The Impact of Information Asymmetry on Debt Pricing and Maturity*

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Abstract

In this paper, I exploit the syndicated loan market to explore the impact of information asymmetry on debt pricing and maturity. As a measure of information asymmetry associated with a borrowing firm, I use the bid-ask spread on the firm's loans traded on the secondary loan market. I find that a higher bid-ask spread on a borrower's traded loans leads to a higher interest rate on the borrower's subsequently issued loans. I show that both information asymmetry between syndicate lenders and a borrowing firm and information asymmetry between secondary loan market participants are priced in the loan interest rate. I also find that a higher bid-ask spread on the borrower's traded loans is translated into shorter maturity of the borrower's subsequently issued loans. This empirical evidence demonstrates that information asymmetry increases the cost of debt capital and decreases debt maturity.

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1. Introduction

The role of information asymmetry in debt contracting has long been of interest to researchers in accounting and finance. The central research question I examine in this paper is whether information asymmetry influences the pricing and maturity of private corporate debt contracts. I address this question by analyzing the impact of information asymmetry on debt contractual terms in the syndicated loan market.

The syndicated loan market is a promising setting to test the impact of information asymmetry on loan pricing and maturity, because it includes the primary loan market where syndicated loans are originated, and the secondary market, where syndicated loans may be subsequently traded. I use the bid-ask spread on a borrower's traded loans as a measure of information asymmetry associated with the borrowing firm, and I relate it to the price and maturity of subsequent loans issued by the borrowing firm. This information asymmetry measure is motivated by prior research which demonstrates that information asymmetry is the key determinant of the bid-ask spread in the secondary loan trade (Wittenberg-Moerman, 2006).[1]

I also examine whether loan pricing is primarily affected by information asymmetry between lenders and a borrowing firm or by information asymmetry between secondary market traders. Because some syndicate loan issues are sold on the secondary market, while others are held to maturity by the original lenders, the syndicated loan market offers an opportunity to differentiate between the effect of information asymmetry in the primary and in the secondary loan markets. On the one hand, when, at the loan

[1] Following Copeland and Galai (1983), Glosten and Milgrom (1985) and Kyle (1985), many papers rely on the bid-ask spread as the main measure of information asymmetry (e.g. Lee et al., 1993, Yohn, 1998, Leuz and Verrecchia, 2000, Kalimipalli and Warga, 2002). In this paper I rely on the plausible assumption that the information set of the syndicate lenders is positively correlated with the information set of the secondary loan market participants.

origination, syndicate lenders do not anticipate a subsequent loan sale, they should not price adverse selection in the secondary loan trade in the cost of the loan's financing. In this case, the effect of the bid-ask spread on the loan's interest rate may be primarily attributed to adverse selection between syndicate lenders and a borrowing firm in the primary loan market. On the other hand, when a loan sale is anticipated at the origination, lenders also price the expected adverse selection in the secondary loan trade.[2]

I find that information asymmetry regarding a borrower increases the loan interest rate and decreases maturity. Specifically, the bid-ask spread on a borrower's traded loans is manifested in the interest rate on a borrower's subsequently issued loans. I show that an increase of one standard deviation in the bid-ask spread is associated with an increase of 27.3 basis points in the interest rate. I also find that a higher bid-ask spread on the borrower's traded loans is translated into a shorter maturity of the borrower's subsequent loans. An increase of one standard deviation in the spread reduces maturity by 5 months.

To differentiate between the effects of information asymmetry in the primary and secondary loan markets on loan pricing, I estimate whether, at the loan origination, lenders anticipate a loan's subsequent sale. First, because institutional loans dominate secondary loan trading, I consider loans issued by institutional investors as likely to be traded after origination. Second, I estimate loan trade probability. I find that information asymmetry, the efficiency of post-sale monitoring and the expected liquidity of the secondary trade are key determinants of a loan's salability.

The results show that information asymmetry significantly increases the interest rate spread of syndicated loans irrespective of whether or not they are anticipated to be

[2] Through the paper, I use the terms "information asymmetry" and "adverse selection" interchangeably.

traded. However, the effect of information asymmetry on loan pricing is more pronounced for loans that lenders expect to be subsequently sold on the secondary market. For these loans, lenders also price the loan's expected liquidity in the secondary loan trade. Ultimately, the results suggest that information asymmetry between syndicate lenders and a borrowing firm and information asymmetry between secondary loan market participants is priced in the interest rate. To the best of my knowledge, this paper represents the first attempt to empirically unravel and quantify the effect of adverse selection in the primary and in the secondary markets on the pricing of debt securities.

My study is closely related to prior research which shows that investors demand an extra return to induce them to hold assets subject to high information asymmetry. Diamond and Verrecchia (1991), Baiman and Verrecchia (1996), Easley et al. (2002), Pastor and Stambaugh (2003), Easley and O'Hara (2004) and Lambert et al. (2006) emphasize that adverse selection in secondary markets significantly influences the cost of equity capital. Francis et al. (2005) and Berger et al. (2006) show that the cost of capital decreases with an increase in a firm's information quality. However, Hughes et al. (2005) and Core et al. (2006) question the claim that information asymmetry is priced in the equity cost of capital. This paper contributes to existing research by exploring the impact of information asymmetry on the pricing of private debt contracts. This paper documents that information asymmetry in both the primary and secondary loan markets significantly increases the cost of debt capital.

This study also contributes to literature that examines the impact of information quality on debt pricing. The syndicated loan market proves to be an excellent empirical setting in which to examine this question for two reasons. First, the syndicated loan

market involves an exceptionally wide range of debt contracts, a range that includes loans issued to public and private firms, as well as investment grade and leveraged debt issues. Second, an active secondary loan market provides an opportunity to employ a measure of information asymmetry explicitly related to the debt market. Prior studies which examine debt pricing rely mainly on equity market-based measures of information asymmetry, such as the equity analyst ratings of a firm's disclosure policy, equity analyst coverage and forecast dispersion, and equity institutional holdings.[3] The ability of equity market-based measures of information asymmetry to successfully estimate the extent of private information in the debt market is questionable. Moreover, these measures may not be relevant in the setting of private debt contracts, where lenders, not public market forces such as analysts and big stakeholders, perform the primary monitoring of the firm.

In addition, this paper contributes to literature that examines the influence of asymmetric information on debt maturity. Prior research supports the proposition that information asymmetry plays an important role in determining debt maturity; however, this proposition is difficult to explore because the extent of information asymmetry is not directly observable. To measure information asymmetry, prior studies employ growth options, the size and age of a firm, discretionary accruals, and a firm's ex post changes in earnings and stock returns.[4] Because these variables are likely to be noisy measures of information asymmetry, many studies find relatively weak results when applying these variables to the maturity estimations. Employing the bid-ask spread on a borrower's traded loans as an information asymmetry measure provides much stronger support for a significant relation between debt maturity and information asymmetry.

[3] See Sengupta (1998), Yu (2005), Mansi et al. (2006), Gu and Zhao (2006) and Wang and Zhang (2006).
[4] See, for example, Barclay and Smith (1995), Guedes and Opler (1996), Stohs and Mauer (1996), Barclay et al. (2003), Johnson (2003), Ortiz-Molina and Penas (2006) and Bharath et al. (2006).

This paper also broadens our understanding of the role of information asymmetry in the syndicated loan market. Simons (1993), Dennis and Mullineaux (2000), Lee and Mullineaux (2004) and Sufi (2006a) suggest that loans to information-opaque borrowers are characterized by a more concentrated syndicate and by a larger portion of a loan retained by the arranger of syndication. In addition, Dennis and Mullineaux (2000) argue that the arranger is less likely to syndicate a loan when information about the borrower is less transparent.[5] Because these findings imply that lenders emphasize the importance of a borrower's information environment, it is only natural to pose the question of how information asymmetry regarding a borrower influences the loan contractual terms.

Finally, this paper contributes to concurrent literature which explores the interaction between the primary and the secondary loan markets. Guner (2006) finds that active loan sellers charge lower interest rates on syndicated loans. Gupta et al. (2006) demonstrate that loans that are more likely to be sold experience lower interest rates. While these papers emphasize the effect of loan trade probability on loan pricing, they do not explore adverse selection in the secondary loan trade, which is the main focus of this paper. Adverse selection significantly influences loan liquidity and therefore determines, to a large extent, the "liquidity premium" that lenders will face when a loan is sold on the secondary loan market. This paper demonstrates that syndicate lenders price expected adverse selection in the secondary loan trade in a loan's primary market financing cost.

The following section provides a brief description of the syndicated loan market. The third section describes the data and research design. The fourth section discusses empirical findings. The fifth section presents conclusions and avenues for future research.

[5] The related research also includes Ivashina (2005), who examines how information frictions between the arranger and participant lenders affect interest spread, and Bharath et al. (2006), who examine the impact of accruals quality on the cost and maturity of syndicated loans.

2. The syndicated loan market: Background and development

The U.S. syndicated loan market provides borrowers with a source of financing alternative to high yield bonds and relationship-based bilateral bank loans. A syndicated loan is a private debt instrument that also has the features of a public debt security, such as credit ratings and an active secondary market. A syndicated loan is provided by a group of lenders and it is structured and managed by one or several commercial or investment banks known as arrangers (Standard & Poor's, 2003). The arranger negotiates the loan agreement, coordinates the documentation process, recruits loan participants and performs primary monitoring and enforcement responsibilities (Dennis and Mullineaux, 2000, and Lee and Mullineaux, 2004). While each of the syndicate lenders is responsible only for a portion of the total loan, the loan is governed by a common loan contract. The terms of the loan are identical for all the members of syndication; the participants' unanimity is required to change the principal terms of the loan contract.[6]

Syndicated loans are floating rate debt issues, priced at a specified interest rate spread above a reference rate, such as Prime, LIBOR and Certificate of Deposit. Syndicated loans are always senior debt instruments and they typically contain more numerous and stricter covenants than public debt issues do (Smith and Warner, 1979, Assender, 2000, Dichev et al., 2002, and Dichev and Skinner, 2002).

After the close of primary syndication, syndicated debt instruments can be traded on the secondary market. Loan sales are structured either as assignments or participations, with investors usually trading through loan trading desks at large underwriting banks. In a

[6] In the syndicated loan market, a loan is referred as a "facility". Usually, a number of facilities with different maturities, interest rate spreads and repayment schedules are structured and syndicated as one transaction (deal) with a borrower. The analysis in this paper is performed at the individual facility level.

sale via assignment, the buyer becomes a direct signatory to the loan. In participation, the original lender remains the holder of the loan and the buyer is taking a participating interest in the existing lender's commitment (Standard & Poor's, 2003). The majority of loan sales in the secondary loan market are performed via assignment. For a more detailed discussion of the secondary loan market, see Wittenberg-Moerman (2006).

The primary and the secondary loan markets have grown rapidly in recent years. The value of outstanding syndicated loans increased from $291 billion in 1991 to $1.6 trillion in 2003; since 1999, U.S. firms have obtained over $1 trillion in new syndicated loans each year. The secondary loan market expanded even faster than the primary market; from a trading volume of $8 billion in 1991, the secondary loan market has increased to a trading volume of $145 billion in 2003. Leveraged loans (loans rated below BBB- or Baa3 or unrated and priced at the spread equal, or higher than 150 basis points above LIBOR) constitute the fastest growing part of both loan markets.

3. Data and research design

3.1. Data sources and sample selection

I use data from the Loan Trade Database (LTD) and the DealScan database, provided by the Loan Pricing Corporation (LPC). Starting in 1998, the LTD provides the indicative loan bid and ask price quotes on syndicated loans traded on the secondary loan market.[7] The price quotes are reported to LPC by trading desks at institutions that make a market in these loans. Bid and ask prices are quoted as a percent of par and are

[7] The LTD coverage is limited in 1998, but it increases sharply in 1999. Since 1999, the annual rate of increase in the number of the traded facilities covered by the database has been consistent with the increase in the secondary loan market trading volume. According to LPC estimates, the LTD covers 80% of the trading volume of the secondary loan market in the U.S.

aggregated across market makers. In addition to price coverage, the database provides the quote date and the number of market makers reporting indicative price quotes to LPC.

I subsequently match the LTD to the DealScan database; connecting these two databases allows me to identify borrowers from the LTD on the primary loan market. DealScan covers a majority of the syndicated loan issues in the U.S. and provides a wide range of loan characteristics, such as interest rate, amount, maturity, seniority, purpose and covenants. By connecting the two databases, I identify 3,611 traded loans over the period from June 1998 to December 2003, representing 1,435 borrowers (Table 1). From this sample, I drop loans to non-U.S. firms or not issued in U.S. Dollars. Finally, I exclude 47 loans which lack sufficient secondary pricing data. The remaining sample contains 1,418 borrowers with 3,417 loans traded on the secondary market.

To construct an information asymmetry measure, I require that a borrower have traded loans prior to the subsequent loan issue. I estimate the information asymmetry variable as an average bid-ask spread on a borrower's loans traded on the secondary loan market over the twelve month period prior to the month of a subsequent loan issue. This requirement restricts the analysis to 808 borrowers who have had loans syndicated during the year following the secondary trading of their previous loans. This leads to a sample of 2,966 syndicated loans for which the contractual terms may be linked to the information asymmetry measure based on secondary loan trading. Finally, I exclude loans for which data is not available on the interest rate, loan size and maturity. The final sample results in 2,486 syndicated loans to749 borrowers.

I match the sample borrowers with CRSP and COMPUSTAT databases. DealScan uses the Ticker identifier to classify publicly reporting firms. However, many public

borrowers are missing Tickers or have been assigned outdated Tickers. By using the Tickers available on DealScan, I identify 298 of the borrowers as publicly reporting and publicly traded firms. To improve the identification, I match the rest of the sample borrowers with COMPUSTAT/CRSP by name, industry and state location. This procedure results in the recognition of an additional 168 borrowers as publicly reporting firms, 81 of which are also publicly traded on U.S. stock exchanges. The accuracy of this matching is high, with 80% of the firms being matched on all three parameters.

3.2. Descriptive statistics

Table 2, Panel A presents summary statistics for the total sample of syndicated loans (detailed variable definitions are in Appendix A). Loans are priced at relatively high interest rates, with a mean and median of about 300 basis points above LIBOR.[8] The bid-ask spread has a mean of 1.194% and a median of 0.668% of par value; on average, this information asymmetry measure is based on the 9-month trading history of the borrower's two previous loans traded on the secondary loan market. The sample loans are characterized by a mean size of $277M and a mean maturity of 55 months. On average, sample loans have a BBB- S&P senior debt rating; 26 percent of the sample facilities also have a loan-specific rating. In addition, a typical sample loan is constrained by 3 financial covenants. The sample loans have, on average, 11 syndicate participants.

The further analysis of loan characteristics indicates that institutional term loans issued by institutional investors represent 32.3 percent of the sample loans. 38.8 percent

[8] Because Angbazo et al. (1998) demonstrate that loan rate and annual fees compliment, rather than substitute for, each other in the loan pricing process, I base the analysis on the All-In-Drawn-Spread measure. This measure is equal to the amount the borrower pays in basis points over LIBOR for each dollar drawn down, so it accounts for both the spread of the loan and the annual fee paid. The results are almost identical when the interest rate spread excluding annual fees is incorporated into the regression analysis.

of the sample loans are revolvers. In terms of loan purpose characteristics, 23.5 percent of the loans are issued with restructuring purposes, such as a takeover, LBO/MBO or recapitalization. Loan agreements of 17.4 percent of the sample loans are subject to the interest-increasing performance pricing option; this option gives lenders the right to receive higher interest rates if the borrower's credit quality deteriorates (Asquith et al., 2005). Furthermore, 64.8 percent of the sample facilities are issued to publicly reporting borrowers. Finally, for a sub-sample of 1,739 syndicated loans, DealScan identifies whether they are backed by collateral; 92.5 percent of these loans are secured. Panel B presents summary statistics for the sample of loans of publicly reporting borrowers.[9]

3.3. Estimation of the interest rate model

In this section, I specify the interest rate model estimation. More specifically, I examine whether information asymmetry influences loan interest rate, controlling for various variables that are likely to affect loan pricing:

$$Interest-rate = \alpha + \beta_1 Bid-ask-spread + \sum \beta_i (Control_i) \quad (1)$$

The key coefficient of interest is β_1, which reflects the effect of information asymmetry on the interest rate. The control variables include a variety of loan and borrower-specific characteristics. In particular, I control for loan size because prior studies find that larger loans are priced at lower interest rates (e.g. Booth, 1992, Beatty et al., 2002, and Bharath et al., 2004). I also control for firm size because small borrowers have greater information asymmetries (Bharath et al., 2004) and a higher probability of financial distress (Mansi et al., 2006). In addition, I include controls for credit quality.

[9] I winsorize the interest rate, maturity and explanatory variables at the 1% and 99% levels. A majority of the explanatory variables are not highly correlated. The correlation coefficients are considerably high only for two pairs of variables: *Maturity* and *Institutional* (0.42), and *Revolver* and *Institutional* (-0.55).

Flannery (1986) and Angbazo et al. (1998) suggest that a longer loan maturity is expected to be associated with a higher default risk compared to that of shorter term loans. However, previous studies indicate an ambiguous relation between debt pricing and maturity. I also control for revolvers which prior research finds to be priced at lower interest rates than term loans (Harjoto et al., 2004 and Zhang, 2004).

I also address the distinctive features of syndicated loans that may be related to loan pricing. Institutional term loans typically have a longer maturity and back-end-loaded repayment schedules compared to amortizing term loans, issued by banks. In addition, a wide range of research, including Diamond (1984 and 1996), James (1987), and Gorton and Winton (2002), suggests that banks are more efficient than other financial institutions in screening and monitoring borrowers. Therefore, institutional loans may be priced at higher rates than bank loans are. In addition, I control for the number of participants in a loan syndicate because prior research suggests that a syndicate is structured with fewer lenders when a borrower is more informationally opaque and when a borrower has a higher default probability (Lee and Mullineaux, 2004, and Sufi, 2006a).[10] I also include the interest-increasing performance pricing option in the interest rate estimation.

3.4. Information asymmetry in the primary vs. secondary loan market

To differentiate between the effects of information asymmetry in the primary and secondary loan markets on loan pricing, I estimate whether, at the loan origination, lenders anticipate a loan's subsequent sale. If investors hold their assets until liquidation, they should not be concerned about adverse selection that arises in the exchange of assets

[10] Simons (1993), Dennis and Mullineaux (2000) and Sufi (2006) find that loans to information-opaque borrowers are characterized by arranger retaining a larger share of the loan. Ivashina (2005) also suggests that the size of the arranger's share affects loan interest rate. For my sample, only twelve percent of the loans have the arranger's share data available, which prevents the inclusion of this variable in the analysis.

in the secondary market (Verrecchia, 2001). Stated differently, if lenders hold loans until maturity, they should not price adverse selection in the secondary trade. Consequently, when the trading of a loan is not anticipated, the effect of information asymmetry on the cost of the loan's financing may be primarily attributed to adverse selection in the primary loan market. If, however, lenders anticipate that they will sell a loan prior to maturity, they should also take into account the loan's expected liquidity on the secondary market. Therefore, when, at the loan origination, a loan is anticipated to be traded, adverse selection in both loan markets is expected to influence the interest rate.[11]

Adverse selection in the secondary trade may be of particular importance for loan pricing because syndicate lenders have a positive probability of a liquidity shock, forcing them to face a "liquidity premium" when selling in the secondary market. Regulatory requirements, such as capital adequacy and credit risk exposure, and the active management of a loan portfolio may force lenders to liquidate a loan prior to maturity. It is important to note that even informed investors, such as syndicate participants, absorb a "liquidity premium" when assets are exchanged, to protect investors on the other side of the transaction against the adverse-selection problem (Verrecchia, 2001). Therefore, when syndicate lenders anticipate that they may sell a loan (or some of it) prior to maturity, they will price a "liquidity premium" in the loan interest rate.

It is important to clarify that this paper does not suggest that syndicated loan financing is more costly for borrowers when lenders trade their loans on the secondary loan market. First, Drucker and Puri (2006) demonstrate that, when loans are sold on the secondary market, borrowers benefit from increased access to private debt capital and

[11] This analysis implicitly assumes that at the loan origination the majority of syndicated participants have similar expectations regarding a loan's potential sale. This assumption does not undermine the research design because loans are classified as anticipated to be traded based on a loan's trade likelihood.

from more durable lending relationships. Second, secondary market activity facilitates credit risk management and the loan portfolio diversification of financial institutions. Therefore, a financial institution's ability to sell loans on the secondary loan market may help borrowers in obtaining loan financing in the primary market.

I employ two approaches to classify loans which lenders expect to be traded on the secondary market. First, I distinguish between bank and institutional loans. Second, I develop a model for estimating loan trade probability.

3.4.1. Loans issued by banks vs. loans issued by institutional investors

I consider loans issued by institutional investors as likely to be traded after origination. Loan participation mutual funds (prime funds), Collateralized Loan Obligations (CLOs) and finance companies constitute the main secondary loan market participants.[12] Additionally, hedge funds and pension funds have increased their activity in loan trading (Yago and McCarty, 2004). Over the period from 1997 to 2003, approximately 41 percent of institutional loans issued on the primary market came to be subsequently traded. In contrast, only 10 percent of term loans issued by banks and 5 percent of revolvers were available for secondary trading (Wittenberg-Moerman, 2006).[13]

To examine whether the impact of information asymmetry on loan pricing depends on a loan's likelihood to be traded, I incorporate into the interest rate model an interaction term between the bid-ask spread and the institutional loan indicator variable.

$$Interest-rate = \alpha + \beta_1 Bid-ask-spread + \beta_2 Institutional + \beta_3 Bid-ask-spread * Institutional + \sum \beta_i (Control_i) \quad (2a)$$

[12] Prime funds are mutual funds that invest in leveraged loans. The CLOs purchase assets subject to credit risk, such as syndicated loans, and securitize them as bonds of various degrees of creditworthiness.

[13] About eight percent of the US syndicated loans issued over the period from 1997 to 2003 were subsequently traded on the secondary loan market (Wittenberg-Moerman, 2006).

The bid-ask spread and the interaction term are the main variables of interest. The coefficient on the bid-ask spread reflects the impact of information asymmetry on the pricing of loans not anticipated to be traded. The coefficient on the interaction term variable reflects the incremental effect of information asymmetry on loan pricing for loans which lenders anticipate being traded.

3.4.2. Loan trade probability model

I estimate a loan's trade probability at the loan origination. Because the majority of traded loans become available on the secondary market shortly after the origination date, it is reasonable to assume that most loan sales are anticipated at the loan origination (Guner, 2006, and Drucker and Puri, 2006). Loan trade probability is estimated by a logit model, where the dependent variable is set to be equal to one if the loan is traded on the secondary loan market between 6/1998 and 12/2004, and set to be equal to zero otherwise. The dependent variable's estimation incorporates the year 2004, which follows the sample period, primarily to identify loans issued in the last year of the sample period which came to be traded afterwards. I incorporate as independent variables in the logit model loan-specific characteristics, credit risk, the efficiency of the post-sale lenders' monitoring, characteristics of the loan's information environment and the expected liquidity of the loan's secondary trade.

Traded loans are typically larger than non-traded ones and have longer maturity. In addition, traded loans are often issued with restructuring purposes. Restructuring purpose loans represent over 40% of the traded loans; the proportion of these loans in the primary market is considerably lower (Wittenberg-Moerman, 2006). To address the active trading of institutional loans, I distinguish between loans issued by banks and by institutional

investors. In addition, LPC reports that leveraged loans represent the majority of secondary trades. Consequently, I expect more risky loans to be more actively traded.

To address the efficiency of the post-sale monitoring, I incorporate into the prediction model an indicator variable for revolving facilities. Because borrowers tend to draw down the credit line when their performance deteriorates, revolvers usually require the lender to have a higher screening and monitoring ability. The efficiency of the post-sale monitoring of a borrower is also influenced by financial covenants imposed by the loan contract. Dichev and Skinner (2002) demonstrate that syndicate lenders set debt covenants fairly tightly relative to the underlying financial variables and use them as "trip wires" for borrowers. Therefore, financial covenants allow the buyer of the loan contract to perform efficient monitoring of the borrower, which decreases the importance of the monitoring effort of the original lender. The efficiency of the post-sale monitoring may be critical for a loan's salability because prior literature questions the original lender's motivation to continue a loan's monitoring after a portion of the loan has been sold (Pennacchi, 1988, Gorton and Pennacchi, 1995, and Gorton and Winton, 2000).

A more transparent information environment, as proxied by the availability of a loan rating and by the high reputation of the arranger of syndication, is also expected to enhance a loan's salability. First, Sufi (2006b) shows that loan ratings reduce information asymmetry between borrowers and uninformed lenders. This effect of loan ratings is particularly important for loan trading because the secondary market involves uninformed market participants who do not possess private information sources usually available to informed lenders (e.g. the arranger and syndicate participants). Therefore, by reducing information asymmetry, the availability of a loan rating may incline uninformed lenders

to participate in the loan's secondary trade. This prediction is consistent with Standard & Poor's (2004) proposition that loan-specific ratings help secondary market liquidity.

Second, I expect loans syndicated by more reputable arrangers to have a higher trade probability. While there is technically an independent loan agreement between the borrower and each of the investors, in practice, the syndicate participants typically rely on information provided by the arranging bank (Jones et al., 2005). In addition, more reputable arrangers are more likely to syndicate loans and are able to sell off a larger portion of a loan to the participants (Dennis and Mullineaux, 2000, Panyagometh and Roberts, 2002). The literature interprets these findings as consistent with the proposition that the arranger's status is a certification of the borrower's financial conditions. Gorton and Haubrich (1990) and Gorton and Pennacchi (1995) also emphasize that the bank's reputation serves as an implicit guarantee in a loan sale with no recourse, which is a common practice in the sale of syndicated loans.[14] Secondary loan market evidence is also consistent with the arranger's primary role in resolving information asymmetry. Wittenberg-Moerman (2006) demonstrates that loans syndicated by more reputable arrangers are traded at significantly lower bid-ask spreads.

I also expect the number of market makers trading the borrower's previous loans to be an important determinant of the loan trade probability. Because market makers making a market in a firm's loans already allocate time and resources to follow the firm, it is reasonable to assume that they will be also involved in trading the firm's subsequent loans. In addition, a high number of institutions making a market in the borrower's loans

[14] These papers analyze the bilateral lender-borrower relationship and therefore refer to the reputation of the selling bank. In the setting of the syndicated market where the arranger manages a number of syndicate lenders, I conjecture that the reputation of the arranger dominates the reputation of the other members of the syndication, including the seller, in a specific transaction. Rajan (1998) also suggests that buyers trust the selling bank in a secondary loan sale, because of the importance of maintaining the bank's reputation.

should be associated with a bigger potential investment base for the borrower's loans. As a result, the greater the number of institutions making a market in a borrower's previously traded loans, the higher the loan's expected liquidity in the secondary trade.

Table 3 summarizes the model's explanatory variable. All the characteristics of traded versus non-traded loans are consistent with the predicted relations.

3.4.3. Instrumental variable approach

To disentangle the effects of the primary and the secondary loan markets' information asymmetry, I employ the following procedure. First, I estimate a loan trade probability logit model. I classify loans as being anticipated to be traded if the fitted value of a loan's trade probability from the logit regression is above 0.5; I set the *Trade-anticipation* indicator variable to be equal to one in this case.

Second, I estimate the interest rate model, which incorporates *Trade-anticipation* and the interaction term between the *Bid-ask spread* and *Trade-anticipation*:

$$Interest-rate = \alpha + \beta_1 Bid-ask-spread + \beta_2 Trade-anticipation + \beta_3 Bid-ask-spread * Trade-anticipation + \sum \beta_i (Control_i) \quad (2b)$$

In this estimation, the coefficient on the bid-ask spread reflects the effect of the primary loan market information asymmetry on loan pricing. The coefficient on the interaction term reflects the incremental effect of adverse selection in the secondary trade on loan pricing. Because Gupta et al. (2006) suggest that interest rate and loan trading may be endogenously determined, the interest rate model is estimated by a two stage instrumental variable approach.[15]

[15] According to Angrist (2001), 2SLS estimation of the dummy endogenous-variable model provides consistent estimates of the coefficients. Bharath at el. (2006) employ a similar approach.

Trade-anticipation is instrumented by the reputation of the arranger (based on the arranger's market share),[16] the number of market makers trading the borrower's previous loans and the availability of a loan-specific rating. These variables are expected to increase trade likelihood, but they do not influence loan pricing. First, loans are priced competitively in the syndicated loan market and therefore the reputation of the arranger is not expected to affect loan pricing (Gupta et al., 2006). To verify that the reputation of the arranger is exogenous to loan pricing, I include this variable in the interest rate model; the results indicate that the reputation of the arranger does not have a significant influence on the interest rate. Second, the number of market makers trading the borrower's prior loans should not directly affect loan pricing. Empirically, there is a statistically and economically insignificant relation between the interest rate and the number of market makers variable when the latter is incorporated into the interest rate model. Third, Sufi (2006) suggests that availability of a loan specific rating does not directly influence loan pricing. The insignificant relation between the interest rate and loan rating availability also holds for my research sample.

I also instrument the interaction term between the bid-ask spread and *Trade-anticipation*; the determinants of loan trade probability and the bid-ask spread variables, which are exogenous to loan pricing, serve as instruments in this estimation. For a discussion of the determinants of the bid-ask spread, see section 4.2.

[16] A loan is considered to be issued by a reputable arranger if it is issued by one of the top four arrangers in the primary loan market, based on the arranger's average market share (see Appendix A for a more detailed definition). I relate the *Arranger-reputation* variable to the top four arrangers for two reasons: 1) each of the top four arrangers - JPMorganChase, Bank of America, Citigroup and Bank One - has a considerable market share over the sample period (above 10%); 2) these financial institutions have been present in the top-four arranger category every year over the sample period. Other arrangers active in the syndicated loan market have a considerably lower market share (3% and below) and have a less stable relative ranking over the sample period.

3.5. Estimation of the loan maturity model

The maturity model seeks to explain whether information asymmetry regarding a borrower affects loan maturity:

$$Maturity = \alpha + \beta_1 Bid - ask - spread + \sum \beta_i (Control_i) \quad (3)$$

The control variables include loan size, credit risk, asset maturity and growth options, which prior research suggests as the determinants of debt maturity. Regarding loan size, previous studies do not find conclusive evidence; some studies suggest a positive relation, while others suggest a nonmonotonic one (Barclay and Smith, 1995, Stohs and Mauer 1996, Scherr and Hulbert, 2001, and Ortiz-Molina and Penas, 2006).

Flannery (1986) claims that because of larger information costs associated with long-term debt, high-quality firms would prefer to issue less underpriced short term debt. At the same time, low-quality firms would prefer to borrow overpriced long term debt, leading to a negative relation between credit quality and maturity. However, Diamond (1991) shows a nonmonotonic relation between the borrower's credit quality and debt maturity. His model suggests that the optimal maturity structure trades off a borrower's favorable private information about its future creditworthiness against a borrower's liquidity risk. To address the possible nonlinearity in the relation between credit rating and maturity, I include in the analysis both the credit rating and its square term.

Previous empirical evidence of the impact of asset maturity on debt maturity is ambiguous. Barclay et al. (2003) and Johnson (2003) find that firms match the maturity of their assets with the maturity of their liabilities; matching maturity choices may assist borrowers to issue longer maturity debt without significantly increasing the agency costs

associated with long-term liabilities. Conversely, Guedes and Opler (1996) suggest that firms only partly match the maturity of assets and liabilities.

I also control for the borrower's growth options. Barclay and Smith (1995), Guedes and Opler (1996) and Barclay et al. (2003) show that firms with higher growth options tend to issue more short-term debt. This finding is consistent with Myers' (1977) prediction that firms with greater growth opportunities can control for underinvestment by shortening debt maturity. I estimate growth options by the borrower's asset tangibility, R&D intensity and market-to-book ratio.

4. Empirical results

4.1 The impact of information asymmetry on loan pricing

Estimation of the interest rate on the loans of public and private borrowers

Table 4, Column (1) presents the results from estimating the interest rate model for the total sample of public and private borrowers. There is clear evidence that the interest rate is positively related to the information asymmetry measure. This result is statistically and economically significant; an increase of one standard deviation in *Bid-ask-spread* is associated with an increase of 27.3 basis points in the interest rate. This effect is substantial, given that the median interest rate for the sample loans is 300 basis points.

The loadings on control variables are consistent with the predicted relations. The negative coefficient on *Loan-size* can be attributed to a higher amount of information regarding large loans and to economies of scale in loan production and monitoring (Booth, 1992, and Jones et al., 2005). Additionally, more risky loans are charged higher interest rates. Consistent with prior empirical research, I do not find that a longer maturity is associated with higher interest rates. As expected, institutional loans carry higher

interest rates. Consistent with Asquith et al. (2005), lenders charge lower rates when an interest-increasing performance pricing option is included in the contract.[17]

I also find a positive relation between the number of financial covenants and the interest rate. This result is explained by lenders imposing more extensive covenants as a borrower's financial risk increases (Standard & Poor's, 2003, Bradley and Roberts, 2004, and Chava et al., 2004).[18] A negative relation between *Number-of-lenders* and the interest rate is consistent with the higher transparency and lower default probability of loans issued by syndicates with a high number of participants. Finally, loans of public firms experience lower interest rates than private firms' loans do, which reflects the differences in their information environment and default probability.

Estimation of the interest rate on the loans of publicly reporting borrowers

To perform an analysis for the loans of public borrowers, I exclude loans for which there is no data available on the borrower's total assets, long-term debt, EBITDA and interest expense. As expected, loans to larger and more profitable borrowers are priced at lower interest rates, while the loans of more leveraged borrowers experience higher interest rates (Table 4, Column (2)). The effect of these variables on loan pricing is also economically significant.[19] I also find that the loans of publicly traded borrowers are priced at lower rates relative to the loans of borrowers who only report to the SEC.

[17]An insignificant relation between *Revolver* and loan pricing may be explained by the fact that the majority (95%) of the revolvers in my sample are revolvers above one year. In contrast to short-term revolvers, long-term revolvers do not benefit from the less stringent regulatory capital requirements than term loans.

[18] When DealScan reports that a facility is not subject to financial covenants, it indicates one the following: 1) LPC has verified that the loan contract does not impose covenants or 2) LPC has not been able to obtain covenant information. It is important to note that DealScan's coverage has significantly improved since 1996 and that all of the sample facilities have been issued during this period. Therefore, I do not expect the covenant coverage issue to have a significant impact on the empirical findings.

[19] An increase of one standard deviation in the *Firm-size* and *Profitability* is associated with a decrease of 32 and 24 basis points in the interest spread, respectively. An increase of one standard deviation in the *Leverage* variable is associated with an increase of 14 basis points in the spread.

The incorporation of these additional control variables into the model does not diminish the power of information asymmetry in explaining the interest rate. The impact of information asymmetry on loan pricing is statistically and economically significant: an increase of one standard deviation in *Bid-ask-spread* increases the interest rate of a syndicated loan by 23.4 basis points.

The results are robust to the inclusion of additional control variables: the average price of the borrower's traded loans, the interest rates on the borrower's previous loans, the time period between loan origination and its first trading date, the discrepancy between S&P and Moody's loan ratings, specific types of financial covenants, additional loan type dummies, restructuring purpose and other loan purpose dummies, the market-to-book ratio, R&D intensity, abnormal accruals and earnings and cash flow volatility.

In addition, I perform the analysis for the sample of loans subject to a performance pricing provision. I find that *Bid-ask-spread* is significantly related to both the maximum and minimum interest rates specified in a loan contract. These results indicate that not only the original interest rate charged on a loan but the whole performance pricing grid increases with an increase in information asymmetry.

4.2 Robustness tests of the loan pricing estimation

In this section, I perform a number of tests to further show that the impact of the bid-ask spread on loan pricing is consistent with the information asymmetry hypothesis. Wittenberg-Moerman (2006) finds that information asymmetry is the key determinant of the bid-ask spread in the secondary loan trade. While this evidence strongly supports the proposition that the bid-ask spread successfully captures information asymmetry regarding the borrower, relying on the bid-ask spread measure may raise some concerns.

First, trading spreads and interest rate may be related to some omitted variables. Second, a positive relation between the interest rate and the bid-ask spread may be at least partially attributed to credit risk considerations. This concern is supported by prior studies that suggest that corporate credit ratings, on which I rely to measure the credit risk of a borrower, frequently lag behind the recent changes in a borrower's credit quality (e.g. Hite and Warga, 1997, and Beaver et al., 2006). Third, the empirical tests do not differentiate between the adverse selection component (related to asymmetric information) and the transitory component of the bid-ask spread (related to the inventory and order-processing costs of the market maker). A number of prior studies unravel the adverse selection component of the stock bid-ask spread. However, because the trading volume and actual transaction data are not available for the traded loans, the models suggested by these studies can not be used to measure the information asymmetry component in loan spreads.[20] To alleviate these concerns, I perform the following tests.

Allowing for interest rate and bid-ask spread endogeneity

Table 5 presents the result from estimating the two stage procedure, where the bid-ask spread is estimated in the first stage and the interest rate model in the second. The challenge of this estimation is in finding instrumental variables related to the bid-ask spread, but that affect the interest rate solely through their impact on information asymmetry regarding the borrower. My instruments for the bid-ask-spread are the *Prior-restructuring*, *Syndicated-market-exposure* and *Accounting-income-volatility*.

[20] Glosten and Harris (1988) use trading volume and trade frequency to break the bid-ask spread into a transitory and adverse selection component. Stoll (1989) and Hasbrouck (1991) estimate the permanent component of the bid-ask spread based on the quoted spread and the actual trade data. Barclay and Dunbar (1991) also rely on the trading volume. The liquidity measure of Acharya and Pedersen (2004) is based on stock returns and trading volume. Because LTD provides bid and ask price quotes aggregated across market makers, I also can not rely on the frequency of the price revisions to estimate a loan's liquidity.

Prior-restructuring indicates whether a borrower has been issued restructuring purpose loans during the two years preceding the loan issuance. Restructuring purpose loans point to a considerable change in a borrower's capital structure, which may be associated with an increase in information asymmetry regarding a borrower. At the same time, *Prior-restructuring* may affect loan pricing solely through its impact on information asymmetry. The *Syndicated-market-exposure* is the ratio of the number of loans issued to a borrower during the five year period preceding the loan issuance, scaled by the borrower's credit rating.[21] The motivation for this instrument relies on Sufi (2006a) who suggests that information asymmetry is reduced when the borrower becomes more "known" in the syndicated market. In other words, for borrowers with a high syndicated market exposure, a higher amount of information is available to the syndicated market participants. To account for the fact that riskier borrowers may need loan financing more frequently, the number of loans issued to the borrower is scaled by the borrower's credit risk. A borrower's market exposure should not be directly related to loan pricing.

The *Accounting-income-volatility* instrument is motivated by prior accounting research which demonstrates that income volatility is associated with a firm's information environment. As suggested by Leuz et al. (2003), I estimate income volatility relative to a firm's cash flow volatility. While income volatility significantly increases the bid-ask spread, it is not expected to affect loan pricing except for its influence on a borrower's information environment. To verify that these instruments are exogenous to loan pricing, I include them in the interest rate model. The results demonstrate that there is a no significant relation between the interest rate and the instrumental variables.

[21] The results are robust to different time periods preceding the loan issuance over which *Prior-restructuring* and *Syndicated-market-exposure* variables are estimated.

Results presented in Table 5 confirm that allowing for endogeneity does not diminish the influence of information asymmetry on loan pricing. In contrast, in this specification the bid-ask spread has a larger impact on loan pricing: an increase of one standard deviation in *Bid-ask-spread* is associated with an increase of 34 and 41 basis points in the interest rate for the total and publicly reporting samples, respectively.[22]

Lending relationship

To show that the results are consistent with the information asymmetry hypothesis, I also rely on the lending relationship. In particular, I identify loans syndicated by lead arrangers with prior lending relationships with a borrower. The effect of information asymmetry should be less pronounced for loans issued by relationship lenders who have obtained private information through prior transactions with a borrower.

Following Bharath et al. (2006), for every sample loan I construct a lending relationship measure by searching all the previous loans of the borrower over the 5 year period preceding the loan's issuance date. Then, for every previous loan I identify the lead arrangers in the syndication. If at least one of the loan's lead arrangers had been a lead arranger of the loans previously issued to the borrower, I classify the loan as being issued by a relationship lender. Consistent with prior research, I base this analysis on the borrower's prior relationship with the arranger of syndication and not with the syndicate participants because the arranger performs the main monitoring of the borrower and the participants typically rely on the information provided by the arranger.

The negative coefficient on the interaction term between *Bid-ask-spread* and *Lending-relationship* demonstrates that the impact of the bid-ask spread on loan pricing is

[22] It is important to note that the results of the bid-ask spread estimation are consistent with Wittenberg-Moerman (2006), which examines the determinants of the bid-ask spread in the secondary loan market.

less pronounced for loans issued by relationship lenders (Table 6). This result strongly supports the information asymmetry interpretation of the empirical findings. Other variables, such as credit risk or the transitory component of the bid-ask spread, cannot explain why the effect of the bid-ask spread on loan pricing is less pronounced for loans syndicated by a lead arranger with prior lending relationship with the borrower.[23]

Further analysis of the credit risk concern

I also restrict the analysis to the sample of loans with available loan rating data. In addition to the default risk, loan rating captures loss-given-default risk - expected loss which the lender would incur in the event of a borrower's default. Moreover, because loan ratings incorporated into the analysis are the original loan ratings assigned around the loan issuance date, these ratings do not fall behind the changes in the borrower's creditworthiness. Therefore, loan rating better captures the credit risk exposure associated with providing funds to the borrower than the corporate credit rating does. The results presented in Table 6 show that *Bid-ask-spread* has both a statistically and an economically significant impact on the interest rate in this specification.[24]

Furthermore, I incorporate into the analysis the average price of the borrower's traded loans (estimated over the twelve month period prior to the month of a loan's issuance). The loan's secondary market price reflects the investor's assessment of the borrower's default probability and it may be a better and timelier measure of the

[23] The results presented in Table 6 are also consistent with Bharath et al. (2006) who show that borrowing from a relationship lender is especially attractive for informationally opaque borrowers. It is important to note that this interpretation of the results also confirms that the bid-ask spread captures mainly information asymmetry regarding the borrower, but not other borrower characteristics.

[24] The loan rating is obtained prior to offering the loan to potential syndicate participants or just after the loan closing. While the loan rating cannot directly influence the loan rate if it is not issued before a loan is syndicated, the information reflected in the rating nevertheless is associated with the interest rate, assuming that the arranger has access to the same (or better) information as the rating agency (Mullineaux and Yi, 2003). In addition, rating agencies also issue a "prospective" rating before the loan closing, which further alleviates concern regarding the rating's issuance date.

borrower's default risk than the corporate credit rating incorporated into the analysis. The untabulated analysis shows that while *Bid-ask spread* continues to be significantly related to the interest rate, the trading price does not have a significant impact on loan pricing.

Additional robustness tests

I also perform an analysis for the sample of loans for which DealScan identifies whether they are backed by collateral. Despite the reduction in the sample size, the information asymmetry variable continues to be significantly related to the interest rate. To further alleviate the omitted variable concern, I incorporate firm fixed effects in the interest rate model. In this estimation, bid-ask spread has even stronger economic effect on loan pricing (the results are untabulated). In addition, clustering at the year level provides qualitatively similar results.

While Lambert et al. (2006) demonstrate that differences in information quality across firms survive the forces of diversification, Hughes et al. (2005) and Core et al. (2006) suggest that information risk may not be priced in a multi-security setting. To test whether the effect of information asymmetry on loan pricing is diversifiable, I distinguish between loans issued in 1998 and 1999 and loans issued between 2000 and 2003. In the latter period, the secondary market has experienced significantly higher trading volume and a significant increase in the number of traded loans. Consequently, by managing a loan portfolio via secondary market sales and purchases, lenders could more easily diversify information risk over the 2000-2003 period. The untabulated results demonstrate the significant influence of information asymmetry on loan pricing irrespective of the loan issuance period. This evidence suggests that the information effect will not be eliminated with further secondary loan market development.

4.3 What is driving the information asymmetry effect?

In this section, I empirically examine whether the effect of information asymmetry on loan pricing is driven primarily by information asymmetry in the primary or the secondary loan market. More specifically, first, I test the trade probability model. Then, I explore how adverse selection in the primary and secondary markets affects loan pricing.

Determinants of loan trade probability

Results of the logit model estimation suggest that the efficiency of post-sale monitoring, information asymmetry and the expected liquidity of the secondary trade are key determinants of a loan's salability (Table 7). Consistent with the more intense monitoring required for revolvers, these facilities have a lower trade probability than term loans. In addition, the high number of financial covenants which lenders use as "trip wires" for borrowers increases a loan's probability to be traded. Regarding information asymmetry, the availability of a loan rating which reduces information asymmetry between a borrower and uninformed lenders facilitates secondary trading. Furthermore, the high reputation of the arranger increases loan trade probability; this is consistent with the arranger's dominant role in resolving information asymmetry regarding a borrower. In addition, the higher the number of market makers following the borrower's previous loans, the higher the probability that a loan will be traded after origination.

There is also evidence that larger loans, loans with longer maturity, loans with restructuring purposes and loans issued to larger borrowers have a higher probability of a secondary trade. Consistent with expectations, institutional loans are more likely to be traded. Finally, riskier loans have a higher trade probability. The impact of all the explanatory variables on loan trade probability is also economically significant. Overall,

the model's explanatory power is relatively high: the model correctly classifies 76 to 84 percent of loans subsequently traded and 70 to 76 percent of non-traded loans.[25]

The results of the prediction model are robust to a number of specifications. First, the incorporation of a more stringent measure of *Secondary-trade*, which considers a loan to be traded only if it becomes traded within one year after origination, results in similar findings. Second, the results of the model are robust to the inclusion of additional variables: the bid-ask spread on a borrower's loans, a borrower's distressed loans (loans traded at a bid price below 90 percent of the par value), the number of syndicate participants, the performance pricing provision, dividend restrictions, secured dummy, leverage and profitability; I find an insignificant relation between these variables and loan trade probability.[26] The prediction model does not incorporate the characteristics of the selling lender. This caveat is driven by the limited coverage of the LTD; the database does not identify which of the syndicate participants are involved in a loan's trade.

The effect of adverse selection on loan pricing

The results presented in Table 8 show that an increase of one standard deviation in the bid-ask spread increases the interest rate from 20 to 25 basis points (depending on the model specification). Because the coefficient on the *Bid-ask-spread* reflects the impact of information asymmetry on the pricing of loans not anticipated to be traded, the observed effect is primarily attributed to information asymmetry in the primary loan market.

[25] While the entire amount of a loan may be traded on the secondary market, it is also possible for only a partial amount to be traded. The LTD does not provide information regarding the share of a loan that is traded. According to LPC, the average loan trade size amounted to $2.5 million over the sample period.

[26] Drucker and Puri (2006) find that general covenants such as sweeps increase trade probability. I do not control for the existence of sweeps because 99.5 percent of the loans in the research sample, for which this data is available, are subject to sweep constraints. In addition, sales via assignment, which represent the majority of the secondary loan sales, typically require the contest of the borrower and arranger, although consent may be withheld only if a reasonable objection is made. I do not control for the arranger consent and borrower consent required for loan sale because such consents are required for 97 percent of the sample loans for which the relevant data is available.

The coefficient on the interaction term is also significant, suggesting that the effect of information asymmetry on loan pricing is even more pronounced for loans which lenders expect to be traded. This effect of information asymmetry on loan pricing is substantial, either *Investor* or *Trade-anticipation* variables are employed to identify loans which are anticipated to be traded. An increase of one standard deviation in the interaction term variable is associated with an additional increase of 7 to 9 basis points in the interest rate. This incremental effect of information asymmetry on loan pricing is attributed to the adverse selection in the secondary trade. In other words, for loans which are likely to be traded, loan pricing also reflects a loan's expected liquidity on the secondary loan market. Ultimately, the empirical findings demonstrate that both information asymmetry between syndicate lenders and a borrowing firm and information asymmetry between secondary loan market participants is priced in the loan interest rate.

To verify the stability of the results, I estimate the interest rate model which incorporates the actual trade probability value (*Trade-probability*), instead of the *Trade-anticipation* indicator variable. In this specification, I also find that the interest rate is positively related to the interaction term between the bid-ask spread and trade probability; however the economic effect of this variable is less significant.

In addition, I estimate the interest rate model for two sub-samples: loans anticipated to be traded (*Trade-anticipation* equal to one) and loans not anticipated to be traded (*Trade-anticipation* equal to zero). Untabulated results demonstrate that an increase of one standard deviation in *Bid-ask-spread* translates into an increase of 32 and 24 basis points in the interest rate for the "trade anticipated" and "trade non-anticipated" samples, respectively. The more considerable impact of information asymmetry on the pricing of

loans anticipated to be traded is consistent with lenders pricing both primary and secondary loan market information asymmetry when the secondary trade is anticipated.

I believe that it is important to reconcile my findings with Gupta et al. (2006).[27] While Gupta et al. (2006) find that loans that are likely to be traded experience a lower interest rate, I find an insignificant relation between the interest rate and the *Trade-anticipation* variable. There are a number of reasons for this discrepancy. First, Gupta et al. (2006) do not explicitly control for information asymmetry regarding the borrower. In an attempt to replicate Gupta et al. (2006), I estimate the interest rate model which incorporates the *Trade-probability* variable, but excludes the *Bid-ask-spread* measure.[28] In this specification, I find a significantly negative relation between *Trade-probability* and the interest rate, suggesting that loans that are likely to be traded experience a lower interest rate. However, this result does not hold when I control for information asymmetry regarding the borrower: when the interest rate model includes the *Bid-ask-spread* variable, the coefficient on *Trade-probability* is statistically and economically insignificant. Because *Bid-ask-spread* and *Trade-probability* are significantly negatively correlated (the Pearson/Spearman rank correlation coefficients are -0.27/-0.23 for my sample), omitting the information asymmetry variable from the interest rate model causes a seemingly negative relation between *Trade-probability* and the interest rate variable.

Second, Gupta et al. (2006) classify loans traded on the secondary loan market but reported to LPC by only one market maker as non-traded (illiquid). Conversely, in this

[27] A direct comparison with Guner (2006) is not possible. Guner (2006) finds that loans issued by more active loan sellers experience lower interest rates. In the empirical setting of this study, institutional investors are the more active loan sellers. At the same time, institutional investors usually issue loans with interest rates higher than those charged on amortizing term loans and revolvers.

[28] Following Gupta et al. (2006), I employ a two stage instrumental variable procedure, where the trade probability is estimated in the first stage and the interest rate model in the second.

study, loans reported to LPC by only one market maker are classified as traded, which is consistent with them being traded on the secondary loan market.[29] The imperfect loan classification in Gupta et al. (2006) is driven by data limitations – the authors have data only for loans with prices quoted by at least two market makers. As a result, compared to this paper, Gupta et al. (2006) classify only relatively more liquid loans as being traded; this may explain the negative relation between the interest rate and trade probability suggested by their study. Third, while Gupta et al. (2006) explore the entire DealScan population, constructing an information asymmetry measure restricts the analysis in this paper to the borrowers with previously traded loans. Differences in the research samples may also contribute to the discrepancy in the empirical findings.

4.4 The impact of information asymmetry on loan maturity

The results presented in Table 9 show that the impact of information asymmetry on loan maturity is both statistically and economically significant. For the total sample and for the sample of public borrowers, an increase of one standard deviation in *Bid-ask-spread* reduces loan maturity by approximately 5 months. This effect represents around 8 percent of the median loan maturity of the sample loans. This evidence suggests that syndicate lenders issue loans with shorter maturities to informationally opaque borrowers. A short loan maturity induces more frequent refinancing of the borrower's loans, which allows lenders to more frequently renegotiate the loan contractual terms.

The results also suggest that loan maturity increases with loan size, but it decreases with the size of the borrower's total assets. Consistent with Diamond (1991), I find a

[29] Gupta et al. (2006) define liquidity as the secondary market activity. Therefore, their prediction model measures the probability that the loan will become traded on the secondary market.

nonmonotonic relation between credit quality and debt maturity. Generally, lenders issue loans with longer maturity to more risky borrowers; however, if a borrower's credit quality considerably deteriorates, loan maturity decreases. As expected, institutional loans and restructuring purpose loans have longer maturity. The results also indicate that financial covenants are associated with longer maturity. Because financial covenants mitigate the consequences of borrower-lender informational asymmetries, imposing financial covenants allows lenders to issue loans with longer maturity. I also examine the relation between *Asset-maturity*, *Asset-tangibility* and loan maturity; I do not find that these variables have a significant impact on loan maturity choices.

It is important to note that the negative relation between *Bid-ask spread* and loan maturity, as suggested by the empirical analysis, is inconsistent with the credit risk interpretation. If a bid-ask spread on a borrower's traded loans proxy for a borrower's credit risk, a higher bid-ask spread should be associated with longer maturity because lenders issue loans with longer maturity to more risky borrowers. Therefore, credit risk interpretation predicts a positive relation between *Bid-ask spread* and loan maturity, in contrast to the negative relation shown by the empirical estimation of the maturity model.

To further alleviate the credit risk concern, I perform the analysis for the sample of loans with an available loan credit rating (Table 10). *Bid-ask-spread* continues to be significantly related to loan maturity; the negative relation between these variables further undermines the credit risk interpretation. In addition, the untabulated analysis demonstrates that the impact of information asymmetry on loan maturity is robust to the incorporation of the average price of the borrower's traded loans in the maturity

estimation. *Bid-ask spread* continues to be significantly related to the interest rate in this specification, but the trading price does not significantly influence loan maturity.

Additional robustness tests

Because prior debt maturity research employs growth options as the main information asymmetry measure, I limit the sample to loans with R&D data available. *Bid-ask spread* continues to be significantly related to loan maturity in this specification, and the impact of this variable on loan maturity is much stronger than that of *R&D-intensity* (Table 10). The untabulated results also demonstrate that allowing for endogeneity between the bid-ask spread and loan maturity does not alter the main conclusion that information asymmetry significantly decreases loan maturity.

The results are robust to the inclusion of additional loan- and borrower-specific characteristics, such as the interest rate, revolver,[30] secured dummy, performance-pricing, the number of syndicate participants, the average price of the borrower's traded loans, the maturity of the borrower's previous loans, the time period between loan origination and its first trading date, the discrepancy in loan-specific ratings, specific types of financial covenants, additional dummies for loan type and purpose, and the borrower's market-to-book ratio, profitability, leverage, abnormal accruals and earnings and cash flow volatility. In addition, clustering at the year level provides almost identical results. [31]

I also examine whether the impact of information asymmetry on loan maturity is affected by loan trade probability. To test this question, I estimate the maturity model which incorporates the *Trade-anticipation* indicator variable and the interaction term

[30] The majority (95%) of the revolvers in the research sample are long term revolvers, therefore there is no significant difference in maturity between revolvers and term loans.

[31] All the core results are also unchanged when a logarithm of the loan maturity is incorporated as the dependent variable in the empirical analysis.

between *Trade-anticipation* and *Bid-ask spread*. I do not find that the relation between loan maturity and information asymmetry differs across loans with high or low probability of a secondary trade. This finding is consistent with Guner (2006) who shows that loan sales are not associated with non-price loan contractual terms.

Finally, I estimate a simultaneous equations model, where the interest rate and maturity are jointly determines. I rely on *Performance-pricing* and *Number-of-lenders* as variables affecting loan pricing but exogenous to loan maturity.[32] These variables are both statistically and economically insignificant when incorporated into the maturity model. For the sample of publicly reporting borrowers, *Profitability* and *Leverage* also serve as instruments for loan pricing. My instrument for loan maturity is *Purpose-restructuring*. While restructuring purpose loans have significantly longer maturity, I do not find that loan purpose affects the interest rate. Brav et al. (2006) also rely on loan purpose as an instrument for loan maturity.

The results presented in Table 11 confirm that allowing for joint determination of the interest rate and maturity does not affect the main conclusion that information asymmetry significantly influences loan contractual terms. The bid-ask spread continues to be significantly related to both interest rate and maturity. With respect to the relation between interest rate and maturity, controlling for simultaneity reveals that longer maturity loans are charged higher rates. This significant relation between interest rate and maturity is consistent with theoretical predictions, but was not observed in prior findings; this result indicates a successful identification of the simultaneous equation system. The rest of the explanatory variables are largely unaffected by controlling for simultaneity.

[32] I do not rely on *Revolver* as an instrumental variable for loan pricing because this variable appears to be insignificantly related to the interest rate in a number of specifications.

5. Conclusions and future research

In this paper I examine the impact of information asymmetry on the pricing and maturity of private debt contracts. Empirical findings show that information asymmetry increases the cost of debt capital. I find that a higher bid-ask spread on a borrower's traded loans leads to a higher interest rate on a borrower's subsequently issued loans. Furthermore, I show that information asymmetry in both the primary and secondary loan markets is priced in the interest rate. In other words, this paper documents that information asymmetry between lenders and a borrowing firm and information asymmetry between secondary market participants significantly increases the cost of debt capital. In addition, I find that lenders issue loans with shorter maturities to more informationally opaque borrowers. The higher the bid-ask spread on a borrower's traded loans, the shorter the maturity of the borrower's subsequently issued loans. This evidence demonstrates that the cost and maturity of private debt financing is determined to a large extent by the information asymmetry associated with a borrowing firm.

The investigation of the impact of information asymmetry on debt pricing and maturity in the syndicated loan market points to new opportunities for future research. First, how lenders address information asymmetry in setting other contractual terms of a loan, such as amount, collateral, tightness of the financial covenants and the performance pricing grid structure, is an open empirical question. Second, very little is known about the interaction between the primary and the secondary loan markets. This paper suggests that the trading spread is an important source of information on which lenders may rely in pricing the loan and in shaping the loan maturity structure. The other information channels between the primary and secondary loan markets are largely unexplored.

Appendix A: Variable Definitions

Variables	Description
Interest-rate	The interest rate is based on the All-In-Drawn-Spread measure reported by DealScan. This measure is equal to the amount the borrower pays in basis points over LIBOR for each dollar drawn down, so it accounts for both the spread of the loan and the annual fee paid to the bank group. LPC always uses the LIBOR spread or the LIBOR equivalent spread option to calculate the All-In-Drawn spread.
Bid-ask spread	An average bid-ask spread on the borrower's loans traded on the secondary loan market. The bid-ask spread is estimated over the twelve month period preceding the month of a subsequent syndicated loan issue. The bid-ask-spreads are reported as a percent of par (or cents on the dollar of par value).
Loan-size	Total sample: a logarithm of the loan's amount. Publicly reporting sample: the loan's amount deflated by the borrower's total assets in the year prior to entering into a loan contract.
Firm-size	Publicly reporting sample: a logarithm of the borrower's total assets in the year prior to entering into a loan contract.
Maturity	The number of months between the facility's issue date and the date when the loan matures.
Corporate-rating	The numerical equivalent of the S&P or Moody's senior debt rating. It is set as equal to one if the S&P senior debt rating is AAA, through 22 if the S&P senior debt rating is D, which is the lowest rated debt in the sample. For the borrowers not rated by S&P, I assign Moody's senior debt rating, converted to an equivalent S&P rating. I use a conventional conversion scheme which matches S&P and Moody's ratings in a following manner: S&P AAA ratings are equivalent to Aaa ratings according to the Moody's system, AA ratings are equivalent to Aa ratings and so on. The corporate credit rating variable is set to 23 for firms without an available S&P or Moody's senior debt rating. All the sample facilities that do not have S&P or Moody's firm- and loan-specific ratings are also not rated by Fitch-ICBA.
Loan-rating	The numerical equivalent of the S&P or Moody's loan rating. It is set as equal to one if the S&P loan rating is AAA, through 22 if the S&P loan rating is D. For the borrowers not rated by S&P, I assign Moody's loan rating, converted to an equivalent S&P rating. Syndicated loans which are not rated are not assigned the numerical loan rating variable.
Loan-rating-available	Loans with a loan-specific credit rating available, including Moody's Loan Rating and S&P Loan Rating.
Rating-discrepancy	The absolute difference between the S&P's and Moody's loan ratings.
Number-of-lenders	Number of participants in the loan syndicate, including the arranger.
Institutional	An indicator variable taking the value of one if the loan's type is term loan B, C or D (institutional term loans), zero otherwise.
Revolver	An indicator variable taking the value of one if the loan's type is revolver, zero otherwise.
Purpose-restructuring	An indicator variable taking the value of one if the facility's primary purpose is Takeover, LBO/MBO or Recapitalization, zero otherwise. A loan with a primary purpose of recapitalization is a loan to support a material change in a firm's capital structure, often made in conjunction with other debt or equity offerings.
Performance-pricing	An indicator variable taking the value of one if the loan contract incorporates an interest increasing performance pricing option, zero otherwise.
Covenant-financial	The number of financial covenants imposed by the loan agreement.
Secured	An indicator variable taking the value of one if the loan is backed by collateral, zero otherwise.
Public	An indicator variable taking the value of one if the borrower is a publicly reporting firm in the year when the loan is issued on the syndicated loan market, zero otherwise.

Variables	Description
Traded	An indicator variable taking the value of one if the borrower is a publicly traded firm on U.S. stock exchanges in the year when the loan is issued on the syndicated loan market, zero otherwise.
Leverage	The ratio of the long-term debt to total assets, estimated in the year prior to entering into a loan contract.
Interest coverage	The ratio of EBITDA to interest expense, estimated in the year prior to entering into a loan contract.
Profitability	The ratio of EBITDA to total assets, estimated in the year prior to entering into a loan contract.
Asset-maturity	The measure suggested by Stohs and Mauer (1996) and Johnson (2003): $Asset-Maturity = \frac{CA_i}{CA_i + PPE_i} * \frac{CA_i}{COGS_i} + \frac{PPE_i}{CA_i + PPE_i} * \frac{PPE_i}{Depriciation_i}$, where CA_i is the current assets of firm *i*, PPE_i is the net property, plant and equipment of firm *i*, $COGS_i$ is the cost of goods sold of firm *i*, and $Deprecation_i$ is the depreciation and amortization expense of firm *i*. The asset maturity measure is estimated in the year prior to entering into a loan contract.
Asset-tangibility	The ratio of net PPE to total assets, estimated in the year prior to entering into a loan contract.
R&D-intensity	The ratio of R&D expenditures to sales, estimated in the year prior to entering into a loan contract.
Secondary-trade	An indicator variable taking the value of one if the loan is traded on the secondary loan market between June 1998 and December 2004, zero otherwise.
Arranger-reputation	An indicator variable taking the value of one if the loan is syndicated by one of the top four arrangers, based on the arranger's average market share in the primary loan market. The market share is measured by the ratio of the amount of loans that the financial intermediary syndicated as a lead arranger to the total amount of loans syndicated on the primary loan market over the period from 1998 to 2003. In the case of the multiple arrangers, I consider the highest market share across the arrangers involved in the loan transaction.
Number-of-market-makers	Number of market makers trading a borrower's previous loans on the secondary loan market prior to the loan issuance. The estimation is based on the annual average of a borrower's traded observations.
Syndicated-market-exposure	The ratio of the number of loans issued to the borrower during the five year period preceding the loan issuance, scaled by the borrower's credit rating.
Prior-restructuring	An indicator variable taking the value of one if the borrower has been issued restructuring purpose loans during the two year period preceding the loan issuance, zero otherwise.
Accounting-income-volatility	The ratio of the standard deviation of operating income (scaled by lagged total assets) to the standard deviation of operating cash flow (also scaled by lagged total assets). This ratio is estimated over the 10-year period preceding a loan's issuance year. For a reliable estimation of the earnings volatility measure, I require a minimum of three concurrent observations of operating income and operating cash flow over the estimation period.
Trade-anticipation	Indicator variable set to be equal to one if the fitted value of a loan's trade probability, estimated by the trade probability model, is above 0.5, zero otherwise.
Trade-probability	The fitted value of a loan's trade probability, estimated by the trade probability model.
Lending-relationship	An indicator variable taking the value of one if at least one of the loan's lead arrangers had been a lead arranger of the previous loans of the borrower over the 5 year period preceding the loan's issuance date, zero otherwise.
Price	Loan price is estimated over the twelve month period prior to the month of a subsequent syndicated loan issue. According to a secondary loan market convention, loan price is measured by the loan bid price in the secondary trade.

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Table 1: Sample selection: Identification of the traded facilities

This table presents the sample selection process.

	Number of observations	Number of facilities	% of total trading observations (facilities)
Total trading observations[1]	2,125,589	4,788[2]	
Trading observations with missing Facility-Id and LIN[3,4]	50,591	266[5]	2.4% (5.6%)
Trading observations with less than 13-digit LINs[6]	87,274	252	4.1% (5.3%)
Trading observations with available identifier - Facility-Id and/or 13-digit LIN	1,987,724	4,270	93.5% (89.2%)
Observations successfully matched with the DealScan database	1,732,065	3,611[7,8]	81.5% (75.4%)

1. Institutions providing bid and ask price quotes currently include but are not limited to: Bank of Montreal, The Bank of New York, The Bank of Nova Scotia, BANK ONE, Bank of America Securities LLC, BankBoston, BT Alex Brown/Deutsche Bank AG, The Chase Manhattan Bank, NA, CIBC World Markets, Citibank, NA, Credit Lyonnais, Credit Suisse First Boston Corporation, DLJ Capital Funding, INC., First Union Capital Markets Corp., Goldman, Sachs & Company, J.P. Morgan Securities, Inc., Lehman Brothers, Inc., Merrill Lynch, Pierce Fenner & Smith Incorporated, Morgan Stanley Dean Witter and TD Securities (USA) Inc.
2. Because some of the trading observations are not assigned to specific facilities, this number is an approximation of the total number of traded facilities. This proxy is estimated as the number of distinct facilities identified on the Loan Trade Database (4,522) plus the number of firms (266) with traded observations without facility identification. For further details, see footnotes 3, 4 and 5.
3. Facility-ID is a number assigned by LPC to each syndicated facility on the primary loan market. LIN (Loan Identification Number) is assigned to each syndicated facility traded on the secondary loan market. Loan Trade Database and DealScan are merged by the Facility-ID and/or LIN numbers.
4. According to LPC, observations missing Facility-ID and LIN identifiers belong to the period when LPC just started covering the secondary loan market.
5. Assuming that the borrowers do not change the company name during the period of loan trading, there are 266 firms with missing identifiers (Facility-ID and/or LIN numbers.). As a result, there are at least 266 non-identified facilities, because every borrower might have more than one trading facility.
6. LINs with less than 13 digits can't be matched with the DealScan database. LINs with less than 13 digits are assigned to the trading facilities in the following circumstances: a) the traded loan is private and is not covered by DealScan; b) the traded loan is a "prorate piece" - a combination of two different facilities; since these two facilities are traded as one piece, but were originated as independent facilities in the primary loan market, prorate pieces can not be directly connected to the DealScan database. All these observations also do not have a Facility-ID number.
7. The Facility-ID and/or LIN numbers of 659 facilities do not have an appropriate match on the DealScan database.
8. From the total number of identified facilities, 3,464 facilities are issued to U.S. borrowing firms in U.S. dollars.

Table 2: Descriptive statistics

Panels A and B present descriptive statistics for the total sample of private and publicly reporting borrowers and for the sample of publicly reporting borrowers. The total sample includes 1,610 loans issued to publicly reporting borrowers. To perform a regression analysis for the publicly reporting sample, I exclude loans without data available on the borrower's total assets, long-term debt, EBITDA and interest expense. This procedure results in a sample of 1,482 loans. For variable definitions, see Appendix A.

Panel A: Loans of publicly reporting and private borrowers

Loan Characteristics	Number of observations	Mean	SD	Distribution		
				25%	50%	75%
Interest-rate	2,486	300.7	117.9	250.0	300.0	350.0
Bid-ask-spread	2,486	1.194	1.368	0.500	0.668	1.210
Loan-size (in millions)	2,486	276.9	479.0	69.10	150.0	300.0
Maturity	2,486	55.26	24.92	36.00	60.00	72.00
Corporate-rating	2,486	15.90	4.678	13.00	14.00	21.00
Loan-rating	638	12.89	1.637	12.00	13.00	14.00
Covenant-financial	2,486	2.28	1.991	0.00	3.00	4.00
Number-of-lenders	2,486	10.71	10.59	4.00	7.00	14.00
Institutional	2,486	32.30				
Revolver	2,486	38.82				
Purpose-restructuring	2,486	23.45				
Performance-pricing	2,486	17.38				
Public	2,486	64.76				
Secured	1,739	92.52				

Panel B: Loans of publicly reporting borrowers

Loan Characteristics	Number of observations	Mean	SD	Distribution		
				25%	50%	75%
Interest-rate	1,482	286.5	121.6	225.0	275.0	350.0
Bid-ask-spread	1,482	1.088	1.182	0.487	0.653	1.131
Loan-size (in millions)	1,482	335.6	543.3	98.40	180.0	375.0
Firm-size (total assets, in millions)	1,482	4,905	11,169	636.8	1,345	3,186
Maturity	1,482	53.14	24.90	36.00	60.00	72.00
Corporate-rating	1,482	14.86	4.406	12.00	14.00	16.00
Loan-rating	422	12.62	1.752	12.00	13.00	14.00
Covenant-financial	1,482	2.62	1.897	0.00	3.00	4.00
Number-of-lenders	1,482	12.14	11.62	4.00	9.00	16.00
Leverage	1,482	0.494	0.293	0.296	0.461	0.626
Interest-coverage	1,482	4.008	6.242	1.669	2.656	4.306
Profitability	1,482	0.123	0.082	0.081	0.118	0.160
Asset-maturity	1,399	5.696	5.954	1.884	3.541	7.332
Asset-tangibility	1,479	0.341	0.222	0.160	0.297	0.473
Institutional	1,482	31.31				
Revolver	1,482	37.58				
Purpose-restructuring	1,482	19.03				
Performance-pricing	1,482	21.73				
Traded	1,482	81.31				
Secured	1,130	91.24				

Table 3: Characteristics of traded loans compared to non-traded loans

This panel presents descriptive statistics for the sample of traded and the sample of non-traded loans. The research sample includes 1,247 loans traded on the secondary loan market subsequently to the loan issuance. 1,239 of the sample loans have not been traded after origination (as estimated over the period from June 1998 to December 2004). *** Significantly different from non-traded loans at the 1% level. For variable definitions, see Appendix A.

	Traded loans	Non-traded loans
Loan-size (in millions)	304.5***	249.2
Maturity	64.23***	46.20
Purpose-restructuring	31.36%***	15.50%
Institutional	47.07%***	17.43%
Corporate-rating	16.29***	15.52
Revolver	28.55%***	49.15%
Covenant-financial	2.81***	1.75
Loan-rating-available	35.69%***	15.74%
Arranger-reputation	43.77%***	33.17%
Number-of-market-makers	2.54***	1.92

Table 4: Loan pricing as a function of information asymmetry

This table presents the results from the estimation of the interest rate model.

$$Interest-rate = \alpha + \beta_1 Bid-ask-spread + \beta_2 Loan-size + \beta_3 Corporate-rating + \beta_4 Maturity + \beta_5 \text{Re}volver + \beta_6 Institutional + \beta_7 Performance-pricing + \beta_8 Covenant-financial + \beta_9 Number-of-lenders + \beta_{10} Public/Traded + \beta_{11} Firm-size + \beta_{12} \text{Pr}ofitability + \beta_{13} Leverage + \beta_{14} Interest-\text{cov}erage$$

Regressions include year and 2-digit industry fixed effects. Standard errors are heteroskedasticity robust, clustered at the firm level. Standard errors are reported in parentheses. ***, **,* denote significance at the 1, 5 and 10 percent level, respectively. Variables: ***Interest-rate-spread***-the amount the borrower pays in basis points over LIBOR for each dollar drawn down; accounts for both the spread of the loan and the annual fee. ***Bid-ask-spread***-an average bid-ask spread on the borrower's loans traded on the secondary loan market, reported as a percent of par. ***Loan-size***-total sample: a logarithm of the facility's amount; sample of public borrowers: the ratio of the facility's amount to the borrower's total assets in the year prior to entering into a loan contract. ***Corporate-rating***-the numerical equivalent of the S&P or Moody's senior debt rating. ***Maturity***-the number of months between the facility's issue date and the date when the facility matures. ***Revolver***-an indicator variable taking the value of one if the facility's type is revolver, zero otherwise. ***Institutional-***an indicator variable taking the value of one if the loan's type is term loan B, C or D, zero otherwise. ***Performance-pricing***-an indicator variable taking the value of one if the loan contract incorporates an interest increasing performance pricing option, zero otherwise. ***Covenant-financial***-the number of financial covenants imposed by the loan agreement. ***Number-of-lenders***-number of participants in the loan syndicate (including the arranger). ***Public***-an indicator variable taking the value of one if the borrower is a publicly reporting firm in the year when facility is issued on the syndicated loan market, zero otherwise. ***Traded***-an indicator variable taking the value of one if the borrower is a publicly traded firm on U.S. stock exchanges in the year when facility is issued on the syndicated loan market, zero otherwise. ***Firm-size***-a logarithm of the borrower's total assets in the year prior to entering into a loan contract. ***Profitability***-the ratio of EBITDA to total assets, estimated in the year prior to entering into a loan contract. ***Leverage***-the ratio of the long-term debt to total assets, estimated in the year prior to entering into a loan contract. ***Interest coverage***-the ratio of EBITDA to interest expense, estimated in the year prior to entering into a loan contract.

	Pred. signs	Total sample	Publicly reporting sample
Bid-ask-spread	+	19.940*** (2.97)	19.780*** (4.64)
Loan-size	-	-26.621*** (3.09)	-80.981*** (21.96)
Corporate-rating	+	2.759*** (0.51)	3.042*** (0.81)
Maturity	+	0.056 (0.17)	0.013 (0.23)
Revolver	?	-6.566 (5.60)	-12.829* (7.49)
Institutional	+	54.133*** (7.14)	45.605*** (10.31)
Performance-pricing	-	-60.879*** (5.78)	-57.548*** (7.14)
Covenant-financial	+	6.256*** (1.50)	6.960*** (2.23)
Number-of-lenders	-	-0.912*** (0.25)	-1.127*** (0.31)
Public / Traded	-	-18.724*** (6.71)	-28.953*** (10.41)
Firm-size	-	-	-23.837*** (5.56)
Profitability	-	-	-293.26*** (66.76)
Leverage	+	-	48.686*** (18.40)
Interest-coverage	-	-	-0.088 (0.80)
Adj R-Sq # of observations		34.07% 2,486	37.25% 1,482

Table 5: Allowing for interest rate and bid-ask spread endogeneity

This table presents the results from the two stage estimation of the interest rate model, where the bid-ask spread is estimated in the first stage and the interest rate model in the second. Regressions include year and 2-digit industry fixed effects. Standard errors are heteroskedasticity robust, clustered at the firm level. Standard errors are reported in parentheses. ***, **,* denote significance at the 1, 5 and 10 percent level, respectively. Variables: ***Syndicated-market-exposure-***the ratio of the number of loans issued to the borrower during the five year period preceding the loan issuance, scaled by the borrower's credit rating. ***Prior-restructuring***-an indicator variable taking the value of one if the borrower has been issued restructuring purpose loans during the two year period preceding the loan issuance, zero otherwise. ***Accounting-income-volatility-***the ratio of the standard deviation of operating income (scaled by lagged total assets) to the standard deviation of operating cash flow (also scaled by lagged total assets). For the definition of ***Interest-rate-spread*, *Bid-ask-Spread*** and the rest of the explanatory variables, see Table 4.

	Total sample		Publicly reporting sample	
	Interest rate	Bid-ask-spread	Interest rate	Bid-ask-spread
Bid-ask-spread	25.040***	-	35.101***	-
	(9.24)		(13.60)	
Loan-size	-30.664***	-0.170***	-85.786**	-0.138***
	(4.06)	(0.04)	(25.24)	(0.05)
Corporate-rating	2.970***	0.016**	2.884***	0.022**
	(0.54)	(0.01)	(1.04)	(0.01)
Maturity	-0.296	-	0.205	-
	(0.31)		(0.29)	
Revolver	-3.933	-	-7.675	-
	(6.42)		(7.12)	
Institutional	56.276***	-	52.556***	-
	(7.77)		(11.45)	
Performance-pricing	-68.576***	-	-52.727***	-
	(8.21)		(8.26)	
Covenant-financial	5.686***	-	9.109***	-
	(1.69)		(2.74)	
Number-of-lenders	-0.815***	-	-1.195***	-
	(0.26)		(0.40)	
Public / Traded	-23.868**	-0.234**	-25.793**	-
	(8.03)	(0.09)	(13.70)	
Firm-size	-	-	-21.097***	-
			(6.68)	
Profitability	-	-	-314.64***	-
			(83.40)	
Leverage	-	-	69.186***	-
			(18.24)	
Interest-coverage	-	-	0.013	-
			(0.87)	
Prior-restructuring	-	0.449***	-	0.492***
		(0.09)		(0.11)
Syndicated-market-exposure	-	-0.292**	-	-0.227**
		(0.13)		(0.11)
Accounting-income-volatility	-	-	-	0.102**
				(0.04)
Adj R-Sq	33.81%	18.13%	37.26%	22.63%
# of observations	2,486	2,486	1,211	1,211

Table 6: Loan pricing as a function of information asymmetry: Robustness tests

This table presents the results from the estimation of the robustness tests of the interest rate model. Regressions include year and 2-digit industry fixed effects. Standard errors are heteroskedasticity robust, clustered at the firm level. Standard errors are reported in parentheses. ***, **,* denote significance at the 1, 5 and 10 percent level, respectively. Variables: the dependent variable is ***Interest-rate-spread. Loan-rating***-the numerical equivalent of the S&P or Moody's loan rating. ***Lending-relationship-***an indicator variable taking the value of one if at least one of the loan's lead arrangers had been a lead arranger of the previous loans of the borrower over the 5 years preceding the loan's issuance date, zero otherwise. For the definition of ***Interest-rate-spread*** and the rest of the explanatory variables, see Table 4.

	Pred. signs	Lending relationship test		Loan rating test	
		Total	Public	Total	Public
Bid-ask-spread	+	23.634***	23.267***	29.640***	39.633***
		(3.80)	(5.45)	(8.10)	(13.32)
Loan-size	-	-26.445***	-83.242***	-6.906	-4.318
		(3.05)	(21.95)	(4.79)	(33.56)
Corporate-rating	+	2.746***	2.960***	-	-
		(0.51)	(0.79)		
Loan-rating	+	-	-	22.111***	21.230***
				(2.87)	(3.66)
Maturity	+	0.038	0.015	-0.383	-0.220
		(0.17)	(0.23)	(0.38)	(0.39)
Revolver	?	-6.544	-12.683*	-17.220**	-15.983*
		(5.59)	(7.47)	(8.22)	(8.91)
Institutional	+	54.635***	46.193***	26.249**	19.547
		(7.14)	(10.39)	(13.32)	(13.74)
Performance-pricing	-	-61.634***	-58.545***	-39.790***	-54.761***
		(5.79)	(7.21)	(8.85)	(11.60)
Covenant-financial	+	6.465***	7.157***	4.965*	10.462***
		(1.52)	(2.22)	(2.75)	(3.88)
Number-of-lenders	-	-0.885***	-1.102***	-0.877*	-1.614**
		(0.24)	(0.31)	(0.45)	(0.66)
Public / Traded	-	-17.842***	-28.277***	-10.859	-16.330
		(6.84)	(10.47)	(9.33)	(16.27)
Firm-size	-	-	-23.744***	-	6.045
			(5.44)		(7.17)
Profitability	-	-	-292.00***	-	-76.004
			(66.71)		(81.70)
Leverage	+	-	49.479***	-	2.795
			(18.37)		(25.47)
Interest-coverage	-	-	-0.125	-	0.680
			(0.79)		(0.71)
Lending-relationship	-	-3.062*	-2.478	-	-
		(1.82)	(1.63)		
Lending-relationship* Bid-ask-spread	-	-9.281**	-8.889**	-	-
		(3.87)	(3.93)		
Adj R-Sq		34.18%	37.49%	40.11%	48.53%
# of observations		2,486	1,482	638	442

Table 7: Estimation of the probability of a loan trade on the secondary loan market

This table presents the results from the estimation of the trade probability logit model. The total sample includes 1,247 loans traded on the secondary loan market subsequently to the loan issuance. 1,239 of the sample loans have not been traded after origination (as estimated over the period from June 1998 to December 2004). The publicly reporting sample includes 787 loans traded on the secondary loan market subsequently to the loan issuance and 695 non-traded loans.

$$Secondary\_trade = \alpha + \beta_1 Loan-size + \beta_2 Maturity + \beta_3 Purpose-restructuring + \beta_4 Institutional + \beta_5 Corporate-rating + \beta_6 \text{Re}volver + \beta_7 Covenant-financial + \beta_8 Loan-rating-available + + \beta_9 Arranger-reputation + \beta_{10} Number-of-market-makers + \beta_{11} Firm-size$$

Regressions include year and 2-digit industry fixed effects. Standard errors are heteroskedasticity robust, clustered at the firm level. Standard errors are reported in parentheses. ***, **,* denote significance at the 1, 5 and 10 percent level, respectively. Variables: ***Secondary-trade*** - an indicator variable taking the value of one if the loan is traded on the secondary loan market between June 1998 and December 2004, zero otherwise. ***Loan-rating-available*** **-** an indicator variable taking the value of one if the loan-specific credit rating is available, zero otherwise. Loan rating categories include Moody's Loan Rating and S&P Loan Rating. ***Arranger-reputation*** - an indicator variable taking the value of one if the loan is syndicated by one of the top four arrangers, based on the arranger's average market share in the primary loan market, zero otherwise. ***Number-of-market-makers*** - number of market makers trading a borrower's previous loans on the secondary loan market prior to the current loan issuance. For the definition of the rest of the explanatory variables, see Table 4.

	Pred. signs	Total sample	Publicly reporting sample
Loan-size	+	0.470***	1.717***
		(0.06)	(0.66)
Maturity	+	0.024***	0.029***
		(0.00)	(0.00)
Purpose-restructuring	+	0.479***	0.209*
		(0.16)	(0.12)
Institutional	+	0.847***	0.908***
		(0.14)	(0.18)
Corporate-rating	+	0.030***	0.061***
		(0.01)	(0.01)
Revolver	-	-0.418***	-0.415***
		(0.11)	(0.15)
Covenant-financial	+	0.233***	0.308***
		(0.03)	(0.05)
Loan-rating-available	+	0.590***	0.834***
		(0.16)	(0.21)
Arranger-reputation	+	0.220**	0.405***
		(0.10)	(0.15)
Number-of-market-makers	+	0.135**	0.123**
		(0.06)	(0.05)
Firm-size	+	-	0.435***
			(0.08)
Psuedo R-Squared		30.70%	32.19%
# of loans		2,486	1,482
Traded loans correctly predicted		75.62%	78.14%
Non-traded loans correctly predicted		75.54%	73.09%

Table 8: The impact of adverse selection in the primary and secondary loan markets on loan pricing

Column (1) presents the results from the interest rate model estimation, where institutional loans are considered as anticipated to be traded. Column (2) presents the second stage results from the two stage estimation of the interest rate model, where trade anticipation and the interaction term variables are estimated in the first stage and the interest rate model in the second.

$$Interest-rate = \alpha + \beta_1 Bid-ask-spread + \beta_2 Loan-size + \beta_3 Corporate-rating + \beta_4 Maturity + \beta_5 \text{Re}volver + \beta_6 Institutional + \beta_7 Performance-pricing + \beta_8 Covenant-financial + \beta_9 Number-of-lenders + \beta_{10} Public/Traded + \beta_{11} Firm-size + \beta_{12} \text{Pr}ofitability + \beta_{13} Leverage + \beta_{14} Interest-\text{cov}erage + \beta_{15} Bid-ask-spread * Institutional/+ \beta_{15} Trade-anticipation + \beta_{16} Bid-ask-spread * Trade-anticipation$$

Regressions include year and 2-digit industry fixed effects. Standard errors are heteroskedasticity robust, clustered at the firm level. Standard errors are reported in parentheses. ***, **,* denote significance at the 1, 5 and 10 percent level, respectively. Variables: ***Trade-anticipation***-indicator variable set to be equal to one if the fitted value of a loan's trade probability, estimated by the trade probability model, is above 0.5, zero otherwise. For the definition of ***Interest-rate-spread*** and the rest of the explanatory variables, see Table 4.

	Pred. signs	Bank vs. institutional loans		Controlling for trade anticipation	
		Total	Public	Total	Public
Bid-ask-spread	+	18.068***	17.748***	17.777***	17.255***
		(3.00)	(4.55)	(3.14)	(4.91)
Loan-size	-	-26.624***	-79.899***	-28.981***	-87.629***
		(3.09)	(21.86)	(3.05)	(21.47)
Corporate-rating	+	2.714***	2.968***	2.625***	2.701***
		(0.52)	(0.80)	(0.53)	(0.84)
Maturity	+	0.078	0.041	-0.038	-0.129
		(0.17)	(0.23)	(0.17)	(0.23)
Revolver	?	-6.472	-12.897*	-5.574	-12.517*
		(5.59)	(7.47)	(5.69)	(7.50)
Institutional	+	41.863***	31.532***	49.367***	41.193***
		(8.39)	(11.70)	(7.21)	(10.56)
Performance-pricing	-	-61.385***	-58.089***	-60.157***	-55.794***
		(5.78)	(7.15)	(5.77)	(7.11)
Covenant-financial	+	6.165***	6.888***	4.821***	4.950**
		(1.52)	(2.23)	(1.64)	(2.45)
Number-of-lenders	-	-0.915***	-1.143***	-0.965***	-1.124***
		(0.25)	(0.31)	(0.25)	(0.31)
Public / Traded	-	-18.412***	-28.242***	-18.301***	-27.105***
		(6.73)	(10.40)	(6.73)	(10.43)
Firm-size	-	-	-23.787***	-	-27.045***
			(5.52)		(5.16)
Profitability	-	-	-290.06***	-	-302.87***
			(67.24)		(67.37)
Leverage	+	-	47.808***	-	49.252***
			(18.42)		(18.40)
Interest-coverage	-	-	-0.090	-	-0.101
			(0.80)		(0.81)
Bid-ask-spread *Institutional	+	11.533**	13.896**	-	-
		(5.47)	(6.86)		
Trade-anticipation	-	-	-	3.976	6.747
				(7.72)	(11.66)
Bid-ask-spread * Trade-anticipation	+	-	-	13.038**	12.248**
				(5.55)	(5.87)
Adj R-Sq		34.29%	37.47%	34.51%	37.66%
# of observations		2,486	1,482	2,486	1,482

Table 9: Loan maturity as a function of information asymmetry

This table presents the results from the estimation of the maturity model.

$$Maturity = \alpha + \beta_1 Bid-ask-spread + \beta_2 Loan-size + \beta_3 Corporate-rating + \beta_4 Corporate-rating-square + \beta_5 Institutional + \beta_6 Purpose-restructuring + \beta_7 Covenant-financial + \beta_8 Firm-size + \beta_9 Asset-maturity + \beta_{10} Asset-\tan gibility$$

Regressions include year and 2-digit industry fixed effects. Standard errors are heteroskedasticity robust, clustered at the firm level. Standard errors are reported in parentheses. ***, **,* denote significance at the 1, 5 and 10 percent level, respectively. Variables: ***Maturity***-the number of months between the facility's issue date and the date when the facility matures. ***Bid-ask-spread***-an average bid-ask spread on the borrower's loans traded on the secondary loan market, reported as a percent of par. ***Loan-size***-total sample: a logarithm of the facility's amount; sample of public borrowers: the ratio of the facility's amount to the borrower's total assets in the year prior to entering into a loan contract. ***Corporate-rating***-the numerical equivalent of the S&P or Moody's senior debt rating. ***Institutional-***an indicator variable taking the value of one if the loan's type is term loan B, C or D, zero otherwise. ***Purpose-restructuring-***an indicator variable taking the value of one if the facility's primary purpose is Takeover, LBO/MBO or Recapitalization, zero otherwise. ***Covenant-financial***-the number of financial covenants imposed by the loan agreement. ***Firm-size***-a logarithm of the borrower's total assets in the year prior to entering into a loan contract. ***Asset-maturity***-the weighted average of two ratios: the ratio of current assets to the cost of goods sold, and the ratio of net property, plant, and equipment to depreciation and amortization; these ratios are weighted by the relative size of current assets and net PPE, respectively. ***Asset tangibility***-the ratio of net PPE to total assets, estimated in the year prior to entering into a loan contract.

	Pred. signs	Total sample	Publicly reporting sample
Bid-ask-spread	-	-3.459***	-3.493***
		(0.50)	(0.64)
Loan-size	?	0.782	18.017***
		(0.58)	(4.09)
Corporate-rating	+	7.255***	6.497***
		(1.12)	(1.22)
Corporate-rating-square	-	-0.201***	-0.200***
		(0.03)	(0.04)
Institutional	+	17.180***	17.393***
		(0.81)	(1.03)
Purpose-restructuring	+	12.008***	4.595**
		(1.34)	(1.87)
Covenant-financial	+	1.383***	1.779**
		(0.32)	(0.43)
Firm-size	?	-	-2.121***
			(0.78)
Asset-maturity	+	-	0.130
			(0.20)
Asset-tangibility	+	-	1.100
			(5.34)
Adj R-Sq		44.22%	48.05%
# of observations		2,486	1,399

Table 10: Loan maturity as a function of information asymmetry: Robustness tests

This table presents the results from the estimation of the robustness tests of the maturity model. Regressions include year and 2-digit industry fixed effects. Standard errors are heteroskedasticity robust, clustered at the firm level. Standard errors are reported in parentheses. ***, **,* denote significance at the 1, 5 and 10 percent level, respectively. Variables: the dependent variable is ***Maturity. Loan-rating***-the numerical equivalent of the S&P or Moody's loan rating. ***R&D-intensity***-the ratio of R&D expenditures to sales, estimated in the year prior to a loan issue. For the definition of ***Maturity*** and the rest of the explanatory variables, see Table 9.

	Pred. signs	Loan rating test		R&D test
		Total	Public	Public
Bid-ask-spread	-	-4.106***	-4.422***	-2.277**
		(1.12)	(1.48)	(1.03)
Loan-size	?	0.032	14.675**	16.487***
		(0.93)	(5.15)	(5.33)
Corporate-rating	+	-	-	6.645***
				(1.25)
Corporate-rating-square	-	-	-	-0.207***
				(0.04)
Loan-rating	+	6.316**	6.587**	-
		(2.63)	(3.25)	
Loan-rating-square	-	-0.193	-0.216	-
		(0.22)	(0.25)	
Institutional	+	15.313***	13.909***	16.596***
		(1.21)	(1.41)	(1.47)
Purpose-restructuring	+	6.400***	3.428	3.514
		(1.67)	(2.34)	(3.00)
Covenant-financial	+	0.959*	1.121	1.780**
		(0.55)	(0.72)	(0.53)
Firm-size	?	-	-2.665***	-3.125***
			(0.99)	(0.88)
Asset-maturity	+	-	0.041	0.523
			(0.16)	(0.39)
Asset-tangibility	+	-	5.333	-11.295
			(7.42)	(7.72)
R&D-intensity	-	-	-	-57.055*
				(31.74)
Adj R-Sq		41.74%	51.21%	46.13%
# of observations		638	409	656

Table 11: Simultaneous estimation of the interest rate and maturity

This table presents the results from the simultaneous estimation of the interest rate and maturity.

$$Interest-rate = \alpha + \beta_1 Bid-ask-spread + \beta_2 Loan-size + \beta_3 Corporate-rating + \beta_4 Maturity + \beta_5 \text{Re}volver + \beta_6 Institutional + \beta_7 Performance-pricing + \beta_8 Covenant-financial + \beta_9 Number-of-lenders + \beta_{10} Public/Traded + \beta_{11} Firm-size + \beta_{12} \text{Pr}ofitability + \beta_{13} Leverage + \beta_{14} Interest-\text{cov}erage$$

$$Maturity = \alpha + \beta_1 Bid-ask-spread + \beta_2 Interest-rate + \beta_3 Loan-size + \beta_4 Corporate-rating + \beta_5 Corporate-rating-square + \beta_6 Institutional + \beta_7 Purpose-restructuring + \beta_8 Covenant-financial + \beta_9 Firm-size + \beta_{10} Asset-maturity + \beta_{11} Asset-\text{tan}gibility$$

Regressions include year and 2-digit industry fixed effects. Standard errors are reported in parentheses. ***, **,* denote significance at the 1, 5 and 10 percent level, respectively. For the definition of ***Interest-rate***, ***Maturity*** and the explanatory variables, see Tables 4 and 9.

	Total sample		Publicly reporting sample	
	Interest rate	Maturity	Interest rate	Maturity
Bid-ask-spread	30.397***	-2.159***	34.053***	-2.544***
	(2.12)	(0.45)	(3.75)	(0.53)
Interest-rate	-	-0.079***	-	-0.067***
		(0.02)		(0.02)
Loan-size	-26.497***	-0.574	-151.60***	13.029***
	(2.25)	(0.53)	(25.93)	(3.84)
Corporate-rating	2.556***	13.634***	1.543**	12.126***
	(0.37)	(1.42)	(0.63)	(1.38)
Corporate-rating-square	-	-0.374***	-	-0.349***
		(0.04)		(0.04)
Maturity	2.990***	-	3.961***	-
	(0.33)		(0.69)	
Revolver	-15.634***	-	-28.825***	-
	(5.50)		(8.16)	
Institutional	41.519***	21.156***	36.502***	20.307***
	(9.02)	(1.29)	(12.58)	(1.35)
Performance-pricing	-62.839***	-	-61.257***	-
	(6.25)		(8.17)	
Purpose-restructuring	-	11.741***	-	5.365***
		(1.01)		(1.39)
Covenant-financial	0.600	1.393***	-1.199	1.682***
	(1.49)	(0.22)	(2.34)	(0.30)
Number-of-lenders	-0.799***	-	-1.365***	-
	(0.23)		(0.30)	
Public / Traded	-8.476	-	-39.727***	-
	(5.33)		(9.57)	
Firm-size	-	-	-11.654***	-2.653***
			(4.17)	(0.58)
Profitability	-	-	-290.74***	-
			(52.13)	
Leverage	-	-	44.013***	-
			(13.41)	
Interest-coverage	-	-	0.334	-
			(0.59)	
Asset-maturity	-	-	-	0.172
				(0.13)
Asset-tangibility	-	-	-	6.898*
				(3.96)
R-Sq	31.28%	41.17%	34.03%	47.20%
# of observations	2,486	2,486	1,399	1,399