS. Thus, to purchase the debt claim, the protection seller must pay the initial lender at least  $\lambda C_2^H$ . Then, by renegotiating with the firm, the protection seller can receive at most  $q^I \lambda C_2^L$ . The return to the protection seller from purchasing the debt is therefore  $q^I \lambda C_2^L - \lambda C_2^H < 0$ . This clearly shows that the protection seller has no incentive ex-post to buy the claim from the original creditor to prevent inefficient default and bankruptcy.

There is, however, another avenue for the protection seller to avoid default, and the CDS payment of  $\pi = \lambda C_2^H$  to the creditor: the protection seller could directly help the debtor repay the debt obligation  $R$  at date 1. All the protection seller needs to do is to cover the difference  $(R - C_1^L)$  of the debt obligation to make it incentive compatible for the firm to repay  $R$  and avoid default. As long as  $(R - C_1^L) \leq \lambda C_2^H$  this is an attractive alternative for the protection seller. Interestingly, the Texan brokerage firm Amherst Holdings recently avoided large default payments on CDS contracts

it had sold to investment banks such as J.P. Morgan Chase, Royal Bank of Scotland and Bank of America by pursuing exactly such a strategy. Amherst intervened to repay distressed bonds on which it had written CDS protections to avoid default and thus avoided large default payments.<sup>16</sup> Our analysis suggests that such interventions by protection sellers are efficiency-improving ex post and on those grounds ought to be allowed. The key issue, however, is whether these interventions do not undermine CDS altogether and therefore lead to an ex-ante welfare loss.

## 5.5 Disclosure

According to current market practice, there are few disclosure requirements for bond positions and almost no disclosure requirements for CDS positions. Prior to a Chapter 11 filing neither bonds nor CDS have to be disclosed. Once in Chapter 11, rule 2019(a) requires committees to disclose their security positions, but usually not their derivatives positions.

However, the current debate about moving CDS to organized exchanges (see for example Duffie and Zhu (2009) and Stulz (2009)) has gone hand in hand with a debate on transparency and potential disclosure requirements for CDS positions (although strictly speaking a central clearinghouse is not necessary for disclosure, which could also be mandated in OTC markets). While much of the debate on disclosure has focused on the ability to identify risk concentrations, for example through disclosure to a regulator, our model highlights another potential benefit of CDS position disclosure: Requiring disclosure may allow market participants to contract on CDS positions. Specifically, in our model this may allow the lender to commit not to over-insure once he has acquired the bond, thus overcoming the empty creditor problem. Moreover, even if full commitment to CDS positions is not possible, public disclosure of CDS positions would at least allow the public to gauge creditors incentives when the firm is in distress. Note that this type of disaggregated disclosure to facilitate contracting or gauge renegotiation incentives would only need to apply to investors who simultaneously hold the underlying bond or loan.

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<sup>16</sup>See "A Daring Trade Has Wall Street Seething: Texas Brokerage Firm Outwits the Big Banks in a Mortgage-Related Deal, and Now It's War," Wall Street Journal, June 11, 2009.

## 6 Conclusion

In this paper we propose a limited commitment model of credit default swaps. While many commentators have raised concerns about the ex-post inefficiency of the empty-creditor problem that arises when a debt-holder has obtained insurance against default but otherwise retains control rights, our analysis shows that credit default swaps add value by acting as a commitment device for borrowers to pay out cash. Hence, CDS have important ex-ante commitment benefits. Specifically, they increase investment and, by eliminating strategic default, can make projects that can also be financed in the absence of CDS more efficient. However, we also show that when creditors are free to choose their level of credit protection they will generally over-insure, resulting in an empty creditor problem that is inefficient ex-post and ex-ante. This over-insurance leads to excessive incidence of bankruptcy and too little renegotiation with creditors relative to first best.

Our analysis leads to a more nuanced view on policy than most of the existing law and economics literature. In particular, any policy response to inefficiencies arising from the empty creditor problem should be mindful of the beneficial commitment role of CDS. Eliminating empty creditors altogether, for example by stripping protected creditors of their voting rights or by making restructuring a credit event, would be over-inclusive according to our analysis. A more fruitful approach would be to cap enforceable CDS payments or make CDS positions subject to approval by both the debtor and the creditor. Moreover, disclosure of CDS positions may help alleviate the problem by allowing debtors and creditors to contract on CDS positions taken by creditors.

## 7 Appendix

**Proof of Proposition 5:** Suppose that  $\tilde{F} \geq \tilde{F}'$  and consider a project whose setup cost exceeds  $\tilde{F}$ . This project cannot be financed when setting  $\pi = \lambda C_2^L$ . Increasing the amount of credit protection to  $\pi = \lambda C_2^H$  is efficient if it allows the project to receive financing. This is the case if increasing the amount of credit protection to  $\lambda C_2^H$  increases the amount the firm can pledge to the creditor relative to the case where  $\pi = C_2^L$ . When  $\pi = \lambda C_2^L$  the firm can pledge

$$\theta R + (1 - \theta) (\phi \max [\lambda C_2^L, q\lambda C_2^H] + (1 - \phi) \lambda C_2^L) \quad (27)$$

to the creditor, where the face value of debt is set to the highest value compatible with no strategic default in the high cash flow state,  $R = C_2^L$ . By setting  $\pi = \lambda C_2^H$ , the creditor expects to receive

$$\theta R + (1 - \theta) \phi \lambda C_2^H, \quad (28)$$

where again  $R = C_2^L$ . (28) exceeds (27) when

$$\phi \lambda C_2^H > \phi \max [\lambda C_2^L, q \lambda C_2^H] + (1 - \phi) \lambda C_2^L. \quad (29)$$

When  $q C_2^H > C_2^L$ , (29) simplifies to  $C_2^H > \frac{(1-\phi)}{(1-q)\phi} C_2^L$ . When  $q C_2^H \leq C_2^L$ , (29) simplifies to  $C_2^H > \frac{1}{\phi} C_2^L$ .

**Proof of Proposition 6:** Suppose that  $\tilde{F}' > \tilde{F}$ . Clearly, when setting  $\pi = \lambda C_2^H$  allows financing a project that could otherwise not be financed ( $F > \tilde{F}'$ ), it is optimal to do so. This is the case when the maximum pledgeable cash flow with  $\pi = \lambda C_2^H$  exceeds  $\tilde{F}'$ , i.e. when

$$\begin{aligned} \theta \max [\phi C_2^H, C_2^L] + (1 - \theta) \phi \lambda C_2^H &> \theta [\phi C_2^H + (1 - \phi) \lambda C_2^L] \\ &+ (1 - \theta) (\phi \lambda \max [C_2^L, q C_2^H] + (1 - \phi) \lambda C_2^L). \end{aligned} \quad (30)$$

In addition, if the cost of foregone renegotiation surplus,  $(1 - \theta) (1 - \phi) \lambda C_2^L$ , is smaller than the cost of strategic default,  $\theta (1 - \phi) (1 - \lambda) C_2^L$ , it is optimal to set  $\pi = \lambda C_2^H$  and  $R = C_2^L$  also on the interval  $(\tilde{F}, \tilde{F}']$  to eliminate strategic default, as long as this allows financing. This is possible as long as  $F < \theta C_2^L + (1 - \theta) \phi \lambda C_2^H$ . Comparing the two expressions above, it is easy to see that the cost of foregone renegotiation surplus is smaller than the cost of strategic default when  $\theta > \lambda$ .

**Proof of Proposition 7:** Suppose that  $F \leq \tilde{F}$  such that efficient financing is possible with  $\pi = \lambda C_2^L$ . The creditor will nevertheless choose  $\pi = \lambda C_2^H$  when this increases his expected payoff. Following the same steps as in the proof of Proposition 5, one finds that this is the case when

$$\phi \lambda C_2^H > \phi \max [\lambda C_2^L, q \lambda C_2^H] + (1 - \phi) \lambda C_2^L, \quad (31)$$

which yields the same condition on  $C_2^H$  as in Proposition 5. The crucial difference to Proposition 5 is that the creditor will choose to increase his level of credit protection to  $\lambda C_2^H$  if it increases his

expected payoff, irrespective of whether the project can be financed when  $\pi = \lambda C_2^L$ . Now consider  $F \in (\tilde{F}, \tilde{F}']$ . When this interval is non-empty, the project can only be financed with strategic default when  $\pi = \lambda C_2^L$ . If the project could be financed without strategic default when  $\pi = \lambda C_2^H$ , it is efficient to do so when the costs of strategic default outweigh the cost of lost renegotiation surplus, which is the case when  $\theta > \lambda$ . In that case the firm can issue debt with face value of  $R = C_2^L$ . Creditors will respond by setting  $\pi = \lambda C_2^H$  and willingly fund the project. However, when  $\theta < \lambda$  the firm will issue debt with face value  $R = C_2^H$ . In this case it would be efficient for creditors to choose  $\pi = \lambda C_2^L$  on the interval  $F \in (\tilde{F}, \tilde{F}']$ . However, creditors will inefficiently choose  $\pi = \lambda C_2^H$  when this increases their payoff, which following the same steps as above is the case whenever (16) holds.

**Proof of Corollary 4:** The first assertion is a direct consequence of taking the limit  $\phi \rightarrow 1$  in equation (16). When  $qC_2^H > C_2^L$  the cutoff  $\frac{1-\phi}{(1-q)\phi}C_2^L$  converges to zero as  $\phi \rightarrow 1$ . When  $qC_2^H \leq C_2^L$  the cutoff  $\frac{1}{\phi}C_2^L$  converges to one. In both cases this implies that the condition for over-insurance is always satisfied since  $C_2^H > C_2^L > 0$ . The second assertion of the corollary comes from the fact that when  $qC_2^H > C_2^L$  over-insurance will always occur when the cutoff  $C_2^H$  needs to lie above for over-insurance to occur is smaller than the lowest possible value  $C_2^H$  can take in this case ( $\frac{1}{q}C_2^L$ ). This is the case when  $\frac{1-\phi}{(1-q)\phi}C_2^L \leq \frac{1}{q}C_2^L$ , which simplifies to  $q < \phi$ . The cases  $\phi = -$  and  $q = 1$  follow straightforwardly from (16).

**Proof of Proposition 8:** (19) exceeds (18) when

$$\frac{1}{2}\theta R + (1 - \theta)\phi \left[ \lambda C_2^H - \lambda \frac{C_2^L}{2} \right] > \frac{1}{2} \{ \theta R + (1 - \theta) (\phi \max [\lambda C_2^L, q\lambda C_2^H] + (1 - \phi) \lambda C_2^L) \}. \quad (32)$$

Simplifying this expression yields

$$C_2^H > \begin{cases} \frac{1}{\phi(2-q)}C_2^L & \text{when } qC_2^H > C_2^L \\ \frac{1+\phi}{2}\frac{1}{\phi}C_2^L & \text{otherwise} \end{cases}. \quad (33)$$

We can now compare this cutoff to the one computed in the single creditor case. When  $qC_2^H \leq C_2^L$  we have

$$\underbrace{\frac{1+\phi}{2}\frac{1}{\phi}}_{<1} C_2^L < \frac{1}{\phi} C_2^L, \quad (34)$$

such that over-insurance is more likely in the two-creditor case. When  $qC_2^H > C_2^L$  we know from (17) that a sole creditor would always over-insure when  $\frac{1-\phi}{(1-q)\phi} \leq 1$ . The relevant case to compare is thus when  $\frac{1-\phi}{(1-q)\phi} > 1 \iff \phi < \frac{1}{2-q}$ . For these parameter values a sole creditor would overinsure if  $C_2^H > \frac{1-\phi}{(1-q)\phi} C_2^L$ . In the two-creditor case an individual creditor deviates from the low level of insurance ( $\pi^i = \lambda C_2^L/2$ ) when

$$C_2^H > C_2^* = \frac{1}{\phi(2-q)} C_2^L < \frac{1-\phi}{(1-q)\phi} C_2^L, \quad (35)$$

where the last step uses  $\phi < \frac{1}{2-q}$ .

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**Table 1: Summary of Potential Incidences of the Empty Creditor Problem**

<b>Company</b>	<b>Year</b>	<b>Summary</b>	<b>Outcome</b>
Marconi	2001-2002	Marconi was initially unable to renegotiate with a consortium of banks, some of which had purchased credit protection. Ultimately a debt-for-equity swap was approved, which essentially wiped out equity holders.	Out-of-court restructuring
Mirant	2003	Unable to work out a deal with its creditors, Mirant Corporation, an energy company based in Atlanta, was forced to file for chapter 11. The bankruptcy judge appointed a committee representing interests of equity holders, indicating that there was a reasonable chance that the reorganization value would be high enough to give equity holders a positive claim after paying off all creditors.	Chapter 11
Tower Automotive	2004	A number of hedge funds refused to make concessions on exiting loans to enable new loans that would have improved Tower's cash position. Supposedly the hedge funds had shorted Tower's stock rather than having entered into a CDS position, to similar effect.	Chapter 11
Six Flags	2009	Filed for Chapter 11 after failing to reach a deal with its creditors.	Chapter 11
Lyondell Basell	2009	Filed for Chapter 11 after failing to reach a deal with its creditors.	Chapter 11
General Growth Properties	2009	Filed for Chapter 11 after failing to reach a deal with its creditors.	Chapter 11
Abitibi Bowater	2009	Filed for Chapter 11 after failing to reach a deal with its creditors.	Chapter 11
Harrah's Entertainment	2009	Harrah's barely managed to renegotiate its debt.	Out-of-court restructuring
Unisys	2009	After two failed exchange offers, the IT provider Unisys had to offer creditors bonds worth more than par to reschedule its 2010 debt.	Out-of-court restructuring
GM	2009	Filed for Chapter 11 after failing to reach a deal with its creditors.	Chapter 11
Chrysler	2009	Filed for Chapter 11 after failing to reach a deal with its creditors.	Chapter 11
YRC Worldwide	2009-2010	The trucking company YRC only managed to renegotiate its debt at the last minute, when the Teamsters union threatened to protest in front of the offices of hedge funds which blocked YRC's debt-for-equity offer.	Out-of-court restructuring