Asymmetric Information Effects on Loan Spreads

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This paper estimates the cost arising from information asymmetry between the lead bank and members of the lending syndicate. In a lending syndicate, the lead bank retains only a fraction of the loan, but it acts as the intermediary between the borrower and the syndicate participants. Theory predicts that private information, in the hands of the lead bank, will cause syndicate participants to demand a premium and that a large loan ownership by the lead bank should reduce asymmetric information and the related premium. Nevertheless, the estimated OLS relation between the loan spread and the lead bank's share is positive. This result, however, ignores that we only observe equilibrium outcomes and that, in equilibrium, the asymmetric information premium demanded by participants is offset by the diversification premium demanded by the lead bank. Using exogenous shifts in credit risk of the lead bank loan portfolio as an instrument, I measure the asymmetric information effect of the lead's share on the loan spread.

1. Introduction

Theory suggests that ownership should be an important mechanism for mitigating the effects of asymmetric information. According to the Leland and Pyle (1977) model, an increase in the ownership of the informed party would signal a higher quality of the underlying project thereby reducing the cost of asymmetric information. However, there is little, if any, direct evidence supporting this prediction. The effect of the ownership on the asymmetric information is difficult to show, because ownership is endogenous. The syndicated loan market offers a special case of asymmetric information between the lead bank and participants in the lending syndicate. Consistent with theoretical predictions, the lead bank's ownership of the loan should reduce asymmetric information between the lead and participants, which should reduce the overall loan spread. The advantage of looking at the syndicated loan market is that the lead bank's loan portfolio is observable. This enables me to identify shifts in the lead's ownership that are driven by the lead bank's loan portfolio diversification and that are exogenous to the asymmetric information in the lending syndicate. Using the diversification shifts as an instrument, I am able to isolate the asymmetric information effect of the lead's loan ownership on the spread.

Syndicated loan market is a very important form of corporate financing. In the United States alone, syndicated loan issuance grew from approximately $150 billion in 1987 to $1.7 trillion in 2006. In contrast to a traditional bank loan, which involves a relationship between a borrower and a single lender, a syndicated loan is originated by a "lead bank" which sells pieces of the loan to other (participant) banks. Although it retains only part of the loan, the lead bank acts as the manager for the loan with primary responsibility for ex-ante due diligence on, and ex-post monitoring of the borrower. Participant banks consequently depend

on the information collected by the lead bank. However, there is an adverse selection problem because the lead bank has incentives to syndicate bad or risky loans.[1] In addition, there is a moral hazard problem because after the lead bank sells parts of the loan to syndicate participants its incentive to continue monitoring is reduced. Thus, whereas in a traditional bank loan spread is determined by borrower characteristics, in a syndication loan the private content of the information collected by the lead bank induces an additional premium, driven by the degree of information asymmetry between the lead and participant banks.

An increase in the lead bank share of the loan would reduce asymmetric information between the lead and participants and, therefore, *decreasing* the premium demanded by the participant banks. This prediction is the same for the adverse selection and moral hazard effects. However, an increase in the lead bank share of the loan would also increase the lead's credit risk exposure, resulting in an *increase* in the premium demanded by the participant banks. Indeed, Pavel and Phillis (1987), Pennacchi (1988), Gorton and Pennacchi (1995), and Demsetz (1999), showed that credit risk diversification is among the main reasons for loan sales by the lead bank. Thus, there are two opposing effects, asymmetric information and diversification, that *simultaneously* influence the loan spread. Therefore, the loan spreads and syndicate structure observed in the data represent a set of equilibrium points

[1] Lead banks have an incentive to originate high risk loans due to private benefits from building a relationship with the borrower and/or underwriting fees charged by the lead directly to the borrower at the origination of the loan. Cases of wrongdoing by lead banks include the collapse of Penn Square Bank, which, at the time it defaulted, was servicing in excess of $2 billion in participations as well as the more recent instance of Chase Manhattan's $245 million loan to AroChem (Bank Brussels Lambert and Skopbank v. Chase Manhattan Bank, 1996 US Dist. LEXIS 15631). After Chase charged a direct underwriting fee of $4.95 million, the borrower was unable to meet the minimum financial covenants specified in the loan agreement. To keep the participant lenders from abandoning the loan at closing, Chase attributed the missed covenants to market conditions, thus, misrepresenting the real cause of the technical default. In general, litigation between syndicate members is rare because syndicate loans are not considered a security and a loan agreement typically limits the lead bank's liability.

and the adverse selection/moral hazard effect can not be identified without an exogenous instrument.

The instrument proposed here builds on the intuition of Leland and Pyle (1977). The lead bank typically retains a very large share of the loan, and consequently, it is uniquely exposed to idiosyncratic credit risk. Thus, controlling for overall credit risk, a *unique* contribution to the lead bank's portfolio credit risk would shift the diversification premium demanded by the lead bank without affecting the premium demanded by the participant banks. To construct the instrument, for each loan I build the lead bank's loan portfolio and use annual information on industry level default correlations to construct variance of the probability of default of the lead's loan portfolio, a measure that positively correlates with the credit risk premium demanded by the lead bank.

After instrumenting the lead bank's share, I find the asymmetry of information with the syndicate participants to have a large economic cost reflected in the spread charged to the borrower: a 9% change in lead share (from 10% to 19%) translates to approximately a 29 basis points change in loan spread. This estimate implies that information asymmetry within the lending syndicate accounts for approximately 4% of the total credit cost. This result is net of the reputation of the lead bank, and other important mechanisms used to moderate information asymmetry.

Several previous papers have looked at the determinants of the lending syndicate, including Simons (1993), Preece and Mullineaux (1996), Dennis and Mullineaux (2000), Jones, Lang, and Nigro (2000), Lee and Mullineaux (2004), Panyagometh and Roberts (2002), Esty and Megginson (2003), and Sufi (2007). Their common finding is that syndicate structure is determined by the availability of public information about the borrower as much

as by loan contract characteristics and borrower credit risk. As there is more public information available about a borrower, a larger fraction of a loan is likely to be syndicated. This relation was previously interpreted as evidence of an information asymmetry problem between the lead bank and participants in a lending syndicate. However, as discussed earlier, the lead share observed in the data is a set of equilibriums resulting from interactions between the lead and participant banks. In the absence of instruments, interpretation of the observed data is problematic to interpret.

To the best of my knowledge, Gorton and Pennacchi (1995) is the only other paper that examines the effect of the lead bank share on the loan spread. In the context of secondary market loan sale, they find a negative relation between selling bank share and premium demanded by buying banks.[2] However, the economic effect is insignificant. Overall, the novelty of my paper is that I instrument the asymmetric information and diversification effects.

The remainder of the paper is structured in four sections: empirical framework and data, results, robustness checks, and conclusions.

2. Empirical framework and data

2.1 Empirical framework

Loan syndication is a process whereby a lead bank initiates a loan and then sells a share of the loan to other financial institutions. Before and after the syndication, the lead bank acts as an agent for the lending syndicate in collecting and processing information about the borrower. Prior to syndication, the lead bank conducts due diligence on the borrower and

[2] Participations sold on the secondary loan market represent claims against the selling banks. In that sense, the premium charged by the buying banks is not part of the interest rate charged by the borrower, and it is, more or less, directly observable.

presents a confidential memorandum to potential buyers summarizing its assessment of the borrower's quality. In addition, after syndication, the lead bank is in charge of monitoring the borrower. Thus, before the loan is syndicated, there is an adverse selection problem, because the lead bank has an incentive to syndicate loans of lower quality.[3] After the loan is syndicated, there is a moral hazard problem, because the lead bank only retains part of the loan and, therefore, its incentives to monitor are reduced. Both adverse selection and moral hazard imply that syndicate participants are exposed to the risk of wrong doing by the lead bank and, as a result, they will demand a higher loan spread.

The adverse selection problem in the lending syndicate can be reduced if the lead bank retains a fraction of the loan. The lead bank knows the true underlying quality of the loan. Therefore, a larger lead bank's share would signal a better loan quality and would reduce the spread demanded by the syndicate participants. If the lead's share is an effective mechanism in reducing the adverse selection problem in the lending syndicate, we would expect to find in the data a negative relation between loan spread and lead bank's share. Similarly, for the moral hazard problem, the larger the lead bank's share, the better the incentives alignment between the lead and syndicate participants, and the lower the loan spread.

Both adverse selection and moral hazard effects suggest a negative relation between loan spread and the lead bank's share. However, there is an additional opposing effect that *simultaneously* affects the observed relation between the two variables. A larger lead bank share increases the lead's credit risk exposure. Hence, the spread demanded by the lead bank is a function of diversification and should be positively related to the share that it retains.

[3] Due diligence associated with the loan issuance is not regulated by the Security Act. In addition, the lead bank has no fiduciary responsibility to the loan syndicate members. Disclaimers of the lead bank's responsibility are extensively covered in a typical loan agreement.

[FIGURE 1]

In the absence of instruments, the *observed* relation between loan spreads and lead bank shares corresponds to a set of equilibrium points resulting from the interaction of the two opposing effects: adverse selection/moral hazard (participants) and diversification (lead bank). The appendix presents a moral hazard version of the theoretical framework that captures identification of the adverse selection/moral hazard effect. Figure 1 summarizes the basic elements of the identification. On the figure, the horizontal axis is the lead share and the vertical axis is the loan spread. The curve with the negative slope corresponds to the participants demand and captures the adverse selection/moral hazard effect. The curve with the positive slope corresponds to the lead bank demand and captures the diversification effect. The demands are not observable directly. For each loan we only observe the equilibrium lead share and loan spread, this corresponds to an intersection of the two pricing schedules. Thus, regressing the loan spread against the lead bank share is similar to regressing price against quantity in the context of a supply and demand analysis, which is meaningless.

To identify the premium demanded by the participant banks, we need to identify a variable (instrument) that would affect lead's diversification without directly affecting the degree of adverse selection or moral hazard in the lending syndicate. In Figure 1, this corresponds to shifting the lead's demand while keeping the participants' demand fixed. The instrument that I use to isolate the adverse selection/moral hazard effect measures each loan's contribution to the credit risk of the lead bank's loan portfolio. The rationale behind this method is that the lead bank's portfolio is not perfectly diversified, and it is uniquely

exposed to idiosyncratic risk. In other words, there is a risk component that will be priced by the lead bank but not by the participant banks.

The central risk faced by the banks is the credit risk of their loan portfolio. For each loan, I calculate change in credit risk resulting from the addition of the loan to the lead bank's loan portfolio. To measure credit risk, I use *variance* of the loan portfolio default probability. This measure is an essential element of credit risk management and it directly affects loan spread demanded by the lead bank.[4] It also has an advantage of being computationally similar to the variance of returns of an equity portfolio. Accordingly, for a given bank:

$$\textit{Default probability variance} = w' \Omega w \text{ , where} \qquad (1)$$

w : loan portfolio weights (bank specific);

Ω : probability of default covariance matrix (economy specific).

Loan portfolio weights and the covariance matrix are computed at the 2-digit SIC level. Typically, banks would use their historical default data to estimate expected default probability and its variance. I use probability of default covariance matrices (Ω) calculated for the U.S. market by Standard & Poor's CreditPro database at the 2-digit SIC level (83 by 83 matrix).[5] The matrices are computed annually (in total, there are 12 matrices corresponding to 1993-2004) using default data over the past three years. A diagonal element

[4] The following quote from a J.P. Morgan Chase 2000 10-K report highlights assumptions used in the construction of the default probability variance: "*Credit risk management begins with an assessment of the risk of loss resulting from the default by a borrower or counterparty. <…> Using statistical techniques, estimates are made of both expected losses (on average, over a cycle) and unexpected losses for each segment of the portfolio. Unexpected losses represent the potential volatility of actual losses relative to the expected level of loss. These estimates drive the credit cost and capital allocations to each business unit.*"

[5] S&P CreditPro database uses economy-wide default data. For example, if at the beginning of 2004 there are 10 companies identified with SIC code 21, and 2 of them default within a year, then the probability of default for SIC code 21 in 2004 is 0.2. Variance matrix (Ω) is estimated using binomial distribution. Ω can also be calculated using the option pricing approach first proposed by Merton (1974). For a comparative analysis of the two methods of assessing probability of default correlations, see De Servigny and Renault (2004).

of the matrix is the variance of the probability of default of a given industry, each off-diagonal element is the probability of default covariance between the two corresponding industries.

Portfolio weights (w) are calculated using all completed loans (including non-syndicated loans) issued to U.S. borrowers and reported in Reuters DealScan database. For a given loan, weights are computed using all outstanding loans originated during the previous three years. For example, if a given loan was issued on July 1, 2004, the relevant loan portfolio includes all loans issued after July 1, 2001 and outstanding as of July 1, 2004.[6]

The instrument, the loan's contribution to the credit risk of the lead bank's loan portfolio, is the difference between the default probability variance measured *after* and *before* the loan was added to the portfolio. Only the fraction of the loan retained by the lead is relevant for its portfolio. However, the actual lead's share is determined in equilibrium and, for this reason, it can not be used in the construction of the instrument. Therefore, I use the median lead bank share for each loan size quartile as the new (after) loan weight.

The final sample includes 120 lead banks with an average loan portfolio size of 3,049 deals. For example, the loan portfolio for Bank of America, constructed using DealScan, is approximately 75% of its total domestic commercial loans (50% of its total loan portfolio) as reported in the bank's annual reports. These numbers suggest that a significant fraction of the loan portfolio is incorporated in the analysis. The implied expected default probability for the lead bank's domestic commercial loans portfolio is approximately 0.3%.[7] This is consistent

[6] Loan portfolios are constructed at the parent level and account for bank mergers. Because loan participants often sell their share in the secondary market, I exclude those loans in which the loan share is smaller than 4%. I calculate exposure on revolver lines to be 50% of the total commitment; this is consistent with a study conducted by JP Morgan Chase (see Araten and Jacobs, 2001).

[7] Average default probability variance of a loan portfolio is estimated to be 0.0037. Using naïve binomial approach, this corresponds to the expected default probability of 0.3% (0.0037=0.003*(1-0.003)).

with Carey and Treacy (1998), who find that probability of default of the banking industry aggregate commercial loan portfolio in 1997 was 0.2%.

Using change in default volatility of the lead's loan portfolio as the instrument, the adverse selection/moral hazard effect is estimated recursively in two stages. Equations (2) and (3) correspond to the first and second stages, respectively. A fitted value of the lead share, computed using the first stage estimates, is used to replace the observable lead share in the second stage.

$$Lead\ share = \alpha_1\ Controls + \alpha_2\ Instruments + \varepsilon \quad (2)$$

$$Required\ loan\ spread = \beta_1\ Lead\ bank\ share_F + \beta_2\ Controls + \upsilon \quad (3)$$

I control for factors that might affect the level of adverse selection or moral hazard within the lending syndicate and the borrower's credit risk. I specifically control for the lead bank's reputation, presence of collateral, and covenants, because these mechanisms could moderate adverse selection and moral hazard in the lending syndicate. The general set of controls includes non-price loan characteristics, lender and borrower characteristics, and market conditions. While loan spread and syndicate structure are determined simultaneously in the process of syndication, the non-pricing terms of the loan, including amount, maturity, collateral, and covenants, are typically set before the syndication process. This justifies use of loan characteristics as the control variables.

The full structural model is a system consisting of three equations: a participant's demand, a lead bank demand, and an equilibrium condition. Because I use 2SLS estimation, estimating adverse selection/moral hazard effect independently from diversification effect is equivalent to estimating the two effects simultaneously in a system of equations. I will address the credit risk premium (the lead bank's demand) in the robustness section.

2.2 Data and variables overview

Each observation in the analysis corresponds to a separate loan agreement, for which data were collected from the Reuters DealScan database.[8] The starting sample includes information on 23,087 completed dollar-denominated loans, issued between 1993 and 2004 and involving 9,931 different U.S. borrowers, while excluding regulated and financial industries identified as SIC 40 through 45 and 60 through 64. The central explanatory variable in the analysis - loan share retained by the lead bank - is available for approximately 30% of the cases. Some other variables considered in the analysis, including loan spread, borrower's sales at time of loan origination, and maturity also have limited availability. Each regression indicates the actual number of observations used in the analysis. Overall, the resulting sample is biased towards larger and public companies; this, however, should bias my results against finding adverse selection/moral hazard effect.

Syndicated loans can be structured in several tranches, also called facilities. For U.S. companies, a syndicated loan, on average, consists of 1.4 facilities per loan with a median of 1. Identity of participants, syndicate structure, and general contract terms are typically determined at the deal level. Consequently, for deals with multiple facilities, I look at the loan characteristics of the largest tranche that start at the loan initiation. This classification does not significantly affect the distribution of loan type in the final sample.

There are multiple roles that can be assigned to the members of the lending syndicate. To identify the lead bank, I follow the S&P (2006) definitions. If identified, the administrative agent is defined to be the lead bank. If the syndicate doesn't have an administrative agent, then

[8] DealScan is generally accurate in registering loans at the origination. Because league tables are a powerful marketing tool in the syndicated loan market, lenders have incentives to report this data. For more information on DealScan data, see Carey, Post, and Sharpe (1998).

lenders that act as book runner, lead arranger, lead bank, lead manager, agent, or arranger are defined as the lead bank. Cases in which more than one of these roles appears in the lending syndicate are very rare. Following this criteria, 4.7% of deals have more than one lead arranger. In these cases, I calculate the share retained by the lead arranger to be equal to the sum of the shares retained by the multiple arrangers.

I measure the spread using All-in Drawn Spread *net* of upfront fees. All-in Drawn Spread is measured in basis points and it is defined by the DealScan as the total annual cost, including a set of fees and fixed spread, paid over LIBOR for each dollar used under the loan commitment. The largest fraction of an upfront fee typically goes to the lead arranger as the compensation for structuring the loan. Because my focus is on the participant banks demand, I consider spread net of upfront fees.

[TABLE 1]

Other data sources used in the analysis include S&P CreditPro and Compustat. Table 1 presents summary statistics for the variable in the analysis. Construction of the variables, descriptive statistics, and data sources are explained in the appendix.

3. Results

3.1 Instrumental variables

The fundamental of my instrument is that the lead bank is not fully diversified and it has unique exposure to the idiosyncratic credit risk. Indeed, in the process of syndication, lead bank retains, by far, the largest fraction of the loan. Lead bank's average share is 27% or $44 million, whereas the largest non-syndicated loans typically do not exceed $5 million.

Average participant share is 4%; in addition, participants are likely to sell or securitize their risk.[9]

[TABLE 2]

The change in variance of the loan portfolio default probability is calculated using portfolio weights specific to the lead bank. In Table 2, I verify that the instrument is unique to the portfolio of the lead bank. Specifically, I compute the change in variance of default probability using portfolio weights of several other banks, and look at the correlation between the instrument and these alternative measures.[10] The first row in Table 2 corresponds to the instrument. The rest of the rows correspond to alternative benchmarks: a participant with the largest loan share (row 2), a random participant with a commitment in excess of 4% (row 3), a comparable participant based on the market share and portfolio size (rows 4 and 5), and a random competitor outside of the lending syndicate, based on the average loans size and client size (rows 6 and 7).[11] The correlation between the measure calculated for the lead bank and the measures calculated for the participant banks is very small and statistically insignificant, thus confirming that the instrument measures a unique feature of the lead bank loan portfolio.

If there is measurement error in the calculation of the default volatility, it should make my instrument weak, and therefore make it difficult to measure adverse selection/moral hazard effect. To account for potential measurement problems, I also include as an

[9] Ivashina and Sun (2007) show that, in two years following loan origination, approximately half of the participants in the lending syndicate sell their share on the secondary loan market, while the lead banks tend to remain as part of the syndicate.

[10] For compactness I call the instrument "variance", however I report standard deviation of the probability of default of the lead's loan portfolio.

[11] Participant banks are likely to have smaller in-sample portfolios because it appears that banks that enter syndicated loans as participants are unlikely to be syndicated loan underwriters (lead banks). This fact partially explains the increase in variance of the default volatility (rows 2 through 5). If we pick a random, comparable competitor from the pool of lead underwriters (rows 6 and 7), the default probability variance is comparable to that of the lead bank.

instrument the lead bank's lending limit. The lending limit is a simple additional proxy for the lead's loan portfolio diversification. Since banking is a regulated industry, there are regulatory lending restrictions aimed at reducing banks' portfolio credit risk. In particular, loans to a single lender cannot exceed 15% of a bank's capital for uncollateralized loans, and 25% for collateralized loans. But in addition to regulatory lending limits, banks have internal lending limits, often associated with their internal structure. These limits can be binding. Industry studies indicate that many banks with assets in excess of $1 billion have loan-size limits in the $2-$10 million range.[12] Because I do not directly observe the lending limit, I use the DealScan sample and measure the lending limit as a 75th percentile of the dollar size of the lead bank share, calculated over the year prior to the date of analysis. The results are robust to alternative cutting points. As expected, the distribution of the lead share reveals the average lending limit to be only $35 million, much smaller than the regulatory limit.

[TABLE 3]

Table 3 presents results for the first-stage regression. The focus of the table is on the two instruments: change in default probability variance and lending limit. Both instruments are jointly statistically significant in explaining the share retained by the lead bank. In addition, the signs on these coefficients are consistent with the instruments' economic interpretation. Specifically, an increase in default probability variance reflects a higher credit risk and, therefore, if the loan share is held constant, the lead bank will demand a larger spread. This predicts a negative partial correlation between the lead bank share and change in default probability variance. Similarly, lower lending limit is associated with a higher credit risk. This predicts a positive partial correlation between the lead bank share and lending limit.

[12] See, for example, Bromiley and Stansifer (1994).

3.2 Identification

The general rule for identification of a structural model is that both rank and order conditions are satisfied. Consistent with the rank condition, equations in my system are linearly independent. The order condition requires that the number of instruments not be smaller than the number of endogenous variables in any equation. It is satisfied in my model in that the premiums demanded by both participants and lead are overidentified (i.e., there are more instruments than endogenous variables).

Having two instruments enables me to test the overidentifying restrictions. Accordingly, overidentifying restriction is not rejected with *p*-value equal to 0.30. This confirms the joint validity of my instruments and is further evidence of the efficacy of my economic model.

To ensure that identifying instruments are jointly significant, I estimate the reduced form for lead bank loan share reported in Table 3 before estimating the equation by 2SLS. The critical value for the *F* test of joint significance being quite large, we can proceed with the second stage of the 2SLS estimation of the loan spread equation.

3.3 Spread required by the participant banks: Information asymmetry effects

[TABLE 4]

The main result of this paper is presented in Table 4. In each regression, the dependent variable is the loan spread, and the focus is on the coefficient on the lead share. There is a dramatic difference between the OLS (using unconditional lead share) and 2SLS (using fitted lead share) estimates. This illustrates the bias present in the estimates, if the joint determinants of the loan spread and lead share are not properly accounted for. The negative

coefficient on the fitted lead bank share measures the relation between lead share and the loan spread demanded by the syndicated participants due to adverse selection/moral hazard problem.

The economic significance of this coefficient is large: a 1% (10% to 11%) increase in lead bank share corresponds to a 3.26 basis points reduction in the average participant's premium. Thus, one standard deviation decrease in the fitted value of the lead bank share implies a 41 basis point or 28% increase in the loan spread. However, the first stage regression indicates that logarithm of facility amount is one of the central determinants of the lead bank share. One standard deviation change in logarithm of facility amount implies a 9% change in the lead share. Thus, conditional on economically sound variation in loan size, 9% change in the lead share translates into an approximately 29 basis point change in loan spread. At an average LIBOR rate of 559 basis points and upfront fees of 40 basis points, information asymmetry within the lending syndicate accounts for 4% of the total credit cost.[13] Although, 9% is still an economically large change in lead share, because it is equivalent to a $24 million increase in lead bank exposure.[14]

All regressions include year, loan purpose, and bank fixed effects. In addition, I control for lead bank's reputation and several loan characteristics (including performance pricing, covenants, and collateral) that affect the level of information asymmetry within a syndicate. Performance pricing ties loan spread to the firm's financial indicators, allowing for the

[13] LIBOR of 559 corresponds to the 1993-2004 average of a 3-month interbank rate (source: Datastream).

[14] Standard errors used to compute the significance of the second stage estimates account for the use of fitted value from the first stage as an instrument. Given that the first and second stages are linear and all exogenous variables are included in the first stage, this adjustment represents a special case of the Murphy-Topel two-step adjustment. In general, using clustered errors in two-step estimation is questionable. Following the analysis by Petersen (2007), clustering of standard errors should be evaluated as a reference, rather than the ultimate result. I considered clustering of errors at the bank, firm and industry levels. The changes in standard errors are relatively small, thus suggesting that auto-correlation in the residuals is not significant. The results are available upon request.

spread to change automatically with the changes in the leverage and/or interest coverage ratio. Asquith, Beatty, and Weber (2004), find that the inclusion of performance pricing in bank debt contracts is more likely when the borrower is less transparent. Consistent with my finding, the presence of performance pricing should reduce the costs of asymmetric information within the lending syndicate and, therefore, reduce the premium demanded by the participant banks. The same intuition applies to the inclusion of collateral and financial covenants, although I find a positive sign for these two features.[15]

The availability of public information about borrowers directly affects the informational asymmetry between the lead bank and syndicate participants. The less transparent the borrower, the more syndicate members will have to rely on the information collected and reported by the lead bank. Throughout the paper, I measure information transparency by introducing explicit controls for credit ratings and borrower's size. In addition, for the sample matched to Compustat, I control for asset size, leverage, and profitability. The results continue to hold, and their diminished statistical and economic significance is consistent with the reduced importance of bank information collection in a sample of publicly transparent companies. To assure that reduction in statistical significance is not attributed to omitted variables, regression (2) and (3) present results before and after inclusion of accounting measures. If measurement of credit risk would be a problem, the coefficient on the lead share without proper controls would be downward biased (steeper negative slope in the participants demand). Thus, introduction controls for size, leverage and profitability should bring the

[15] All non-price characteristics of a loan contract are set prior to determining spread and syndicate structure. However, to account for potential endogeneity of loan characteristics, I also estimate Heckman (1978) treatment effects. The results are qualitatively similar and available upon request. In addition, I consider alternative definitions of the financial covenants, including that of Bradley and Roberts (2004). These changes do not affect the results.

coefficient on the lead share up. However, the change is insignificant, suggesting that imprecision in controls for credit risk is an unlikely source of bias.

4. Robustness of the results

4.1 Spread required by the lead bank: Diversification effect

The identification of the adverse selection/moral hazard effect depends on the fact that the lead bank is not fully diversified. In Table 5, I directly test the relation between the lead's share and the spread that it demands. The diversification effect indicates that, as the lead bank share increases, the lead bank becomes more exposed to the credit risk and, therefore, it will demand a higher spread. Similarly to the adverse selection/moral hazard effect, the diversification effect is not directly observable, and can not be identified without proper instruments. To identify diversification effect, I need an instrument that exogenously shifts the level of asymmetric information within the lending syndicate without directly affecting the lead bank credit risk exposure. The lead bank reputation directly affects level of asymmetric information within the syndicate, but it is an unlikely element of a credit risk model. Thus, I use syndicate-specific reputation, measured in terms of the previous connections between syndicate members, to instrument the diversification effect.

My main reputation measure is the maximum number of deals arranged by the same lead bank with the same participants, measured over a three-year horizon and expressed as a percent of the total deals underwritten during this period. To illustrate, assume that for a given syndicate loan, A is the lead bank and banks B and C are the participants. If bank B and bank C participated in 10% and 20%, respectively, of the deals underwritten by bank A over the past three years, the reputation measure for this loan would be 20%. In my sample,

the median and mean of this reputation measure is 11% and 12.5%, respectively. In addition, to account for reciprocal relationships, I use a dummy variable that indicates a past relationship in which the participant and lead banks switched roles. Correlation between the reputation variables is low, confirming that they measure different aspects.

Higher reputation measures reflect lower levels of asymmetric information within the syndicate. Alternatively, for a given spread, when reputation is high, the lead bank would syndicate a larger fraction of the loan. Consequently, I expect a negative sign between the lead bank share and reputation measures. The predictions are consistent with the first stages results in Table 3.

[TABLE 5]

Table 5 reports results of the second-stage regression corresponding to the lead bank's required spread. Measures of syndicate-specific reputation are the identifying instruments, and, therefore, are not included in the second stage regression. As in Table 4, the key coefficient corresponds to the lead bank loan share. The point estimate is, again, significantly different from the OLS analysis. The positive relation between the share retained by the lead bank and the required spread is consistent with the diversification effect. As expected, the risk factors' impact on the spread demanded by both lead and participant banks is similar. It is important to notice that identification of asymmetric information effect and diversification effect are tested *independently* from each other, thus reinforcing the overall validity of the findings.

4.2 Alternative credit risk management techniques

Variance of the default probability of the lead's loan portfolio is, most likely, measured with an error. However, because it is used as an instrument, precision in the measurement is

of the secondary order. The central point is that my instrument correlates with the portfolio specific credit risk. Additionally, for the adverse selection/moral hazard identification to be conceptually invalid, the lead bank needs to be able to eliminate its idiosyncratic exposure at zero or fixed costs. Using active risk management is costly and, in that sense, it would directly affect the cost of credit. Nevertheless, a bank's actual credit risk exposure might be difficult to measure because banks use unobservable risk management techniques including credit derivatives (CDS), securitization through collateralized loan obligations (CLO), and loan sales on the secondary market.

While these mechanisms are becoming more and more popular they were not very important between 1993 and 2004. In fact, CDS on loans started trading in 2004, and standard documentation for the U.S. market was published by the International Swaps and Derivatives Association in June 2006. The first CLO completed by a U.S. bank occurred in late 1997. Total CLO volume for 1997-2001 (U.S. market) is estimated around $100 billion, less than 2% of the total amount of syndicated loans.

Fractions of syndicated loans can also be resold on the secondary loan market. However, less than 5% of the loans originated between 2000 and 2004 are quoted in the secondary loan market. The numbers are even smaller for the previous years. Most of the quoted loans are packaged specifically for institutional investors and therefore are unlikely to have an important information asymmetry problem within the syndicate. Thus, I excluded all the quoted loans from my sample. More broadly, while loan contracts do not explicitly prohibit the lead bank to sell its share, they do require borrower approval for the sale to go though. In that sense, it is unlikely that selling loans on the secondary market is an important way for the lead bank to reduce its credit risk due to "sensitive client relationship issues arising from

loan transfer notification requirements, loan assignment provision, and loan participation restrictions" (OCC, Capital Interpretations, 1999). Analysis of the secondary market data indicate that trading of syndicated loans typically occurs at the participant level, and that most traded loans are loans syndicated to institutional investors. Additional supporting evidence can be found in work on loan sales by Dahiya, Puri, and Saunders (2003) and Drucker and Puri (2006), Ivashina and Sun (2007).

4.3 Upfront fees

[TABLE 6]

Lead bank's compensation consists of an upfront fee not shared with the rest syndicate and spread. One might wonder if the upfront fee, rather than the spread could be used to compensate lead bank for the credit risk exposure. Evidence suggests that there is not much variability in the upfront fees, making it an unlikely channel to settle a diversification premium. I provide additional evidence in Table 6, where I analyze the key result of the paper in the sample where upfront fees are available, approximately 20% of my sample. Thus, Table 6 uses the same specification for two different dependent variables: all-in-drawn spread net of upfront fee, and upfront fee. If upfront fee would be used to settle a diversification premium, then the variance of the default probability of the loan portfolio, constructed to measure the lead's idiosyncratic risk exposure, should be important in explaining upfront fee and not net spread. The estimation of a reduced form for spread (spread as a function of all the exogenous variables) confirms that default probability variance is important in explaining spread but not upfront fee. When upfront fee is used as the dependent variable, there is a significant drop not only in statistical but also in economic explanatory power of variance of default probability.

Conceptually, it is not clear if asymmetric information cost is due to the moral hazard or adverse selection problem between lead banks and syndicate participants. If this is an adverse selection problem, consistent with Leland and Pyle (1977), asymmetric information can not be resolved through a fixed payment (upfront fee).

4.4 Monitoring synergies

There is a concern that concentration of the lead's loan portfolio could be explained by the monitoring expertise of the lead bank. Consistent with the diversification effects, loan portfolio concentration in a particular industry should be associated with higher credit risk and, therefore, the lead bank should demand a higher spread. However, if industry concentration of the loan portfolio is associated with synergies in information collection and monitoring, the spread demanded by the lead bank should be lower. In terms of Figure 1, higher credit risk would shift the lead bank demand to the right and industry monitoring expertise would shift the lead bank demand to the left. This generates opposite predictions for the coefficient on the variance of the probability of default in the first stage regression. Table 3 indicates that an increase in variance off the default probability is associated with the lower lead bank share. This result is consistent with the diversification effect.

[TABLE 7]

Table 7, provides additional evidence by reexamining the central result of the Table 4 for the sample where the loans are issued to industries where lead bank's share of the loan portfolio is less than the sample median (3%). This sample corresponds to the cases in which the lead bank does not have monitoring expertise. If concentration of the loan portfolio is affected by the monitoring expertise of the lead bank, then the results for this sub-sample should not hold. However, the results remain qualitatively the same.

4.5 Adjustment for recovery rates

In the second section, I discussed the construction of change in default probability variance, my main instrument for identifying adverse selection/moral hazard effects. Table 8 examines the robustness of the relation between the spread and the lead share presented in Tables 4 and 5 to alternative specifications of the change in variance of default probability.

[TABLE 8]

Overall, the results in Table 8 confirm the economic and statistical significance of the adverse selection /moral hazard and diversification effect. Perhaps most interesting is the part that corresponds to adjustments for recovery rates (lines 8 through 11). Loss in the event of default is an important component of expected loss, and was not considered in the calculation of the original instrument. I use four alternative proxies for the recovery rates: credit ratings; industry asset tangibility; presence of collateral; and leverage. I scale down the default probabilities for companies likely to have high recovery rates. The results are not sensitive to the scaling factor. Overall, the adjusted measures are highly correlated with the original measure, and the central results remain economically strong and robust.

5. Conclusions

In this paper, I examine how the lead bank's ownership share of the loan affects the information asymmetry in the lending syndicate, and the loan spread charged to the borrower. The observable relation between the lead share and loan spread is endogenous. I instrument the true effect of ownership on the asymmetric information premium, using shifts in the lead bank's credit risk exposure. Thus, I find the information asymmetry problem within a syndicate to have an important economic impact on loan spread. In particular, I find

that a 9% increase in the share retained by the lead bank reduces by approximately 29 basis points the spread required by participants (4% of the total cost).

I conclude that in this market information asymmetry and, thus, the cost of borrowing, can be effectively reduced by controlling the share of the loan retained by the lead arranger. Overall, this paper provides a framework for understanding the syndicated loan market structure as well as banks' merger activity.

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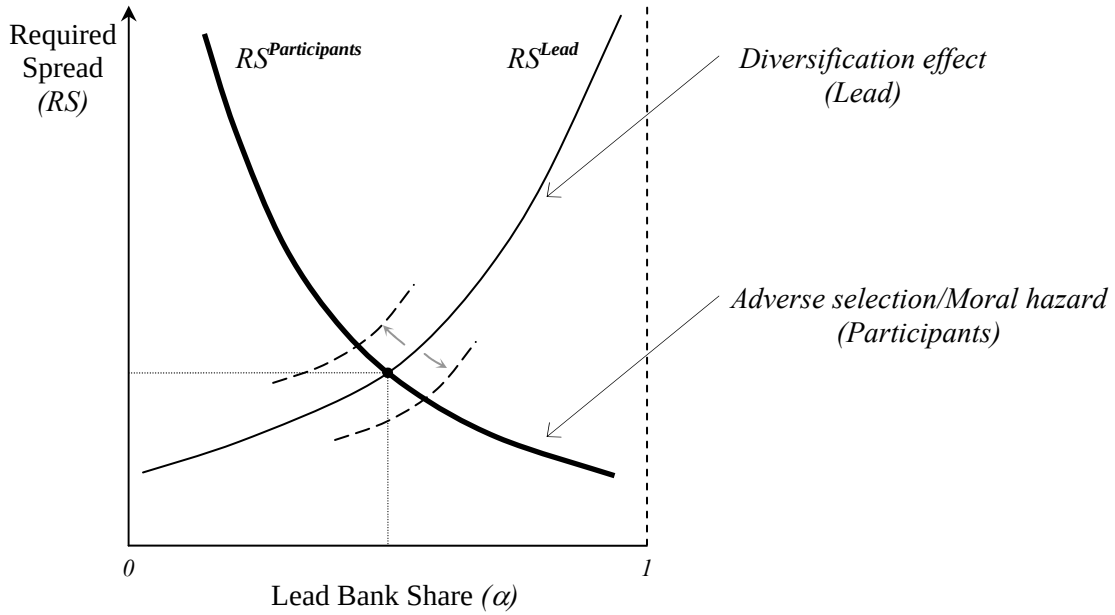
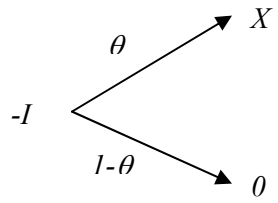
FIGURE 1
SIMULTANEOUS NATURE OF LOAN SPREAD AND LEAD BANK SHARE



Appendix 1

Lead bank's credit risk exposure is an increasing function of its loan share. However, credit risk exposure of the syndicate participants (per dollar of the loan held) is unaffected by the lead's share. Thus, I argue that, for each loan, credit risk component specific to the portfolio of the lead bank exogenously affects the lead's share of the loan; i.e., it only affects interest rate through the lead share. This is the nature of the instrument used to identify the asymmetric information effect. The following simple setup formalizes this idea in a moral hazard framework

Borrower's investment opportunity is a risky project that requires an investment of *I* dollars and the resulting returns are either high *X* or low *0*. The probability of the high outcome is θ, and it is a function of monitoring by the lead bank. Only the lead bank knows its effort (θ):



The project is financed using a syndicated loan. Conditional on success, a borrower pays back to the lenders the principal plus the interest rate *R*, and a fixed fee *F*. Syndicate participants behave competitively and realize zero profit:

$$I=\theta R \text{ or } R=(I/\theta)$$

For a given lead bank share, optimal monitoring solves:

$$\max_{\theta} \alpha\theta R - \tfrac{1}{2}\beta\theta^2$$
$$\alpha R - \hat{\theta}\beta = \alpha\tfrac{I}{\hat{\theta}} - \hat{\theta}\beta = 0$$

$$\hat{\theta} = \sqrt{\tfrac{\alpha I}{\beta}}$$

As the lead's share of the loan increases, it faces a higher idiosyncratic credit risk cost (αC) due to lack of diversification. Monitoring cost is independent of the lead's credit risk exposure. Thus, optimal loan share solves:

$$\max_{\alpha} \ (\alpha\theta R - \tfrac{1}{2}\beta\theta^2 - \alpha C + F) - \alpha I$$
$$\text{s.t. } \theta(X - R) - F \geq 0$$

$$\tfrac{d}{d\alpha}(\theta X - \tfrac{1}{2}\beta\theta^2 - \alpha C) = 0$$
$$\tfrac{d\theta}{d\alpha} X - \tfrac{d\theta}{d\alpha}\beta\theta - C = 0$$

$$\tfrac{d\bar{\theta}}{d\alpha} = \tfrac{1}{2}\sqrt{\tfrac{I}{\alpha\beta}}$$
$$\tfrac{1}{2}\sqrt{\tfrac{I}{\hat{\alpha}\beta}} X - \tfrac{1}{2} I - C = 0$$
$$\hat{\alpha} = \tfrac{X^2}{\beta(2C+I)^2}$$

$$\downarrow C \Longrightarrow \uparrow \alpha \Longrightarrow \downarrow R$$

That is, credit risk unique to the lead's portfolio (C) affects the interest rate only through the lead's loan share. This allows me to measure the asymmetric information effect on the interest rate using instrumental variable approach.

Appendix 2
Variable description

Variable	Definition	Source
	Endogenous variables:	
All-in Spread Drawn	All-in Spread Drawn is defined as total (fees and interest) annual spread paid over LIBOR for each dollar drawn down from the loan net of upfront fees	Dealscan
Lead share	Share of the loan that is retained by lead arranger at loan origination	Dealscan
	Instruments:	
Δ Default probability variance	Change in default probability variance of the lead bank calculated at the loan level using loan portfolio weights constructed from Dealscan and CreditPro default correlation matrices	Dealscan/ S&P CreditPro
Lending limit	Bank specific variable defined as 75^{th} size percentile of the loans issued over the past three years	Dealscan
	Explanatory variables:	
Industry default probability	2-digit SIC industry expected loss probability	S&P Creditpro
Senior debt rating	S&P senior debt ratings	Dealscan/ S&P CreditPro
Not rated	Dummy variable equal to 1 if the borrower is not rated	Dealscan/ S&P CreditPro
Commercial paper rating	Dummy variable equal to 1 if the borrower has a commercial paper rating	Dealscan/ S&P CreditPro
Public	Dummy variable equal to 1 if the borrower is a publicly traded company	Dealscan
Sales at close	Sales at close in millions	Dealscan
Assets	DATA6	Compustat
Leverage	Industry adjusted ratio of book value of debt to total assets: [DATA181+DATA10 (or DATA56 or DATA130 depending on availability and in that order)]/DATA6	Compustat
ROA	Industry adjusted ratio of operating income before depreciation to total assets: DATA13/DATA6.	Compustat
Log (Facility amount)	Logarithm of total facility amount in millions of dollars	Dealscan
Maturity	Maturity of the facility in months	Dealscan
Number of facilities	Number of facilities in the loan package	Dealscan
Collateral	Dummy variable equal to 1 if the loan is secured	Dealscan
Financial covenants	Dummy variable equal to 1 if the loan has financial covenants	Dealscan
Prime base rate	Dummy variable equal to 1 if the base rate is Prime	Dealscan
Performance pricing	Dummy variable equal to 1 if the loan has performance pricing	Dealscan
Ranking	Lead arranger's ranking calculated using lead's market share based on the number of deals	Dealscan
Syndicate reputation: Lead to participant	Maximum number of links between the lead bank and a member of the syndicate, scaled by the total number of deals arranged by the lead bank; this is a syndicate specific measure calculated over a three-year horizon	Dealscan
Syndicate reputation: Reciprocal (dummy)	Dummy variable equal to 1 if over the past three years lead bank was a participant in a syndicate led by on of the current participants (i.e., lead banks and participant bank switched their roles); this is a syndicate specific measure	Dealscan

TABLE 1
SUMMARY STATISTICS

This table presents descriptive statistics for completed dollar denominated loans, originated between 1993 and 2004, to U.S. companies excluding regulated and financial industries identified with 2-digit SIC 40 through 45 and 60 through 64. Borrowers' and lenders' characteristics are computed as of the earliest date prior to the origination of the loan. For definitions of other dependent variables, please see the appendix.

	Full sample Observations = 5,017			Compustat sample Observations = 3,617		
	Median	Mean	StdDev	Median	Mean	StdDev
All-in Spread Drawn (basis points)	120.00	140.30	102.01	110.00	132.96	100.39
Lead share (%)	22.45	27.17	17.17	21.50	26.55	17.14
Fitted lead share (%)	27.45	27.17	12.35	26.62	26.55	12.87
Industry default probability (%)	1.24	2.16	2.41	1.51	2.33	2.44
Not rated (dummy)	0.00	0.49	0.50	0.00	0.46	0.50
Commercial paper rating (dummy)	0.00	0.18	0.38	0.00	0.21	0.41
Public (dummy)	1.00	0.75	0.44	1.00	0.92	0.27
Previous lending relationship (dummy)	1.00	0.60	0.49	1.00	0.63	0.48
Sales at close ($MM)	520.00	2,383.68	7,473.69	696.66	2,854.79	8,338.42
Log (Sales at close)	6.25	6.35	1.67	6.55	6.60	1.64
Assets ($MM)	--	--	--	649.47	3,294.25	8,657.48
Log (Assets)	--	--	--	6.48	6.67	1.66
Leverage (Ind. Adjusted) (%)	--	--	--	0.02	0.06	0.29
ROA (Ind. Adjusted) (%)	--	--	--	0.03	0.05	0.11
Facility amount ($MM)	125.00	270.69	527.33	135.00	299.73	595.12
Log (Facility amount)	4.83	4.81	1.28	4.91	4.88	1.29
Maturity (months)	36.00	39.00	22.00	36.00	39.00	22.00
Number of facilities	1.00	1.35	0.68	1.00	1.34	0.63
Collateral (dummy)	0.00	0.00	0.00	0.00	0.00	0.00
Financial covenants (dummy)	0.00	0.12	0.32	0.00	0.13	0.33
Prime base rate (dummy)	0.00	0.03	0.16	0.00	0.02	0.15
Performance pricing (dummy)	1.00	0.66	0.47	1.00	0.69	0.46
Ranking	6.00	12.49	16.98	6.00	11.83	16.55
Syndicate reputation: Lead to participant	11.02	12.51	8.02	11.32	12.93	8.15
Syndicate reputation: Reciprocal (dummy)	1.00	0.97	0.18	1.00	0.97	0.17
Credit risk: Δ Default probability variance (%)	0.00	0.00	0.22	0.00	0.00	0.20
Credit risk: Lending limit ($MM)	55.00	63.07	58.03	55.00	64.11	54.55

TABLE 2

DESCRIPTION OF CHANGE IN DEFAULT PROBABILITY VARIANCE

This table presents descriptive statistics for the change in default probability variance used as an instrument to identify the spread required by the participant banks. Change in default probability variance is calculated at the loan level and measures the contribution of the particular loan to the variance of the probability of default of the lead bank loan portfolio. Default probability variance is constructed using 2-digit SIC default covariance matrices from the CreditPro database and bank specific 2-digit SIC portfolio weights computed using Dealscan. The first row corresponds to the measure used in the regression analysis. Other rows are presented for comparison. Largest participant is the participant that retains the largest fraction of the loan. Comparable participant is the participant bank that is closest to the lead bank in terms of size. Competitor is a non-participant bank randomly selected among banks reported in Dealscan that are comparable to the lead bank in terms of loan and client size. The last column reports the correlation between change in default probability variance of the lead bank and the comparison group. ***, **, and * indicate *p* values of 1%, 5%, and 10%, respectively.

		Default probability variance (%)	**Change in Default probability variance (%)**				
		Mean	5th %	Median	95th %	Mean	Corr.
1	*Lead bank*	6.1 ***	-0.025	0.0018	0.047	0.001	--
2	*Largest participant (Loan share)*	12.9 ***	-0.151	0.0053	0.144	-0.010	0.012
3	*Random participant*	7.5 ***	-0.041	0.0037	0.126	0.025 **	0.013
4	*Comparable participant (Market share)*	6.9 ***	-0.022	0.0030	0.034	0.002	0.002
5	*Comparable participant (Portfolio size)*	7.0 ***	-0.019	0.0031	0.037	0.013 **	0.022
6	*Random competitor (Loan size)*	6.6 ***	-0.006	0.0034	0.037	0.008 ***	0.035 **
7	*Random competitor (Loan and client size)*	7.9 ***	-0.009	0.0064	0.109	0.019 ***	0.082 ***

TABLE 3
FIRST STAGE REGRESSION: SYNDICATE STRUCTURE

This table presents results of the first-stage regression. The dependent variable is shares retained by the lead arranger. The sample contains completed dollar denominated loans, originated between 1993 and 2004, to U.S. companies excluding regulated and financial industries identified with 2-digit SIC 40 through 45 and 60 through 64. Model (1) corresponds to the sample where loan data were available. Models (2) and (3) re-examine the result for the subsample of loans matched to Compustat. Borrowers' and lenders' characteristics are computed as of the earliest date prior to the origination of the loan. Syndicate reputation variables are used as identifying instruments for diversification effect (Table 5). For definitions of the explanatory variables, please see the appendix. ***, **, and * indicate *p* values of 1%, 5%, and 10%, respectively.

	(1)			*(2)*			*(3)*		
	Coeff.	t-stat		Coeff.	t-stat		Coeff.	t-stat	
Borrower characteristics:									
Industry default probability (%)	0.24	3.0	***	0.06	0.7		0.03	0.3	
Not rated	5.29	7.3	***	6.49	7.5	***	5.66	6.5	***
Senior debt rating									
AAA	7.41	1.2		12.93	1.6		12.91	1.6	
AA +	4.06	0.9		8.51	1.3		8.67	1.3	
AA	6.92	2.3	**	4.33	1.3		4.68	1.4	
AA -	5.01	2.4	**	3.58	1.5		3.86	1.6	*
A +	5.54	3.5	***	5.73	3.3	***	5.59	3.2	***
A -	4.16	3.5	***	4.47	3.5	***	4.37	3.4	***
A -	2.71	2.4	**	3.27	2.5	**	3.19	2.5	***
BBB +	1.99	2.0	**	1.84	1.6	*	1.95	1.7	*
BBB	1.10	1.2		1.20	1.2		1.20	1.2	
BB +	1.04	0.9		2.73	2.0	**	2.69	2.0	**
BB	-0.49	-0.4		-0.32	-0.3		-0.32	-0.3	
BB -	1.13	1.1		1.59	1.3		1.60	1.4	
B +	4.49	4.5	***	4.82	4.1	***	4.62	3.9	***
B	4.48	3.6	***	5.03	3.4	***	4.83	3.3	***
B -	2.69	1.7	*	0.77	0.4		0.84	0.4	
CCC +	5.61	2.6	***	6.76	2.9	***	6.31	2.8	***
CCC	4.51	1.1		4.24	1.0		4.46	1.0	
CCC-	7.71	1.7	*	7.52	1.5		7.00	1.4	
Commercial paper rating	0.73	1.1		0.94	1.2		1.26	1.6	*
Public	0.21	0.5		0.63	0.8		0.54	0.7	
Previous lending relationship	-1.11	-3.0	***	-1.13	-2.6	***	-1.03	-2.4	**
Log (Sales at close)	-0.52	-3.4	***	-0.44	-2.2	**			
Log (Assets)							-1.35	-5.5	***
Leverage (Ind. Adjusted)							-1.19	-1.6	***
ROA (Ind. Adjusted)							-4.01	-2.1	**
Contract characteristics:									
Log (Facility amount)	-6.69	-30.7	***	-6.49	-24.8	***	-5.88	-20.7	***
Maturity (Months)	-0.03	-3.7	***	-0.03	-3.0	***	-0.03	-3.3	***
Number of facilities	-5.80	-19.2	***	-5.31	-14.3	***	-4.95	-13.3	***
Collateral	0.49	1.2		0.81	1.6	*	0.50	1.0	
Financial covenants	-0.20	-0.4		-0.21	-0.3		-0.33	-0.5	
Prime base rate	1.14	1.0		0.85	0.6		0.95	0.7	
Performance pricing	-1.80	-4.3	***	-1.85	-3.8	***	-2.06	-4.2	***

TABLE 3 – *continued*

Lead bank characteristics:									
Ranking		0.10	3.8	***	0.11	3.8	***	0.11	3.8	***
Credit risk: Δ Default prob. variance (%)	z_1	-2.58	-3.2	***	-1.09	-2.2	**	-1.01	-2.2	**
Credit risk: Lending limit ($MM)	z_2	0.01	2.5	***	0.01	2.2	**	0.01	2.3	**
Syndicate characteristics:									
Syndicate reputation: Lead to participant	z_3	-0.48	-14.3	***	-0.48	-12.1	***	-0.47	-11.8	***
Syndicate reputation: Reciprocal	z_4	-5.00	-5.1	***	-3.67	-3.1	***	-3.68	-3.1	***
Instruments:									
F-test: ($z_1 = z_2 = z_3 = z_4 = 0$)			6.9	***		6.8	***		6.2	***
F-test: ($z_1 = z_2 = 0$)			3.0	**		2.8	**		2.8	**
F-test: ($z_3 = z_4 = 0$)			10.3	***		12.0	***		9.8	***
Fixed Effects:		Yes			Yes			Yes		
Bank		Yes			Yes			Yes		
Year		Yes			Yes			Yes		
Loan purpose		5,017			3,617			3,617		
Observations		0.53			0.55			0.55		
Adjusted R^2		Yes			Yes			Yes		

TABLE 4

DETERMINANTS OF LOAN SPREADS: ASYMMETRIC INFORMATION EFFECT

This table reports results of the second stage regression corresponding to the spread required by the participant banks (asymmetric information effects). Participants' pricing behavior is identified using C*hange in Default probability variance* and *Lending Limit* measurements that exogenously shift the spread demanded by the lead bank. The dependent variable, *All-in Drawn Spread*, includes fixed fees (excluding upfront fee) and variable spread that the borrower pays for each dollar drawn down under loan commitment. Each observation in the regression corresponds to a different deal. The first set of results reports coefficients estimated by OLS. Models (1), (2), and (3) report point estimates for the second stage regression using predicted values for share retained by the lead arranger from Table 3. The sample contains completed dollar denominated loans, originated between 1993 and 2004, to U.S. companies excluding regulated and financial industries identified with 2-digit SIC 40 through 45 and 60 through 64. Model (1) corresponds to the sample where loan data were available. Models (2) and (3) re-examine the result for the subsample of loans matched to Compustat. Borrowers' and lenders' characteristics are computed as of the earliest date prior to the origination of the loan. For definitions of the explanatory variables, please see the appendix. ***, **, and * indicate *p* values of 1%, 5%, and 10%, respectively.

	OLS			***2SLS***								
				(1)			***(2)***			***(3)***		
	Coeff.	t-stat		Coeff.	t-stat		Coeff.	t-stat		Coeff.	t-stat	
Syndicate structure:												
Lead share (%)	0.26	3.3	***	-3.26	-2.0	**	-2.18	-1.6	*	-2.13	-1.6	*
Borrower characteristics:												
Industry default probability (%)	0.79	1.7	*	1.68	2.4	**	0.25	0.4		0.16	0.3	
Not rated	6.49	1.6		25.24	2.5	**	21.63	1.3		23.25	1.6	
Senior debt rating												
AAA	-23.89	-0.7		2.02	0.1		30.93	0.5		21.28	0.4	
AA +	-77.97	-3.1	***	-63.37	-2.1	**	-43.04	-0.9		-35.98	-0.8	
AA	-27.48	-1.6		-3.53	-0.2		-20.30	-0.9		-5.89	-0.3	
AA -	-52.85	-4.6	***	-33.62	-2.0	**	-38.20	-2.1	**	-27.99	-1.6	
A +	-53.41	-6.0	***	-33.57	-2.4	**	-36.61	-2.0	**	-31.43	-1.8	*
A -	-51.40	-7.7	***	-36.60	-3.4	***	-39.90	-2.9	***	-34.53	-2.7	***
A -	-39.19	-6.1	***	-29.57	-3.3	***	-26.61	-2.3	**	-23.25	-2.2	**
BBB +	-28.97	-5.1	***	-21.82	-2.9	***	-24.12	-2.9	***	-19.25	-2.3	**
BBB	-23.12	-4.7	***	-19.12	-3.1	***	-20.14	-2.9	***	-17.25	-2.6	***
BB +	11.43	1.7	*	15.20	1.9	**	22.80	2.1	**	23.10	2.2	**
BB	20.87	3.4	***	19.45	2.7	***	21.65	2.9	***	23.32	3.2	***
BB -	27.39	4.9	***	31.48	4.5	***	31.27	3.8	***	32.84	4.1	***
B +	44.58	8.0	***	60.85	5.9	***	54.64	3.8	***	52.93	4.0	***
B	59.01	8.5	***	75.36	6.6	***	64.82	4.2	***	60.08	4.1	***

TABLE 4 – *continued*

B -	60.71	6.8	***	70.23	6.1	***	69.16	5.6	***	62.39	5.1	***
CCC +	107.53	9.0	***	127.23	7.5	***	127.25	5.8	***	119.35	5.9	***
CCC	193.74	8.4	***	209.99	7.4	***	205.83	7.2	***	198.12	7.1	***
CCC-	164.41	6.5	***	191.96	5.8	***	158.11	4.5	***	126.61	3.8	***
Commercial paper rating	-10.51	-2.8	***	-7.90	-1.7	*	-7.40	-1.4		-5.97	-1.1	
Public	-11.44	-5.0	***	-10.66	-3.9	***	-7.52	-1.6		-1.97	-0.4	
Previous lending relationship	0.77	0.4		-3.02	-1.0		0.03	0.0		0.21	0.1	
Log (Sales at close)	-5.06	-5.9	***	-6.91	-5.1	***	-5.36	-3.3	***			
Log (Assets)										-9.70	-2.7	***
Leverage (Ind. Adjusted)										33.51	6.5	***
ROA (Ind. Adjusted)										-103.60	-7.1	***
Contract characteristics:												
Log (Facility amount)	-12.13	-9.2	***	-35.68	-3.1	***	-26.80	-1.6	*	-23.68	-1.7	*
Maturity (Months)	-0.05	-1.1		-0.17	-2.1	**	-0.21	-2.1	**	-0.19	-1.9	*
Number of facilities	6.79	3.9	***	-13.61	-1.4		-9.77	-0.7		-8.48	-0.7	
Collateral	47.04	20.2	***	48.82	16.9	***	54.97	15.0	***	49.06	15.2	***
Financial covenants	13.30	4.3	***	12.54	3.4	***	15.08	3.9	***	15.55	4.1	***
Prime base rate	161.82	25.3	***	165.95	21.2	***	169.76	19.9	***	160.94	19.1	***
Performance pricing	-19.76	-8.5	***	-26.16	-6.3	***	-19.58	-3.5	***	-19.25	-3.3	***
Lead bank characteristics:												
Ranking	0.40	2.7	***	0.74	3.1	***	0.58	1.7	*	0.55	1.8	*
Syndicate characteristics:												
Syndicate reputation: Lead to participant	-0.73	-3.8	***	-2.40	-2.9	***	-2.13	-1.7	*	-1.95	-1.7	*
Syndicate reputation: Reciprocal	7.24	1.3		-10.13	-1.0		-4.29	-0.4		-4.54	-0.4	
Fixed Effects:												
Bank		Yes			Yes			Yes			Yes	
Year		Yes			Yes			Yes			Yes	
Loan purpose		Yes			Yes			Yes			Yes	
Observations		5,017			5,017			3,617			3,617	
Adjusted R^2		0.59			0.50			0.55			0.61	

TABLE 5

DETERMINANTS OF LOAN SPREADS: DIVERSIFICATION EFFECT

This table reports results of the second stage regression corresponding to the spread required by the lead bank (diversification effects). For compactness, credit ratings are not reported. The spread demanded by the lead bank is identified using syndicate specific *Reputation* measurements that exogenously shift the spread required by the participant banks. The dependent variable, *All-in Drawn Spread,* includes fixed fees (excluding upfront fee) and variable spread that the borrower pays for each dollar drawn down under the loan commitment. Each observation in the regression corresponds to a different deal. Models (1), (2), and (3) report point estimates for the second stage regression using predicted values for share retained by the lead arranger from Table 3. As in Table 4, Model (1) corresponds to the sample where loan data were available and Models (2) and (3) re-examine the result for the subsample of loans matched to Compustat. Borrowers' and lenders' characteristics are computed as of the earliest date prior to the origination of the loan. For definitions of the explanatory variables, please see the appendix. ***, **, and * indicate *p* values of 1%, 5%, and 10%, respectively.

	(1)			*(2)*			*(3)*		
	Coeff.	t-stat		Coeff.	t-stat		Coeff.	t-stat	
Syndicate structure:									
Lead share (%)	1.36	3.7	***	1.98	4.4	***	1.80	4.1	***
Borrower characteristics:									
Industry default probability (%)	0.52	1.1		-0.01	0.0		0.04	0.1	
Not rated	0.71	0.2		-5.33	-0.9		0.27	0.1	
Commercial paper rating	-11.38	-2.9	***	-11.70	-2.7	***	-11.08	-2.6	***
Public	-11.65	-5.0	***	-10.45	-2.4	**	-4.03	-1.0	
Previous lending relationship	2.13	1.0		5.00	2.0	**	3.91	1.6	*
Log (Sales at close)	-4.61	-5.1	***	-3.64	-3.2	***			
Log (Assets)							-5.28	-3.6	***
Leverage (Ind. Adjusted)							37.45	9.3	***
ROA (Ind. Adjusted)							-92.34	-8.9	***
Contract characteristics:									
Log (Facility amount)	-4.99	-1.7	*	0.12	0.0		0.06	0.0	
Maturity (Months)	-0.02	-0.3		-0.08	-1.3		-0.04	-0.6	
Number of facilities	12.89	4.4	***	12.35	3.6	***	12.20	3.8	***
Collateral	46.68	19.6	***	51.57	18.0	***	47.63	17.3	***
Financial covenants	13.49	4.3	***	15.88	4.4	***	16.86	4.9	***
Prime base rate	160.31	24.6	***	165.89	21.5	***	160.04	21.7	***
Performance pricing	-17.65	-7.1	***	-11.72	-4.0	***	-10.97	-3.9	***
Lead bank characteristics:									
Ranking	0.26	1.7	*	0.07	0.4		0.04	0.2	
Credit risk: Δ Default prob. variance (%)	9.91	2.2	**	11.33	2.0	**	14.19	2.5	**
Credit risk: Lending limit ($MM)	-0.07	-2.5	**	-0.02	-1.0		-0.02	-0.8	
Fixed Effects:									
Senior debt credit rating	Yes			Yes			Yes		
Bank	Yes			Yes			Yes		
Year	Yes			Yes			Yes		
Loan purpose	Yes			Yes			Yes		
Observations	5,017			3,617			3,617		
Adjusted R2	0.58			0.58			0.61		

TABLE 6
ROBUSTNESS CHECK: UPFRONT FEE

This table verifies that the diversification premium demanded by the lead bank is part of the *All-in Drawn Spread* and not the *Upfront Fee.* Results of the Table 4 are reexamined for the subsample where Upfront Fee is available. *All-in Drawn Spread* includes fixed fees and variable spread that the borrower pays for each dollar drawn down under the loan commitment, net of upfront fee. Panel A highlights results from the first-stage regression where the dependent variable is *All-in Drawn Spread*. Full specification of the first stage is the same as in Table 3 Model (1). Panel B reports results of the second stage regression corresponding to the spread required by the participant banks (asymmetric information effects). For compactness, credit ratings are not reported. For definitions of the explanatory variables, please see the appendix. ***, **, and * indicate *p* values of 1%, 5%, and 10%, respectively.

Dependent variable:	All-in Drawn Spread			Upfront Fee		
	Coeff.	t-stat		Coeff.	t-stat	
Panel A: First stage regression (Spread)						
Credit risk: Δ Default prob. variance (%)	31.19	2.9	***	8.62		
Credit risk: Lending limit ($MM)	-0.02	0.44		0.01		
Adjusted R^2	0.54			0.25		
Panel B: Second stage regression (Participants' pricing)						
Syndicate structure:						
Lead share (%)	-3.86	-1.7	*	-1.41	-1.2	
Borrower characteristics:						
Industry default probability (%)	0.34	0.3		0.83	1.4	
Not rated	33.23	1.9	*	-4.63	-0.6	***
Commercial paper rating	11.30	0.7		-1.81	-0.2	***
Public	-5.54	-0.8		-5.57	-1.7	***
Previous lending relationship	-0.67	-0.1		-6.02	-2.3	
Log (Sales at close)	-4.72	-1.8	*	-2.80	-2.2	***
Contract characteristics:						
Log (Facility amount)	-37.81	-2.3	**	-8.71	-1.1	***
Maturity (Months)	-0.40	-2.5	**	0.00	0.0	
Number of facilities	-17.47	-1.3		-3.36	-0.5	*
Collateral	51.66	7.6	***	17.85	5.6	***
Financial covenants	-3.31	-0.4		-0.21	-0.1	**
Prime base rate	133.28	9.5	***	26.51	4.0	***
Performance pricing	-18.75	-2.9	***	-13.68	-4.5	***
Lead bank characteristics:						
Ranking	0.81	2.0	**	0.12	0.6	
Syndicate characteristics:						
Syndicate reputation: Lead to participant	-2.18	-1.8	*	-0.57	-1.0	**
Syndicate reputation: Reciprocal	-12.65	-0.5		-17.58	-1.6	***
Fixed Effects:						
Senior debt credit rating		Yes			Yes	
Bank		Yes			Yes	
Year		Yes			Yes	
Loan purpose		Yes			Yes	
Observations		1,067			1,067	
Adjusted R^2		0.39			0.21	

TABLE 7

ROBUSTNESS CHECK: INFORMATION COLLECTION EXPERTISE

This table re-examines the results for the subsample of loans extended to companies in industries where the lead bank does not have monitoring (or information collection) expertise. A bank is said not to have monitoring expertise if its loan portfolio in a given 2-digit SIC industry is below the median level of 3%. Results are comparable to Model (1) in Tables 3, 4 and 5. The dependent variable for the second stage is *All-in Drawn Spread*; it includes fixed fees (excluding upfront fee) and variable spread that the borrower pays for each dollar drawn down under the loan commitment. Each observation in the regression corresponds to a different deal. For compactness, credit ratings are not reported. For definitions of the explanatory variables, please see the appendix. ***, **, and * indicate *p* values of 1%, 5%, and 10%, respectively.

	First stage			Second stage					
	Lead share			Participants' pricing			Lead's pricing		
	Coeff.	t-stat		Coeff.	t-stat		Coeff.	t-stat	
Syndicate structure:									
Lead share (%)				-2.82	-1.6	*	0.71	1.4	
Borrower characteristics:									
Industry default probability (%)	0.14	1.3		0.60	0.8		0.05	0.1	
Not rated	4.24	3.8	***	13.43	1.2		-1.76	-0.3	
Commercial paper rating	0.40	0.4		-9.43	-1.3		-10.99	-1.7	*
Public	0.59	1.0		-11.88	-2.8	***	-13.63	-3.7	***
Previous lending relationship	-1.67	-3.0	***	-1.85	-0.4		3.86	1.1	
Log (Sales at close)	-0.55	-2.2	**	-6.50	-3.3	***	-4.61	-3.0	***
Contract characteristics:									
Log (Facility amount)	-6.70	-19.4	***	-35.46	-2.6	***	-11.65	-2.6	***
Maturity (Months)	-0.03	-2.5	**	-0.15	-1.4		-0.03	-0.4	
Number of facilities	-6.08	-13.1	***	-12.79	-1.0		8.68	1.9	**
Collateral	0.39	0.6		52.93	12.6	***	51.80	14.3	***
Financial covenants	0.01	0.0		13.97	2.5	***	13.96	2.9	***
Prime base rate	-0.14	-0.1		176.52	15.8	***	177.03	18.0	***
Performance pricing	-1.77	-2.8	***	-36.60	-6.8	***	-30.09	-7.9	***
Lead bank characteristics:									
Ranking	0.11	3.2	***	0.50	1.7	*	0.08	0.4	
Credit risk: Δ Default prob. variance (%)	-4.41	-3.2	***				11.39	1.5	
Credit risk: Lending limit ($MM)	0.01	1.0					-0.09	-2.5	***
Syndicate characteristics:									
Syndicate reputation: Lead to participant	-0.51	-10.5	***	-1.84	-1.9	*			
Syndicate reputation: Reciprocal	-4.09	-3.0	***	-4.50	-0.4				
Fixed Effects:									
Senior debt credit rating		Yes			Yes			Yes	
Bank		Yes			Yes			Yes	
Year		Yes			Yes			Yes	
Loan purpose		Yes			Yes			Yes	
Observations		2,397			2,397			2,397	
Adjusted R^2		0.51			0.53			0.60	

TABLE 8
ROBUSTNESS CHECK: ALTERNATIVE DEFINITIONS OF DEFAULT PROBABILITY VARIANCE

This table evaluates the robustness of the relationship between spread and lead bank share reported in Tables 4 and 5 to alternative definitions of *Default probability variance*. The first line repeats the central result of the paper reported in Tables 4 and 5 using the original measure of *Default probability variance* calculated using lagged cross-industry matrices of default correlations. Revolver lines were scaled by 50% and maturity was assumed to be less than three years. The rest of the lines report point estimates of the *Lead Share* for alternative definitions of *Default probability variance*. The first column reports correlation with the original measure, the last column the F-stat of the joint significance of the four instruments used in the reduced form of the *Lead Share*. Lines 2 through 5 consider alternative specifications for the default correlations matrices. Lines 6 and 7 consider alternative assumptions for the outstanding portfolio. Lines 8 through 11 consider several methods of incorporating recovery rates in the analysis. ***, **, and * indicate *p* values of 1%, 5%, and 10%, respectively.

		Corr.	Participant banks (Table 4)			Lead bank (Table 5)			Instruments
			Coeff.	t-stat		Coeff.	t-stat		F-stat
1	***Original measure (Tables 4 & 5)***	--	-3.26	-2.0	**	1.36	3.7	***	6.9
2	*Loan share: median share by loan size*	0.98	-2.86	-1.8	*	1.36	3.8	***	6.8
3	*Default matrix: 1 year default horizon*	0.79	-4.06	-2.0	**	1.44	3.9	***	7.2
4	*Default matrix: not lagged, 1 year horizon*	0.71	-2.30	-1.7	*	1.20	3.2	***	5.1
5	*Default matrix: not lagged, 3 year horizon*	0.73	-2.01	-1.7	*	1.20	3.2	***	4.9
6	*Loans drawn: until maturity*	0.97	-3.43	-1.9	**	1.36	3.7	***	6.9
7	*Loans drawn: 100% revolver loans*	0.95	-2.46	-1.7	*	1.35	3.7	***	6.6
8	*Recovery rates: credit rating*	0.96	-3.00	-1.9	*	1.34	3.7	***	6.8
9	*Recovery rates: asset tangibility*	0.96	-3.92	-2.2	**	1.34	3.7	***	7.3
10	*Recovery rates: collateral*	0.96	-2.35	-1.7	*	1.34	3.7	***	6.6
11	*Recovery rates: loan size/sales*	0.95	-3.90	-2.1	**	1.31	3.6	***	7.3