

NBER WORKING PAPER SERIES

CREDIT DEFAULT SWAPS AND THE EMPTY CREDITOR PROBLEM

Patrick Bolton
Martin Oehmke

Working Paper 15999
<http://www.nber.org/papers/w15999>

NATIONAL BUREAU OF ECONOMIC RESEARCH
1050 Massachusetts Avenue
Cambridge, MA 02138
May 2010

For helpful comments we thank Bernard Black, Charles Calomiris, Pierre Collin-Dufresne, Florian Ederer, Mark Garmaise, Charles Jones, Edward Morrison, and seminar participants at Columbia University, Ohio State University, UCLA Anderson, MIT Sloan, Columbia Law School, and the NBER Corporate Finance meetings. The views expressed herein are those of the authors and do not necessarily reflect the views of the National Bureau of Economic Research.

NBER working papers are circulated for discussion and comment purposes. They have not been peer-reviewed or been subject to the review by the NBER Board of Directors that accompanies official NBER publications.

© 2010 by Patrick Bolton and Martin Oehmke. All rights reserved. Short sections of text, not to exceed two paragraphs, may be quoted without explicit permission provided that full credit, including © notice, is given to the source.

Credit Default Swaps and the Empty Creditor Problem
Patrick Bolton and Martin Oehmke
NBER Working Paper No. 15999
May 2010
JEL No. G3,G33

ABSTRACT

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.

Patrick Bolton
Columbia Business School
804 Uris Hall
New York, NY 10027
and NBER
pb2208@columbia.edu

Martin Oehmke
Finance and Economics Division
Columbia Business School
3022 Broadway, Uris Hall 420
New York, NY 10027
moehmke@columbia.edu

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 (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 credit event on a prespecified reference asset. In exchange for this promised payment, the protection seller receives a periodic premium payment from the buyer. The credit 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. In most cases 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), or is 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, creditors are generally able to extract more in debt renegotiations, and borrowers have less of an incentive to strategically renegotiate down their debt repayments to their own advantage. 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.¹ 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.² 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 (typically, once a company enters Chapter 11 equity holders lose all claims on the firm). In the

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

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

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.³

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.⁴ Harrah's Entertainment, the casino operator, only barely managed to restructure its debt, and, 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 2010.⁵ Most recently, the trucking company YRC only managed to restructure 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 allegedly blocking YRC's debt-for-equity exchange offer so as to trigger a default and cash in on more lucrative CDS payments.⁶

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 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

³See "Shareholders in Mirant Gain Voice in Reorganization," *New York Times*, September 20, 2003.

⁴See, 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.

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

⁶"YRC and the Street's Appetite for Destruction," *Wall Street Journal*, January 5, 2010.

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 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 mostly focused on the detrimental *ex-post* consequences of empty creditors for efficient debt restructuring. Hence, the resulting policy proposals regarding the treatment of CDS in and out of bankruptcy risk underestimating some of the potential ex-ante benefits of CDS markets. In particular, 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 not be efficient according to our analysis. While such a rule would prevent CDS protection from inhibiting efficiency-enhancing debt restructuring, 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. 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 effects of CDS on renegotiation between debtors and creditors, and the associated costs and benefits. 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. 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. Zachariadis and Olaru (2010) propose a model in which a debtholder can trade in a firm's equity after a restructuring proposal has been made, but before the vote on the proposal takes place. They show that this ability to trade generally raises the creditor's payoff, but can lead to inefficient liquidation when debt and equity markets differ in

their assessment of the firm's survival probability.

The emerging empirical literature on the effects of CDS on credit market outcomes supports our main findings. For example, 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 firm that can undertake a two-period investment project which 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. At date 1 the project generates high cash flow C_1^H with probability θ , and low cash flow $C_1^L < C_1^H$ with probability $1 - \theta$. Similarly, at date 2 the project generates C_2^H with probability ϕ , and $C_2^L < C_2^H$ with probability $1 - \phi$. The realization of C_2 is revealed to the firm at time 1. The project can be liquidated after the realization of the first-period cash flow for a liquidation value of $L < C_2^L$, implying that early liquidation of the project is inefficient. The liquidation value at date 2 is normalized to zero.

The firm has no initial wealth and finances the project 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. Liquidation can be interpreted as outright liquidation, as in a Chapter 7 cash auction, or, more generally, as forcing the firm into Chapter 11 reorganization; for example by filing an

involuntary bankruptcy petition. In the latter interpretation L denotes the expected payment the creditor receives in Chapter 11. Both the firm and the creditor are risk neutral, and the riskless interest rate is zero.

The main assumption of our model is that the firm 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 $C_1^L = 0$.

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 $\lambda \in (0, 1)$.⁷ 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 insurance 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 market, CDS contracts are redundant

⁷For 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, for example, in Rajan (1992). 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 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 π by the protection seller to the lender if a ‘credit event’ occurs at date 1, against a fair premium f that is paid by the protection buyer to the seller. We assume that a 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 standard 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 for CDS contracts that recognize restructuring as a credit event, in practice there is often significant uncertainty for creditors whether a particular restructuring qualifies.⁸ We discuss the different ISDA restructuring clauses and the implications of making restructuring a credit event that triggers the CDS 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 , or the lender chooses to renegotiate the debt contract in an out-of-court restructuring. Bankruptcy is a credit event and triggers the payment π 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 the lender does not receive the CDS payment π , since an out-of-court restructuring does not constitute a credit event. A workout also involves costs, as the lender must verify date 2 cash flows and pay the verification cost $(1 - \lambda) C_2$, such that the surplus from

⁸For 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. The ruling was subsequently overturned. See www.isda.org for more information.

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 for the remainder of the paper 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 in renegotiation are exogenously given by q (for the lender) and $1 - q$ (for the firm). In the presence of CDS, however, the relative bargaining positions can change, since 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 π in order to be able to renegotiate. In the presence of credit protection, the creditor thus receives the maximum of what he would receive absent CDS and his outside option π generated by the CDS: $\max[q\lambda C_2, \pi]$. Moreover, when π exceeds the available renegotiation surplus λC_2 , the CDS payment in the event of bankruptcy exceeds what the firm can offer to the creditor in renegotiation, such that renegotiation becomes impossible. Overall CDS protection thus makes creditors tougher negotiators in out-of-court restructurings, and in the extreme case may prevent renegotiation altogether.⁹

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.¹⁰ Also, the higher the potential gains from continuation the larger are the due diligence costs incurred in restructuring negotiations, which is reflected in our assumption of proportional verification costs.¹¹ As for the effects of CDS protection on out-of-court restructurings, our model captures in a simple way the empty

⁹Formally 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 Rubinstein bargaining see also Binmore, Rubinstein, and Wolinsky (1986). Note that we could also assume that instead of receiving $\max[q\lambda C_2, \pi]$ the protected creditor receives his outside option π plus a share q of the remaining bargaining surplus. Qualitatively, none of our results would change.

¹⁰For example, Bris, Welch, and Zhu (2006) find that bankruptcy costs are very heterogeneous and can reach up to 20% of assets. Their paper also provides a useful summary of older studies of bankruptcy costs, many of which find significant costs of bankruptcy.

¹¹None of the implications of the model depend on proportional verification costs. Strategic default is costly as long as verification costs are positive, whether they are proportional or fixed. Moreover, even when there are no verification costs, CDS will play a role by strengthening the creditor's role in renegotiation. The difference is that in this latter case strategic default is not costly from a welfare perspective.

creditor effects that analysts are concerned about. As Yavorsky (2009) argues: “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.”

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 effects of introducing a CDS market.

Two types of non-payment of debt can occur in our model. If the low cash flow realizes at date 1, 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. If the high cash flow realizes 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 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 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 first establish under which conditions the project can be financed without strategic default occurring in equilibrium. Since strategic default is costly ($\lambda < 1$), this is the optimal form of financing whenever 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 .¹² This maximum

¹²For 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

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 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

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

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 \widehat{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. in the liquidity default state. However, when the ex-ante setup costs exceeds \widehat{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.

stronger assumption $C_1^H \geq C_2^H [1 - \lambda(1 - q)]$ 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 $C_2 = C_2^L$. 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 $\max[\hat{F}, F']$, 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 $F > \max[\hat{F}, F']$ the project cannot be financed. In this case, strategic default would always arise when $C_1 = C_1^H$. This implies a maximum pledgeable cash flow of

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

which is insufficient to finance the project.

Propositions 1, 2 and 3 are summarized in Figure 1. Jointly they imply that limited commitment causes two types of inefficiencies. First, it leads to underinvestment relative to the first best. While it would be efficient to fund any project for which the expected cash flows exceed the setup cost,

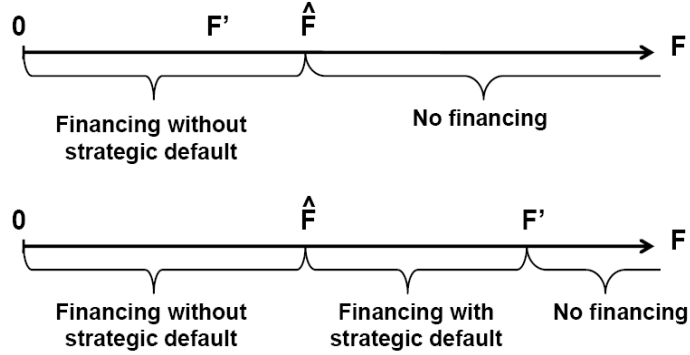


Figure 1: The figure illustrates the two possible outcomes absent a CDS market. Either all projects up to \hat{F} receive financing without strategic default and no projects beyond \hat{F} are financed (top), or, when ϕ is sufficiently high, there is an additional region $(\hat{F}, F']$ where the project can be financed with strategic default occurring in equilibrium.

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

$$F \leq \max \left[\hat{F}, F' \right] < \underbrace{\theta C_1^H + (1 - \theta) C_1^L + \phi C_2^H + (1 - \phi) C_2^L}_{\text{expected cash flows}} \quad (9)$$

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 \hat{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 since renegotiation takes place even when not strictly necessary.

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

These inefficiencies relative to first best are a direct consequence of limited commitment. This highlights the potential beneficial effect of commitment devices. In particular, a direct implication of Corollaries 1 and 2 is that any mechanism that can serve as a commitment device for the firm to pledge cash flows to the creditor 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 in a fairly priced CDS market. As we will see, the main effect of CDS protection is to increase the lender's bargaining position in renegotiation: 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 the lender's bargaining power has two effects. First, when creditors are protected through CDS, they are generally able to extract more surplus during renegotiation following either a liquidity default or a strategic default, thus increasing the firm's pledgeable income at date 0. This is welfare-enhancing since it allows more investment to be undertaken at time 0.

Second, 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. In particular, if the borrower has a CDS position of size π , 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 π exceeds $q\lambda C_2$, the incentive constraint (1) becomes

$$C_1^H - R + C_2 \geq C_1^H + \max[\lambda C_2 - \pi, 0]. \quad (10)$$

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. This second effect is welfare-enhancing since strategic renegotiation is costly and should be avoided when possible.

However, when the lender acquires a CDS position this can also lead to situations in which the creditor is unwilling to renegotiate with the firm even after a liquidity default, when renegotiation would be efficient given the positive renegotiation surplus of λC_2 . This happens because credit insurance can turn the lender into 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. Renegotiation breaks down 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. Moreover, when credit insurance 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. As a benchmark we first characterize 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 it 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 to freely chooses 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, even when CDS prices perfectly anticipate the creditor's inefficient behavior in renegotiation.

3.1 Efficient Credit Insurance

What level of credit insurance maximizes surplus? First, it is easy to see that the borrower would choose a level of credit protection of at least λC_2^L . 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 allow creditors to extract more in renegotiation and to provide a commitment device for the firm not to default strategically. 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 (10). 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 $\pi = \lambda C_2^L$. Then 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

$$\tilde{F} = \theta C_2^L + (1 - \theta) (\phi \lambda \max [C_2^L, qC_2^H] + (1 - \phi) \lambda C_2^L) > \hat{F}. \quad (11)$$

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

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

Proposition 4 illustrates two benefits of CDS markets, which we illustrate in Figure 2. First, 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. Second, when $\hat{F} < F'$ the presence of CDS protection can reduce the incidence of strategic default. Projects for which $F \in (\hat{F} < F']$ can attract financing even in the absence of CDS, but only with strategic default in equilibrium. The introduction of CDS eliminates strategic default and the associated deadweight loss of $\theta(1 - \phi)(1 - q)C_2^L$. Introducing a CDS market can thus make existing projects more efficient and allow for financing of additional projects, thus alleviating both inefficiencies outlined in Corollaries 1 and 2. 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. *CDS increase the set of projects that can receive financing in the first place.*
2. *The presence of CDS eliminates strategic defaults for some projects that can be financed even in the absence of CDS.*

Could it be efficient to raise the level of CDS protection above λC_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

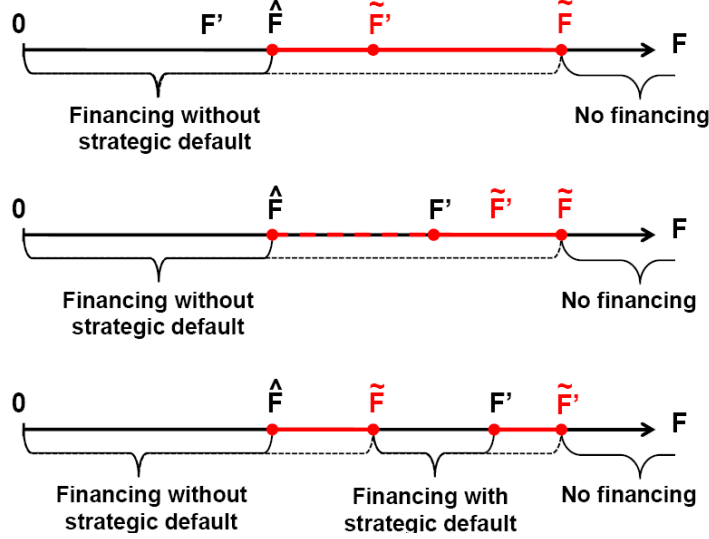


Figure 2: The figure illustrates the two benefits from CDS. If absent CDS the project can be financed without strategic default for setup costs up to \hat{F} and cannot be financed beyond \hat{F} , setting $\pi = \lambda C_2^L$ allows financing without strategic default up to \tilde{F} (top). When absent CDS there is a region $(\hat{F}, F']$ in which financing absent CDS involves strategic default, $\pi = \lambda C_2^L$ may allow financing without strategic default up to \tilde{F} (middle), or it may eliminate strategic default on $(\hat{F}, \tilde{F}]$, and allow the financing of new projects (with strategic default) on $(F', \tilde{F}']$ (bottom).

the expected date 2 cash flow turns out to be 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 λC_2^L , such that the lender prefers to collect his insurance payment of $\pi > \lambda C_2^L$. Hence $\pi > \lambda C_2^L$ leads to inefficient renegotiation after liquidity defaults.

However, even despite this loss of renegotiation surplus it may still be efficient to set the level of CDS protection to λC_2^H .¹³ 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 when $\tilde{F} \geq \tilde{F}'$. The last project that can 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 λC_2^H can then only be efficient if the project's setup cost exceeds the critical value \tilde{F} , such that the project could not be financed at all when $\pi = \lambda C_2^L$. If a setting $\pi = \lambda C_2^H$

¹³When the level of credit protection exceeds λC_2^L , it is always optimal to raise it up to λC_2^H to maximize the effect of increased bargaining power. Any level beyond λC_2^H will eliminate renegotiation altogether and is strictly dominated.

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 do so, even though renegotiation will be impossible in some state of the world.

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*

$$C_2^H > \begin{cases} \frac{1-\phi}{(1-q)\phi} C_2^L & \text{when } qC_2^H > C_2^L \\ \frac{1}{\phi} C_2^L & \text{otherwise} \end{cases}. \quad (13)$$

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

$$F^\# = \theta \max [C_2^L, \phi C_2^H] + (1-\theta) \phi \lambda C_2^H. \quad (14)$$

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.

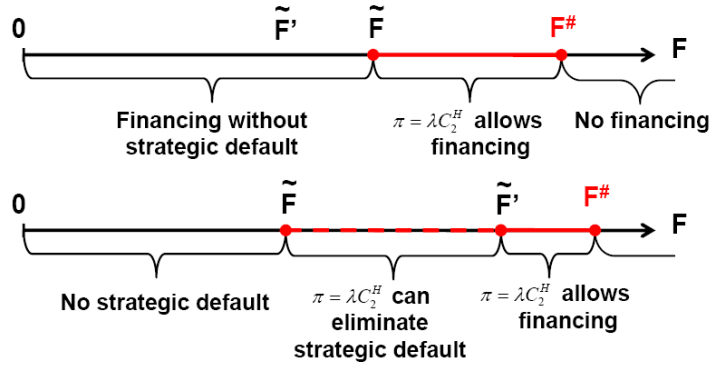


Figure 3: The figure illustrates when it may be optimal to raise the level of credit protection to $\pi = \lambda C_2^H$. Either it must allow a project to attract financing that could not be financed with $\pi = \lambda C_2^L$ (top), or, if strategic default is sufficiently costly it may also be optimal to set $\pi = \lambda C_2^H$ in the region where financing with $\pi = \lambda C_2^L$ would involve strategic default (bottom).

Propositions 5 and 6 show that it can be efficient to raise the level of credit protection to λC_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 λC_2^L allows the project to attract financing. This is possible when C_2^H is sufficiently large, as stated in condition (13). 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 $\pi = \lambda C_2^H$ also in the region in which financing with $\pi = \lambda C_2^L$ would involve strategic default. These cases are illustrated in Figure 3.

To summarize, from an efficiency standpoint it thus is optimal to choose a level of credit protection of at least λC_2^L . This increases the investment opportunity set by increasing pledgeable income, and it reduces the incidence of strategic defaults for projects that can be financed in absence of CDS. 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 λC_2^H .

3.2 The Lender's Choice of Credit Insurance

We now turn to the lender's choice of credit protection. We will show that lenders will generally choose to over-insure relative to the efficient benchmark of Section 3.1, thus becoming to empty

creditors that are excessively tough from a social perspective.

Consistent with current market practice, we assume that the lender cannot commit ex ante to a specific level of credit protection. This is reasonable, because credit derivative positions do not have to be disclosed, such that commitment to a certain level of credit protection is impossible. In choosing credit protection, the lender will thus take the face value R as given and will then choose a level of credit protection π 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 π . 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.¹⁴

By the same argument as in Section 3.1, we know that the lender will choose a level of credit protection of at least λC_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 λC_2^L to $\pi = \lambda C_2^H$. In fact, the lender will always do so if the increased level of credit protection raises his expected payoff from owning the debt contract, 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 λC_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 greater than \bar{C}_2 , where*

$$\bar{C}_2 = \begin{cases} \frac{1-\phi}{(1-q)\phi} C_2^L & \text{when } qC_2^H > C_2^L \\ \frac{1}{\phi} C_2^L & \text{otherwise} \end{cases}. \quad (15)$$

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

¹⁴We use this property to simplify our calculations. In particular, 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 π and the insurance premium f will exactly offset.

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 $C_2^H > \bar{C}_2$ 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 λC_2^H whenever $C_2^H > \bar{C}_2$. However, we know from Proposition 5 that it is only efficient to raise the level of credit protection to λC_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 *inefficient* empty creditors as an equilibrium outcome of the lender's optimal choice credit protection choice, even when the CDS market correctly anticipates the creditor's inefficient behavior in renegotiation.

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 ϕ tends to one;*
2. *$qC_2^H > C_2^L$ and $q \leq \phi$.*

On the other hand, 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 ϕ 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, (15) 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. In the latter situation 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 obtaining 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 \bar{C}_2 defined in Proposition . We will 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 $\pi_i = \lambda C_2^L/2$ to the payoff 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 \bar{C}_2 .

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

$$\frac{1}{2} \{ \theta R + (1 - \theta) (\phi \max [\lambda C_2^L, q \lambda C_2^H] + (1 - \phi) \lambda C_2^L) \}. \quad (16)$$

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 the deviating creditor 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:

$$\frac{1}{2} \theta R + (1 - \theta) \phi \left[\lambda C_2^H - \lambda \frac{C_2^L}{2} \right]. \quad (17)$$

An individual creditor thus prefers to increase his level of credit protection to $\lambda C_2^H - \lambda \frac{C_2^L}{2}$ whenever (17) exceeds (16). 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^* :*

$$C_2^* = \begin{cases} \frac{1}{\phi(2-q)} C_2^L & \text{when } q C_2^H > C_2^L \\ \frac{1+\phi}{2} \frac{1}{\phi} C_2^L & \text{otherwise} \end{cases}. \quad (18)$$

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 with multiple creditors in separate issues than with a single creditor.

The intuition for the worsening of the over-insurance problem when there are multiple creditors in separate issues 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 shared by 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 further compare the multiple creditor case to the single creditor case, it is instructive to consider the case when $q = 1$. In this case creditors receive the entire surplus in renegotiation, even in the absence of CDS. From (15) we know that in this case a lone creditor would have no incentive to over-insure. In the two-creditor case, on the other hand, over-insurance still emerges even when $q = 1$, as shown by condition (18). The reason is that even though creditors jointly receive the entire renegotiation surplus even absent CDS, 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 in equal amounts by two creditors. Unlike in the previous case, 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, irrespective of whether the two creditors 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 to seek default protection is less clear. For example, if creditor i purchases protection π_i , which is anticipated to result in an exchange offer to forestall default of π_i for each creditor, then it is redundant for creditor j to also get default 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 is that in equilibrium one of the two creditors 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 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, when credit protection is fairly priced, a pair (π_1, π_2) such that $\max[\pi_1, \pi_2] = \lambda C_2^L/2$ could be a candidate equilibrium outcome. In what follows, we will focus in the symmetric candidate equilibrium in which both creditors purchase $\lambda C_2^L/2$ of credit protection.

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 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

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

Equation (19) 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 ϕ . When the surplus is low, renegotiation fails and the creditor receives the CDS payment $\lambda C_2^H/2$. However, in expected terms this payment is offset by the cost of purchasing CDS protection, which under fair pricing is given by $(1 - \theta)(1 - \phi)\lambda C_2^H/2$.

The deviation is profitable if (19) exceeds the creditor's payoff when protection is given by $\pi_i = \lambda C_2^L/2$. This payoff is given by

$$\theta \frac{R}{2} + (1 - \theta) \frac{1}{2} [\phi \max[\lambda C_2^L, q\lambda C_2^H] + (1 - \phi) \lambda C_2^L]. \quad (20)$$

Comparing (19) to (20) shows that the deviation is profitable whenever

$$C_2^H > \begin{cases} \frac{1-\phi}{(1-q)\phi} C_2^L & \text{when } qC_2^H > C_2^L \\ \frac{1}{\phi} C_2^L & \text{otherwise} \end{cases}. \quad (21)$$

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.

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 more credit protection. The most profitable deviation for creditor i is 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 λC_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 λC_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

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

Comparing this payoff to

$$\theta \frac{R}{2} + (1 - \theta) \frac{1}{2} \left[\phi \max [\lambda C_2^L, q \lambda C_2^H] + (1 - \phi) \lambda C_2^L \right], \quad (23)$$

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

$$C_2^H > \begin{cases} \frac{1}{\phi(2-q)} C_2^L & \text{when } q C_2^H > C_2^L \\ \frac{1+\phi}{2} \frac{1}{\phi} C_2^L & \text{otherwise} \end{cases}. \quad (24)$$

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 creditors. Given that trading among creditors has become relatively commonplace, even during times of distress, this second case may be the one that is empirically more relevant.

5 Discussion and 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. Both the costs and benefits of CDS arise from the same economic force: empty creditors' 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 (e.g. Hu and

Black (2008a,b), Lubben (2007)) has mostly been concerned with the potential negative ex-post consequences of empty creditors. The premise of this literature is that the bundling of economic ownership and control rights is efficient, and hence that the introduction of CDS results in distortions, giving rise to inefficiencies. Accordingly, these studies argue that it would generally be efficiency-enhancing to mitigate or undo the separation of cash flow and control rights effected through CDS, thereby eliminating the empty creditor problem. Usually, the focus is on interventions in the bankruptcy process, i.e. once a firm is in Chapter 11. It is argued, in particular, that it would be efficient for bankruptcy courts to 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 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.21¹⁵

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

¹⁵They 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)”.

once the firm is in Chapter 11 and CDS contracts have been settled.¹⁶ Thus, the focus on disclosure and on denying voting rights to protected creditors *in bankruptcy* may be misplaced. Our analysis suggests that the critical legal intervention is likely to be *prior* to the bankruptcy filing, with a focus on eliminating inefficient obstacles to debt restructuring *outside* of Chapter 11, while preserving the commitment benefits of CDS.

We divide our policy discussion into six main subsections. The first two cover in turn situations where from an efficiency standpoint CDS are likely to be harmless and mostly harmful. The last four subsections cover the issues of: i) whether it would be efficient to make debt restructuring a credit event; ii) whether it would be efficient for the protection seller to become the debt claimholder before or after a default; iii) the possibility of ex-post intervention by the protection seller should renegotiation fail; and (iv) the benefits of mandating disclosure of CDS positions.

5.1 When are CDS likely to be harmless?

Given that in our analysis CDS lead to ex-ante commitment benefits by strengthening creditors' ex-post bargaining power, it would be inefficient to remove the creditor's voting rights unless CDS give rise to significant ex-post debt restructuring inefficiencies. Thus, as a general principle it would be efficient for courts to uphold a 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. It would be inefficient if the mere presence of CDS protection led to an automatic 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, since in this case, the denial of voting rights to hedged creditors would erode the ex-ante benefits of CDS that we highlight in this article.

When would we expect the commitment benefits of CDS to be largest? Since the benefits of CDS stem from an increase in the creditor's bargaining power, they are particularly large when absent CDS creditors have limited bargaining power, i.e. when q is low. This is likely to be the case

¹⁶Clearly, once all CDS are settled, they should not matter in Chapter 11. It is possible, however, that important 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.

when creditors are unsecured, and when the debtor's assets are mostly intangible. On the other hand, when the creditors' bargaining power is strong even absent CDS, the commitment benefits are likely to be smaller. This is more likely when creditors are secured and when the firm's assets are mostly tangible.

It is also important to note that from an efficiency perspective our model provides no grounds for limiting speculative 'naked' positions in CDS markets. Since in our model the harmful effects of CDS on renegotiation can only arise through investors who hold both the bond and the CDS, speculation in CDS markets does not cause any inefficiency (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 not 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. In our model there are thus no efficiency gains from limiting 'naked' CDS positions, although in practice there may be other reasons, outside our model, for considering such a policy.

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 (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 large enough 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 so high that the CDS gives rise to an inefficient breakdown in debt restructuring, then clearly the CDS is harmful. As stated in 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 is desirable from an efficiency perspective, 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 involved, 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. For example, a limit on a maximum allowable default payment may be welfare improving. In the case of multiple creditors, on the other hand, reducing voting rights of creditors with a disproportionate amount of protection may lower the incentive to overinsure. Another avenue of intervention could be to require that 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. However, this intervention would require detailed disclosure of CDS positions, which we discuss further below.

5.3 The consequences of making debt restructuring a credit event

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, as the standard North American CDS as defined by ISDA does not count restructuring as a credit event (JPMorgan (2009)). However, there are also CDS contracts that include restructuring as a credit event.¹⁷

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 implies that in addition this contractual difference also has important repercussions on creditor behavior and

¹⁷In fact, restructuring was originally included as a credit event in the 1999 ISDA credit derivatives definitions. However problems with restructuring clauses emerged when Conseco Finance restructured debt to terms that were advantageous to creditors, yet still this restructuring counted as a credit event. 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) and the modified-modified restructuring clause introduced in 2003 (Mod-Mod-R) limit the set of securities a lender can deliver in the case of a restructuring credit event. For more details on the different contractual clauses see JPMorgan (2006).

credit market outcomes. In particular, making restructuring a credit event constitutes one simple way of eliminating the empty creditor problem altogether, since the default payment π would be made whether or not debt restructuring is successful. Hence, 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.

However, recall that in our model the economic value added by CDS stems from their role as a commitment device. In particular, a creditor with CDS protection becomes a tougher counterparty in renegotiations when the CDS contract does not trigger a default payment upon 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 restructuring inefficiencies resulting from the empty creditor problem, it also eliminates any economic gains from CDS as a commitment device.

A related way around the 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 presence of CDS would have no effect on debt restructuring. However, as with debt restructuring as a credit event, the put option CDS would also eliminate the beneficial commitment role of CDS.

5.4 Who is best placed to renegotiate debt?

Should the CDS involve a simple default payment π , 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 debt claim should be transferred to the party that is best placed to negotiate with the debtor in Chapter 11. If the protection seller's bargaining power q^I is higher than the creditor's bargaining power q , then there are obviously gains from trade in transferring

the debt claim to the protection seller, who 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 thus be more efficient than 'cash settlement,' under which the protection buyer retains the bond in default.

Is there also an efficiency gain from transferring ownership of the debt to the insurance company before default occurs? In contrast to a transfer of the bond once in Chapter 11, by selling the bond to the protection seller before a default, the initial lender would undermine the commitment value of the CDS. Indeed, the debtor then renegotiates the debt directly with the insurance company, which does not have the outside option from CDS protection in renegotiation. Thus it is only if the difference in bargaining strengths between the original debtholders and the insurance company is large enough to more than compensate for the lost outside option π , that it is unambiguously attractive for the initial lender to sell his debt claim before default. However, transfer of ownership before may be efficient when the original lender and the debtor fail to renegotiate. We discuss this possibility in the next section.

5.5 Ex-post interventions by the protection seller

Up to now we have assumed that the protection seller remains passive when the debtor and creditor renegotiate, effectively ruling out Coasian dynamics that may alleviate the inefficiencies caused by empty creditors. In this subsection we discuss how active involvement by the protection seller may reduce the inefficiencies created by CDS.

One avenue for the protection seller to avoid default, and the CDS payment of $\pi = \lambda C_2^H$ to the creditor, is to directly help the debtor repay the debt obligation R at date 1. If the protection seller fears an inefficient breakdown in renegotiation, all he needs to do is cover the difference $R - C_1^L$ of the debt obligation. Hence, as long as $R - C_1^L \leq \lambda C_2^H$ this is an attractive alternative for the protection seller. In fact, the Texan brokerage firm Amherst Holdings pursued exactly this strategy to avoid 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.¹⁸ Our analysis suggests that such interventions are efficiency-improving ex post.

An alternative way for the protection seller to avoid the inefficiency that arises from the failure to renegotiate is to purchase the debt claim from the protection buyer in cases where renegotiation between the debtor and creditor breaks down. 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 λC_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 this amount. Then, by renegotiating with the firm, the protection seller can receive $q^I \lambda C_2^L$. The net payment the protection seller needs to make if he purchases the debt claim is thus given by $\lambda C_2^H - q^I \lambda C_2^L$. If the protection seller does not purchase the debt claim, renegotiation will fail and the protection seller has to make a payment on the outstanding CDS of $\pi = \lambda C_2^H$. This suggests a potential role for protection sellers to purchase outstanding debt in cases when renegotiation between the debtor and the original creditor fails.

However, while we have seen protection sellers making direct payments to avoid default on issues, we are not aware of cases in which insurance companies have bought up the outstanding debt of an issuer in order to avoid a breakdown of renegotiation. It is an open question whether this is the case because protection sellers are not taking a sufficiently active role to avoid inefficient defaults due to empty creditors, or whether there are other difficulties, such as locating the holders of the debt, that prevent this intervention in practice. Finally, a key issue with both types of ex-post intervention described here is whether they do not undermine the CDS market altogether, or lead to opportunistic behavior by the firm or the initial creditor, thereby leading to an ex-ante welfare loss.

¹⁸See "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.

5.6 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 bond nor CDS positions have to be disclosed. Once in Chapter 11, rule 2019(a) requires ad-hoc 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, 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 such commitment to CDS positions is not possible, public disclosure of CDS positions would allow the public to gauge creditors' incentives when the firm is in distress. Note that in our analysis 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.

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 existing projects 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 occurs even when CDS markets perfectly anticipate the

inefficient behavior of empty creditors, and 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 inefficient in our framework. An approach that may avoid such inefficiencies would be to cap enforceable CDS payments or to 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 λC_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

$$\theta R + (1 - \theta) (\phi \max [\lambda C_2^L, q\lambda C_2^H] + (1 - \phi) \lambda C_2^L) \quad (25)$$

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

$$\theta R + (1 - \theta) \phi \lambda C_2^H, \quad (26)$$

where again $R = C_2^L$. (26) exceeds (25) when

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

When $qC_2^H > C_2^L$, (27) simplifies to $C_2^H > \frac{(1-\phi)}{(1-q)\phi}C_2^L$. When $qC_2^H \leq C_2^L$, (27) 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

$$\begin{aligned} \theta \max [\phi C_2^H, C_2^L] + (1 - \theta) \phi \lambda C_2^H &> \theta [\phi C_2^H + (1 - \phi) \lambda C_2^L] \\ &+ (1 - \theta) (\phi \lambda \max [C_2^L, qC_2^H] + (1 - \phi) \lambda C_2^L). \end{aligned} \quad (28)$$

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

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

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 λC_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 (15) holds.

Proof of Corollary 4: The first assertion is a direct consequence of taking the limit $\phi \rightarrow 1$ in equation (15). 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 $\phi = 0$ and $q = 1$ follow straightforwardly from (15).

Proof of Proposition 8: (17) exceeds (16) when

$$\frac{1}{2}\theta R + (1-\theta)\phi \left[\lambda C_2^H - \lambda \frac{C_2^L}{2} \right] > \frac{1}{2} \left\{ \theta R + (1-\theta) (\phi \max [\lambda C_2^L, q\lambda C_2^H] + (1-\phi) \lambda C_2^L) \right\}. \quad (30)$$

Simplifying this expression yields

$$C_2^H > \begin{cases} \frac{1}{\phi(2-q)}C_2^L & \text{when } qC_2^H > C_2^L \\ \frac{1+\phi}{2}\frac{1}{\phi}C_2^L & \text{otherwise} \end{cases}. \quad (31)$$

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

$$\underbrace{\frac{1+\phi}{2}\frac{1}{\phi}}_{<1} C_2^L < \frac{1}{\phi}C_2^L, \quad (32)$$

such that over-insurance is more likely in the two-creditor case. When $qC_2^H > C_2^L$ we know from (??) 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 over-insure 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

$$C_2^H > C_2^* = \frac{1}{\phi(2-q)}C_2^L < \frac{1-\phi}{(1-q)\phi}C_2^L, \quad (33)$$

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

References

- ALLEN, F., AND E. CARLETTI (2006): “Credit Risk Transfer and Contagion,” *Journal of Monetary Economics*, 53, 89–111.
- ARPING, S. (2004): “Credit Protection and Lending Relationships,” Working Paper, University of Amsterdam.
- ASHCRAFT, A. B., AND J. A. C. SANTOS (2007): “Has the CDS Market Lowered the Cost of Corporate Debt,” Working Paper, Federal Reserve Bank of New York.
- BERNDT, A., R. A. JARROW, AND C. KANG (2006): “Restructuring Risk in Credit Default Swaps: An Empirical Analysis,” Working Paper, Carnegie Mellon University.
- BINMORE, K., A. RUBINSTEIN, AND A. WOLINSKY (1986): “The Nash Bargaining Solution in Economic Modelling,” *The RAND Journal of Economics*, 17(2), 176–188.
- BOLTON, P., AND D. S. SCHARFSTEIN (1990): “A Theory of Predation Based on Agency Problems in Financial Contracting,” *American Economic Review*, 80(1), 93–106.
- (1996): “Optimal Debt Structure and the Number of Creditors,” *Journal of Political Economy*, 104(1), 1–25.
- BRAV, A., AND R. D. MATHEWS (2009): “Empty Voting and the Efficiency of Corporate Governance,” Working Paper, Duke University.
- BRIS, A., I. WELCH, AND N. ZHU (2006): “The Costs of Bankruptcy: Chapter 7 Liquidation versus Chapter 11 Reorganization,” *Journal of Finance*, 61(3), 1253–1303.
- DUFFEE, G. R., AND C. ZHOU (2001): “Credit derivatives in banking: Useful tools for managing risk?,” *Journal of Monetary Economics*, 48(1), 25 – 54.
- DUFFIE, D., AND H. ZHU (2009): “Does a Central Clearing Counterparty Reduce Counterparty Risk?,” Working Paper, Stanford University.

- HART, O., AND J. MOORE (1994): “A Theory of Debt Based on the Inalienability of Human Capital,” *Quarterly Journal of Economics*, 109(4), 841–879.
- (1998): “Default and Renegotiation: A Dynamic Model of Debt,” *Quarterly Journal of Economics*, 113(1), 1–41.
- HIRTLE, B. (2008): “Credit Derivatives and Bank Credit Supply,” Working Paper, Federal Reserve Bank of New York.
- HU, H. T. C., AND B. BLACK (2006): “The New Vote Buying: Empty Voting and Hidden (Morphable) Ownership,” *Southern California Law Review*, 79, 811–908.
- (2007): “Hedge Funds, Insiders, and the Decoupling of Economic and Voting Ownership: Empty Voting and Hidden (Morphable) Ownership,” *Journal of Corporate Finance*, 13, 343–367.
- (2008a): “Debt, Equity, and Hybrid Decoupling: Governance and Systemic Risk Implications,” *European Financial Management*, 14, 663–709.
- (2008b): “Equity and Debt Decoupling and Empty Voting II: Importance and Extensions,” *University of Pennsylvania Law Review*, 156(3), 625–739.
- JPMORGAN (2006): “Credit Derivatives Handbook,” JP Morgan Corporate Quantitative Research, December 2006.
- (2009): “Credit Market Outlook and Strategy,” North America Credit Research, 20 February 2009.
- KAHAN, M., AND E. B. ROCK (2007): “Hedge Funds in Corporate Governance and Corporate Control,” *University of Pennsylvania Law Review*, 155(5), 1021–1093.
- KALAY, A., AND S. PANT (2008): “One Share-One Vote is Unenforceable and Sub-optimal,” Working Paper, University of Utah.
- LUBBEN, S. J. (2007): “Credit Derivatives and the Future of Chapter 11,” Working Paper, Seton Hall University School of Law.
- MORRISON, A. C. (2005): “Credit Derivatives, Disintermediation, and Investment Decisions,” *Journal of Business*, 78(2), 621–647.

- PACKER, F., AND H. ZHU (2005): “Contractual Terms and CDS Pricing,” *BIS Quarterly Review*, pp. 89–100.
- PARLOUR, C. A., AND G. PLANTIN (2008): “Loan Sales and Relationship Banking,” *Journal of Finance*, 63(3), 1291–1314.
- PARLOUR, C. A., AND A. WINTON (2008): “Laying off Credit Risk: Loan Sales versus Credit Default Swaps,” Working Paper, UC Berkeley.
- RAJAN, R. G. (1992): “Insiders and Outsiders: The Choice between Informed and Arm’s-Length Debt,” *Journal of Finance*, 47(4), 1367–1400.
- STULZ, R. (2009): “Credit Default Swaps and the Credit Crisis,” Working Paper, Ohio State University.
- SUTTON, J. (1986): “Non-Cooperative Bargaining Theory: An Introduction,” *The Review of Economic Studies*, 53(5), 709–724.
- THOMPSON, J. R. (2007): “Credit Risk Transfer: To Sell or to Insure,” Working Paper, University of Waterloo.
- YAVORSKY, A. (2009): “Analyzing the Potential Impact of Credit Default Swaps in Workout Situations,” Special Comment, Moody’s Investor Services.
- ZACHARIADIS, K., AND I. OLARU (2010): “Trading and Voting in Distressed Firms,” Working Paper, London School of Economics.

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

Company	Year	Summary	Outcome
Marconi	2001-2002	Marconi was initially unable to renegotiate with a consortium of banks, some of which had purchased credit protection. As the Financial Times ("Restructuring at Risk from CDSs", October 18, 2004) points out "Banks that bought CDS "insurance" to cover loans to Marconi held out against an early refinancing plan for the engineering group that would have involved them giving up the benefits of the insurance cover." Ultimately a debt-for-equity swap was approved, essentially wiping out equity holders. See also "Liar's Poker," The Economist, May 15, 2003.	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. CFO Magazine ("Default Swap Faults," October 1, 2004) notes that "Citigroup rejected troubled energy company Mirant Corp.'s efforts to reorganize without a Chapter 11 proceeding. Citigroup insisted that it turned down Mirant's reorganization plan because the bank found the plan unlikely to restore the company's solvency for long. But other creditors suspected that Citigroup had bought credit default swaps against Mirant, which might have given the bank a greater interest in seeing the company file for bankruptcy than in helping finance a restructuring." Subsequently, 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. See "Shareholders in Mirant get Voice in Reorganization," New York Times, September 20, 2003.	Chapter 11
Tower Automotive	2004-2005	A number of hedge funds refused to make concessions on exiting loans to enable new loans that would have improved Tower's cash position. Allegedly the hedge funds had shorted Tower's stock (rather than having entered into a CDS position, but to similar effect). See Partnoy and Skeel, "The Promise and Perils of Credit Derivatives," University of Cincinnati Law Review, 2005. See also "Hedge-Fund Lending to Distressed Firms Makes for Gray Rules and Rough Play," Wall Street Journal, July 18, 2005.	Chapter 11
Six Flags	2009	Six Flags filed for Chapter 11 after failing to reach a deal with its creditors. The Economist reports that a Fidelity mutual fund turned down an offer that would have given unsecured creditors an 85% equity stake, even though according to an analysis by Fitch Ratings, the same creditors would receive at most 10% of equity after a bankruptcy filing (see "No Empty Threat," Economist, June 18, 2009). Mike Simonton, from Fitch, says that one possible scenario is that "the bondholder has a credit-default swap -- essentially an insurance policy -- that would pay it a higher sum than an out-of-court agreement." (quoted from "Plagued by Debt, Six Flags Faces Its Own Wild Ride, Washington Post, April 13, 2009)	Chapter 11

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

Lyondell Basell	2009	Filed for Chapter 11 after failing to reach a deal with its creditors. A research report by Deutsche Bank ("DB Current Issues, Decemer 21, 2009 on credit default swaps) notes that "traders speculated on the filing for bankruptcy of the European parent company after its US subsidiary Lyondell Chemical Co filed for Chapter 11 bankruptcy protection in January 2009. The European parent decided not to do so, since the risk of liquidation following a bankruptcy filing under European law was deemed high. Many investors and CDS protection buyers (agreeing on cash settlement) reacted indignantly, and at least for some investors the reason might have been that a restructuring following Chapter 11 bankruptcy would have been a credit event triggering the CDS payments." See also "Burning down the House," The Economist, March 5, 2009.	Chapter 11
General Growth Properties	2009	General Growth, the mall operator, filed for Chapter 11 after failing to reach a deal with its creditors. According to the Financial Times (see "CDS Derivatives are Blamed for Role in Bankruptcy Filings," April 17, 2009) "Lawyers say CDS holdings were [...] a factor in the default filing for Chapter 11 protection of General Growths properties." Also the Economist notes that the bankruptcy of General Growth Properties "ha[s] been blamed on bondholders with unusual economic exposures." ("No Empty Threat," June 18, 2009)	Chapter 11
Abitibi Bowater	2009	Faced with cash flow problems, AbitibiBowater attempted to extend the maturities of bonds due in August 2009, in return for higher yields. Abitibi filed for Chapter 11 after failing to reach a deal with its creditors. The FT points out that "Some creditors, including Citigroup, which held a small exposure to AbitibiBowater, hedged themselves in the CDS market, meaning their economic interest in the deal was different to lenders who had not bought credit insurance, according to people familiar with the matter." See "No Empty Threat," Economist, June 18, 2009 and "CDS Derivatives are Blamed for Role in Bankruptcy Filings," Financial Times, April 17, 2009.	Chapter 11
Harrah's Entertainment	2009	Apollo Management and TGT, the owners of Harrah's, the Las Vegas gaming company, sought to restructure its debt through two exchange offers in 2009. While eventually the offer was successful, according to a person involved credit derivatives "were one of the limiting factors." See "CDS Investors Hold the Cards," Financial Times, July 22, 2009.	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. According to the Financial Times, many holders of Unisys debt also held CDS protection, thus strengthening their bargaining position. For more details see "CDS Investors Hold the Cards," Financial Times, July 22, 2009.	Out-of-court restructuring

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

GM	2009	GM filed for Chapter 11 after failing to reach a deal with its creditors. According to the Financial Times, "Hedge funds and other investors stand to make billions of dollars on credit insurance contracts if GM declares bankruptcy, a prospect that is complicating efforts to persuade creditors to agree to a restructuring plan for the automaker." The article further notes that "Holders of such swaps would be paid in the event of a default – but would lose money if they agreed to restructure GM’s debt. For investors who own bonds and CDS, this could create an incentive to favour a bankruptcy filing." See "Credit Insurance Hampers GM Restructuring," Financial Times, May 11, 2009.	Chapter 11
Chrysler	2009	Filed for Chapter 11 after failing to reach a deal with its creditors. As in the GM case, credit default swaps may have played a role in Chrysler's inability to restructure its debt. The Wall Street Journal ("Chrysler Chapter 11 Is Imminent," April 30, 2009) notes that "Bank-debt holders, many of them hedge funds or distressed debt funds, voted against the latest deal for various reasons [...]. Some said their funds had bigger positions in Ford Motor Co. or General Motors Corp. and could benefit by a Chrysler bankruptcy and the production capacity that may eliminate. Some funds may also have credit-default swaps on Chrysler bank debt that pay out in the event of a bankruptcy."	Chapter 11
YRC Worldwide	2009-2010	The trucking company YRC struggled to undertake a debt-for-equity exchange in the fall of 2009. Initially some creditors opposed the offer, even though they would likely receive less in bankruptcy than if they accepted the offer. This raised suspicion that the hold-out creditors were hoping to profit on their CDS positions (the hedge fund Brigade Capital was named as one of the potential holdouts). Eventually YRC managed to renegotiate its debt, when the Teamsters union threatened to protest in front of the offices of hedge funds which blocked YRC's debt-for-equity offer. See "YRC and the Street's Appetite for Destruction," Wall Street Journal, January 5, 2010.	Out-of-court restructuring