The Effects of CDS Trading Initiation on the Ownership Structure of Syndicated Loans

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Abstract

This study shows that the initiation of CDS trading for an entity's debt increases the share of loans retained by loan syndicate lead arrangers and the incidence of sole lending loans. Further evidence shows this finding is consistent with CDS initiation reducing the effectiveness of a lead arranger's stake in the loan to serve as a mechanism to address the adverse selection/moral hazard problem in the syndicated loan market. Additional findings corroborate this interpretation by revealing a moderating effect for firms with greater transparency and for loans originated by a lead arranger with a strong reputation in this market.

1. Introduction

This study addresses whether the initiation of credit default swaps (CDS) affects the ownership structure of syndicated loans. The emergence of the CDS market is one of the most important financial innovations of the last twenty years. These instruments, which pay their holders the face value in a case of a reference entity (i.e., borrower) credit event (e.g., debt default) in return for a premium, were issued first in the early 1990s and reached a peak of $62.2 trillion of notional outstanding value (ISDA, 2013). Theoretical work suggests that this financial innovation can introduce both positive and negative externalities to the structure of ownership in the syndicated loan market, which is a primary source of corporate financing. However, to date there is little empirical evidence investigating the effect of CDS initiation on the ownership structure of syndicated loans. We find that the share of loans retained by syndicate lead arranger banks and the incidence of sole lending loans significantly increase after CDS initiation. We provide additional evidence that suggests that these findings are consistent with the CDS market introducing a negative externality to the syndicated loan market by reducing the effectiveness of a lead arranger's stake in the loan to serve as a mechanism to address the adverse selection/moral hazard problem in this market.

Loan syndication has evolved as an efficient mechanism that permits the lead arranger to share risk with syndicate participants, who depend on the lead arranger to screen borrowers before loan syndication and monitor borrowers throughout the life of the loans. Adverse selection and moral hazard problems arise because the lead arranger's screening and monitoring efforts are unobservable. To mitigate these information asymmetry problems, syndicate participants require the lead arranger to retain a larger share of a loan, i.e., have "skin in the game," than would otherwise be optimal from a pure risk-sharing perspective.

Initiation of a CDS market introduces several externalities to the syndicated loan market. CDSs create a positive externality in that they provide an alternative mechanism through which the lead arranger can reduce risk exposure to a loan. This externality reduces the lead arranger's need to sell a significant share of a loan to syndicate participants, and other things equal, should result in the lead arranger retaining a larger share of a loan. However, the ability of the lead arranger to transfer risk to other parties using CDSs introduces a negative externality in that CDS trading reduces the effectiveness of lead arranger ownership to serve as a mechanism to mitigate the information asymmetry problems of adverse selection and moral hazard. Other things equal, this results in the lead arranger being required by syndicate participants to retain a larger share of a loan. CDS initiation introduces another negative externality by increasing the default risk of the reference entity because lenders and speculators that hold CDSs on the borrower may have incentives to encourage it to default (e.g., Che and Sethi (2013) and Subrahmanyam et al. (2014)). This increase in default risk increases the lead arranger's incentive to reduce loan ownership. How these externalities play out in affecting loan syndication structure is an unexplored empirical matter and therefore the focus of our study.

We begin our study by first developing a framework for understanding the economic effects of CDS initiation on the structure of loan syndication. These effects include changes in the lead arranger's opportunities to share risk, changes in adverse selection and moral hazard, and changes in a borrower's credit risk. We do this by building on Ivashina (2009), which develops an equilibrium model of loan syndication in which the observed loan spread and a lead bank's share of a loan corresponds to the intersection of two pricing schedules representing the syndicate participants' demand for a proportional share of a loan and the lead bank's willingness to retain a proportional share of a loan. We show that CDS initiation can lead to a variety of new

equilibrium combinations of loan share retained by the lead arranger and borrower loan spread. However, an important observation is that an increase in neither loan share retained nor loan spread following CDS initiation is sufficient for evidence of an increase in adverse selection/moral hazard associated with loan syndication.[1] Observing simultaneous increases in both loan share retained and loan spread are necessary for there to be an economically significant increase in adverse selection/moral hazard.

To analyze empirically the effect of CDS trading initiation on the ownership structure of the syndicated loan market, we obtain CDS trading information from Markit and collect a sample of 27,205 loan contracts from Dealscan over the period 1993-2012. We use a difference-in-difference research design to investigate the effects of CDS initiation on the share retained by the lead arranger and on the likelihood of non-syndicated lending of subsequent loans for loans issued by firms before and after there are CDS contracts traded on the firms' debt. In all tests we include as controls firm- and loan-specific characteristics. We find that CDS initiation is associated with an increase in the loan share retained by the lead arranger as well as an increase in the probability of sole lending. These findings are consistent with two alternative explanations. The first is that CDS initiation introduces a positive externality arising from the availability to the lead arranger of an alternative means to diversify credit risk exposure to a loan. The second is that CDS initiation introduces a negative externality arising from the reduced effectiveness of lead arranger ownership to serve as a mechanism to mitigate adverse selection/moral hazard problems.

As a means to help distinguish whether the ownership structure changes we document more likely arise from the lead arranger's diversification benefit or an increase in adverse

[1] Although adverse selection and moral hazard problems arise at different times throughout loan syndication, we make no attempt to distinguish them in our tests. For the sake of parsimony, when referencing these information asymmetries we use the phrase "adverse selection/moral hazard" to denote the fact either or both may be present.

selection/moral hazard problems, we also test for the effect on loan spreads arising from CDS initiation. Findings from this test indicate that average loan spread increases.[2] As we explain in section 2, finding an increase in both loan share retained by the lead arranger and loan spread is evidence consistent with CDS initiation introducing a negative externality arising from an increase in adverse selection/moral hazard that more than offsets any possible positive externality from diversification.

To corroborate the interpretation of our results we also test whether this negative externality is moderated, as expected, for firms with greater transparency. If a borrower's risks and activities are more transparent, then the adverse selection/moral hazard problems are less severe and monitoring by lead arrangers is less important to syndicate participants. As a result, the adverse selection/moral hazard problem created by CDS trading is likely to be less severe for more transparent firms. We test our prediction of a moderating influence of a borrower's transparency using a measure of the debt-contracting value of borrowers' accounting information in explaining credit ratings (Ball et al., 2008). Findings from these tests support our prediction that for firms with higher transparency there are smaller increases in loan share retained by the lead arranger, the probability of sole lending, and loan spreads following CDS initiation. Similarly, we also find that, as predicted, our documented effects of CDS initiation on loan share retained, the probability of sole lending, and loan spreads are less pronounced when the lead arranger has a strong reputation in the syndicated loan market. This is because lead arrangers with a strong reputation to protect have greater incentives to screen and monitor borrowers, which mitigates the adverse selection/moral hazard problems.

[2] Ashcraft and Santos (2009) finds similar results with respect to loan spreads, but only for those loans the study classifies as belonging to opaque borrowers. See footnote 26 below for more discussion. Ashcraft and Santos (2009) does not examine the effect of CDS initiation on loan syndication ownership structure.

A research design problem common to studies on CDS initiation is that CDS initiation is possibly endogenously related to an increase in credit risk of the reference entity. Following prior literature, we conduct additional tests including the use of a propensity score matched sample and the Heckman two-stage correction for self-selection bias. Findings from these tests reveal the same inferences as those based on our tabulated findings.

Our study contributes to the literature by documenting the effects of CDS initiation on syndicated loan ownership structure. Although prior studies find that CDS initiation is associated with an increase in reference entity bankruptcy risk (Subarhmanyam et al., 2014) and an increase in loan spread for relatively opaque reference entities (Ashcraft and Santos, 2009), ours is the first to show that lead arranger ownership stake in the reference entity also increases. Borrowing from Ivanshina (2009), we show that these prior literature results cannot be used to infer or predict how CDS initiation will affect syndicated loan ownership structure, i.e., the share retained by the lead arranger. An increase in loan spread and borrower bankruptcy risk can result from an increase in credit risk arising from actions taken by non-lender CDS holders or from an increase in adverse selection/moral hazard problems; whereas the former cause of an increase in loan spread results in a decrease in share retained by the lead arranger, the latter results in an increase. Moreover, finding an increase in both loan share retained by the lead arranger and loan spread enables us to infer that CDS initiation results in an increase in adverse selection/moral hazard that more than offsets possible diversification benefits to the lead arranger. Thus, CDS initiation reduces the effectiveness of a lead arranger's stake in the loan to serve as a mechanism to address the adverse selection/moral hazard problem.

The remainder of the paper is organized as follows. The next section discusses the institutional background, related literature, and provides our predictions. Section 3 presents our

research design, section 4 describes our sample and data, and section 5 presents our results. Section 6 provides concluding remarks.

2. Institutional Background, Related Literature, and Predictions

2.1 Loan Syndication

In a syndicated loan, a lead arranger—typically a commercial or investment bank—arranges for an entity to borrow funds from a pool of lenders that often are other commercial or investment banks, or other institutional investors such as hedge funds and pension funds.[3] A key purpose of loan syndication is that it permits the primary lender, i.e., the lead arranger, to diversify risk and to hold a portion of the loan rather than the full amount of the loan.

The lead arranger screens borrowers for creditworthiness and is responsible for monitoring the borrower over the life of the loan. Because screening and monitoring efforts are costly and unobservable, the loan syndication process suffers from adverse selection and moral hazard problems that potentially can adversely affect the loan syndication process. The adverse selection problem arises from syndicate participants being at an informational disadvantage relative to the lead arranger because the lead arranger screens borrowers – many of which often have long-term relationships with the lead arranger. At the time of loan origination and syndication, there is no direct means for syndicate participants to observe the risk characteristics of the borrower that are relevant to loan pricing. Subsequent to origination, syndicate participants rely on the lead arranger to monitor the borrower for changes in creditworthiness but have no means to observe directly efforts undertaken by the lead arranger, which creates a moral hazard problem. If these information problems are severe enough, there could be a breakdown in

[3] During our sample period, top lead arrangers in the loan syndication market, as reflected by loan market share, include JP Morgan, Bank of American Merrill Lynch, Citigroup, and Deutsche Bank. See Ross (2010) for a comprehensive description of the role lead arranger banks play in loan syndication.

the syndication process, whereby the lead arranger cannot attract other lenders to participate in the syndicate.

A costly means to solve the adverse selection/moral hazard problem is for the lead arranger to hold a portion of the loan. Requiring the lead arranger to have "skin in the game" (e.g., Sufi, 2007) serves as a commitment for the lead arranger to set loan terms that reflect the riskiness of the loan and to exert monitoring effort subsequent to loan origination/syndication. The solution is costly because the lead arranger is unable to diversify its risk exposure to the loan as much as would be the case in the absence of adverse selection/moral hazard. Of course, if the borrower's activities and risk characteristics are observable at relatively low cost by lenders, including loan syndication participants, then information asymmetry between the lead arranger and the other lenders in the syndicate is mitigated, and the lead arranger may be required to retain a smaller portion of the loan.

Ivashina (2009) develops an equilibrium model in which a lead bank's share of a loan and the observed loan spread correspond to the intersection of two pricing schedules representing the syndicate participants' demand for a proportional share of a loan and the lead bank's willingness to retain a proportional share of a loan. Figure 1, which plots loan spread and share retained by the lead arranger, illustrates the model. In the presence of adverse selection arising from syndicate participants being unable to observe the creditworthiness of the borrower and the moral hazard problem arising from their inability to assess whether the lead arranger monitors the borrower's activities throughout the life of the loan, the syndicate participants demand curve is downward-sloping. Other things equal, syndicate participants demand a higher loan spread the greater is the adverse selection/moral hazard problem. The downward slope of their demand curve, DSynd, reflects their requiring a lower loan spread when the lead arranger retains a larger

proportion of the loan, which reduces the adverse selection/moral hazard problem. Because of the lead arranger's desire to diversify loan portfolio risk, as the share retained increases, the greater must be the loan spread to compensate the lead arranger for the greater risk exposure. Hence, the lead arranger's demand curve, DLeadA, is upward sloping. The intersection of the two demand curves yields the equilibrium loan spread and share retained by the lead arranger given by E(0).[4]

2.2 Credit Default Swaps

A credit default swap (CDS) is an agreement that provides that the seller of the CDS compensate the buyer in the event of a debt default or other specified credit event relating to a specific entity. The CDS contract typically requires the buyer of the CDS to makes a series of payments to the seller throughout the life of the loan and, in exchange, the buyer receives a payoff if the debt defaults. In essence, the CDS is an insurance contract, and therefore the seller's premium is larger the greater is the likelihood of debt default when the CDS contract is signed. Soon after CDS contracts were initiated in the 1990s, secondary markets for CDSs developed, providing market participants with timely information regarding a borrower's credit-worthiness, regardless of whether the entity's debt is publicly traded.

CDS contracts typically are made available to investors mostly from monoline insurers such as AIG and Ambac, which operate primarily as CDS sellers, as well financial institutions and hedge funds, including J.P. Morgan and Goldman Sachs, which serve as market-makers as well as CDS sellers.[5] CDS transactions are conducted through an over-the-counter market and

[4] We use loan spread as the primary loan characteristic of interest. It is possible that the lead arranger and syndicate participants consider other loan characteristics, e.g., loan covenants, when arriving at the equilibrium loan spread and share retained by the lead arranger. As described below, we consider other loan characteristics in additional tests examining the effect of CDS initiation on loan syndication.

[5] Borrowers are unlikely to trade their own CDSs. There are at least two reasons. First, firms are not likely to sell CDSs linked to their debt because investors would be unwilling to buy CDS protection from the firm itself. If the firm goes bankrupt, then CDS buyers cannot be compensated for the loss incurred given that the firm is already

thus are unobservable to parties outside of the deal. Although the parties to CDS transactions are not publicly disclosed, in aggregate, banks are net protection buyers of CDS (Song et al., 2013; Suestersic, 2013; Martin and Roychowdhury, 2015).[6] The buyer of a CDS need not hold the debt security on which the CDS is written. However, if the buyer does hold the debt security, then the risk of default is transferred from the holder of the debt security to the CDS seller. This transfer of risk plays an important role in loan syndication.

2.3 CDS and Loan Syndication

2.3.1 Adverse selection and moral hazard effects

If a CDS market for a firm's debt is available, the lead arranger anonymously can purchase CDSs to lay off credit risk associated with the portion of the loan it holds. Thus, lead arranger banks that have purchased CDSs have a reduced incentive to screen and monitor borrowers (e.g., Morrison, 2005). As a result, holding a portion of the loan no longer provides as credible commitment as before CDS initiation that the lead arranger will provide a fair assessment of the riskiness of the loan and exert monitoring effort.[7,8]

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bankrupt. In other words, the counterparty risk is 100% in this case. Second, the firm is unlikely to buy CDSs because buying a CDS is tantamount to betting that the firm's credit risk will increase. Such an action is equivalent to shorting the firm's stock, which is an action that is unlikely to be approved by the firm's board of directors.

[6] Another important characteristic of the CDS market is that its dominant players are major banks and financial institutions. There is a concern that these banks and financial institutions may have access to material non-public information on CDS obligors through their lending activities and then trade on this information (e.g., Acharya and Johnson, 2007; Kim et al., 2014). To the extent that lenders possess private information on their borrowers' creditworthiness, CDS sellers can take into account their own information disadvantage when pricing CDS contracts (Fink 2004).

[7] Moreover, because CDSs allow banks and creditors to transfer risk exposure to third parties through the purchase of CDS protection, an "empty creditor" problem is created in that creditors with CDS insurance are better off when the borrowing firm defaults and may even have incentives to push the borrower into default (Hu and Black, 2008a, 2008b) or inefficient bankruptcy because the lender's total pay-off would be higher in that event (Bolton and Oehmke, 2011). A key feature of the Bolton and Oehmke (2011) model is that debt renegotiation may occur because the borrower may not generate enough cash to make promised payments to the lender. Without CDSs, the lender and the borrower will restructure the debt and share the renegotiation surplus based on their bargaining power. However, with the availability of a CDS market, the lender will tend to use CDSs to insure against the potential default in the interim period. Purchasing a CDS gives the lender a better outside option in renegotiation because the CDS pays out when the renegotiation fails and the borrower defaults. This outside option enables the lender to extract more from the borrower in renegotiation because the lender has stronger bargaining power. Bolton and Oehmke (2011) shows that, in equilibrium, the lender tends to purchase too much CDS protection relative to the

Thus, CDS initiation exposes syndicate participants to increased adverse selection/moral hazard risk. Of course, loan syndicate participants are likely to take actions to protect themselves from these increased risks arising from CDS initiation, resulting in a new equilibrium loan spread and share retained by the lead arranger. In the context of the Ivashina (2009) framework, for a given level of lead bank's share in the loan, syndicate participants will demand higher spreads because of CDS initiation, which results in a shift of the syndicate demand curve to the right. This is shown in Figure 2, where DSynd_pre and Dsynd_post are the demand curves before and after CDS initiation.[9] Note that in the absence of a shift in the lead arranger's demand curve, DLeadA, the resulting equilibrium, E(1), is a greater share retained by the lead arranger after CDS initiation and a larger loan spread. We refer to this shift in the syndicate participants' demand curve as the adverse selection/moral hazard effect arising from CDS initiation. In the limit, if the increase in the adverse selection/moral hazard effect is sufficiently large, the lead arranger will have to retain the entire loan, i.e., the loan will be issued as a sole lending loan, and the syndicate structure fully breaks down.[10]

2.3.2 The diversification effect

Although CDS initiation affects the loan syndicate participants' pricing schedule, it also potentially affects the lead arranger's pricing schedule. The development of the CDS market for

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social optimum—even when CDSs are fairly priced—because the lender does not internalize the loss surplus that arises from failed renegotiation.

[8] Even though the CDS seller will set a CDS price that takes into account the empty creditor problem, this does not imply that the lead arranger will not purchase a CDS contract. This is because the CDS seller—acting as an insurer—likely is more efficient and therefore more willing than the lead arranger to absorb the borrower's credit risk. To the extent that this is not the case, the lead arranger will not purchase CDSs and there will be no change in the lead arranger's incentive to screen and monitor the borrower.

[9] For ease of exposition and because there is no effect on our predictions, we do not consider the slope and potential changes in the slope of the Dsynd and the DLeadA curves after CDS initiation.

[10] Borrowers may change their behavior to address the moral hazard problem created by CDS initiation. For example, they can alter their disclosure/transparency policies. There is evidence that firms change their disclosure and reporting behavior after CDS initiation (e.g., Kim et al., 2014; Martin and Roychowdhury, 2015). The fact that they did not change their reporting behavior until after CDS initiation suggests that it was not optimal for them to do so before. Therefore, the outcome in the lending market we observe is the equilibrium outcome of a tradeoff between increased disclosure costs and increased private lending costs.

a borrower provides the lead arranger (and other holders of a borrower's debt) with an additional way to hedge or lay off credit risk exposure to the borrower, while also maintaining a lending relationship with the borrower (Saretto and Tookes, 2013).[11] Even if lenders do not purchase CDSs immediately, the existence of CDS markets provides a liquid resale option and makes holding credit risk more attractive. Because CDS initiation provides an additional way for the lead arranger to reduce the risk exposure from holding a share in a loan, in the context of the Ivashina (2009) framework, for each level of shares retained by the lead arranger, the lead arranger is willing to charge a lower level of loan spread. As shown in Figure 3, this implies a shift of the lead arranger's demand curve to the right (as indicated by the red demand curve), where DLeadA_pre and DLeadA_post_1 are the lead arranger's demand curves before and after CDS initiation. Note that in the absence of a shift in the syndicate participants' demand curve, Dsynd, after CDS initiation the resulting equilibrium, E(1), is a greater share retained by the lead arranger but a lower loan spread faced by the borrower. We refer to this shift in the lead arranger's demand curve as the diversification effect. In the limit, if the diversification effect is sufficiently large, the new equilibrium can result in the lead arranger retaining 100 percent of the loan, i.e., the loan is issued as a sole lending loan.[12]

[11] Even though, in principle, syndicate participants also can purchase CDSs to reduce their exposure to the borrower's credit risk, they have less incentive than the lead arranger to do so. Typically the lead arranger's primary objective in arranging debt financing for the borrower is to generate origination fees, and therefore prefers to have minimal exposure to the borrower's credit risk. In contrast, syndicate participants purchase shares of the syndicated loans with the objective of generating interest revenue from the loans. Purchasing CDSs by syndicate participants would reduce their exposure to loans at a cost of sacrificing their net revenue.

[12] Another benefit of the lead arranger holding CDSs is that doing so can provide lenders the opportunity to reduce regulatory capital requirements (Martin and Roychowdhury, 2015). If the lead arranger passes on this hedging benefit to the firm, then the firm may be able to borrow at lower interest rates for each level of share retained by the lead arranger (Cebenoyan and Strahan, 2004; Hirtle 2009). This implies that the diversification curve will shift to the right, which is consistent with the reasoning above.

2.3.3 The credit risk effect

CDS initiation also can have an additional potential effect on the lead arranger's pricing schedule beyond the diversification effect discussed above. In particular, CDS holders who are not creditors may also have incentives to cause the borrower to default on its loans (Soros, 2009; Stulz, 2010; Portes, 2010; Markose et al., 2012; Che and Sethi, 2013), which increases the credit risk of loans in the lead arranger's portfolio.[13] Consistent with this possibility, Subrahmanyam et al. (2014) finds credit risk for borrowers increases following CDS initiation.[14] The increase in default risk on the lead arranger's portfolio will shift the lead arranger's curve to the left, as the lead arranger will want to diversify more for a given level of interest spread.[15] Thus, despite the potential benefits of diversification brought about by CDS initiation, it is possible that the credit risk effect could result in the lead arranger's curve shifting on net to the left, which is illustrated as DLeadA_post_2 in Figure 3 (as indicated by the green demand curve). Note that in contrast to the equilibrium associated with the diversification effect, E(1), the equilibrium associated with the credit risk effect, E(2), is a smaller share retained by the lead arranger but a greater loan spread faced by the borrower. That is E(1) and E(2) have opposite effects on share retained by the lead arranger and loan spread when compared to E(0).

[13] To see this, consider the hypothetical example of insurers issuing homeowner policies that provide a payoff to the policyholder in the event of a house fire for a home not owned by the policyholder. Although CDS holders cannot necessarily directly cause a borrower to default on a loan (or, by analogy, "burn down" a home), actions they take collectively in the credit markets—including "bear raiding," i.e., spreading negative information about a borrower—can make it difficult for a borrower to secure future borrowing.

[14] Subrahmanyam et al. (2014) attribute the increase in bankruptcy risk to the empty creditor problem (see footnote 7). However, bankruptcy risk could also increase because of the incentives of CDS holders that do not hold a portion of a borrower's debt.

[15] Based on Ivashina (2009), which suggests that changes in default risk affect the lead arranger's demand schedule and not the syndicate participants' demand schedule, we expect changes in default risk to have no effect on the DSynd curve.

2.3.4 The new equilibrium in the syndicated loan market

Whether the resulting equilibrium following CDS initiation results in an increase or decrease in the share of a loan retained by the lead arranger and an increase or decrease in the loan spread depends on the net effect of the diversification and credit risk effects on the lead arranger's demand curve and on the relative magnitude of the adverse selection/moral hazard effect. Figure 4 illustrates examples in which the adverse selection/moral hazard effect associated with CDS initiation is sufficiently large that it leads to an increase in share retained by the lead arranger and loan spread regardless of whether the shift in the lead arranger's demand curve is dominated by the diversification effect (a shift to the right) or the credit risk effect (a shift to the left). That is, in Figure 4, for both of the new equilibria, E(1) and E(2), share of a loan retained by the lead arranger and loan spread are higher than are the amounts for E(0). Observing an increase in both share of a loan retained by the lead arranger and loan spread is possible if the lead arranger's curve shifts either to the right or left, but only if there also is an adverse selection/moral hazard effect that causes a shift to the right in the syndicate participants' demand curve.

Figure 5 illustrates examples in which the impact of CDS initiation on share of loan retained by the lead arranger and loan spread is not determined solely by the magnitude of the adverse selection/moral hazard effect. In the case of the first equilibrium, E(1), the diversification effect causes DLeadA to shift to the right, which results in an increase in the share retained by the lead arranger but a decrease in the borrower's loan spread. Conversely, in the case of the second equilibrium, E(2), the credit risk effect dominates the diversification effect, causing DLeadA to shift to the right such that there is a decrease in the share retained by the lead arranger but an increase in the borrower's loan spread.

Taken together, Figures 4 and 5 illustrate that CDS initiation can lead to a variety of new equilibrium combinations of changes in loan share retained by the lead arranger and loan spread.[16] However, two other observations based on the figures are noteworthy. First, as Figure 4 makes clear, observing an increase in both loan share retained and loan spread is not possible without CDS initiation creating an economically significant adverse selection/moral hazard effect. Second, observing an increase in loan spread is not sufficient for determining the impact of CDS initiation on the share retained by the lead arranger. Alternatively stated, it is necessary to observe how share retained by the lead arranger changes in response to CDS initiation to have a more complete understanding of how the various effects we identify interact to yield equilibrium changes in the loan syndication market.

Although we cannot predict equilibrium changes in lead arranger loan share and borrower loan spread for new loans issued following CDS initiation, we can make the following conditional statements. First, empirically observing an increase in both loan share and loan spread indicates that CDS initiation creates a net adverse selection/moral hazard effect, i.e., the adverse selection/moral hazard effect dominates the diversification or credit risk effect. Second, observing an increase in loan share retained and a decrease in loan spread indicates that CDS initiation creates a net diversification benefit, i.e., the diversification effect dominates the credit risk effect. Third, observing an increase in loan spread but a decrease in loan share retained indicates that CDS initiation creates a net credit risk cost, i.e., the credit risk effect dominates the diversification effect.[17]

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[16] Equilibrium combinations not explicitly illustrated in Figures 4 and 5 also possibly include shifts in the two demand curves such that there is no change in either loan share retained or loan spread. It is also possible that CDS initiation has no impact on either demand curve, in which case there will be no change in both loan share retained and loan spread.

[17] Another potential mechanism through which CDS trading may cause the loan syndication market to break down is reduced demand for loans. In particular, it is possible that parties other than the lead arranger could sell CDSs rather than participate in the syndicated loan to gain exposure to the borrower's credit risk. In other words, CDSs and

3. Research Design

3.1 Syndicated Loan Market and CDS Initiation

To test whether CDS initiation leads to an increase, decrease, or no change in the share retained by the lead arranger, we estimate the following linear regression model given by equation (1):

$$LEAD\_OWN_{it} = \beta_1 TradedPost_{it} + Controls + FirmFE + MonthFE + \varepsilon_{it} \quad (1)$$

LEAD_OWN is percentage of a loan retained by lead arranger. *TradedPost* is a compound indicator variable that equals one if a loan is issued after the month of CDS initiation (*Post* = 1) for a firm that ever has a CDS market for its debt at any time during the sample period (*Traded* = 1), and zero otherwise. *FirmFE* and *MonthFE* are firm and month fixed effects. Equation (1) is essentially a difference-in-difference research design in which the individual main effects of *Traded* and *Post* are subsumed by *FirmFE* and *MonthFE* (e.g., Bertrand and Mullainathan, 2003). If CDS initiation is associated with an increase (decrease, no change) in the share retained by the lead arranger, then $\beta_1 > 0$ ($\beta_1 < 0$, $\beta_1 = 0$).

To test our related prediction that CDS initiation leads to a lower incidence of loan syndication, or, alternatively stated, that there is an increase in the probability that subsequent debt issuances are arranged through sole lending, we estimate the following linear probability regression given by equation (2):[18]

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syndicated loans may be substitutes for potential lenders. However, this is unlikely to be the case because lenders have significant protections under the loan agreement and a CDS, by construction, does not pay the level of interest payments that the loan pays. Therefore, it is unlikely that a CDS is a substitute for lending. Moreover, we are unaware of any theory or empirical evidence to support this potential source of reduced demand for loan syndication.

[18] Equation (2) uses ordinary least squares rather than probit regression because including firm fixed effects in a probit model will result in biased coefficients for other independent variables (Cameron and Trivedi, 2005). Nonetheless, we also estimate a probit model to assess the effect of CDS initiation on loan syndication. Untabulated findings yield inferences identical to those based on tabulated findings.

$$Nonsyndication_{it} = \beta_1 TradedPost_{it} + Controls + FirmFE + MonthFE + \varepsilon_{it} \quad (2)$$

Nonsyndication equals one if there is only one lender on the loan, i.e., the loan is not syndicated, and zero otherwise.[19] If CDS initiation is associated with an increase (decrease, no change) in the probability of nonsyndication, then $\beta_1 > 0$ ($\beta_1 < 0$, $\beta_1 = 0$).

Equations (1) and (2) include a set of control variables for a variety of firm- and loan-specific characteristics suggested by prior research to affect loan syndication. The firm characteristics include return on assets, *ROA*; profit margin, *Profit*; the debt-to asset-ratio, *Leverage*; firm size as measured by the natural logarithm of total assets, *Log_asset*; and credit rating, *Rating*. Loan characteristics, include loan spread, *LoanSpread*, revolver lines, *Revolver*; term loan B or below, *TermLoanB*; and presence of guarantors, *Guarantor*; the loan dollar amount in billions, *FacilityAmt*; the loan term in months, *Maturity*; the number of financial covenants, *NCOV*; an indicator variable that equals one if a loan is secured and zero otherwise, *Securdum*; and a set of 30 indicator variables for loan purpose, e.g., whether a loan is used to finance an acquisition or whether a loan is used to execute a leveraged buyout.[20] We also include in the regressions a control for the market risk premium, i.e., the monthly market value-weighted excess return. The appendix provides details of all variable definitions. We cluster standard errors at the firm level.

[19] The data provider we use, DealScan, does not include a comprehensive sample of sole lending loans. As a result, the composition of loans we classify in our sample as syndicated and nonsyndicated may not be representative of the population of loans. This can be viewed as measurement error in the dependent variable in equation (2). This should only pose a problem for the inferences we draw relating nonsyndication to CDS initiation only if this measurement error is correlated with CDS initiation. However, there is no evidence in the literature that suggests such a correlation exists. See also Gopalan, Nanda, and Yerramilli (2011), which similarly uses DealScan to classify sole lending and syndicated loans.

[20] To the extent that changes in ownership structure and loan spread are simultaneously determined, inclusion of loan characteristics, particularly *LoanSpread*, in equations (1) and (2), can mitigate the effects of potential simultaneity bias on the *TradedPost* coefficient.

3.2 The Effect of CDS Trading on Loan Pricing

To examine the effect of CDS initiation on loan pricing, we estimate the following regression model:

$$LoanSpread_{it} = \beta_1 TradedPost_{it} + Controls + FirmFE + MonthFE + \varepsilon_{it} \quad (3)$$

The dependent variable, *LoanSpread* , is loan spread based on the all-in-drawn spreads over LIBOR at issue date for loans issued to firm *i* in year *t*. Because loan spreads are highly skewed, following prior studies (e.g., Graham and Qiu, 2008; Chava et al., 2009), we measure *LoanSpread* as the natural logarithm of the actual loan spread. If CDS initiation is associated with an increase (decrease, no change) in the loan spread, then $\beta_1 > 0$ ($\beta_1 < 0$, $\beta_1 = 0$). Equation (3) includes the same set of control variables as those in equations (1) and (2), omitting *LoanSpread*.[21] In addition, we include in equation (3) an additional loan characteristic, the number of lenders, *Lender_num*.[22]

4. Data and Sample

We start by merging the quarterly CRSP-Compustat database with Dealscan to identify a sample of non-financial US firms that have private loan information and accounting and price

[21] We also estimate versions of equations (3) in which we replace *LoanSpread* with each of four non-price loan terms, *FacilityAmt*, *Maturity*, *NCOV*, and *Securdum*, to examine whether there is any trade-off between price and non-price terms. For example, after CDS initiation borrowers may be charged a higher loan spread—CDS initiation is costly, but may be able to get expanded access to bank lending capital—CDS initiation is beneficial. If this is the case, then the effect of CDS initiation on loan contract terms is ambiguous. However, following prior research, we can interpret the effect of CDS initiation on loan pricing more definitively if the inferences are consistent across the *LoanSpread* and four non-price loan term estimations. Untabulated findings indicate that there is no evidence of any such trade-off between spreads and these non-price terms after CDS initiation.

[22] To the extent that changes in ownership structure and loan spread are simultaneously determined, inclusion of *Lender_num* in equation (3) can mitigate the effects of potential simultaneity bias on the *TradedPost* coefficient. We include *Lender_num* rather than *LEAD_OWN* because *LEAD_OWN* is missing for a substantial number of observations in the loan spread equation. However, untabulated findings from estimations the include *LEAD_OWN* rather than *Lender_num* yield the same inferences regarding the *TradedPost* coefficient in equation (3). In addition, we also estimated equations (1) and (3) as a seemingly-unrelated-regression system. Untabulated findings also reveal the same inferences regarding the *TradedPost* coefficients as those based on tabulated findings.

information.[23] We conduct our loan contract analyses at the facility level, i.e., individual loan level, to take advantage of the heterogeneity within every loan package. This results in 28,580 loan facilities over the period 1993-2012. We use the following steps to identify CDS initiations for the firms in our sample. First, we identify all the firms in our merged sample that ever had a CDS traded on their debt according to Markit. Next, for every firm we identify the first date on which a five-year-to maturity, U.S.-dollar-denominated CDS contract is traded. We use this date as the date of the onset of CDS trading. We eliminate all firms that have a CDS initiation date in January 2001 because the Markit database begins its coverage then and thus the CDS initiation date for these firms is ambiguous. The resulting sample includes 757 CDS traded firms with 7,793 loans over the period 1993-2012.[24] This is the sample we use for estimation of equations (2) and (3).

To develop the sample for estimation of equation (1) we exclude observations for which shares retained by the lead arranger are unavailable and for which loans are originated by sole lenders. The resulting sample for the lead arranger's ownership analysis contains 576 CDS traded firms and 2,580 loans.

We obtain our control sample using all US private loans issued by non-CDS-traded firms with available data in Dealscan. This results in a full sample of 27,205 loans from 5,499 unique firms for the non-syndication and loan spread analyses, equations (2) and (3), and 7,458 syndicated loans from 2,487 firms for the lead arranger's ownership analysis, equation (1).

Table 1 presents mean and standard deviation statistics for the full sample, as well as separate statistics for loans before and after CDSs trading for CDS traded firms. The average

[23] Financial firms are those with two-digit SIC between 60 and 64, inclusive (Ivashina, 2009).
[24] To the extent that there are firms that drop out of the loan market following CDS initiation, our tests relating to the probability of non-syndication and loan spreads are biased in favor of the null. This is because their non-inclusion post-CDS initiation is evidence of non-syndication, and such firms likely faced higher loan spreads that caused them to drop out.

natural logarithm of loan spread is 5.069 with standard deviation of 0.819. The average share of the loan retained by the lead arranger is 25% with standard deviation of 18%. The average loan amount is 0.273 billion with standard deviation of 0.458. Debt maturity has a mean of 45.491 months. The average number of financial covenants is 1.717, and 56.3% of the loans are secured. 25.9% of the loans are made by a single lender. Revolvers comprise 69% of the sample. Although we do not test for differences in means for CDS firms and the full sample, the statistics in table 1 suggest that firms with CDS contracts are larger, more profitable, more highly levered, and have higher credit ratings.

Comparing loans before and after CDS trading for CDS traded firms provides some interesting observations, although we do not conduct any tests of differences in means. Although firms' credit ratings appear to improve slightly after CDS trading, on average they pay higher loan spreads. In addition, average loan size and average loan maturity increase, the number of financial covenants for a loan and the likelihood of collateral also decrease, and the incidence of single-lender loans seems to decrease.

5. Results

5.1 Syndicated Loan Market and CDS Initiation

Table 2, Column 1, reports the regression summary statistics associated with estimation of equation (1). The key finding is that the *TradedPost* coefficient, 0.028, is significantly positive (t-statistic = 2.62).[25] The magnitudes of the coefficients are also economically significant. In particular, the *TradedPost* coefficient implies that the onset of CDS trading leads to an incremental increase in the percentage of the loan retained by the lead arranger in excess of

[25] Throughout, when discussing a coefficient, we use the term significant to denote a five percent significance level under a two-sided alternative.

2.8%, which is nearly 20% of the sample mean for loan share retained by CDS traded firms, 17.3%, before CDS initiation.

Table 2, Column 2, reports regression summary statistics associated with estimation of equation (2). The key finding is that the coefficient on *TradedPost* is significantly positive (coefficient = 0.054; t-statistic = 4.55). This finding indicates that the probability of loan syndication decreases by 5.4% after the introduction of CDSs.

Taken together, the findings in Columns 1 and 2 of table 2 are consistent with CDS initiation increasing the loan share retained by the lead arranger and the probability of sole lending. As explained in the prior section, these increases after CDS initiation could reflect the positive effect of a more efficient alternative diversification mechanism for the lead arranger or because the negative effect of reducing the effectiveness of ownership in mitigating adverse selection/moral hazard problems. To identify which effect most likely accounts for such increases, we now turn to observing the effect of CDS initiation on loan spreads.

5.2 The Effect of CDS Trading on Loan Pricing

Table 2, Column 3, reports the regression summary statistics associated with estimation of equation (3). The key finding is that the *TradedPost* coefficient is significantly positive (coefficient = 0.137; t-statistic = 5.37). The magnitude of the coefficient is also economically significant, implying that the onset of CDS trading leads to an increase of approximately 14% of loan spreads. This implies that for a firm that faced a loan spread of 208bp before CDS initiation, the average loan spread for firms in our sample, its loan spread increased to approximately 237.1bp after CDS initiation. Finding an increase in loan spread following CDS initiation, together with the findings in Columns 1 and 2 showing an increase in loan share retained by the lead arranger and an increase in the likelihood of sole lending, indicates that there

is a significant increase in the adverse-selection/moral hazard effect.[26] Moreover, the findings suggest that CDS initiation results in an increase in adverse selection/moral hazard that more than offsets possible diversification benefits to the lead arranger. Thus, CDS initiation reduces the effectiveness of a lead arranger's stake in the loan to serve as a mechanism to address the adverse selection/moral hazard problem.

The majority of the control variables' coefficients are significant, with signs that are largely consistent with prior research. For example, firms with high return on assets, *ROA*, on average have a lower cost of debt.[27] The coefficient on the credit risk measure, *Rating,* is significantly positive, which is consistent with riskier firms paying higher loan spreads; larger firms (*Log_asset*) and firms with more tangible assets (*Tangible*) enjoying lower load spreads, and more highly leveraged firms (*Leverage*) paying higher spreads; the significantly negative coefficient on *Revolver* and significantly positive coefficient on *TermLoanB* indicate that revolver loans and term loans with credit ratings B or below face lower and higher rates (Harjoto et al., 2004; Zhang, 2008; Nandy and Shao, 2010; Lim et al., 2013).

Regarding the four non-price loan terms, the loan maturity (*Maturity*) and the number of covenants (*NCOV*) coefficients are insignificant. However, there is a significantly positive relation between the loan spread and collateral (*Securedum*) (Berger and Udell, 1990; Bradley

[26] Although Ashcraft and Santos (2009) does not examine the effect of CDS initiation on the share retained by the lead arranger or the probability of sole lending, viewed in isolation the study's finding of no effect of CDS trading on loan spreads for the average sample firm suggests that the adverse selection/moral hazard and diversification effects are, on average, offsetting. There are several sample and research design differences between Ashcraft and Santos (2009) and our study that likely account for different loan spread results. For example, relative to our, Ashcraft and Santos (2009) is limited to a smaller sample (approximately 1/10 our sample size) comprised of mostly larger borrowers that, other things equal, are relatively transparent and less likely to be affected by CDS initiation.

[27] In contrast, the *Profit* coefficient is positive, indicating that firms with higher profitability pay higher loan spreads. Note, however, that this result is incremental to the negative effect of *ROA*. Untabulated findings from estimations of equation (3) that omit *ROA* indicate that the *Profit* coefficient is significantly negative.

and Roberts, 2004), which perhaps reflects the endogenous determination of loan contractual terms.[28]

5.3 Additional Tests

5.3.1 Effect of borrower transparency

The findings in table 2 indicate that following CDS initiation there is a significant increase in the adverse-selection/moral hazard effect. However, if a borrower's risks and activities are readily transparent, then the adverse selection problem is less severe and monitoring by lead arrangers is less important to syndicate participants (Sufi, 2007; Ball et al., 2008).[29] As a result, if a borrower's activities are readily transparent, CDS initiation is less likely to have any effect on adverse-selection or moral hazard. Thus, the initiation of CDS trading is less likely to have an adverse impact on the loan syndication market and the syndicate structure for highly transparent firms. In the context of the syndicate analysis in Figure 3, other things equal, CDS initiation creates a less severe adverse selection/moral hazard problem for a transparent borrower than for an opaque borrower. As a result, there is a smaller shift to the right of the syndicate participants' demand curve, DSynd, for a transparent borrower. Thus, we predict that CDS initiation causes a higher increase in share retained by lead arranger, a higher propensity for sole lending, and a higher increase in loan spread for more opaque firms.

To test our prediction that greater borrower transparency leads to a smaller increase in shares retained by the lead arranger, a smaller increase in the probability that subsequent debt issuances are arranged through sole lending, and a smaller increase in loan spreads, we estimate

[28] Untabulated findings from estimations of equation (3) that exclude the four non-price loan terms yield the same inference regarding the association between *TradedPost* and loan spread, i.e., the *TradedPost* coefficient is significantly positive. These additional findings are consistent with simultaneous determination of loan terms not being the cause of the positive relation.

[29] In the context of the analysis in section 2, this implies that the DSynd curve for a borrower with higher transparency is to the left of the Dsynd curve for a borrower with lower transparency. Thus, other things equal, greater borrower transparency is expected to lead to a lower equilibrium loan spread and share retained by the lead arranger.

equations (1), (2), and (3) separately for firms above and below the sample median, by year, of our financial reporting transparency measure, *DCV*. *DCV* is the debt-contracting value of borrowers' accounting information developed in Ball, Bushman, and Vasvari (2008) and extended by Dou (2012). *DCV* is the Somers' D-statistic derived from the explanatory power of accounting variables (i.e., earnings, leverage, equity book value and interest coverage) in a model of firm credit ratings and ranges from zero—low transparency—to one—high transparency, and reflects the inherent ability of firms' accounting amounts to capture credit quality. If, as we predict, financial reporting transparency mitigates the adverse effect of CDS trading on loan syndication ownership structure and loan spread, then the *TradedPost* coefficient will be smaller for relatively high *DCV*.

We use *DCV*, a measure of financial statement transparency, rather than equity bid-ask spread or analysts' coverage (Ashcraft and Santos, 2009) as our measure of transparency for several reasons. First, whereas *DCV* relates specifically to the credit market, equity bid-ask spread and analysts' coverage relate primarily to the equity market. Second, *DCV* is particularly relevant to the credit markets at the time of loan initiation because accounting information is primary source of information lenders use when they initiate loans. In this regard, prior studies provide consistent evidence that accounting information plays an important role in the design of debt contracts (e.g., Ball et al., 2008; Graham et al., 2008; Armstrong et al., 2010; Amiram, 2013).

Table 3, panels A, B, and C, reports summary statistics associated with estimation of equations (1), (2), and (3) for the subsamples of high and low financial reporting transparency, *DCV*, i.e., firms for which *DCV* is above or below the sample median, by year. The key finding in table 3 is that the *TradedPost* coefficients are significantly higher for low

transparency firms for all three analyses, which is consistent with our prediction that transparency has a moderating influence on the adverse effect of CDS initiation on the loan syndication market.

Regarding share retained by the lead arranger, panel A reveals that the *TradedPost* coefficients for low and high *DCV* firms are 0.032 and −0.008, and the difference is significantly positive (χ^2-statistic = 8.27, p-value = 0.004).[30] This finding implies that CDS trading is associated with an increase in the percentage of the loan retained by the lead arranger that is 4% smaller (= 0.032 – (–0.008)) for high *DCV* firms relative low *DCV* firms.

Regarding the probability of non-syndication, panel B reveals that the *TradedPost* coefficients for low and high *DCV* firms are 0.070 and 0.024, and the difference is significantly positive (χ^2-statistic = 8.35, p-value = 0.004). This finding implies that CDS trading is associated with an increase in the probability of sole lending that is concentrated among the least transparent firms: the increase in the probability of sole lending is 4.6% (= 0.070 – 0.024) smaller for high *DCV* firms relative low *DCV* firms.

Finally, regarding loan spread, panel C reveals that the *TradedPost* coefficients for low and high *DCV* firms are 0.153 and 0.074, and the difference is significantly positive (χ^2-statistic = 7.23, p-value = 0.007). This finding implies that CDS trading is associated with an increase in loan spread that is 7.9% (= 0.153 – 0.074) smaller for high *DCV* firms relative to low *DCV* firms, which is consistent with the finding in Ashcraft and Santos (2009) that opaque firms pay a higher loan spread following CDS initiation.

[30] Because we have a signed prediction for the difference in *TradedPost* coefficients between low and high transparency firms, we use a five percent significance level under a one-sided alternative. For ease of exposition, the reported p-values in table 3 assume a two-sided alternative.

We also estimated versions of equations (1), (2), and (3) that use stock price bid-ask spread, *BA_spread*, and analysts' coverage, measures of transparency used in Ashcraft and Santos (2009), in place of DCV. Untabulated findings indicate that these measures of transparency are less effective than DCV in distinguishing whether transparency has a moderating influence on the adverse effect of CDS initiation on the loan syndication market.[31]

5.3.2 The role of lead bank reputation

Another factor that possibly mitigates the adverse selection/moral hazard problem at the level of the lead arranger is the reputational costs of the lead arranger. The syndicated loan market is one of repeated interactions, and most reputable lead arrangers may be able to overcome moral hazard concerns. Sufi (2007), among other studies, finds that lead arranger reputation can serve as an effective mechanism in reducing moral hazard, even though reputation does not eliminate moral hazard. Thus, because we expect lead arranger banks with higher reputation are less likely to reduce their monitoring effort and to push borrowers into bankruptcy, we predict that the negative effect of CDS initiation on loan syndication and loan pricing is more pronounced for lead arrangers with a less established reputation in the syndicated loan marketplace. To see this in the context of the syndicate analysis in Figure 3, if a high reputation lead arranger has a greater incentive to monitor a borrower than a lead arranger with a low reputation, then CDS initiation will result in a smaller shift to the right of the syndicate participants' demand curve, DSynd.

To test this prediction, we estimate versions of equations (1), (2), and (3) separately for observations with lead arrangers that have relatively high reputations. Following Sufi (2007), we measure lead arranger reputation, *MKT_PCT*, as the percentage market share of syndicated loan

[31] See footnote 26 for a discussion of sample differences between our study and Ashcraft and Santos (2009) that could account differences in findings relating to bid-ask spread and analysts' dispersion and loan spread.

amount initiated by the lead arranger in the prior calendar year.[32] We classify observations into high and low reputation subsamples as follows. For each year, we first sort loans by the *MKT_PCT* for the loan's lead arranger. We then classify those loans in the top quintile of *MKT_PCT* as the high reputation sample for each given year. Table 4, panels A, B, and C, reports the regression summary statistics relating to the three sets of estimations.

Regarding share retained by the lead arranger, panel A reveals that the *TradedPost* coefficients for the low and high reputation subsamples are 0.034 and 0.001, and the difference is significantly positive (χ^2-statistic = 6.51, p-value = 0.011).[33] This finding implies that CDS trading is associated with an increase in the percentage of the loan retained by the lead arranger that is 3.3% smaller when a lead arranger has a high reputation.

Regarding the probability of non-syndication, panel B reveals that the *TradedPost* coefficients for low and high reputation subsamples are 0.062 and 0.037, and the difference is significantly positive (χ^2-statistic = 2.81, p-value = 0.093). This finding implies that CDS trading is associated with an increase in the probability of sole lending that is concentrated among the low reputation lead arrangers: the increase in the probability of sole lending is 2.5% smaller when the lead arranger has a high reputation.

Finally, regarding loan spread, panel C reveals that the *TradedPost* coefficients for low and high low and high reputation subsamples are 0.148 and 0.061, and the difference is significantly positive (χ^2-statistic = 9.17, p-value = 0.003). This finding implies that CDS

[32] We obtain *MKT_PCT* from the historical league tables in SDC Platinum. JP Morgan, Bank of American Merrill Lynch, and Citigroup are the largest banks in the syndicated loan market in terms of lending volume during our sample period. These three banks together control approximately 50% of the market share in the global syndicated loan market.

[33] Because we have a signed prediction for the difference in *TradedPost* coefficients between firms in the low and high reputation subsamples, we use a five percent significance level under a one-sided alternative. For ease of exposition, the reported p-values in table 4 assume a two-sided alternative.

trading is associated with an increase in loan spread that is 8.7% smaller when the lead arranger has a high reputation.

5.3.3 Propensity score matching and Heckman two-stage estimation

A key assumption of the regression approach represented by equations (1) through (3) and similarly employed in prior literature (Ashcraft and Santos, 2009; Subarhmanyam et al., 2014) is that the timing of CDS introduction is exogenous. However, it is possible that the initiation of CDS trading for a reference entity is the result of an increase in its credit risk. Hence, changes in syndicate ownership structure and loan terms could be the result of change in credit risk and not CDS initiation. If this is the case, then the estimated parameters in equations (1) through (3) are subject to endogeneity bias.[34]

We use two approaches to address potential endogeneity bias when assessing the effect of CDS initiation on loan pricing, propensity score matching and the Heckman two-stage approach. Because each of these approaches relies on different assumptions, finding a consistent result across the different approaches provides support for inferences that we draw. We implement propensity score matching following Ashcraft and Santo (2009) and Subrahmanyam et al. (2014). In particular, we match each CDS traded firm-quarter beginning in 2001 until the first quarter when CDS trading is introduced with a firm-quarter for a non-CDS traded firm. We do this by first estimating a Probit model with *TradedPost* as the dependent variable and the firm-specific variables as independent variables, and then using the estimated model parameters to

[34] Identifying whether an increase in loan spread is the result of CDS initiation or an increase in credit risk of the reference entity potentially is more problematic than identifying whether a change in the lead arranger's ownership stake is the result CDS initiation or an increase in credit risk. This is because, if an increase in credit risk affects the lead arranger's pricing schedule as suggested in section 2.3.3, the direct effect of an increase in credit risk is a decrease in the lead arranger's share. Thus, even if an increase in credit risk causes CDS initiation, observing an increase in the lead arranger's ownership implies that CDS initiation is the underlying cause of the increase in the lead arranger's ownership. However, if there is a decrease in the lead arranger's ownership following CDS initiation, it is difficult to identify whether CDS initiation or an increase in credit risk is the underlying cause.

calculate propensity scores for each firm. We match each CDS firm to the non-CDS trading firm whose propensity score is closest, doing so without replacement.

The Heckman two-stage correction model treats the selection bias as an omitted variable bias. In the first step, we estimate a selection model similar to that used in Ashcraft and Santos (2009) and Subrahmanyam et al. (2014):

$$\Pr(TradedPost_{it}) = F(Z_{it} + e_{it}), \tag{4}$$

where Z is a set of explanatory variables that are assumed to determine the likelihood of CDS trading. These include stock return volatility, firm size, leverage, profitability, credit ratings, whether the firm has rated debt as of last loan before CDS initiation, proportion of tangible assets, loss given default, probability of default, *ROA* and stock market excess return. In the second step, we estimate equations (1), (2), and (3) but including the Inverse Mills ratio obtained from the first step as an additional explanatory variable.

Untabulated findings indicate that the effect of CDS initiation on the lead arranger's ownership and the probability of non-syndication is robust to controlling for endogeneity by using the propensity score matching and the two-stage Heckman correction for the selection of firms with CDS traded. In particular, the *TradedPost* coefficient is significantly positive for both the lead arranger retention and probability of non-syndication estimations.

Untabulated findings also indicate that the effect of CDS initiation on loan pricing is robust to the propensity score matching and the two-stage Heckman-correction. In particular, the coefficients on *TradedPost* based on the propensity score matched sample and in the Heckman second-stage regression are positive and significant. Taken together, these findings provide additional support that the inferences we draw from the table 2 findings—that CDS initiation has

adverse effects on the syndicated loan market and loan pricing—are not the result of the selection bias associated with the onset of CDS trading for a firm.

6. Summary and Concluding Remarks

CDS market initiation can create externalities in the syndicated loan market that can increase or decrease lead arranger's ownership of a syndicated loan. We find that, on average, lead arrangers' ownership in syndicated loans increases after CDS initiation. We find evidence that this increase occurs because any potential diversification benefit lead arrangers enjoy following CDS initiation is more than offset by CDS markets limiting the ability of lead arrangers' ownership to mitigate the adverse selection/moral hazard problems in loan syndication. We conduct our analyses using a sample of 27,205 loan contracts from Dealscan over the period 1993-2012, and test our predictions using a difference-in-difference research design.

We corroborate the interpretation of these results by predicting and finding evidence that the negative externality we document is moderated for firms with greater transparency and for loans originated by a lead arranger with a strong reputation in the syndicated loan market. In addition, inferences from our tests of the effects of CDS initiation are robust to using propensity score matching and the Heckman two-stage correction for self-selection bias.

APPENDIX: Variable Definition

Variables	Description
Loan characteristics	
Log_spread	The natural logarithm of loan spread, which equals the spread between the interest rate on the loan and the relevant Libor rate, per dollar of loan, measured in basis points.
FacilityAmt	The loan dollar amount in billions.
Maturity	The term of the loan in months.
NCOV	The number of financial and net worth covenants reported on Dealscan. If no data are available we assume the number of covenants in the contracts is zero.
Securedum	An indicator variable equal to one if the debt is collateralized and zero otherwise, if missing collateral data, we treat it as 0.
Nonsyndication	An indicator variable that equals one if a loan is not syndicated, and zero otherwise. A loan is not syndicated if there is only one lender on the loan.
LEAD_OWN	The fraction of the loan owned by the lead arranger.
TermLoanB	An indicator variable that equals one if the loan is term loan B, C D, and zero otherwise.
Revolver	An indicator variable that equals one if the loan is a revolver, and zero otherwise.
Guarantor	An indicator variable that equals one when borrower has a guarantor, and zero otherwise.
Lender_num	The number of lenders on a loan.
MKT_PCT	The percentage market share of syndicated loan amount initiated by the lead arranger in the prior calendar year.
Firm characteristics and others	
TradedPost	A compound indicator variable that equals one if a loan is issued after the month of CDS initiation (Post = 1) for a firm that ever has a CDS market for its debt at any time during the sample period (Traded = 1), and zero otherwise.
ROA	Return on assets. It is defined as operating income after depreciation divided by beginning of period total assets.
Profit	Operating income after depreciation divided by beginning of period total assets.
Leverage	Total debt (short-term debt plus long-term debt) divided by total assets.

(Continued)

APPENDIX - *continued*

Variables	Description
Tangible	Property, plant and equipment (PPE) divided by total assets.
Log_asset	The natural logarithm of a firm's total asset.
MKT_RF	The market value-weighted excess return from Ken French website.
DCV	A credit market based earnings quality measure computed as the Somers' D association statistic obtained from industry-specific probit regressions that predict credit ratings; industries are based on Fama and French(1997) industry groupings. Specifically, for any given year t, we estimate an ordered probit model using quarterly data in the past five years for each industry grouping: $$P(Rating_{q,i} \le N) = \Phi(\sum_{n=1}^{N} \mu_n + \sum_{k=1}^{4} \alpha_k E_{q-k,i} + \sum_{k=1}^{4} \beta_k COV_{q-k,i} + \sum_{k=1}^{4} \delta_k LEV_{q-k,i} + \sum_{k=1}^{4} \gamma_k NW_{q-k,i}),$$ where *Rating* is constructed by assigning 1 to firms with the highest S&P credit rating AAA in quarter q, 2 to AA+ and so on. *E* is EBITDA in quarter q-k divided by total assets at the beginning of the quarter. *COV* is interest coverage in quarter q-k (EBITDA divided by total interest expense). *LEV* is the long-term debt in quarter q-k divided by total assets. *NW* is common equity in quarter q-k divided by total assets. Each regression requires at least 100 firm-quarter observations. *DCV* is measured as Somers's D, a goodness-of-fit statistic.
Rating	A numeric rank of S&P credit ratings. We assign 1 to AAA, 2 to AA+, 3 to AA and etc. For firms without credit ratings, we follow the approach in Beaver et al. (1998) to use accounting measures to generate credit ratings.

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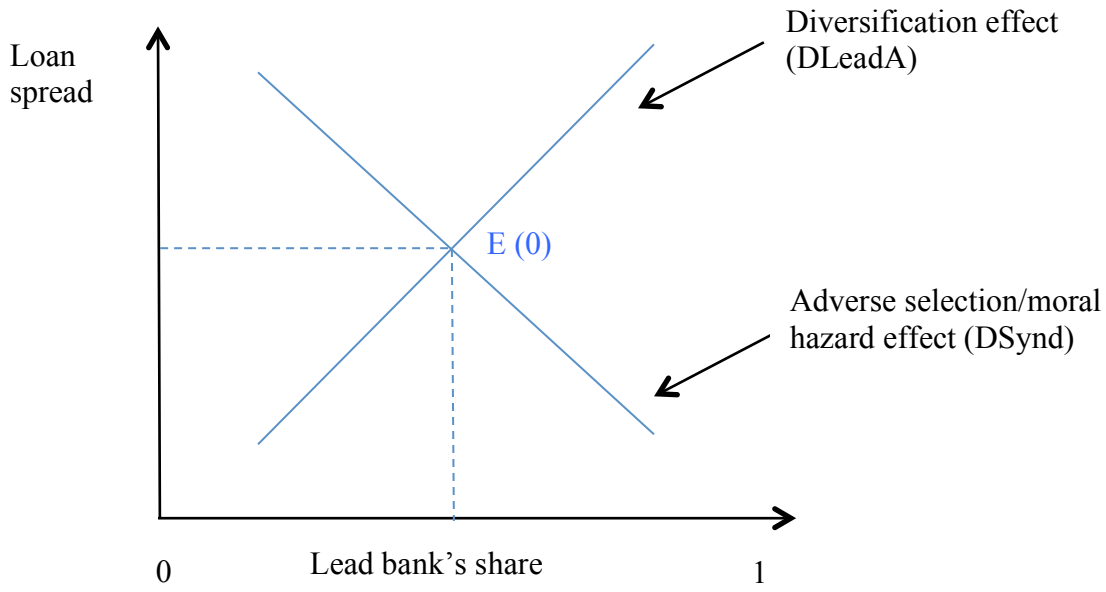

Figure 1. Equilibrium outcome of two demand curves within a loan syndicate

The share retained by the lead arranger and loan spread are simultaneously determined as the result of interaction between the syndicate participants' demand curve (adverse selection/moral hazard effect) and the lead arranger's demand curve (diversification effect). E(0) is the equilibrium outcome of the two effects.

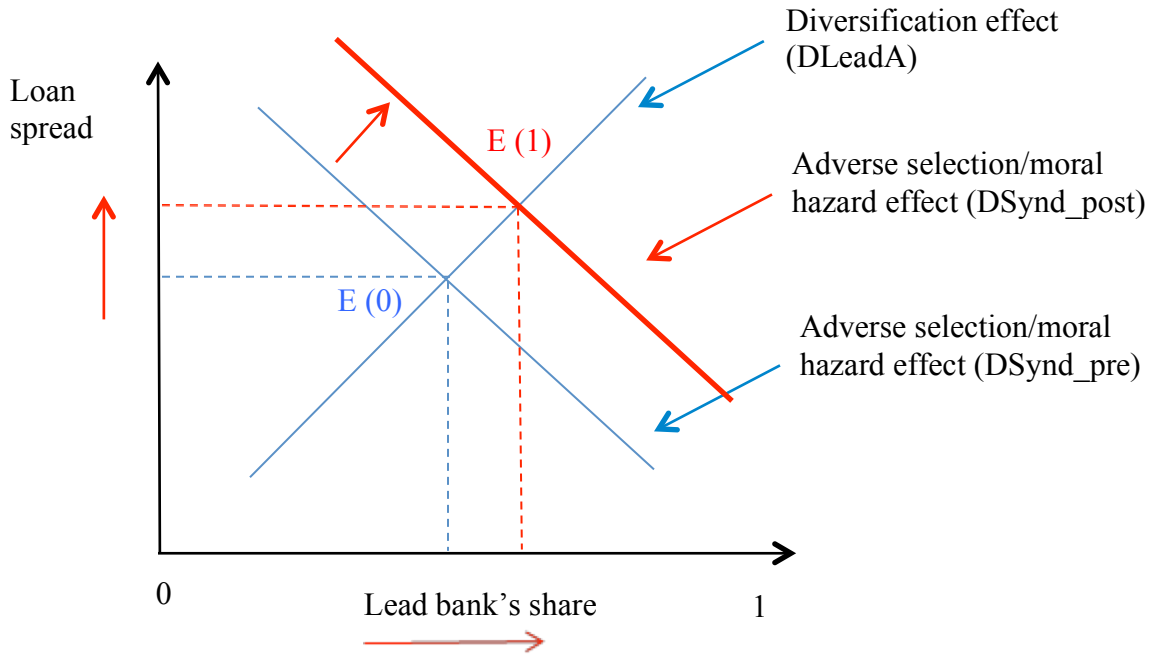

Figure 2. CDS initiation and the adverse selection/moral hazard effect

The share retained by the lead arranger and loan spread are simultaneously determined as the result of interaction between the syndicate participants' demand curve (adverse selection/moral hazard effect) and the lead arranger's demand curve (diversification effect). E(0) is the equilibrium outcome of the two effects before CDS initiation. After CDS initiation, if DSynd_pre shifts to the right as indicated by the red line (DSynd_post), then the new equilibrium outcome is E(1).

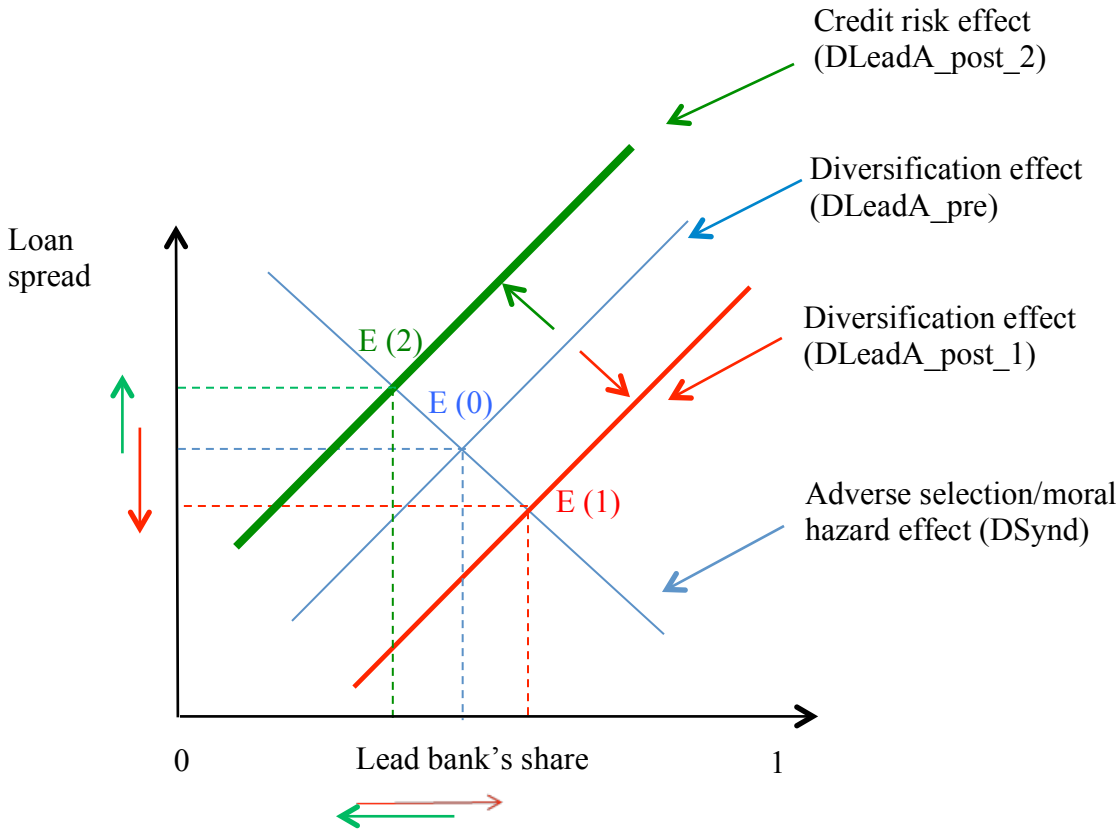

Figure 3. CDS initiation and the diversification effect vs. the credit risk effect

The share retained by the lead arranger and loan spread are simultaneously determined as the result of interaction between the syndicate participants' demand curve (adverse selection/moral hazard effect) and the lead arranger's demand curve (diversification effect). E(0) is the equilibrium outcome of the two effects before CDS initiation. After CDS initiation, if DLeadA_pre shifts to DLeadA_post_1 as indicated by the red line, then the new equilibrium outcome is E(1). If DLeadA_pre shifts to DLeadA_post_2 as indicated by the green line, then the new equilibrium outcome is E(2).

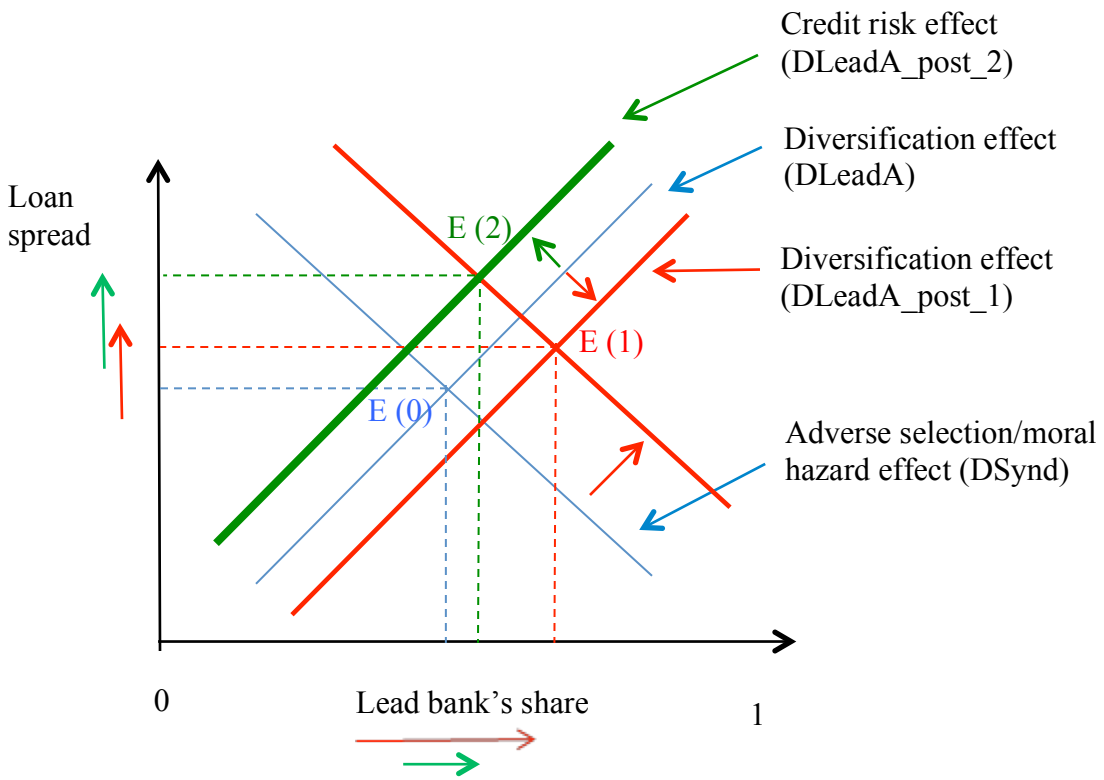

Figure 4. CDS initiation and a dominant adverse selection/moral hazard effect

The share retained by the lead arranger and loan spread are simultaneously determined as the result of interaction between the syndicate participants' demand curve (adverse selection/moral hazard effect) and the lead arranger's demand curve (diversification effect). E(0) is the equilibrium outcome of the two effects before CDS initiation. After CDS initiation, there is a substantial shift in the adverse selection/moral hazard curve to the right. If DLeadA shifts to DLeadA_post_1 after CDS initiation as indicated by the red line, then the new equilibrium outcome is E(1). If DLeadA shifts to DLeadA_post_2 after CDS initiation as indicated by the green line, then the new equilibrium outcome is E(2).

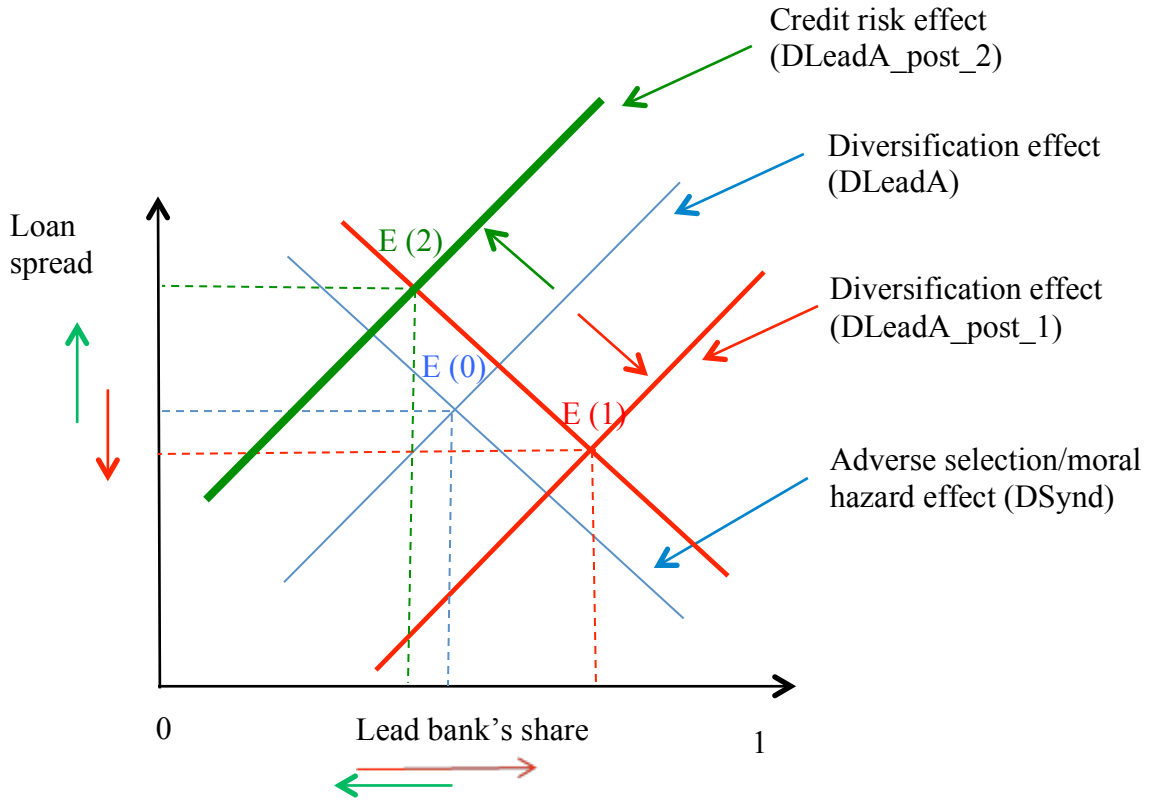

Figure 5. CDS initiation and a moderate adverse selection/moral hazard effect

The share retained by the lead arranger and loan spread are simultaneously determined as the result of interaction between the syndicate participants' demand curve (adverse selection/moral hazard effect) and the lead arranger's demand curve (diversification effect). E(0) is the equilibrium outcome of the two effects before CDS initiation. After CDS initiation, there is a moderate shift in the adverse selection/moral hazard curve to the right. If DLeadA shifts to DLeadA_post_1 after CDS initiation as indicated by the red line, then the new equilibrium outcome is E(1). If DLeadA shifts to DLeadA_post_2 after CDS initiation as indicated by the green line, then the new equilibrium outcome is E(2).

Table 1 -Summary Statistics

This table presents sample mean and standard deviation statistics. Variables are defined in the Appendix.

	All loans (N=27,205)		Loans before CDS initiation for CDS traded firms (N=4,606)		Loans after CDS initiation for CDS traded firms (N=3,187)	
Variable	Mean	Std Dev	Mean	Std Dev	Mean	Std Dev
ROA	0.017	0.037	0.024	0.023	0.023	0.021
Profit	-0.035	0.439	0.009	0.285	0.037	0.259
Tangible	0.336	0.251	0.394	0.248	0.385	0.243
Leverage	0.348	0.241	0.402	0.232	0.366	0.207
Log_asset	6.558	1.944	7.939	1.295	8.993	1.082
Rating	11.903	3.433	10.440	3.828	10.046	3.626
DCV	0.526	0.126	0.538	0.127	0.486	0.133
Log_spread	5.069	0.819	4.576	0.926	4.700	0.946
LEAD_OWN	0.250	0.181	0.173	0.130	0.141	0.110
FacilityAmt	0.273	0.458	0.437	0.508	0.791	0.783
Maturity	45.491	24.098	45.581	27.233	47.277	22.876
NCOV	1.717	1.621	1.468	1.582	1.116	1.193
Securedum	0.563	0.496	0.366	0.482	0.308	0.462
Lender_num	7.274	7.669	11.396	9.287	12.073	8.023
Nonsyndication	0.259	0.438	0.082	0.274	0.030	0.170
Revolver	0.690	0.462	0.724	0.447	0.724	0.447
TermLoanB	0.082	0.274	0.095	0.293	0.103	0.304
Guarantor	0.080	0.272	0.051	0.221	0.133	0.339
MKT_RF	0.644	4.359	0.593	4.594	0.494	4.217
MKT_PCT	10.266	10.689	14.751	11.984	11.677	6.985

Table 2
Effect of CDS trading on loan syndicate structure and loan spread: OLS model

	(1)	(2)	(3)
Variable	*LEAD_OWN*	*Nonsyndication*	*Log_spread*
TradedPost	0.028***	0.054***	0.137***
	(2.62)	(4.55)	(5.37)
ROA	-0.504***	-0.113	-1.625***
	(-2.96)	(-0.76)	(-7.85)
Profit	-0.022	-0.006	0.034*
	(-1.11)	(-0.57)	(1.91)
Tangible	-0.060	-0.053	-0.217***
	(-1.31)	(-1.16)	(-3.06)
Leverage	-0.067**	-0.121***	0.419***
	(-2.50)	(-4.71)	(11.44)
Log_asset	-0.054***	-0.078***	-0.114***
	(-6.89)	(-10.01)	(-10.61)
Rating	0.000	0.000	0.030***
	(0.04)	(0.00)	(9.56)
MKT_RF	0.136	-1.405***	4.578***
	(0.61)	(-2.86)	(5.73)
FacilityAmt	-0.011	-0.016***	-0.064***
	(-1.41)	(-2.59)	(-3.76)
Maturity	-0.001***	-0.002***	-0.001***
	(-6.07)	(-9.65)	(-3.09)
NCOV	-0.014***	-0.023***	-0.002
	(-4.60)	(-8.36)	(-0.40)
Log_spread	0.019**	0.028***	-
	(2.57)	(3.83)	
Securedum	-0.009	0.021**	0.218***
	(-1.03)	(2.31)	(15.35)
Revolver	-0.023***	-0.040***	-0.175***
	(-4.21)	(-7.15)	(-20.03)
TermLoanB	0.115***	0.006	0.145***
	(5.41)	(0.69)	(10.95)
Guarantor	0.022**	0.016	0.005
	(2.29)	(1.47)	(0.27)
Lender_num	-	-	-0.003***
			(-4.28)
Firm & Month & Purpose FE	YES	YES	YES
Observations	7,458	27,205	27,205
Adjusted R-squared	0.660	0.619	0.769

t-statistics in parentheses are based on standard errors clustered by firm. *, **, and *** indicate significance at the 10%, 5%, and 1% level. Variables are defined in the Appendix.

Table 3

Panel A: The effect of CDS trading on the share of the loan retained by the lead arranger, conditional on the borrower's financial reporting transparency

	Dependent Variable: *LEAD_OWN*	
	(1)	(2)
Variables	High Transparency	Low Transparency
TradedPost	-0.008	0.032**
	(-0.41)	(2.09)
ROA	-0.523	-0.513**
	(-1.50)	(-2.01)
Profit	-0.003	-0.015
	(-0.07)	(-0.47)
Tangible	-0.118	-0.059
	(-1.17)	(-0.93)
Leverage	-0.078*	-0.069
	(-1.84)	(-1.53)
Log_asset	-0.060***	-0.054***
	(-4.22)	(-4.76)
Rating	-0.001	0.001
	(-0.18)	(0.42)
MKT_RF	-0.002	0.021
	(-0.22)	(0.83)
FacilityAmt	-0.000	-0.013
	(-0.01)	(-1.34)
Maturity	-0.001***	-0.001***
	(-4.52)	(-4.30)
NCOV	-0.016***	-0.016***
	(-2.60)	(-3.66)
Log_spread	0.006	0.031***
	(0.49)	(2.99)
Securedum	-0.008	-0.009
	(-0.51)	(-0.69)
Revolver	-0.015**	-0.028***
	(-2.11)	(-3.56)
TermLoanB	0.120***	0.128***
	(4.05)	(3.96)
Guarantor	0.032**	0.007
	(2.07)	(0.55)
Firm & Month & Purpose FE	YES	YES
Observations	3,400	4,058
Adjusted R-squared	0.682	0.689
Test for subsample differences:		
TradedPost	χ^2 =8.27***	p-value=0.004

t-statistics in parentheses are based on standard errors clustered by firm. *, **, and *** indicate significance at the 10%, 5%, and 1% level. Variables are defined in the Appendix.

Table 3 (Continued)
Panel B: The effect of CDS trading on the probability of a loan being not syndicated, conditional on the borrower's financial reporting transparency

	Dependent Variable: *Nonsyndication*	
	(1)	(2)
Variables	High Transparency	Low Transparency
TradedPost	0.024	0.070***
	(1.18)	(4.28)
ROA	-0.056	-0.304
	(-0.22)	(-1.37)
Profit	-0.012	0.011
	(-0.67)	(0.58)
Tangible	-0.129*	-0.018
	(-1.65)	(-0.27)
Leverage	-0.095**	-0.130***
	(-2.55)	(-3.09)
Log_asset	-0.072***	-0.084***
	(-5.38)	(-7.74)
Rating	-0.001	0.001
	(-0.45)	(0.33)
MKT_RF	-0.004	0.004
	(-0.55)	(0.61)
FacilityAmt	-0.006	-0.027***
	(-0.59)	(-3.11)
Maturity	-0.001***	-0.002***
	(-5.58)	(-7.51)
NCOV	-0.024***	-0.021***
	(-5.63)	(-4.82)
Log_spread	0.032***	0.027**
	(2.85)	(2.50)
Securedum	0.028*	0.002
	(1.88)	(0.19)
Revolver	-0.034***	-0.043***
	(-4.57)	(-5.27)
TermLoanB	0.009	0.004
	(0.87)	(0.27)
Guarantor	0.002	0.029*
	(0.11)	(1.80)
Firm & Month & Purpose FE	YES	YES
Observations	12,709	14,496
Adjusted R-squared	0.672	0.620
Test for subsample differences:		
TradedPost	χ^2 =8.35***	p-value=0.004

t-statistics in parentheses are based on standard errors clustered by firm. *, **, and *** indicate significance at the 10%, 5%, and 1% level. Variables are defined in the Appendix.

Table 3 (Continued)
Panel C: The effect of CDS trading on loan spread, conditional on the borrower's financial reporting transparency

	Dependent Variable: *Log_spread*	
	(1)	(2)
Variables	High Transparency	Low Transparency
TradedPost	0.074*	0.153***
	(1.78)	(4.15)
ROA	-2.009***	-1.460***
	(-5.51)	(-4.71)
Profit	0.018	0.058*
	(0.61)	(1.92)
Tangible	-0.090	-0.393***
	(-0.73)	(-4.05)
Leverage	0.323***	0.497***
	(6.35)	(8.40)
Log_asset	-0.116***	-0.114***
	(-7.08)	(-6.89)
Rating	0.029***	0.031***
	(6.53)	(6.78)
MKT_RF	4.152***	-0.912
	(3.21)	(-1.61)
FacilityAmt	-0.069***	-0.069***
	(-2.85)	(-3.12)
Maturity	-0.000	-0.001***
	(-0.40)	(-3.51)
NCOV	-0.005	0.005
	(-0.89)	(0.80)
Lender_num	-0.005***	-0.002**
	(-3.99)	(-2.14)
Securedum	0.189***	0.215***
	(8.11)	(10.37)
Revolver	-0.159***	-0.170***
	(-12.83)	(-13.81)
TermLoanB	0.124***	0.154***
	(6.98)	(7.27)
Guarantor	0.030	-0.019
	(1.02)	(-0.82)
Firm & Month & Purpose FE	YES	YES
Observations	12,709	14,496
Adjusted R-squared	0.800	0.765
Test for subsample differences:		
TradedPost	χ^2 =7.23***	p-value=0.007

t-statistics in parentheses are based on standard errors clustered by firm. *, **, and *** indicate significance at the 10%, 5%, and 1% level. Variables are defined in the Appendix.

Table 4

Panel A: The effect of CDS trading on the share of the loan retained by the lead arranger, conditional on the lead arranger's reputation

	Dependent Variable: *LEAD_OWN*	
	(1)	(2)
Variables	High Reputation	Low Reputation
TradedPost	0.001	0.034*
	(0.05)	(1.91)
ROA	-0.646*	-0.362
	(-1.89)	(-1.54)
Profit	-0.011	-0.036
	(-0.27)	(-1.38)
Tangible	-0.027	-0.100
	(-0.42)	(-1.48)
Leverage	-0.095**	-0.077**
	(-2.19)	(-2.11)
Log_asset	-0.045***	-0.059***
	(-3.79)	(-5.48)
Rating	-0.002	0.001
	(-0.52)	(0.23)
MKT_RF	-0.355*	-0.045
	(-1.66)	(-0.95)
FacilityAmt	-0.004	-0.017
	(-0.44)	(-1.16)
Maturity	-0.000**	-0.001***
	(-2.29)	(-4.87)
NCOV	-0.004	-0.014***
	(-0.83)	(-3.60)
Log_spread	0.024**	0.018*
	(2.19)	(1.66)
Securedum	-0.007	-0.013
	(-0.55)	(-1.18)
Revolver	-0.031***	-0.017***
	(-3.39)	(-2.59)
TermLoanB	0.165***	0.094***
	(4.39)	(3.49)
Guarantor	0.014	0.012
	(1.14)	(0.88)
Firm & Month & Purpose FE	YES	YES
Observations	2,466	4,992
Adjusted R-squared	0.687	0.662
Test for subsample differences:		
TradedPost	χ^2 =6.51**	p-value=0.011

t-statistics in parentheses are based on standard errors clustered by firm. *, **, and *** indicate significance at the 10%, 5%, and 1% level. Variables are defined in the Appendix.

Table 4 (Continued)
Panel B: The effect of CDS trading on the probability of a loan being not syndicated, conditional on the lead arranger's reputation

	Dependent Variable: *Nonsyndication*	
	(1)	(2)
Variables	High Reputation	Low Reputation
TradedPost	0.037**	0.062***
	(2.29)	(3.43)
ROA	0.397	-0.205
	(1.34)	(-1.16)
Profit	0.015	-0.007
	(0.75)	(-0.55)
Tangible	-0.104*	-0.042
	(-1.75)	(-0.68)
Leverage	-0.083*	-0.112***
	(-1.87)	(-3.28)
Log_asset	-0.035***	-0.089***
	(-2.70)	(-8.53)
Rating	-0.000	-0.000
	(-0.05)	(-0.21)
MKT_RF	0.815	-0.108
	(1.43)	(-0.17)
FacilityAmt	0.001	-0.043***
	(0.16)	(-4.14)
Maturity	-0.001***	-0.002***
	(-4.69)	(-7.82)
NCOV	-0.015***	-0.023***
	(-3.27)	(-6.61)
Log_spread	0.031***	0.020**
	(2.77)	(2.01)
Securedum	-0.002	0.016
	(-0.13)	(1.36)
Revolver	-0.017**	-0.045***
	(-2.21)	(-6.53)
TermLoanB	0.015	0.001
	(1.55)	(0.09)
Guarantor	0.008	0.007
	(0.70)	(0.47)
Firm & Month & Purpose FE	YES	YES
Observations	6,974	20,231
Adjusted R-squared	0.627	0.617
Test for subsample differences:		
TradedPost	χ^2 =2.81*	p-value=0.093

t-statistics in parentheses are based on standard errors clustered by firm. *, **, and *** indicate significance at the 10%, 5%, and 1% level. Variables are defined in the Appendix.

Table 4 (Continued)
Panel C: The effect of CDS trading on loan spread, conditional on the lead arranger's reputation

	Dependent Variable: *Log_spread*	
	(1)	(2)
Variables	High Reputation	Low Reputation
TradedPost	0.061	0.148***
	(1.50)	(4.29)
ROA	-2.209***	-1.501***
	(-3.46)	(-6.64)
Profit	0.130***	0.032
	(2.83)	(1.56)
Tangible	-0.216	-0.210***
	(-1.24)	(-2.61)
Leverage	0.456***	0.435***
	(4.89)	(9.83)
Log_asset	-0.063**	-0.106***
	(-2.49)	(-8.46)
Rating	0.045***	0.023***
	(6.41)	(6.45)
MKT_RF	-2.421**	4.289***
	(-1.97)	(4.92)
FacilityAmt	-0.012	-0.115***
	(-0.55)	(-5.39)
Maturity	0.000	-0.001***
	(0.12)	(-4.10)
NCOV	0.012	-0.002
	(1.36)	(-0.37)
Lender_num	-0.003**	-0.004***
	(-2.23)	(-3.12)
Securedum	0.203***	0.206***
	(7.57)	(12.10)
Revolver	-0.139***	-0.172***
	(-8.05)	(-18.17)
TermLoanB	0.100***	0.145***
	(4.25)	(9.38)
Guarantor	0.001	0.010
	(0.04)	(0.55)
Firm & Month & Purpose FE	YES	YES
Observations	6,974	20,231
Adjusted R-squared	0.834	0.757
Test for subsample differences:		
TradedPost	χ^2 =9.17***	p-value=0.003

t-statistics in parentheses are based on standard errors clustered by firm. *, **, and *** indicate significance at the 10%, 5%, and 1% level,. Variables are defined in the Appendix.