The Journal of FINANCE
The Journal of THE AMERICAN FINANCE ASSOCIATION

THE JOURNAL OF FINANCE • VOL. LXXV, NO. 2 • APRIL 2020

# Does Borrowing from Banks Cost More than Borrowing from the Market?

MICHAEL SCHWERT*

**ABSTRACT**

This paper investigates the pricing of bank loans relative to capital market debt. The analysis uses a novel sample of loans matched with bond spreads from the same firm on the same date. After accounting for seniority, lenders earn a large premium relative to the bond-implied credit spread. In a sample of secured term loans to noninvestment-grade firms, the average premium is 140 to 170 bps or about half of the all-in-drawn spread. This is the first direct evidence of firms' willingness to pay for bank credit and raises questions about the nature of competition in the loan market.

THE TWO PRIMARY SOURCES OF debt for firms are private bank loans and public bonds issued in the market. The academic literature offers a number of theories on the interaction between the private and public debt markets (e.g., Diamond (1991), Rajan (1992), Chemmanur and Fulghieri (1994)) and empirical evidence on cross-sectional and time series variation in the quantities of loans and bonds issued (e.g., Faulkender and Petersen (2006), Rauh and Sufi (2010), Becker and Ivashina (2014)). We know less, however, about the pricing of bank loans and the relative pricing of private and public debt. This paper fills that gap by offering new evidence on the relative costs of loan and bond debt.

The central finding of this paper is that banks earn a substantial interest rate premium relative to the price of credit risk implied by the bond market after accounting for seniority. I arrive at this finding by constructing a novel data set consisting of new loan facilities and secondary bond market quotes from the same firm on the same date. These data allow for a clean comparison of

*Michael Schwert is at the Wharton School, University of Pennsylvania. I thank Stefan Nagel (the Editor); an anonymous associate editor; two anonymous referees; Felipe Aldunate; Bo Becker; Darrell Duffie; Erik Gilje; Will Gornall; Daniel Green; Kewei Hou; Pete Johnson; Ryan Lewis; Bill Maxwell; Mark Mitchell; Erwan Morellec; Greg Nini; Michael Roberts; Farzad Saidi; Bill Schwert; Ilya Strebulaev; René Stulz; and seminar participants at Arizona State, BI Oslo, Boston College, Chicago Booth, Emory, EPFL and HEC Lausanne, the Federal Reserve Board, Ohio State, Oklahoma, Penn State, Stockholm School of Economics, Wharton, the 2017 Colorado Finance Summit, the 2018 FinanceUC Conference, the 2018 Columbia Junior Workshop in New Empirical Finance, the 2018 Texas Forum on Corporate Finance, and the 2019 Utah Winter Finance Conference for helpful suggestions. I am also grateful for discussions with employees of Greif, Huntington Bank, and Scotts Miracle-Gro. Chuck Fang and Rick Ogden provided excellent research assistance. I have read *The Journal of Finance*'s disclosure policy and have no conflicts of interest to disclose. I have a consulting relationship with AQR Capital Management that provides access to the bond quote data used in this paper.

DOI: 10.1111/jofi.12849

**Table I**

**Empirical Evidence on Loan and Bond Recovery Rates**

This table reports summary statistics on defaulted debt recovery rates from Moody's Ultimate Recovery Database. The sample includes cases involving public firms rated by Moody's that filed for bankruptcy between 1997 and 2017, excluding debtor-in-possession loans and firms in the financial and utilities industries. The first set of rows includes all defaults in which the firm had both loans and bonds outstanding, while the second set restricts the sample to defaults with first-lien term loans and senior unsecured bonds. Observations are aggregated by default event. The reported recovery rates are value-weighted averages of instrument-level recoveries, with weights based on amounts outstanding at the time of default. Instrument-level recoveries are based on Moody's suggested method (settlement value or trading price) and discounted from emergence to the default date by the instrument's interest rate. Recovery of 100% means the claim was paid principal and accrued interest. Firm-level recovery is the family recovery rate reported by Moody's.

| | Mean | *SD* | p10 | p50 | p90 | Defaults |
|---|---|---|---|---|---|---|
| *All defaults with loans and bonds outstanding* | | | | | | |
| Firm-level recovery | 0.51 | 0.26 | 0.16 | 0.48 | 0.90 | 316 |
| All loan types | 0.84 | 0.26 | 0.38 | 1.00 | 1.00 | 316 |
| Line of credit | 0.87 | 0.24 | 0.44 | 1.00 | 1.00 | 289 |
| Term loan | 0.76 | 0.30 | 0.29 | 1.00 | 1.00 | 202 |
| All bond types | 0.32 | 0.30 | 0.01 | 0.22 | 0.80 | 316 |
| Senior secured | 0.51 | 0.34 | 0.05 | 0.49 | 1.00 | 88 |
| Senior unsecured | 0.35 | 0.33 | 0.01 | 0.27 | 1.00 | 163 |
| *Defaults with first-lien term loans and senior unsecured bonds* | | | | | | |
| Firm-level recovery | 0.54 | 0.26 | 0.18 | 0.56 | 0.90 | 95 |
| First-lien term loan | 0.83 | 0.28 | 0.32 | 1.00 | 1.00 | 95 |
| Senior unsecured bond | 0.33 | 0.33 | 0.003 | 0.23 | 0.93 | 95 |

pricing in the loan and bond markets that is unaffected by firm-time observable factors.[1] I account for the firm's priority structure of debt using both reduced-form and structural models of credit risk.

From a credit risk standpoint, the key difference between loans and bonds is that loans are senior in bankruptcy.[2] Default is the only state in which creditors are not paid in full, so expected payoffs in default are a crucial determinant of the cost of credit. Table I presents evidence from Moody's Ultimate Recovery Database on bankruptcies of firms with both loans and bonds outstanding at the time of default from 1997 to 2017. The average recovery rate for loans is 84%, with lenders recovering principal and accrued interest in most cases, whereas senior unsecured bonds recover 35% on average. This difference in exposure to default losses implies that loan credit spreads should be smaller than bond credit spreads.

Duffie and Singleton (1999) develop a reduced-form default intensity model that serves as a useful benchmark. In their model, the credit spread on a risky

[1] The sample consists of large firms with access to public debt markets, so it does not represent the population of corporate borrowers. I discuss external validity in Section I.

[2] Besides seniority, there exist many other differences in the cash flows and economic features of loans and bonds that I discuss in this paper.

zero-coupon bond equals the "risk-neutral mean-loss rate," or the probability of default times the expected loss given default. The probability of default is the same for all debt instruments issued by the same firm, assuming that cross-default provisions are in place, so the relative spreads on bonds and loans depend only on their expected losses given default. Table I shows that the unconditional expected loss given default for senior unsecured bonds is four times higher than the expected loss given default for loans. The Duffie and Singleton (1999) model therefore predicts that bond spreads should be about four times as large as loan spreads.[3]

Figure 1 visually summarizes the relative pricing of corporate bonds and loans, uncovering facts not previously reported in the literature. The top panel plots bond and loan spreads relative to the London Interbank Offered Rate (LIBOR) swap curve as nonparametric functions of distance-to-default (Bharath and Shumway (2008)), and the bottom panel plots the ratio of the spreads. The sample comprises new loans with secondary market quotes for senior unsecured bonds from the same firm on the loan's start date.[4] Maturities under three years and loan-bond pairs with a maturity difference greater than two years are excluded to mitigate the effect of maturity structure on the relative spreads.

At first glance, the plot in Panel A appears intuitive. When the firm is close to default, bond spreads are significantly higher than loan spreads but fall short of the bond-loan spread ratio of four-to-one predicted by the Duffie and Singleton (1999) model when the distance-to-default is zero. However, the loan and bond spreads are similar when the firm is far from default, which is puzzling in light of the bank's senior position in the priority structure. Panel B of Figure 1 shows that the ratio of bond spreads to loan spreads is significantly lower than four in all rating categories. Strikingly, the loan and bond spreads of investment-grade firms are statistically indistinguishable.[5] This suggests that bank lenders earn a substantial premium relative to the market pricing of their risk exposure.

To quantify the magnitude of this premium, I apply a structural model of credit risk. This analysis focuses on a subsample of the data that contain term loans secured by a first lien and senior unsecured bonds, so that seniority is

[3] The expected loss given default in Duffie and Singleton (1999) is under the risk-neutral measure, whereas Table I provides an estimate of the physical expectation. The current discussion is for illustration and may be affected by systematic risk in recoveries. Section III.B discusses the risk premium on recoveries necessary to explain loan pricing.

[4] I address the difference between primary and secondary market pricing in Section II.A.2. The comparison of fixed-rate bond spreads and floating-rate loan spreads is innocuous, as Duffie and Liu (2001) show that the fixed-floating credit spread basis is on the order of one basis point.

[5] While loans to noninvestment-grade firms are generally secured and therefore senior to unsecured bonds, loans to investment-grade firms are typically unsecured and on equal footing with bondholders. However, it is unusual for an investment-grade firm to default before being downgraded. The Internet Appendix, available in the online version of this article on *The Journal of Finance* website, shows that loans were unsecured in only 7% of the 316 default events in Moody's Ultimate Recovery Database from 1997 to 2017 that involved both loans and bonds. In this sample of defaults, there is one instance in which bonds received a materially higher recovery than loans, and there are no instances in which unsecured bonds recovered more than secured loans.

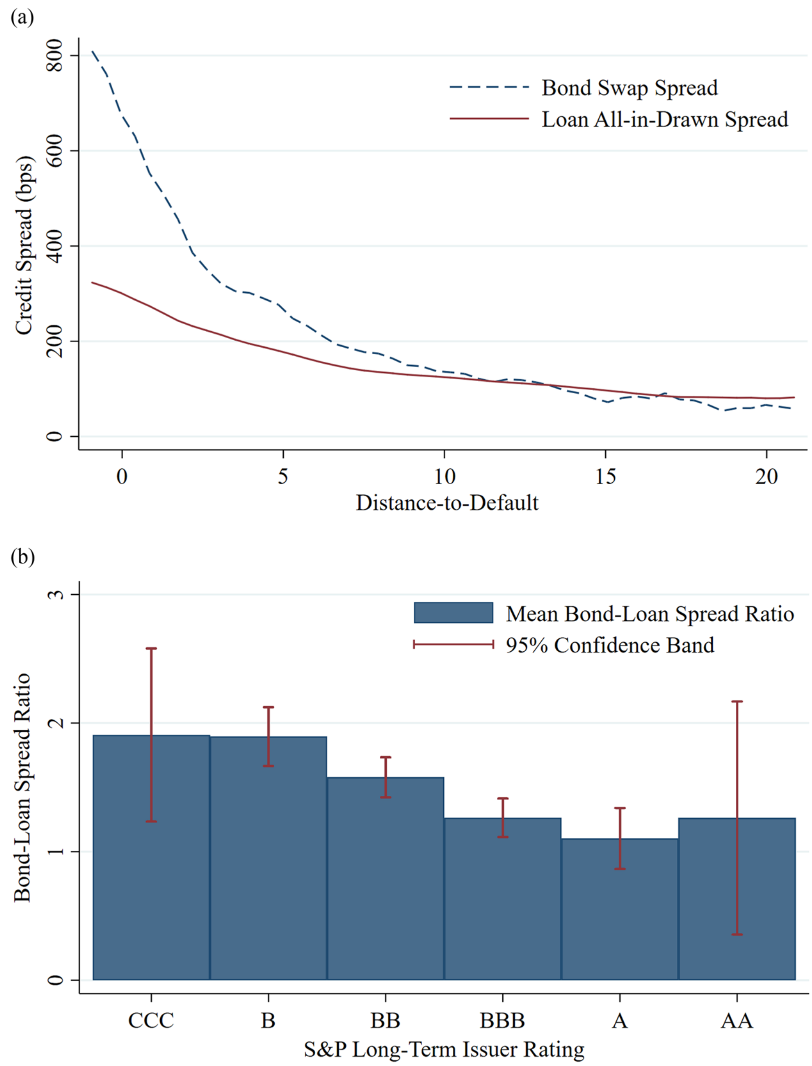



**Figure 1. Loan and bond spreads as functions of credit risk.** This figure provides evidence on bond and loan credit spreads and the ratio of spreads as functions of credit risk. Variables are defined in the Appendix. Panel A plots nonparametric regression estimates of bond and loan credit spreads on distance-to-default using a rectangular kernel. For context, in this sample, the average distance-to-default for A-rated firms is 11.8, for BBB-rated firms it is 9.0, for BB-rated firms it is 6.2, for B-rated firms it is 3.6, and for CCC-rated firms it is 1.4. Panel B contains a bar chart of the mean ratio of bond spread to loan spread by S&P long-term issuer credit rating category. Confidence bands are based on standard errors clustered by firm and month. (Color figure can be viewed at wileyonlinelibrary.com)

unambiguous and the impact of embedded options on loan value is minimal. The model extends Merton (1974) to value senior and junior debt claims as options on the firm's assets. Since recoveries are the key driver of relative pricing in this setting, I consider two specifications of recoveries in the model, one that borrows the bankruptcy cost estimates from Glover (2016) and another that calibrates the distribution of firm-level recoveries to match the empirical distribution. The model also accounts for the value of the firm's option to prepay the loan and the costs of bond issuance. To implement the model, I set the parameters governing the firm value process to price corporate bonds exactly, so that the loan spread computed under the model represents the value of loan cash flows as though the loan were traded in the public bond market.

The result of the structural estimation is that the average bond-implied loan spread is between 140 and 170 bps lower than the average all-in-drawn spread of 279 bps in the subsample of secured term loans. Put differently, 46% to 59% of the average loan spread is a premium in excess of the cost of credit implied by the bond market. In addition to quantifying the loan premium, I use the structural model to show that costs of distress, bond issuance, and loan illiquidity must be implausibly high to justify the pricing of loans. I modify the model to show that extreme assumptions about the pricing of tail risks are necessary to match observed loan spreads. These auxiliary tests support the existence of a substantial loan premium. For robustness, I apply the reduced-form default intensity approach from Duffie and Singleton (1999) and find quantitatively similar estimates of the premium.

The literature offers no evidence on the ability of existing models of credit risk to price seniority, so it is important to understand whether this could be driving the estimated loan premium. To address this issue, I analyze a separate panel data set of secondary market quotes for secured and unsecured bonds of the same firm on the same date. In stark contrast to the results on loans and bonds, the data on secured and unsecured bonds conform closely to the Duffie and Singleton (1999) prediction that the ratio of credit spreads should equal the ratio of expected losses given default. This result suggests that credit pricing models are able to account for seniority and that the loan premium is not driven by model misspecification.

The empirical analysis in this paper offers strong evidence that banks earn significantly higher rates than implied by the pricing of credit risk in the capital markets. Returning to the question posed in the title of the paper, this does not imply that borrowing from banks costs more than issuing public debt because the counterfactual senior secured loan from the model is not available in the capital markets.[6] Indeed, Figure 1 shows that the costs of bank and bond credit are similar for investment-grade firms, while for noninvestment-grade firms

[6] Of course, this raises the question of why banks are the primary providers of senior secured debt. Addressing this question is beyond the scope of the current paper, but theory points to monitoring incentives as a key factor (Diamond (1993), Park (2000), Gornall (2018)). Readers should interpret the results here as reflecting the pricing of debt conditional on the issuance quantities chosen by firms and be cautious in extrapolating the findings of this paper to the extreme cases of all-loan and all-bond debt structures.

borrowing from a bank is less costly because the bank is senior to bondholders in the event of default.[7] Therefore, borrowing from banks is often in line with the manager's objective of minimizing interest expenses to maximize cash flows.

Why do banks earn a premium above the market price of credit risk? Loans offer many benefits beyond what firms receive from bonds, such as the ability to raise a large amount of debt on short notice, flexibility in the amount of borrowing and terms of repayment, and a positive signal of the firm's quality from the bank's willingness to provide funds after screening the borrower. Section III provides an in-depth discussion of these issues, but ultimately it is difficult to pin down a specific feature of a loan that explains the premium because several benefits coexist in each loan. Another way to address this question is to examine how the economic surplus generated by loans is shared by banks and firms. I show that the loan premium is unrelated to loan size, which is inconsistent with the bank passing through the fixed component of its costs under perfect competition. In line with this view, I provide evidence of a high level of collaboration among banks in this market, which raises questions about their incentives to compete on price.

Although several earlier papers study the effects of specific loan terms or lender characteristics on variation in pricing within the loan market, this paper is the first to apply credit pricing models to the loan market and to compare the pricing of loans and bonds in a clean setting.[8] To my knowledge, the results on secured and unsecured bond spreads are also the first application of credit pricing models to bonds of different seniority.[9] Although these models are able to price seniority in the bond market, they predict substantially lower loan spreads than observed in the data. The finding of an economically large loan premium builds on the literature that uncovers the value of bank specialness indirectly (e.g., Fama (1985), James (1987)) by quantifying the firm's willingness to pay for bank services. In addition to these contributions, this paper raises questions about the cost of capital in the syndicated loan market that will be important to explore as this market continues to grow.

[7] The loan spread is actually higher than the matched bond spread for 23% of loans in the restricted sample and 35% of loans in the full sample. Nevertheless, the majority of loans have lower interest costs than the unsecured bonds of the same firm.

[8] Becker and Ivashina (2014) compare loan and bond spreads in their analysis of aggregate quantities, but their comparison focuses on new issue yields and does not control for firm-time unobservables. Among papers that focus on narrower issues related to loan pricing, Hubbard, Kuttner, and Palia (2002), Santos (2011), Lambertini and Mukherjee (2016), and Wallen (2017) focus on bank capital; Drucker and Puri (2005) find loan discounts associated with equity underwriting; Ivashina (2009) focuses on lead arranger skin-in-the-game; Santos and Winton (2008), Hale and Santos (2009), Schenone (1976), and Gustafson (2018) study informational rents; Ivashina and Sun (2011) and Lim, Minton, and Weisbach (2014) focus on nonbank tranches; Dougal et al. (2015) and Murfin and Pratt (2019) find overweighting of information from past loans; Murfin and Petersen (2016) study seasonality; and Botsch and Vanasco (2019) show that banks learn about borrower quality over time.

[9] Dobranszky (2008) and Sarbu, Schmitt, and Uhrig-Homburg (2013) apply similar techniques to credit default swaps (CDS) on debt instruments of different seniorities. In contrast to my findings in the cash market, Dobranszky (2008) finds that loan CDS are priced similarly to bond CDS after accounting for differences in expected recoveries.

The remainder of the paper is organized as follows. Section I describes the construction of the sample. Section II outlines an extension of the Merton (1974) model and estimates counterfactual loan spreads under the model. Section III explores potential explanations for the loan premium. Section IV concludes.

## I. Data

This paper relies on a novel sample design that allows for a clean comparison of loan and bond credit spreads. The sample consists of new loan facilities paired with the nearest outstanding unsecured bond by maturity from the same firm on the loan's start date. The advantage of this construction is that it eliminates the impact of unobservable firm-time factors that could correlate with credit risk and the pricing of debt, which leads to a more appropriate market-based counterfactual for loan pricing than alternative approaches such as comparing new issue spreads at different points in time or comparing loan spreads with bond index spreads by credit rating. Moreover, at any point in time the probability of default is the same for all of the firm's debt instruments under standard cross-default provisions, which leads to an intuitive relation between credit spreads and expected recoveries.

It is, of course, important to recognize the limitations of this approach. First, the sample is restricted to firms with outstanding corporate bonds, so it is not representative of the universe of bank borrowers. Firms with access to public debt markets are larger and less financially constrained than firms without such access (Faulkender and Petersen (2006)), so external validity is a key concern. The top panel of Figure 2 shows that loans to nonrated firms, which do not have bond market access, are priced at slightly higher spreads conditional on credit risk than rated firms, which are eligible for inclusion in my sample. Intuitively, firms without bond market access have weaker bargaining power vis-à-vis banks as they have fewer outside options. Thus, the loan premium uncovered by my analysis is likely to be larger in magnitude for nonrated firms.

Second, the sample consists of firms that decide to borrow from a bank instead of issuing a new bond, so there is also potential for selection among bank borrowers with bond market access. This is a necessary evil in the absence of widely available secondary market pricing of corporate loans. The primary concerns for my analysis are that the pricing of these firms' bonds is unusual, the firms are in bad financial health, or the observations occur during periods of market turmoil. To alleviate the first concern, the bottom panel of Figure 2 shows that bond credit spreads of firms that take out a new loan in the current month are similar, conditional on credit risk, to the spreads of firms that do not take a new loan.[10] With regard to financial health, the vast majority of sample firms have positive equity returns and operating profits prior to the loan, and these firms continue to have access to the bond market, with

[10] The Internet Appendix presents similar figures for loan borrowers identified by the presence of a new loan originated in the past six months or any outstanding loan based on DealScan start and end dates.

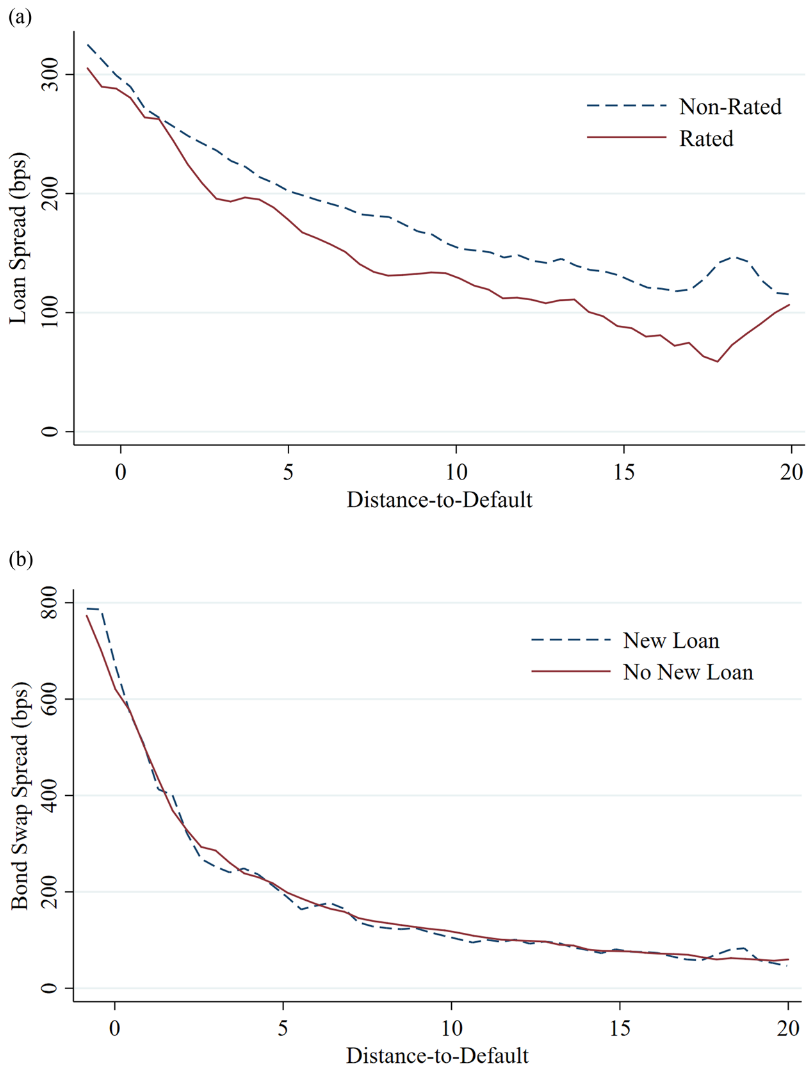



**Figure 2. Comparison with out-of-sample loan and bond spreads.** This figure provides evidence on bond and loan credit spreads as functions of credit risk for issuers that do or do not qualify for inclusion in the sample to provide evidence on the external validity of my analysis. Variables are defined in the Appendix. Panel A plots nonparametric regressions of loan all-in-drawn spreads on distance-to-default using a rectangular kernel, splitting the DealScan-Compustat sample into rated and nonrated firms, which do and do not have access to the public debt markets, respectively. Panel B plots nonparametric regressions of bond swap spreads on distance-to-default using a rectangular kernel, splitting the monthly panel of secondary market bond quotes from Bank of America Merrill Lynch into firms that did and did not originate a new loan in the month. (Color figure can be viewed at wileyonlinelibrary.com)

**Table II**
**Sample Construction**

This table summarizes the construction of the sample. The starting point is the intersection of DealScan and Compustat from 1997 to 2017 with the loan denominated in U.S. dollars and nonmissing data on debt and equity market capitalization, excluding financial, utility, and quasi-public firms. The sample of loans is restricted to senior revolving credit facilities and term loans with an all-in-drawn spread relative to LIBOR, excluding loans for commercial paper backup, debtor-in-possession financing, and merger-related purposes. Each loan is matched with the closest senior unsecured bond by maturity in the Bank of America Merrill Lynch bond quote data, dropping bonds with credit spread below zero or above 1,500 bps. To mitigate the effect of maturity differences and short maturities on the results, I drop bond-loan pairs with an absolute maturity difference over two years and require both the loan and the bond to have at least three years to maturity. For the quantitative model estimation, I select a restricted sample of term loans secured by a first lien with debt structure data available from Capital IQ or SEC filings. I define a loan package as a group of facilities with the same borrower and start date.

| Selection Criteria | Loan Facilities | Packages | Firms | Amount ($ Billion) |
|---|---|---|---|---|
| DealScan-Compustat (1997 to 2017) | 31,321 | 22,569 | 5,519 | 13,266 |
| Revolvers and TLs with rate data | 25,672 | 18,651 | 4,708 | 10,734 |
| Exclude CP backup, DIP, M&A | 17,714 | 13,930 | 4,175 | 7,009 |
| Match with senior unsecured bond | 3,346 | 2,668 | 808 | 2,890 |
| Maturity restrictions | 1,682 | 1,383 | 606 | 1,782 |
| Full bond-loan sample | 1,682 | 1,383 | 606 | 1,782 |
| Term loans secured by first lien | 260 | 225 | 150 | 160.9 |
| Debt structure data available | 199 | 173 | 115 | 127.4 |
| Restricted sample for model | 199 | 173 | 115 | 127.4 |

one-quarter issuing a bond within one year and three-quarters issuing a bond within five years after the loan. Finally, most of the sample observations occur during the economic expansions before and after the financial crisis, as there were few new loans during the crisis. Overall, this evidence suggests that one can reasonably draw general conclusions about the relative pricing of loans and bonds from my analysis.

### *A. Sample Construction*

Table II summarizes the sample construction. I begin with data on loan originations from 1997 to 2017 in DealScan merged with firm characteristics from the quarter prior to origination from Compustat.[11] Following the corporate finance literature, I exclude loans to financial firms (SIC 6000-6999), utilities (SIC 4900-4999), and quasi-public firms (SIC above 8999) from the sample. Next, I restrict the sample to U.S. dollar denominated loans with nonmissing data on short-term and long-term debt from Compustat and market capitalization and equity volatility from CRSP; I drop a small number of subordinated

[11] I thank Michael Roberts for sharing the DealScan-Compustat link table from Chava and Roberts (2008).

loans; I require that the all-in-drawn spread be relative to the LIBOR, the standard base rate for corporate loans; I restrict the sample to revolving credit facilities and term loans, omitting leases, letters of credit, and other less common loan types; I exclude commercial paper backup loans, as such loans are rarely drawn; I exclude debtor-in-possession loans because issuers of these loans are in default at the time of origination; and I exclude loans for purposes related to mergers and acquisitions, including buyouts and sponsored loans, to mitigate the impact of these major corporate events on the analysis.

I merge corporate bond quotes from Bank of America Merill Lynch (BAML) on the origination date of each loan by matching the leading six digits of the CUSIP (the issuer CUSIP) in the BAML data with the same identifier in Compustat.[12] To ensure that the loan and bond are issued by the same corporate entity, I manually check that the six-digit CUSIP matches have the same company name in the respective data sets. For each loan, I match the senior unsecured bond with the smallest absolute maturity difference, dropping pairs with an absolute maturity difference greater than two years. To mitigate the impact of short maturities on the results, I drop loans and bonds with less than three years to maturity. I also exclude bonds with negative credit spreads and distressed bonds with spreads in excess of 1,500 bps. After applying these criteria, the full bond-loan sample consists of 1,682 loan facilities issued by 606 firms for a total of $1.8 trillion in capacity.

I restrict the sample to term loans that are secured by a first lien for the structural model estimation to ensure that there is no ambiguity about the priority of debt and to mitigate the impact of embedded options.[13] The model requires measurement of the firm's debt structure, specifically, the amount of senior and junior debt at the time of the loan. I obtain data on the firm's debt structure at the quarter-end immediately before the origination date from two sources. First, Capital IQ provides detailed capital structure data from 2002 to 2017, which I merge with 158 out of the 260 secured term loans. To ensure the quality of the Capital IQ data, I require that secured and unsecured debt sum to total debt and that total debt from Capital IQ match total debt in Compustat. The Capital IQ data have good coverage of the sample firms in recent years, but coverage is poor prior to the financial crisis. To fill gaps in the Capital IQ data, I hand-collect information on debt structure from 10-K and 10-Q filings in the EDGAR database provided by the SEC, adding required data for 41 observations. For the remaining observations, the firms do not report liabilities in enough detail to construct accurate measures of debt structure.

[12] These data are available from 1997 to 2017 and form the basis of Bank of America's bond indices. In academic research, they are used by Schaefer and Strebulaev (2008) and Feldhutter and Schaefer (2018). Quote data provide better coverage than transaction data, which are available from TRACE on the origination date for 357 out of 1,682 loans in the full bond-loan sample. For those observations, the correlation between BAML and TRACE yields is 0.94.

[13] I identify loans secured by a first lien using the secured indicator in the DealScan Facility table and excluding loans marked as second or third lien facilities in the DealScan Market Segment table. The Internet Appendix reports detailed evidence, hand-collected from SEC filings, on the liens securing each loan.

The restricted sample consists of 199 loans to 115 firms totaling $127 billion in volume.

### *B. Sample Characteristics*

Table III reports sample summary statistics. Panel A describes the full sample and Panel B describes the restricted sample for the structural model. All firms in the sample have access to the public debt markets, so they are generally large and have substantial tangible assets. Most of the sample firms are performing well, with positive operating profits in the quarter prior to the loan and positive stock returns over the years before and after the loan origination. There is significant cross-sectional variation in capital structure and debt structure. Consistent with Rauh and Sufi's (2010) finding that firms with a tiered debt structure tend to be of medium to low quality, most of the firms in the full sample are in the BBB and BB rating categories. The median loan facility has $700 million in capacity, maturity of five years, and an all-in-drawn spread over LIBOR of 150 bps. Approximately half of the loans are secured and one-quarter are term loans. The median bond has $400 million in principal outstanding and five years to maturity, with a secondary market asset swap spread of 161 bps. The sample of bonds has greater variance in credit spreads than the matched loans due to their junior position in the debt structure. The distributions of maturities are well matched as a result of the sample restrictions.

To provide context on the external validity of this study, the Internet Appendix compares the sample with the DealScan-Compustat universe. The main difference between the sample and the universe is that the sample is restricted to bond issuers, so the firms are larger, less volatile, and less reliant on bank financing, and almost all have credit ratings. In contrast, nearly half of the firms in the DealScan universe are nonrated. Similarly, the loans of the sample firms are larger and have lower credit spreads than the typical loan in the universe, and the bank syndicates include more lenders and the largest banks are more likely to serve as lead arranger or participate in the syndicate. The distribution of borrower industries in the sample, however, is similar to the distribution in the universe. Overall, the firms in the full sample are more creditworthy and have less severe information asymmetry than the typical borrower in the syndicated loan market. When generalizing the results in this paper, it is worth keeping these differences in mind.

For the empirical analysis using the structural model, I restrict the sample to secured term loans and unsecured bonds to establish clear priority in the event of default and to mitigate the impact of embedded options on the pricing of the loan. The most significant differences between the restricted sample and the full bond-loan sample are with respect to creditworthiness and the distribution of observations over time. Consistent with the notion that bank lenders are more likely to be secured after the firm's creditworthiness deteriorates (Rauh and Sufi (2010)), the firms in the restricted sample are closer to default and

**Table III**

**Summary Statistics**

This table reports summary statistics on the full sample in Panel A and on the restricted sample of secured term loans for the structural model in Panel B. Variables are defined in the Appendix. All ratios are winsorized at the 1% level to mitigate the impact of outliers. The distribution of Standard & Poor's (S&P) long-term issuer credit ratings in the month of loan origination is in the bottom row of each panel, with AA including AAA and AA ratings and CCC including CCC and CC ratings.

Panel A: Full Sample

| | Mean | *SD* | p10 | p50 | p90 | Observations |
|---|---|---|---|---|---|---|
| *Loan characteristics* | | | | | | |
| All-in-drawn spread (bps) | 159 | 106 | 40 | 150 | 300 | 1,682 |
| Facility amount ($MM) | 1,059 | 1,224 | 150 | 700 | 2,500 | 1,682 |
| Maturity | 4.94 | 0.83 | 4.00 | 5.00 | 5.45 | 1,682 |
| Term loan | 0.23 | 0.42 | 0 | 0 | 1 | 1,682 |
| Secured loan | 0.49 | 0.50 | 0 | 0 | 1 | 1,220 |
| Lead arranger count | 3.34 | 2.84 | 1 | 2 | 6 | 1,682 |
| Participant count | 9.67 | 8.84 | 1 | 7 | 20 | 1,682 |
| Performance pricing | 0.49 | 0.50 | 0 | 0 | 1 | 1,682 |
| LIBOR swap rate (%) | 2.74 | 1.78 | 1.10 | 1.81 | 5.46 | 1,682 |
| *Bond characteristics* | | | | | | |
| Swap spread (bps) | 231 | 217 | 37 | 161 | 509 | 1,682 |
| Face value ($MM) | 496 | 392 | 200 | 400 | 950 | 1,682 |
| Maturity | 5.08 | 1.16 | 3.56 | 5.02 | 6.56 | 1,682 |
| Years since issuance | 3.61 | 2.78 | 0.42 | 3.53 | 6.01 | 1,676 |
| Callable | 0.40 | 0.49 | 0 | 0 | 1 | 1,676 |
| LIBOR swap rate (%) | 2.76 | 1.79 | 1.09 | 1.88 | 5.48 | 1,682 |
| *Firm characteristics* | | | | | | |
| Quasi-market assets ($B) | 23.1 | 40.6 | 1.65 | 8.70 | 54.9 | 1,682 |
| Quasi-market leverage | 0.32 | 0.20 | 0.11 | 0.28 | 0.65 | 1,682 |
| Asset volatility | 0.21 | 0.09 | 0.12 | 0.20 | 0.33 | 1,682 |
| Distance-to-default | 7.88 | 4.87 | 1.97 | 7.20 | 14.7 | 1,682 |
| Trailing stock return | 0.19 | 0.44 | −0.28 | 0.14 | 0.62 | 1,682 |
| Subsequent stock return | 0.12 | 0.42 | −0.35 | 0.10 | 0.54 | 1,682 |
| Asset market-to-book | 1.37 | 0.74 | 0.69 | 1.16 | 2.36 | 1,682 |
| Asset tangibility | 0.33 | 0.24 | 0.06 | 0.27 | 0.71 | 1,675 |
| Profitability | 0.03 | 0.02 | 0.01 | 0.03 | 0.06 | 1,633 |
| Short-term debt/total | 0.10 | 0.13 | 0 | 0.05 | 0.28 | 1,682 |
| Bank debt/total | 0.18 | 0.22 | 0 | 0.06 | 0.52 | 1,120 |
| Secured debt/total | 0.19 | 0.25 | 0 | 0.03 | 0.59 | 1,120 |
| Undrawn capacity/debt | 0.26 | 0.29 | 0 | 0.19 | 0.61 | 1,120 |
| Loans per firm | 2.28 | 1.59 | 1 | 2 | 5 | 606 |
| *Distribution of credit ratings* | AA | A | BBB | BB | B | CCC |
| S&P long-term issuer rating | 0.01 | 0.17 | 0.36 | 0.27 | 0.16 | 0.01 |

*(Continued)*

**Table III**—*Continued*

| Panel B: Restricted Sample | Mean | *SD* | p10 | p50 | p90 | Observations |
|---|---|---|---|---|---|---|
| *Loan characteristics* | | | | | | |
| All-in-drawn spread (bps) | 279 | 121 | 162.5 | 275 | 425 | 199 |
| Facility amount ($MM) | 640 | 655 | 100 | 400 | 1,490 | 199 |
| Maturity | 5.46 | 1.14 | 4.00 | 5.10 | 7.00 | 199 |
| Term loan A | 0.30 | 0.46 | 0 | 0 | 1 | 199 |
| Term loan B | 0.58 | 0.50 | 0 | 1 | 1 | 199 |
| Other term loan | 0.13 | 0.33 | 0 | 0 | 1 | 199 |
| Secured by all assets | 0.30 | 0.46 | 0 | 0 | 1 | 199 |
| Lead arranger count | 3.83 | 2.83 | 1 | 3 | 8 | 199 |
| Participant count | 6.01 | 9.77 | 0 | 3 | 15 | 199 |
| Performance pricing | 0.24 | 0.43 | 0 | 0 | 1 | 199 |
| LIBOR swap rate (%) | 2.41 | 1.60 | 0.95 | 1.84 | 5.13 | 199 |
| *Bond characteristics* | | | | | | |
| Swap spread (bps) | 372 | 216 | 121 | 328 | 662 | 199 |
| Face value ($MM) | 513 | 332 | 200 | 425 | 902 | 199 |
| Maturity | 5.65 | 1.27 | 3.90 | 5.68 | 7.16 | 199 |
| Years since issuance | 2.37 | 1.91 | 0.41 | 1.93 | 4.31 | 197 |
| Callable | 0.82 | 0.39 | 0 | 1 | 1 | 197 |
| LIBOR swap rate (%) | 2.43 | 1.60 | 1.10 | 1.89 | 5.13 | 199 |
| *Firm characteristics* | | | | | | |
| Quasi-market assets ($B) | 8.44 | 10.9 | 1.32 | 5.51 | 19.8 | 199 |
| Quasi-market leverage | 0.46 | 0.19 | 0.25 | 0.43 | 0.72 | 199 |
| Asset volatility | 0.21 | 0.09 | 0.12 | 0.19 | 0.33 | 199 |
| Distance-to-default | 5.29 | 3.54 | 1.14 | 4.70 | 10.4 | 199 |
| Trailing stock return | 0.33 | 0.84 | −0.35 | 0.17 | 0.99 | 199 |
| Subsequent stock return | 0.20 | 0.56 | −0.36 | 0.15 | 0.65 | 199 |
| Asset market-to-book | 1.20 | 0.53 | 0.73 | 1.07 | 1.88 | 199 |
| Asset tangibility | 0.31 | 0.21 | 0.07 | 0.25 | 0.61 | 199 |
| Profitability | 0.03 | 0.02 | 0.01 | 0.03 | 0.05 | 193 |
| Short-term debt/total | 0.05 | 0.07 | 0.001 | 0.02 | 0.15 | 199 |
| Bank debt/total | 0.39 | 0.21 | 0.08 | 0.38 | 0.67 | 199 |
| Secured debt/total | 0.44 | 0.24 | 0.09 | 0.43 | 0.77 | 199 |
| Undrawn capacity/debt | 0.13 | 0.15 | 0 | 0.10 | 0.32 | 199 |
| Loans per firm | 1.50 | 0.99 | 1 | 1 | 3 | 115 |
| *Distribution of credit ratings* | A | BBB | BB | B | CCC | NR |
| S&P long-term issuer rating | 0 | 0.01 | 0.56 | 0.34 | 0.04 | 0.05 |

receive smaller loans than the firms in the full sample.[14] Almost all of the observations are from 2003 to 2007 and 2011 to 2017, periods of expansion in syndicated lending. The typical firm has a debt structure consisting of 39% bank

[14] The Internet Appendix provides evidence on credit rating changes since the issuance date of the matched bond. Overall, the distribution of rating changes is fairly symmetric in both the full and the restricted samples, with the modal firm having been upgraded by one or two notches. The subset of firms experiencing severe downgrades is small in both samples.

debt and 61% capital market debt prior to origination of the secured term loan.[15] Almost all firms have existing bank debt prior to the new loan origination and most firms have a substantial "debt cushion" of outstanding unsecured bonds, but there is broad cross-sectional variation in debt structure, which highlights the need to account for firm-specific circumstances when pricing loans in the structural model. Most firms also have capacity for incremental borrowing from a revolving line of credit, so I account for this potential when measuring senior debt in the model.

### C. Determinants of Bond and Loan Credit Spreads

As a first step in understanding the relative pricing of corporate bonds and bank loans, I explore the cross-sectional determinants of their credit spreads. Table IV reports regressions of loan and bond spreads on firm and loan characteristics related to credit risk. The left three columns consider loan spreads and the right three columns consider bond spreads. The leftmost column in each set considers several basic observable credit risk variables: leverage, asset volatility, maturity, and credit rating. Each column to the right includes additional variables expected to correlate with credit spreads.

The basic credit variables explain 70% and 72% of cross-sectional variation in loan and bond spreads, respectively. Consistent with the lower priority of bonds, the coefficients on these covariates are larger in magnitude for bonds than for loans. Explanatory power is increased further by including additional firm characteristics and loan terms. Overall, the results in Table IV indicate that observable credit risk, firm characteristics, and loan terms can explain the bulk of cross-sectional variation in loan and bond spreads. Interestingly, while the evidence in Figure 1 suggests that the level of loan spreads is higher than implied by credit risk, the relative pricing of loans is explained largely by observable creditworthiness.

There are interesting differences in the correlations between credit spreads and other firm and loan characteristics. After controlling for credit rating, it appears that loan spreads are driven more by loan terms than by the firm's credit risk, whereas bond spreads are strongly associated with several firm characteristics. Loan spreads are strongly decreasing in the amount of the loan, but only weakly correlated with firm size and profitability, which are strong determinants of the matched bond spreads. In contrast, secured loans and term loans have significantly higher credit spreads, but the issuance of these loan types is not associated with differences in bond spreads. The strong positive correlation between secured status and loan spreads is counterintuitive, but the choice to secure the loan is likely associated with unobservable risk. The analysis in Section II circumvents this issue by focusing on secured term loans.

[15] Firm characteristics in Table III are from the quarter-end prior to the loan origination date. One shortcoming of this approach is that the new loan may add secured debt, resulting in mismeasurement of the firm's debt structure at origination. In the Internet Appendix, I address this issue by showing that the model estimates are quantitatively similar if I measure debt structure at the quarter-end after origination.

**Table IV**

## Determinants of Loan and Bond Credit Spreads

This table reports regressions of all-in-drawn loan spreads and bond swap spreads on firm, loan, and bond characteristics. Variables are defined in the Appendix. Loans with missing data for *Secured Loan* are assumed to be unsecured in this table. Within $R^2$ represents the goodness of fit after accounting for month fixed effects (but not rating or industry effects). $t$-Statistics based on standard errors clustered by firm and month are reported in brackets. $^*$ and $^{**}$ denote $p$-values less than 0.05 and 0.01, respectively.

| | Loans | | | Bonds | | |
|---|---|---|---|---|---|---|
| Log(Swap Spread) | (1) | (2) | (3) | (4) | (5) | (6) |
| Quasi-market leverage | $0.40^{**}$ | 0.25 | $0.36^{*}$ | $1.20^{**}$ | $0.99^{**}$ | $1.21^{**}$ |
| | [2.68] | [1.58] | [2.31] | [5.63] | [4.80] | [5.07] |
| Asset volatility | 0.18 | 0.03 | 0.29 | $1.19^{**}$ | $0.84^{*}$ | $0.92^{*}$ |
| | [0.79] | [0.10] | [1.16] | [3.64] | [2.20] | [2.06] |
| Maturity | $0.05^{**}$ | $0.03^{*}$ | 0.01 | $0.06^{**}$ | $0.07^{**}$ | $0.10^{**}$ |
| | [3.19] | [1.99] | [0.78] | [3.64] | [3.91] | [5.00] |
| Log(Loan amount) | | $-0.05^{**}$ | $-0.03^{**}$ | | 0.01 | 0.03 |
| | | [−4.38] | [−2.86] | | [0.75] | [1.21] |
| Log(Quasi-market assets) | | 0.01 | 0.004 | | $-0.14^{**}$ | $-0.13^{**}$ |
| | | [0.47] | [0.23] | | [−7.05] | [−5.68] |
| Profitability | | $-1.25^{*}$ | −0.69 | | $-2.65^{**}$ | $-2.65^{**}$ |
| | | [−2.16] | [−1.09] | | [−3.37] | [−3.11] |
| Asset market-to-book | | −0.01 | −0.003 | | −0.04 | 0.02 |
| | | [−0.43] | [−0.09] | | [−1.28] | [0.51] |
| Secured loan | | $0.15^{**}$ | $0.14^{**}$ | | 0.03 | −0.003 |
| | | [2.80] | [3.73] | | [0.58] | [−0.05] |
| Term loan | | $0.14^{**}$ | $0.15^{**}$ | | −0.01 | 0.02 |
| | | [4.71] | [6.00] | | [−0.36] | [0.61] |
| Bank debt/total | | | −0.01 | | | −0.17 |
| | | | [−0.14] | | | [−1.48] |
| Month FEs | X | X | X | X | X | X |
| S&P rating FEs | X | X | X | X | X | X |
| *Two-digit SIC FEs* | | X | X | | X | X |
| Adjusted-$R^2$ | 0.80 | 0.82 | 0.86 | 0.79 | 0.82 | 0.84 |
| Within $R^2$ | 0.70 | 0.74 | 0.79 | 0.72 | 0.77 | 0.80 |
| Observations | 1,633 | 1,633 | 1,093 | 1,633 | 1,633 | 1,093 |

Surprisingly, the ratio of bank debt to total debt has an insignificant coefficient in both regressions.[16] The weak correlation between debt structure and loan spreads is puzzling, given the importance of seniority for determining payoffs in default. In structural models of credit risk with multiple debt types (e.g., Black and Cox (1976), Carey and Gordy (2016)), the value of senior debt depends on the value of assets relative to the face value of senior debt and depends only weakly on the amount of total debt. In contrast, these results suggest that the firm's overall credit risk is what matters for determining loan

[16] The Internet Appendix reports regressions of the bond-loan spread ratio that lead to a similar conclusion. Similar results also obtain if total leverage or rating fixed effects are omitted from the regression.

spreads at origination, while the relative proportions of bank and bond debt have no effect.

## II. Quantifying the Loan Premium

The results presented thus far indicate that banks earn a premium relative to the cost of credit implied by the corporate bond market. To quantify the magnitude of this premium, I estimate counterfactual loan spreads in a structural model of credit risk. The model serves two purposes. First, it delivers loan-level quantitative estimates of how the bond market would price loan cash flows, taking firm-specific circumstances into account without requiring a full term structure of credit spreads. Second, it offers a framework to examine the ability of distress costs, illiquidity, issuance costs, and prepayment options to explain the pricing of loans.

Before describing the model, it is helpful to review the factors that affect the valuation of risky debt and the important features of a pricing model in the context of this study. Generally speaking, the credit spread of a debt instrument depends on the probability and timing of default, the expected recovery of principal in the event of default, and the systematic risk exposures of the default probability and expected recovery. The ideal model of credit pricing would account for all three factors with the correct functional form. Unfortunately, the literature shows that existing structural models fail to match observed bond spreads, so these models must fail to capture at least one of the channels affecting the price of credit (e.g., Eom, Helwege, and Huang (2004), Huang and Huang (2012)).

The sample construction in this paper offers important advantages over prior studies of credit pricing because it shuts off some of these channels. Specifically, the pairing of bonds and loans from the same firm on the same date implies that any future default occurs at the same time for both instruments under standard cross-default provisions. Thus, the probability and timing of default, as well as its systematic risk, are the same for the paired bonds and loans, which means that differences in pricing must be driven by differences in expected recoveries and their associated systematic risk. My empirical approach involves recovering the volatility parameter that prices the bond under a structural model of credit risk, and then applying the same model to obtain a counterfactual loan spread under the absolute priority rule. Given the importance of recoveries in this context, I show that the model estimates are robust to alternative assumptions about the distribution of recoveries, adherence to absolute priority, and the pricing of tail risks.[17]

In this section, I outline the model and apply it to the data to quantify the loan premium. I begin by describing the model and its application to the data, with

[17] It is important to note that the model used in this analysis is not a model of the firm's capital structure decision or any other nonprice outcome. The firm value process is characterized under the risk-neutral measure and allows a simple representation of the distribution of payoffs and state prices implied by bond credit spreads. There is no need to model the physical process or the risk premium because the inputs and outputs of the model are credit spreads.

special attention to the treatment of recoveries. Next, I explore the sensitivity of the model estimates to parameter inputs. I then report estimates from the calibrated model specification that suggest banks earn a large premium relative to the loan spreads implied by the bond market. Finally, I discuss the robustness of the estimates and provide supplementary evidence on the ability of credit risk models to price seniority in the corporate bond market.

### *A. Structural Credit Pricing Model*

The structural model is an extension of the Merton (1974) model with two classes of debt. In the Merton (1974) model, the firm's value follows a geometric Brownian motion under the risk-neutral measure,

$$d \ln V_t = \left(r - \frac{1}{2}\sigma^2\right)dt + \sigma dW_t^Q. \tag{1}$$

Assume that the firm has two zero-coupon debt issues outstanding, a senior loan with face value $K_S$ and a junior bond with face value $K_J$, both maturing at time $T$. The payoff to senior debt is equivalent to a portfolio containing a risk-free bond and a short put option struck at the face value of senior debt. The payoff to junior debt is equivalent to a portfolio containing a long call option struck at the face value of senior debt and a short call option struck at the sum of total face value of debt. Under this basic setup, the value of senior debt is

$$D_S = V - \Big[V\,\Phi(d_{1,S}) - K_S\, e^{-rT}\,\Phi(d_{2,S})\Big], \tag{2}$$

where

$$d_{1,S} = \frac{\ln(V/K_S) + \left(r + \frac{1}{2}\sigma^2\right)T}{\sigma\sqrt{T}}, \quad d_{2,S} = d_{1,S} - \sigma\sqrt{T}. \tag{3}$$

The value of junior debt is

$$D_J = \Big[V\,\Phi(d_{1,S}) - K_S\, e^{-rT}\,\Phi(d_{2,S})\Big] - \Big[V\,\Phi(d_1) - (K_S + K_J)\, e^{-rT}\,\Phi(d_2)\Big], \tag{4}$$

where

$$d_1 = \frac{\ln\left(V/(K_S + K_J)\right) + \left(r + \frac{1}{2}\sigma^2\right)T}{\sigma\sqrt{T}}, \quad d_2 = d_1 - \sigma\sqrt{T}. \tag{5}$$

The yields of the loan and bond can be expressed as $y_S = \frac{1}{T}\ln(K_S/D_S)$ and $y_J = \frac{1}{T}\ln(K_J/D_J)$, respectively, because they are modeled as zero-coupon securities.

The model setup involves some simplifying assumptions that merit explanation. First, the firm can default only on the maturity date $T$ and there are no coupon payments on debt. To assess the impact of these assumptions, I apply an extension of Black and Cox (1976) with coupon payments (Bao (2009)) that allows for early default. This alternative setup leads to quantitatively similar results because of the restrictions imposed by the sample construction. Second, both classes of debt are assumed to have the same maturity, which rarely occurs in the data. However, estimates of the loan premium are similar when the sample is split by the order of maturities. Third, the firm's debt structure is assumed to be fixed between the valuation date and maturity. I show that the estimated premium is similar when debt structure is measured immediately before or after loan origination, so near-term changes in debt structure do not affect the results. The additional results referenced here are reported in the Internet Appendix.

The table below describes the data items used to set the observable model parameters related to market values, debt structure, and interest rates.

| Parameter | Description | Data Variable | Source |
|---|---|---|---|
| $K_S$ | Senior debt amount | Bank, lease, and undrawn debt | Capital IQ, EDGAR |
| $K_J$ | Junior debt amount | Total debt minus senior debt | Capital IQ, EDGAR |
| $V$ | Value of assets | Quasi-market assets | Capital IQ, CRSP |
| $T$ | Debt maturity | Loan and bond maturities | DealScan, BAML |
| $r$ | Risk-free rate | LIBOR swap rate | Bloomberg |
| $y$ | Debt yield | Swap spread plus swap rate | DealScan, BAML |

The face value of senior debt is measured as the sum of bank debt, leases, and undrawn debt capacity at the quarter-end prior to origination in Capital IQ and EDGAR. Including the amount of undrawn debt capacity in the face value of senior debt is a conservative approach that assumes the firm would draw its available lines of credit before defaulting on its debt. The face value of junior debt is set to the difference between total debt (including undrawn capacity) and senior debt. Quasi-market assets are the sum of total debt from Capital IQ and equity market capitalization on the loan origination date. Loan and bond maturities are allowed to differ, with the respective values used in the implied volatility and counterfactual valuation steps described below. Risk-free rates are maturity-matched LIBOR swap rates adjusted for continuous-time discounting in the model. Debt yields are the sums of swap rates and credit spreads relative to the LIBOR swap curve.

After setting the other model parameters, I recover the asset volatility $\sigma$ implied by the bond spread and use it to value the loan under the model. Equation (4) describes a one-to-one relation between the value of debt and asset volatility, so it is straightforward to solve numerically for the implied volatility by equating the observed credit spread and the zero-coupon spread in the model.[18] I define the loan premium as the difference between the observed all-in-drawn spread and the loan spread under the model.

[18] This approach is similar to that introduced by Kelly, Manzo, and Palhares (2016) to estimate credit-implied volatility from CDS spreads.

### *A.1. Treatment of Recoveries*

One drawback of the Merton (1974) model is the assumption that firm value follows a geometric Brownian motion, which underestimates the likelihood of left-tail outcomes that result in loss of principal for senior creditors.[19] I address this problem using two alternative approaches. The first involves a proportional firm-level bankruptcy cost, while the second draws the firm-level recovery from a random distribution calibrated to match empirical recoveries.

The bankruptcy cost specification follows prior literature on structural models (e.g., Leland (1994)) and offers a closed-form solution for the values of senior and junior debt. In the event of default, I assume that a fraction $\alpha$ of firm value is lost to the direct and indirect costs of financial distress. Applying the option-pricing framework to the modified payoffs in the default zone, the value of senior debt is

$$D_{S,\alpha} = (1-\alpha)\big(1 - \Phi(d_{1,S})\big)V + K_S\, e^{-rT}\,\Phi(d_{2,S}), \tag{6}$$

where

$$d_{1,S} = \frac{\ln\left(\frac{V}{\min\{K_S/(1-\alpha),\, K_S+K_J\}}\right) + \left(r + \frac{1}{2}\sigma^2\right)T}{\sigma\sqrt{T}}, \quad d_{2,S} = d_{1,S} - \sigma\sqrt{T}. \tag{7}$$

The adjustment to $d_{1,S}$ and $d_{2,S}$ reflects the effect of the bankruptcy cost on the likelihood of the defaulted firm value being below the face value of senior debt. If $\frac{K_S}{1-\alpha} > K_S + K_J$, then the defaulted firm value is insufficient to make senior creditors whole, so the junior creditors receive no recovery. Under the model with bankruptcy costs, the value of junior debt is

$$D_{J,\alpha} = (1-\alpha)\Big[V\big(\Phi(d_{1,S}) - \Phi(d_1)\big) - K_S\, e^{-rT}\big(\Phi(d_{2,S}) - \Phi(d_2)\big)\Big] + K_J\, e^{-rT}\,\Phi(d_2), \tag{8}$$

where $d_1$ and $d_2$ are defined as in equation (5). The choice of $\alpha$ is important for the model estimates, but there is substantial disagreement in the literature about the magnitude of bankruptcy costs. In my baseline specification, I use the result from Glover (2016) that the costs of financial distress are approximately equal to $0.45 - 0.2Lev_{Book}$, where $Lev_{Book}$ is the ratio of book debt to book assets.[20] However, the qualitative conclusions of my analysis are robust to a wide range of bankruptcy cost parameters.

[19] This issue is related to the volatility "smirk" phenomenon in equity options markets, where options struck out-of-the-money have higher implied volatility than at-the-money options. One solution to this problem would be to add downward jumps to the firm value process. Although this approach would increase the likelihood of left-tail outcomes, it offers little benefit in my setting because the risk-neutral probability of default is reflected in bond spreads. The random recovery approach described here can be thought of as a specific version of a model with jumps of random size in the event of default.

[20] Glover (2016) corrects for selection bias in the estimation of distress costs from defaulted firms and accounts for systematic risk exposures. In table 7 of Glover (2016), he shows that book leverage explains a large amount of the variation in estimated distress costs, so I incorporate that finding into my specification.

As an alternative to the bankruptcy cost model, which still relies on the left-tail distribution of asset value imposed by the Merton (1974) model, I draw recoveries from a random distribution that matches the empirical distribution of firm-level recoveries. The random recovery specification allows for a more flexible distribution of loss given default and follows industry practice (e.g., Moody's Investors Service (2006)), but it does not offer a closed-form solution for the value of debt. I therefore implement this specification by simulation, taking 1,000 draws for each observation. The volatility parameter is backed out of bond spreads assuming zero bankruptcy cost, which results in the highest default probability and the most conservative loan premium estimate. The simulation involves drawing the asset value at maturity from the log-normal distribution implied by equation (1), and then, if asset value is below the face value of debt, drawing a firm-level recovery rate from a beta distribution and allocating the payoffs according to absolute priority.

The parameters of the beta distribution, which is bounded between zero and one, are set to match the empirical distribution of firm-level recoveries. Table I, Panel B, shows that the empirical distribution of firm-level recoveries for defaulted firms satisfying the criteria for inclusion in the restricted sample has a mean of 0.54 and standard deviation of 0.26. Table I indicates that the distribution of firm-level recoveries is fairly symmetric, which leads to a highly skewed distribution of loan recoveries under absolute priority, with term loans recovering principal and accrued interest in most cases. Based on this evidence, I calibrate the firm-level recovery distribution to have a mean of 0.50 and a standard deviation of 0.25.

### A.2. Additional Model Features

There are some additional differences between loans and bonds that I embed in the model. Although these features do not capture all of the economic factors affecting the relative pricing of loans and bonds in this sample, they are some of the most prominent.

First, the model does not account for the fixed costs of issuance, which are potentially an important difference between the pricing of loans and bonds in my data. The bond quotes are from the secondary market, which means they do not account for the underwriting fees and underpricing that the firm would incur to issue a new bond.[21] For the subset of bonds in my sample with data on fees and transaction prices after issuance, the mean gross spread and initial

[21] Along the same lines, the all-in-drawn loan spread does not reflect the up-front fees paid to the loan arrangers and I assume that loans are issued at par because data on original issue discounts are missing for most loans in DealScan. Berg, Saunders, and Steffen (2016) find that the mean (median) up-front fee for term loans is 0.80% (0.50%) of face value. Bruche, Malherbe, and Meisenzahl (2000) find that leveraged term loans are underpriced by a mean (median) of 0.85% (0.75%) relative to secondary market prices shortly after origination. I find similar magnitudes for the subset of loans in my sample with data on up-front fees and post-origination pricing. Both of these omitted factors lead to an underestimate of the loan premium, since the true cost of borrowing for the issuer is higher than implied by the all-in-drawn spread alone.

return are each about 1.5%, implying a total cost of bond issuance of 3%.[22] To adjust for the cost of bond issuance, I compute the yield-to-maturity of the bond using the quoted price and the approximate primary market price obtained by discounting the quoted price by the issuance cost, and then add the difference in yields to the option-adjusted swap spread provided in the BAML data. Higher issuance costs lead to higher adjusted bond spreads and lower estimates of the loan premium.

Second, most term loans can be prepaid at par any time after issuance, often with a penalty if prepayment occurs in the first year or two. This feature offers valuable flexibility to borrowers who want to adjust their capital structure or undertake a significant investment without paying a make-whole premium. Since the base rate of the loan is floating, the prepayment option is equivalent to a receiver swaption on the issuer's credit spread, under which the issuer exchanges the value of a new loan at the prevailing market spread (i.e., par value) for the value of the remaining interest and principal payments. I value this feature as a Bermudan option in a binomial tree with nodes at each quarterly loan coupon payment, using the volatility of bond spreads over the past year scaled by the ratio of loan and bond spreads to proxy for the volatility of the loan spread.[23] After obtaining the value of the prepayment option for each loan, I add it to the face value of the loan and compute the yield-to-maturity of a noncallable loan. To obtain a call-adjusted loan spread, I subtract the difference between the yield-to-maturity of the callable loan (i.e., priced at par) and the noncallable loan. The loan premium adjusted for prepayment is the difference between the call-adjusted loan spread and the loan spread implied by the model.

Finally, I model illiquidity to account for the features of loans that increase transaction costs relative to bonds. Specifically, trading a loan likely involves higher search costs than trading a bond due to a narrower investor base and the fact that loan contracts involve more paperwork and longer settlement times.[24] I model loan illiquidity with a higher discount rate $r + \lambda$ for lenders relative to the discount rate $r$ used to price bonds. This approach follows the

[22] The magnitude of underpricing is substantially higher than the average levels reported by Cai, Helwege, and Warga (2007) and Nagler and Ottonello (2018), but the samples in those papers are broader and the variance of their estimates is high. The issuance costs used in my specification lead to a conservative estimate of the loan premium relative to the costs implied by these earlier papers.

[23] See the Internet Appendix for a detailed explanation of the valuation procedure. The procedure involves building out a binomial tree of the loan spread at each future date and the associated payoff from swapping the spread for the remaining contractual spread payments. The prepayment option is valued by iterating backward through the tree, weighting the firm's decision to exercise the prepayment option against the discounted continuation value of the option. Many of the loans have restrictions on prepayment, including penalties or prohibitions up to a certain time after the loan, but the data in DealScan are incomplete so I do not account for them. Ignoring these restrictions leads to overvaluation of the prepayment option and underestimation of the loan premium.

[24] Differences in information asymmetry could also lead to differences in liquidity across the two markets, but this issue is mitigated by the sample construction in this study. Specifically, since the loan and bond are claims on the same assets and the loan is senior to the bond, the loan is less sensitive to uncertainty about the value of the underlying assets.

characterization in Duffie and Singleton (1999), who model illiquidity as a fractional carrying cost incurred continuously over the life of a debt instrument. The secondary market for syndicated loans has become more active in recent years, with increased participation by institutional investors and contract terms designed to encourage this participation (Becker and Ivashina (2017)). To assess the relative liquidity of loans, I obtain data from Thomson-Reuters LSTA on secondary market quotes for 68 of the 199 term loans in the restricted sample from 2010 to 2016. Quote data are the best available source of evidence on transaction costs in the secondary market for loans because unlike the corporate bond market, there is no disclosure requirement for transactions. The unconditional mean bid-ask spread in these data is 75 bps, which is similar to the effective bid-ask spread for large corporate bond trades estimated by Bao, Pan, and Wang (2011). Based on this evidence, I set the liquidity parameter $\lambda$ to zero in my baseline specification, but I use it in comparative statics to assess the magnitude of illiquidity necessary to justify the observed pricing of loans.

### *A.3. Model Comparative Statics*

Before presenting estimates from the model, it is important to understand how modeling assumptions and the measurement of parameters affect the results. Figure 3 presents comparative statics exercises in which I show the effects of varying each model parameter individually while holding the others fixed. The plots give a sense of the importance of each parameter in determining the loan premium, which is defined as the difference between the observed all-in-drawn spread and the loan spread under the model. For each comparative statics exercise except the one that focuses on the mean recovery in the simulated model, I estimate the loan premium under the model with bankruptcy costs. I do not account for the value of prepayment and the cost of bond issuance in these exercises, but the reported sensitivities are similar if I do account for these additional factors.

The top-left panel of Figure 3 shows the effect of shifting the value of assets by 25% in either direction. As can be seen, this has little effect on the estimated loan premium because the calculation of asset volatility from the bond spread largely offsets any mismeasurement of asset value. When asset value is shifted downward, the firm's leverage shifts up and the level of asset volatility necessary to match the bond spread is reduced. The top-right panel performs a similar exercise on the face value of senior debt for large shifts of −50% to +150%. The effects are slightly larger here but a similar dynamic prevents mismeasurement of the debt structure from having outsized effects on the estimated loan premium. In this case, an upward shift in senior debt reduces asset coverage for the loan but also increases total leverage, which reduces bond-implied asset volatility and the likelihood of very low realizations of firm value that impair senior creditors. These comparative statics demonstrate the robustness of my empirical approach and are encouraging in light of the difficulty of modeling potentially complex debt structures and precisely measuring the market value of assets.

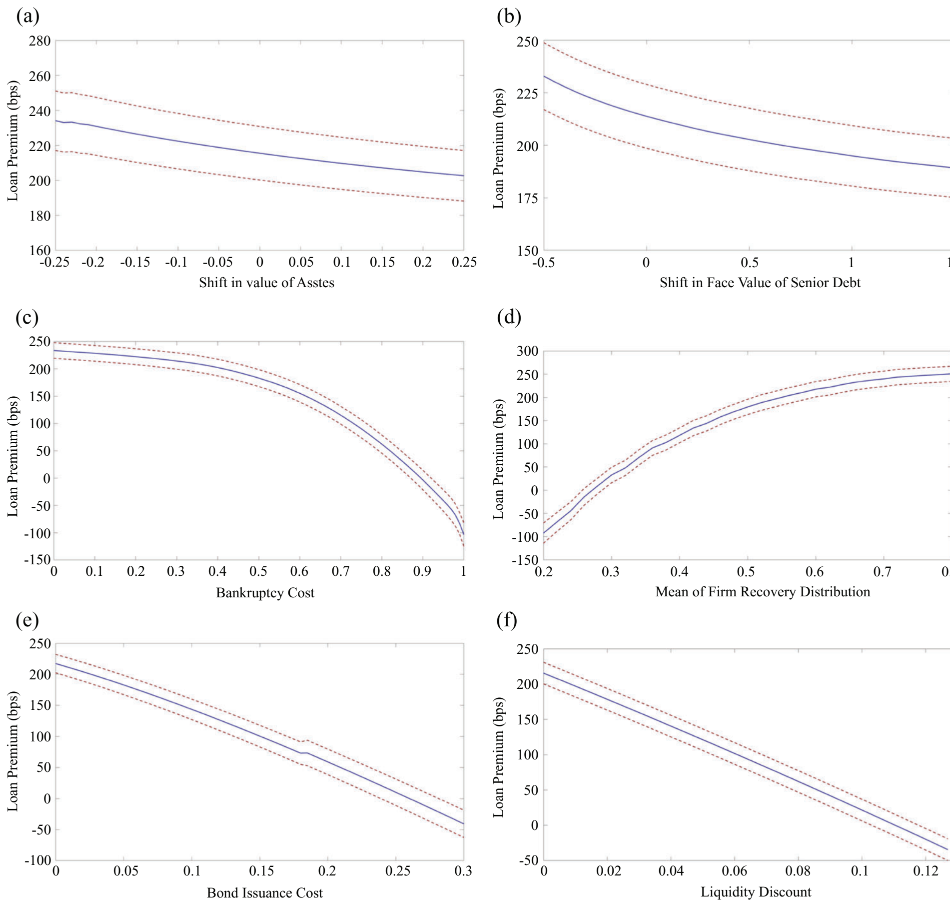



**Figure 3. Model comparative statics.** This figure provides comparative statics evidence for the key parameters of the loan pricing model. Each panel plots the loan premium as a function of an individual model parameter. The loan premium is defined as the difference between the observed all-in-drawn spread and the loan spread under the model. The model parameters include the value of assets, the face value of senior debt, the bankruptcy cost, the mean of the simulated recovery distribution, the fixed cost of bond issuance, and the liquidity discount. All of the plots are based on the model with bankruptcy costs described in Section II.A.1, except for middle-right panel, which shows the effect of varying the mean of the recovery distribution in the simulated model. (Color figure can be viewed at wileyonlinelibrary.com)

The panels in the second row of Figure 3 highlight the importance of the assumptions about recovery rates for loan pricing in the model. The left panel in this row shows that the loan premium is nonlinearly decreasing in the bankruptcy cost, with a steeper slope at higher values of $\alpha$. The statistics on debt structure in Table III, Panel B, which show that the average debt cushion (i.e., unsecured debt divided by total debt) for the sample of term loans is 56%, offer some intuition for this functional form. When the bankruptcy cost is small, an upward shift has little effect on the likelihood of the asset value falling below the face value of senior debt, but once the bankruptcy cost is large, a marginal increase reduces the expected payoff of the loan. The right panel of the second row shows a similar pattern with respect to the mean of the beta distribution of firm-level recoveries in the simulated version of the model. When the firm-level recovery rate is high, there is a low likelihood of the loan being impaired, but when the firm-level recovery is low, the loan payoff is highly sensitive to it.

Although the comparative statics on recoveries show that the loan premium is sensitive to assumptions about the distribution of recoveries, they also show that implausibly high costs of financial distress are necessary to justify the pricing of loans under either model setup. The mean loan premium is over 100 bps with a bankruptcy cost of 70%, and a bankruptcy cost of 87% is necessary to push the loan premium to zero. Similarly, the mean of the beta distribution of recoveries must be below 28% to drive the mean loan premium to zero.[25] Overall, these results suggest a need to take care in interpreting the model estimates of the loan premium, but provide support for the existence of a loan premium.

The bottom row of Figure 3 provides evidence on the additional model features discussed in Section II.A.2. The bottom-left panel shows that higher bond issuance costs, which lead to upward adjustment of the bond spread used to calibrate asset volatility in the model, lead to lower estimates of the loan premium. The issuance cost can be interpreted as the difference between primary and secondary market pricing of bonds and has the effect of increasing the bond spread used to recover asset volatility in the model. The conservative issuance cost estimate of 3% used in the baseline model is associated with a large loan premium. This cost must exceed 24% to match the observed pricing of loans, so it is unlikely that issuance costs are responsible for the findings of this paper.

Similarly, the bottom-right panel shows that the liquidity discount for loans as a percentage of face value must exceed 10% to justify the level of the loan spread. In the context of this approach to counterfactual pricing, the liquidity discount is relative to the pricing of a bond issued by the same firm. Therefore, it must reflect excess transaction costs rather than costs of information asymmetry, which would be smaller for the loan as a senior claim on the same assets. Given the similarity between the observed bid-ask spreads for term loans and corporate bonds, it is unlikely that illiquidity is a primary driver of the loan premium.

### *A.4. Alternative Approach: Reduced-Form Default Intensity Model*

The structural model outlined above uses assumptions about the process governing firm value and the relation between firm value and debt payoffs to price bonds and loans. For robustness, here I consider a simple alternative approach based on Duffie and Singleton (1999). These authors show that under

[25] Note that the beta distribution is skewed to the right when the mean is below one-half, so this specification results in a high probability of very low recoveries.

mild technical conditions, the credit spread on a risky zero-coupon bond equals $qL$, where $q$ is the risk-neutral default probability and $L$ is the expected loss given default. Under cross-default, $q$ is the same for loans and bonds from the same firm on the same date, so relative spreads depend only on relative losses in default. Based on the empirical evidence in Panel B of Table I, I assume that $L$ is 17% for loans and 67% for bonds. The simple prediction from this reduced-form default intensity model is that the loan spread should be about one-quarter of the bond spread.

The specification of the reduced-form model makes the simplifying assumption that the ratio of losses given default matches the historical data and is the same for all firms. In the absence of strong evidence to the contrary, it seems reasonable to assume that expected recoveries in my sample are in line with the historical experience of firms with similar debt composition.[26] An advantage of this approach is that it does not take a stand on the treatment of priority in default, whereas the structural model assumes strict adherence to the absolute priority rule.[27] The implicit assumption underlying the reduced-form approach is that the risk premium associated with recovery rates, or the ratio of risk-neutral and physical expected losses, is the same for loans and bonds. This is appropriate in light of the fact that default occurs in the same economic states for loans and bonds in this sample. Nevertheless, in Section II.B.1, I consider the possibility that the recovery risk premium is higher for loans than for bonds.

### *B. Estimates of the Loan Premium*

Table V summarizes the estimates of the loan premium as well as the risk-neutral default probabilities and expected recoveries under the structural model. The specifications used here account for both the costs of bond issuance and the value of the loan prepayment option described in Section II.A.2. The effects of excluding these features are shown below the estimates of the loan premium.

Panel A specifies recoveries using the proportional bankruptcy cost based on Glover (2016). This model generates an average loan spread of 108 bps, which is 171 bps lower than the average all-in-drawn spread in the sample. Excluding the cost of bond issuance and the value of prepayment individually

[26] The Internet Appendix contains a time series plot that reveals a dip in loan recoveries during the last few years of the sample period, but this is attributable to the low realized firm-level recoveries of bankrupt energy firms after a sharp drop in the price of crude oil. Overall, the time series evidence suggests that loan and bond recoveries have a similar relation with firm-level recoveries throughout the sample period.

[27] It is difficult to assess the historical frequency of absolute priority deviations between senior and junior creditors without reviewing detailed reorganization plans because many loans are secured by specific collateral and therefore senior only to the extent the collateral is sufficient to fund repayment. In the recovery sample described in Table I, deviations from absolute priority occur in at most one-quarter of default events, under the assumption that loans are strictly senior to bonds, and in most such cases the magnitude of the transfer from senior to junior creditors is small.

**Table V**

**Estimates of the Loan Premium from the Structural Model**

This table reports estimates of the loan premium from the structural model. Panel A specifies recovery rates using a firm-level bankruptcy cost $\alpha = 0.45 - 0.2Lev_{Book}$. Panel B draws firm-level recoveries from a beta distribution with a mean of 50% and a standard deviation of 25%. Panel C uses the reduced-form $qL$ approach based on Duffie and Singleton (1999) using $L_S = 0.17$ and $L_J = 0.67$. Model spreads are obtained by computing implied asset volatility using the bond spread as the junior credit spread in the model, then using that asset volatility to compute the senior credit spread for the loan. The loan premium is computed after accounting for the effect of bond issuance costs and the value of the loan prepayment option. I report estimates of the loan premium excluding these model features individually. *Fraction of Loan Spread* is the loan premium divided by the observed all-in-drawn spread. *Interest Expense* is the loan premium times the amount of outstanding loans at the quarter-end prior to origination. *Fraction of EBITDA* is the quarterly interest expense from the loan premium divided by the previous quarter's EBITDA. The Internet Appendix describes the computation of risk-neutral quantities in the model under the log-normal distribution of firm value. The bottom two rows of Panels A and B report estimates based on the extreme pricing of tail risk described in Section II.B.1.

Panel A: Bankruptcy Cost Specification

| | Mean | *SD* | p10 | p50 | p90 |
|---|---|---|---|---|---|
| *Estimates of the loan premium* | | | | | |
| All-in-drawn spread (bps) | 279 | 122 | 163 | 275 | 425 |
| Model spread (bps) | 108 | 66.7 | 32.9 | 95.2 | 184 |
| Loan premium (bps) | 171 | 108 | 61.3 | 153 | 315 |
| excl. issue costs | 191 | 106 | 87.1 | 175 | 326 |
| excl. prepayment | 199 | 112 | 83.7 | 180 | 345 |
| *Economic magnitudes* | | | | | |
| Fraction of loan spread | 0.59 | 0.23 | 0.31 | 0.60 | 0.87 |
| Interest expense ($MM) | 23.7 | 44.2 | 0.62 | 10.2 | 46.0 |
| Fraction of EBITDA (%) | 2.91 | 4.23 | 0.06 | 1.91 | 6.25 |
| *Risk-neutral model quantities* | | | | | |
| Probability of default | 0.27 | 0.12 | 0.12 | 0.25 | 0.44 |
| Expected firm-level recovery | 0.43 | 0.06 | 0.35 | 0.43 | 0.51 |
| Expected loan recovery | 0.85 | 0.12 | 0.70 | 0.84 | 0.98 |
| Expected bond recovery | 0.11 | 0.11 | 0 | 0.08 | 0.26 |
| *Floor pricing of tail risk* | | | | | |
| Model spread (bps) | 298 | 174 | 86.4 | 272 | 537 |
| Loan premium (bps) | −19.3 | 160 | −212 | −34.0 | 177 |

Panel B: Simulated Recovery Specification

| | Mean | *SD* | p10 | p50 | p90 |
|---|---|---|---|---|---|
| *Estimates of the loan premium* | | | | | |
| All-in-drawn spread (bps) | 279 | 122 | 163 | 275 | 425 |
| Model spread (bps) | 140 | 66.2 | 50.1 | 135 | 227 |
| Loan premium (bps) | 140 | 120 | 24.3 | 112 | 287 |
| excl. issue costs | 154 | 115 | 58.6 | 126 | 295 |
| excl. prepayment | 168 | 123 | 55.6 | 149 | 314 |
| *Economic magnitudes* | | | | | |
| Fraction of loan spread | 0.46 | 0.27 | 0.15 | 0.46 | 0.80 |
| Interest expense ($MM) | 18.8 | 37.2 | 0.36 | 7.09 | 39.4 |
| Fraction of EBITDA (%) | 2.06 | 3.74 | 0 | 1.36 | 5.44 |

*(Continued)*

**Table V**—*Continued*

Panel B: Simulated Recovery Specification

| | Mean | *SD* | p10 | p50 | p90 |
|---|---|---|---|---|---|
| *Risk-neutral model quantities* | | | | | |
| Probability of default | 0.32 | 0.13 | 0.16 | 0.31 | 0.50 |
| Expected firm-level recovery | 0.50 | 0.02 | 0.48 | 0.50 | 0.52 |
| Expected loan recovery | 0.80 | 0.10 | 0.66 | 0.80 | 0.94 |
| Expected bond recovery | 0.24 | 0.11 | 0.09 | 0.22 | 0.38 |
| *Floor pricing of tail risk* | | | | | |
| Model spread (bps) | 309 | 158 | 100 | 300 | 527 |
| Loan premium (bps) | −30.0 | 168 | −216 | −29.6 | 183 |

Panel C: Reduced-Form Approach

| | Mean | *SD* | p10 | p50 | p90 |
|---|---|---|---|---|---|
| *Estimates of the loan premium* | | | | | |
| All-in-drawn spread (bps) | 279 | 122 | 163 | 275 | 425 |
| Model spread (bps) | 137 | 53.8 | 84.6 | 127 | 196 |
| Loan premium (bps) | 142 | 77.6 | 66.3 | 130 | 224 |
| excl. issue costs | 159 | 77.9 | 83.3 | 148 | 242 |
| excl. prepayment | 170 | 83.8 | 88.4 | 160 | 253 |
| *Economic magnitudes* | | | | | |
| Fraction of loan spread | 0.50 | 0.09 | 0.36 | 0.52 | 0.61 |
| Interest expense ($MM) | 20.2 | 32.2 | 0.78 | 9.50 | 40.1 |
| Fraction of EBITDA (%) | 2.46 | 3.55 | 0.03 | 1.73 | 5.47 |

leads to increases in the loan premium of 20 and 30 bps, respectively. Thus, it is important to account for these features but they are unlikely to account for a large fraction of the loan premium.[28] The loan premium is an economically significant 59% of the mean all-in-drawn spread, which is equivalent to $23.7 million in annual interest expense or 2.9% of the issuer's EBITDA. There is substantial cross-sectional variation in the magnitude of the loan premium, but nearly all loans in the sample have a higher spread than implied by the model.

Panel B of Table V simulates the pricing model using a firm-level recovery distribution calibrated to match the empirical distribution in Table I. This model leads to a higher mean loan spread of 140 bps and a lower loan premium of 140 bps, due to the greater likelihood of low firm-level recoveries relative to the log-normal distribution of firm value. The premium is still large in economic terms under this model, with 46% of the average spread being a premium over the bond-implied spread, which equates to $18.8 million in annual interest expense or 2.1% of EBITDA for the average borrower.

[28] For comparison, the credit spread difference attributable to callability is 79 bps (39 bps) for the mean (median) bond in the restricted sample, using the call adjustment implemented by BAML. Intuitively, the effect of callability on loan spreads is smaller because the base rate is floating and spread volatility is lower due to seniority.

Moving on to the quantities that underly the loan premium in the structural model, Panel A reports an average risk-neutral default probability of 27% in the model with bankruptcy costs, which is significantly higher than the five-year cumulative default rate of 8.2% for BB-rated issuers since 1970 (Moody's Investors Service (2018)). After considering the B-rated issuers in this sample, who default at a historical rate of 21% over a five-year window, the implied ratio of risk-neutral and physical default probabilities is in line with prior research that finds a ratio between two and three (Almeida and Philippon (2007), Berndt et al. (2018)). The expected recoveries for bonds are below the mean recoveries in Table I, consistent with risk-neutral pricing, but the expected recoveries for loans are in line with the empirical recoveries. This raises concerns about the pricing of recoveries, as the model with bankruptcy costs appears to underweight tail risks. The conservative approach to recovering asset volatility without bankruptcy costs under the simulated recovery specification leads to higher default probabilities in Panel B. Expected loan and bond recoveries are closer to their respective empirical means in Table I than in the bankruptcy cost specification.[29]

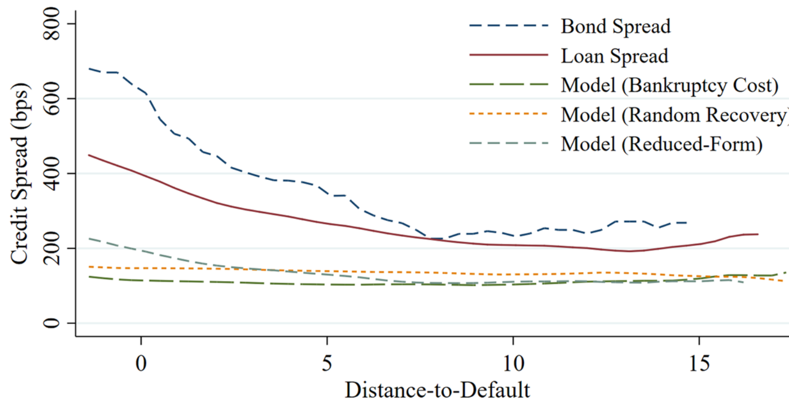
Panel C reports estimates of the loan premium from the reduced-form $qL$ model. Rather than specify the distribution of firm value or recoveries, this model takes the historical average recoveries from Table I and assumes that the ratio of risk-neutral expected losses is the same as the historical ratio, which amounts to assuming that loans and bonds have the same risk premium. Given that default occurs in the same economic states for loans and bonds in this sample, this is a reasonable benchmark. The results from this model are in line with the estimates from the structural model, with a mean loan premium of 142 bps, which is equivalent to 50% of the all-in-drawn spread.

Figure 4 plots the loan spreads generated by the three models. The plot in Panel A is similar to Figure 1, as it corresponds to nonparametric regressions of credit spreads on distance-to-default, but the sample is now restricted to term loans and the model estimates of the loan spread are added to the picture. The pattern exhibited by bond and loan spreads is similar to the pattern in the full sample. Consistent with the results in Table V, the model generates loan spreads that are substantially lower than the all-in-drawn spreads paid by firms. The loan premium is economically large for firms across the spectrum of credit quality.

Panel B plots the time series of credit spreads in the restricted sample with model estimates of the bond-implied loan spread. The bars at the bottom of the plot denote the number of observations per year and reflect the growth of the leveraged loan market during the sample period. It is important to note that since the data comprise new loan originations, most of the observations occur during economic expansions, as there are few loans during the financial

[29] The Internet Appendix shows that the distribution of loan recoveries in the simulation closely matches the historical distribution of loan recoveries from the Moody's Ultimate Recovery data used in Table I.

(a)




(b)

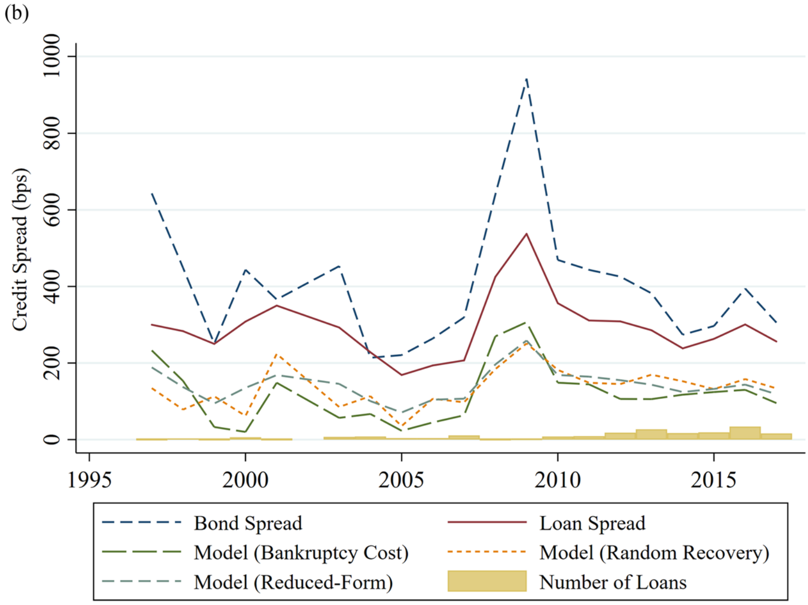



**Figure 4. Estimates of loan spreads under the model.** This figure plots the cross-sectional and time series distributions of credit spreads and model estimates of the loan spread in the restricted sample. Model spreads are computed under the two recovery specifications described in Section II.A.1. Reduced-form model spreads are based on the $qL$ model described in Section II.A.4. Panel A reports nonparametric regressions of bond and loan credit spreads on distance-to-default using a rectangular kernel. Panel B reports the time series of average credit spreads and model estimates by year. The bars at the bottom of the graph represent the number of observations in each year. (Color figure can be viewed at wileyonlinelibrary.com)

crisis. The main takeaway from this plot is that the loan premium fluctuates with movements in the bond market but exceeds 100 bps in nearly each year of the sample.

To summarize, the model estimation shows that loan spreads are significantly higher than implied by the pricing of corporate bonds from the same firm. The structural and reduced-form models lead to similar quantitative estimates, with the broad conclusion being that more than half of the typical loan spread is a premium in excess of the bond market price of credit risk. Next, I consider the possibility that the bond market offers inadequate information about the pricing of tail risks and estimate the risk premium on recoveries necessary to reconcile the pricing of loans.

### *B.1. Risk Premium on Loan Recoveries*

The results above show that the structural model generates expected loan recoveries that are only slightly below the historical averages in Table I, which raises the concern that the model is underestimating the risk of very low realizations of firm value or the market's pricing of that risk. This could stem from the log-normal distribution of firm value in the model or from an inability of bond spreads to offer information about the pricing of states in which the bond payoff is zero.

To assess whether the loan premium is driven by mispricing of tail risks, I modify the structural model to estimate the loan premium under a strict floor on the pricing of tail risks, taking a similar tack as Coval, Jurek, and Stafford (2009) in their analysis of senior CDX tranches. Specifically, I set the Arrow-Debreu state prices to zero whenever the bond recovers zero, which is equivalent to setting the loan payoff to zero when the firm's value is below the face value of senior debt in the model. Since state prices cannot be below zero in the absence of arbitrage, this sets a ceiling on the loan spread if the range over which the bond has a positive payoff is correctly priced. The bottom rows of Panels A and B in Table V show that the structural model generates spreads that are much closer to the observed all-in-drawn spreads under this extreme pricing assumption. This supports the notion that banks earn a premium over the market price of credit risk, as it is unreasonable to assume that market participants would place no value on all states in which senior creditors are impaired.

As an alternative lens on this issue, I estimate the recovery risk premium required to explain the observed pricing of loans. This analysis uses the $qL$ framework and the physical expectations of recoveries from the historical data in Table I. I define the recovery risk premium as the ratio of risk-neutral and physical expected losses given default, with a higher risk premium corresponding to higher risk-neutral expectations about losses in default. To compute the loan recovery risk premium, I first back out the risk-neutral default probability from the bond spread under the historical loss given default of 67%. I then recover the risk-neutral loss given default implied by the loan spread.[30] The estimated loan recovery risk premium is over four for the average loan, which means that the physical expected loss given default of 17% corresponds to a risk-neutral expected loss given default above 68%, which would fall in the bottom 10% of realized recoveries in the historical data. Overall, it seems that an extreme price of recovery risk is necessary to match the observed pricing of loans.

### *B.2. Pricing of Seniority by Models of Credit Risk*

The results presented so far indicate that banks earn a large premium in excess of the pricing of credit risk in the corporate bond market. However, it is possible that existing models are ill-equipped to capture the relative pricing of senior and junior credit instruments, which would point to a flaw in my approach. The literature offers little evidence on this matter, likely due to the lack of variation in contractual seniority within the corporate bond market (Bao and Hou (2017)). To verify the ability of models of credit risk to price seniority, I construct a separate sample of secured and unsecured bonds and compare their pricing to the predictions of the $qL$ framework.[31]

The sample of secured bonds comes from the BAML quote data, the same source as for the bond spreads in the preceding analysis, without conditioning on whether the firm has an outstanding bank loan. For each secured bond-month observation, I select the nearest unsecured bond by maturity from the same firm in the same month. The sample is restricted to pairs of bonds with a maturity difference of less than two years, with each bond having at least three years to maturity and one year to the next call date. I confirm the secured status of the bonds using data from Mergent FISD. Many firms with data on secured bond spreads are privately held, so I group firms by credit rating instead of measuring risk with distance-to-default, which can only be computed for public firms. These issuers are of relatively poor credit quality, with few bonds rated above BBB, so I restrict my focus to bonds rated between BBB and CCC. The resulting bond-month panel includes 1,623 observations from 67 firms over the period 2003 to 2017. The observations are concentrated toward the end of the sample period, likely due to improved secured creditor rights under the Bankruptcy Abuse Prevention and Consumer Protection Act of 2005.

[30] To be conservative, this calculation assumes that the bond recovery risk premium equals one, but the true risk premium is likely higher as bond recoveries are lower during economic downturns. Higher values of the bond recovery risk premium correspond to higher values of the loan recovery risk premium. The Internet Appendix reports estimates of the loan recovery risk premium over a broad range of assumed levels of the bond recovery risk premium.

[31] Note that I do not estimate the structural model on this sample because it relies on strict adherence to absolute priority, which is empirically less likely for secured bonds than for bank loans.

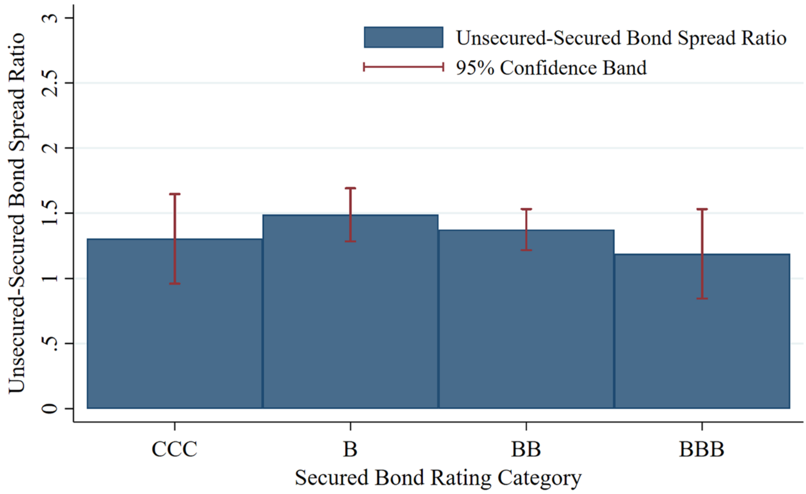



**Figure 5. Ratio of unsecured to secured bond spreads by credit rating.** This figure provides a bar chart of the ratio of unsecured to secured bond spreads by rating category. The sample is a monthly panel of secured bonds paired with the nearest unsecured bond by maturity from the same firm in the same month. The sample comprises 1,623 observations from 67 firms in the BBB, BB, B, and CCC rating categories. Rating categories on the horizontal axis are based on the Moody's rating of the secured bond in the unsecured-secured pair. Confidence bands are constructed using standard errors clustered by firm and month. (Color figure can be viewed at wileyonlinelibrary.com)

Figure 5 presents a bar chart analogous to Panel B of Figure 1 for secured and unsecured bonds.[32] The chart reveals a relation between secured and unsecured bond spreads that contrasts with the relation between loan and bond spreads. For a benchmark, under the $qL$ framework, the ratio of unsecured and secured bond spreads is $0.65/0.49 = 1.33$, using the respective average recoveries of 35% and 51% for unsecured and secured bonds in Table I. In line with this prediction, the ratio of unsecured and secured bond spreads in Figure 5 has an unconditional mean of 1.40 and the $qL$ benchmark is within the confidence band for each rating category. Although the seniority difference between secured and unsecured bonds is not as stark as the difference between loans and bonds, this evidence supports the ability of existing models of credit risk to price seniority in the corporate bond market and suggests that the findings presented in this paper are specific to the loan market.

### *B.3. Other Robustness Checks*

The quantitative analysis of loan pricing relies on a simple and transparent model. However, simplicity comes at the cost of potentially missing key

[32] Figure 5 groups the bond pairs by the secured bond rating category. The Internet Appendix shows that the results are qualitatively similar if bond pairs are grouped by the unsecured bond rating instead.

economic or institutional features that affect the pricing of loans. The estimated loan premium depends on the assumptions underpinning the model and the sample selection criteria. It is therefore important to understand how unmodeled loan characteristics and excluded loan types impact the results.

Loan contracts include many fees and pricing features that are not captured by the all-in-drawn spread (Berg, Saunders, and Steffen (2016)). These cash flows include up-front and cancellation fees stipulated in the loan contract, as well as fees paid by the firm in exchange for covenant waivers in the event of technical default. The former set of fees are sparsely populated in DealScan, while the latter need not be disclosed by firms. Many loans are issued at discounts and interest rate floors have become common in the recent low rate environment (Bruche, Malherbe, and Meisenzahl (2017)). The existence of discounts and additional cash flows means that the all-in-drawn spread understates the actual cost of borrowing, so the estimates in the previous section understate the true loan premium.

I measure loan maturity using contractual maturity, but loans are renegotiated frequently (Roberts and Sufi (2009)) and many contain amortization features, so effective maturity is shorter than contractual maturity. In the presence of an upward-sloping term structure of credit spreads, this implies that my model underestimates the loan premium. Similarly, the ordering of maturities in the loan-bond pair can affect their relative pricing (Bao and Hou (2017)). The Internet Appendix shows that for the 38% of loans maturing after their matched bonds, the fraction of the average loan spread attributable to the estimated premium is 50% under the simulated recovery specification, which is qualitatively similar to the 43% average fraction for loans maturing before their matched bonds. Along the same lines, results for the four-fifths of observations with a callable bond are almost identical to the results for noncallable bonds.[33] Overall, it does not seem that mismeasurement of maturity structure has a material effect on my findings.

Finally, the analysis relies on a narrow sample of secured term loans to identify the loan premium clearly without ambiguity about seniority and embedded options. However, this raises the concern that the results are driven by firms with unusual attributes and may not generalize. The discussion in Section I should alleviate many concerns about external validity. To go further, however, the Internet Appendix presents model estimates for the full bond-loan sample, including unsecured term loans and revolving credit facilities. Although this analysis requires stronger assumptions about the priority of unsecured loans and ignores the value of options embedded in lines of credit, the results are qualitatively similar to the findings reported above.

[33] Note that the definition of callable bonds excludes make-whole provisions, which allow the firm to prepay the bond at a small premium to the present value of future coupon and principal payments because these options always have negative exercise value and should have little impact on the bond price.

## III. Interpreting the Loan Premium

In this section, I explore potential explanations for the high level of loan spreads relative to the credit spreads on corporate bonds. I first explore the determinants of the loan premium by estimating cross-sectional regressions of the premium on firm and loan characteristics. I next discuss potential explanations for the findings and their implications.

### *A. Cross-Sectional Determinants of the Loan Premium*

The preceding results suggest that the loan premium is unlikely to be driven by costs of financial distress, differences between primary and secondary market pricing, illiquidity and carrying costs, or the inability of credit models to price seniority. However, a number of other differences between bank loans and bonds could explain the loan premium. Banks overcome information asymmetry by screening firms before providing credit and monitoring them to ensure repayment. Banks also provide valuable flexibility to firms through lines of credit and the ability to renegotiate contract terms at relatively low cost.[34]

To provide additional evidence on possible explanations for the loan premium, Table VI reports regressions of all-in-drawn spreads and estimates of the loan premium on firm and loan characteristics. The regressions include year fixed effects, so the coefficients should be interpreted as cross-sectional correlations between loan spreads and the explanatory variables. The first column reports coefficients in the all-in-drawn spread regression for the restricted sample that are similar to the results in Table IV for the full sample. Specifically, the all-in-drawn spread is increasing in leverage and asset volatility, which explain most of the cross-sectional variation in loan spreads. Loan spreads for Term Loan B tranches are higher than for other term loans, consistent with these loans having a slower amortization rate and a higher likelihood of being covenant light.

The coefficient estimates in the loan premium regressions vary across the different model specifications, but some interesting patterns emerge. In particular, the loan premium is increasing in the pre-origination leverage of the borrower. This is in line with the picture in Figure 4 and suggests that the premium as a fraction of the all-in-drawn spread is fairly stable across the credit spectrum. In addition, the estimates of the loan premium from the structural model are strongly negatively correlated with the ratio of bank debt to total debt. This pattern is attributable to the model penalizing loans to firms with less unsecured debt to insulate against drops in firm value ("debt cushion"),

[34] Although the literature highlights many benefits of borrowing from banks, Rajan (1992) identifies costs of the bank's informational advantage over outside creditors. In related work, Feldhutter, Hotchkiss, and Karakas (2016) show that corporate bond prices contain a premium attributable to state-contingent control rights, as reflected in lower yields relative to the yields implied by CDS. Bank loans offer greater control than bonds to creditors through maintenance covenants and seniority in default, so it seems that a stronger effect should exist for loans. However, any incremental value of control rights would bias my analysis toward finding a smaller loan premium.

**Table VI**

## Cross-Sectional Determinants of the Loan Premium

This table reports regressions of loan spreads and estimates of the loan premium on firm and loan characteristics. Variables are defined in the Appendix. *Log(Spread)* is the log of the all-in-drawn loan spread. *Log(Premium)* is the log of the loan premium estimated under the structural or reduced-form model. All ratios and estimates are winsorized at the 1% level. Industry fixed effects are based on the Fama-French 17-industry classification. Within $R^2$ represents the goodness of fit after accounting for year fixed effects. $t$-Statistics based on standard errors clustered by firm and month are reported in brackets. $^*$ and $^{**}$ denote $p$-values less than 0.05 and 0.01, respectively.

| | | Log(Premium) | | |
|---|---|---|---|---|
| Dependent Variable | Log(Spread) | Bankruptcy Cost | Random Recovery | Reduced Form |
| Quasi-market leverage | 1.36$^{**}$ | 1.14$^{**}$ | 0.63$^{*}$ | 0.81$^{**}$ |
| | [6.01] | [6.44] | [2.41] | [4.69] |
| Bank debt/total | 0.04 | −0.79$^{**}$ | −1.29$^{**}$ | −0.04 |
| | [0.27] | [−5.30] | [−5.96] | [−0.34] |
| Asset volatility | 0.55 | 0.18 | −0.63 | 0.40 |
| | [1.31] | [0.51] | [−0.97] | [1.36] |
| Loan maturity | −0.001 | −0.04 | 0.08 | 0.01 |
| | [−0.04] | [−1.43] | [1.93] | [0.30] |
| Log(Loan amount) | −0.05 | 0.001 | 0.02 | −0.01 |
| | [−1.77] | [0.04] | [0.69] | [−0.38] |
| Profitability | −0.82 | −0.92$^{*}$ | −1.05 | −0.95 |
| | [−1.28] | [−2.07] | [−1.76] | [−1.73] |
| Trailing stock return | −0.07 | −0.01 | 0.02 | −0.03 |
| | [−1.31] | [−0.23] | [0.24] | [−0.78] |
| Asset market-to-book | 0.12$^{*}$ | 0.12$^{**}$ | 0.06 | 0.10$^{*}$ |
| | [2.02] | [2.70] | [0.86] | [2.04] |
| Log(Lender count) | 0.004 | −0.02 | 0.01 | −0.002 |
| | [0.16] | [−0.84] | [0.26] | [−0.09] |
| Term loan B | 0.19$^{*}$ | 0.15$^{**}$ | 0.17$^{*}$ | 0.15$^{**}$ |
| | [2.47] | [2.69] | [2.09] | [2.99] |
| Revolver in package | −0.11$^{*}$ | −0.08$^{*}$ | −0.17$^{**}$ | −0.08$^{**}$ |
| | [−2.58] | [−2.07] | [−2.93] | [−2.51] |
| Performance pricing | −0.05 | −0.09 | −0.13 | −0.05 |
| | [−1.01] | [−1.66] | [−1.84] | [−1.01] |
| Industry FEs | X | X | X | X |
| Year FEs | X | X | X | X |
| Adjusted-$R^2$ | 0.68 | 0.72 | 0.67 | 0.62 |
| Within $R^2$ | 0.69 | 0.73 | 0.70 | 0.64 |
| Observations | 145 | 145 | 145 | 145 |

while the observed loan spreads exhibit no association with debt structure. Thus, the loan premium is larger for loans with a larger debt cushion that are effectively more senior.

The profitability coefficients in Table VI suggest that firms pay a higher premium precisely when they are earning lower profits and may be in greater need of external financing. However, Table III indicates that almost all firms in the sample have positive operating profits and Figure 4 shows that most of the loans are made during economic expansions. Moreover, the coefficient on the trailing stock return is insignificant and the sample excludes loans obtained to finance major transactions (e.g., buyouts). Overall, it seems unlikely that the firm's need for external financing can fully explain the loan premium, although it does play a role.

Access to revolving credit and the ability to renegotiate contract terms are valuable features of bank financing. Table VI shows that the loan premium does not cross-subsidize the provision of revolving credit, as term loans bundled with revolving credit have lower spreads than nonbundled loans. The coefficients on covariates associated with the likelihood of renegotiation, including the firm's asset volatility, the loan's maturity, the number of lenders in the syndicate, and an indicator for performance pricing, are statistically insignificant or inconsistently signed. Therefore, it is difficult to conclude that the loan premium primarily serves to compensate the bank for future costs of renegotiation. This makes sense in light of the fact that the firm usually pays a fee for each renegotiation of the loan.

Finally, Table VI shows a lack of association between the size of the loan and both the all-in-drawn spread and estimates of the loan premium. The implication of this result is that the dollar cost of borrowing from a bank scales with the size of the loan, or in other words, there are no economies of scale in bank borrowing. This contrasts with the strong negative correlation between bond spreads and firm size reported in Table IV and suggests that the banks are not passing through their fixed costs to borrowers. Given that most of the loans in this sample are syndicated widely to both banks and nonbank institutional investors, it is difficult to pin down the exact cost function of the bank. Nevertheless, this finding raises questions about whether the loan premium equals the cost of bank services, as one would expect in a competitive market, since bank activities such as screening and monitoring are likely to have a substantial fixed cost component.

Although the results in Table VI offer some evidence on factors that could explain the loan premium, it is worth noting the limitations of these regressions. The loan premium is estimated with noise due to the model's simplifying assumptions, so the reported coefficients are imprecisely estimated but unbiased to the extent that model noise is uncorrelated with the explanatory variables. In addition, statistical power is limited by the strict sample construction, which offers a clean setting for characterizing the relative pricing of loans and bonds, but is not as well suited for studying the economics of firm-bank relationships.

### B. Discussion

Why is credit risk priced differently in the private and public debt markets? One obvious reason is that loans offer valuable benefits to the firm beyond what the capital markets can provide. For instance, it is possible to borrow large amounts on short notice in the loan market, so firms often use bank loans to fund major transactions. The sample excludes loans issued for such purposes, so it seems unlikely that the speed of funding is a key driver of the loan premium.

Another benefit of a loan is that the firm can renegotiate the terms of the loan with its lenders (Roberts and Sufi (2009)), whereas the ability to renegotiate bonds is limited by the Trust Indenture Act of 1939. My calculation of the loan premium accounts for the prepayment option, which raises the loan spread by about 30 bps. It is harder to put a price on other loan modifications, such as an expansion of the loan capacity or the waiver of a covenant violation, but these opportunities are contingent on the financial condition of both the firm and the bank (Sufi (2009), Chodorow-Reich and Falato (2019)) and usually involve payment of a renegotiation fee, which mitigates their ex ante value.

The loan can also provide a signal of the firm's quality to the market, as the bank's decision to lend is based on private information obtained from screening the borrower. The literature shows that this informational hierarchy has material effects on capital structure decisions (Rauh and Sufi (2010)) and the cost of capital-market debt (Datta, Iskandar-Datta, and Patel (1999), Houston, Lin, and Wang (2014)). However, the structure of loan cash flows seems inconsistent with the loan premium reflecting compensation for information production or other costs borne by the lead arrangers. The all-in-drawn spread studied in this paper is paid to all syndicate members, whereas up-front fees paid to the arrangers would be a more appropriate way to compensate for their efforts.

The firms in my sample appear to be unconstrained, with strong operating performance and access to capital markets, yet they pay a substantial premium over the market price of credit risk to obtain bank loans. This evidence suggests that the interaction between firms and banks generates economic surplus, regardless of exactly which channels drive it.[35] An important question is how this surplus is divided. Do banks simply pass through their costs to firms, as one would expect in a perfectly competitive banking market? Or does part of the loan premium represent the bank's share of the surplus created from the loan, which would be evidence of market power? The ability of my data to answer these questions is limited, but patterns in the data point to imperfect competition. The insignificant relation between the loan premium and the size of the loan seems inconsistent with banks strictly passing through their costs. Although it is impossible to observe the bank's cost structure, it is highly likely that the costs of loan production have a fixed component, in which case the loan premium should be smaller for larger loans in a competitive market.

To explore this issue outside of the context of loan pricing, I consider the incentives for banks to compete on price in this market. The loans in my sample are syndicated, with an average of three major banks serving as lead arranger, which means holding a relatively large position in the loan and taking

[35] James (1987) shows that the stock market reaction to new loan announcements is positive, consistent with a loan generating a positive signal about the firm's value. In the Internet Appendix, I show that abnormal stock returns around new loans in my sample are statistically insignificant. The sample firms are larger and less constrained than the typical bank borrower, so obtaining a bank loan may be less of a positive surprise for them. Consistent with James (1987), I find that abnormal returns around new loans to firms without outstanding bonds are significantly positive.

**Table VII**

**Evidence on Co-Syndication by the Most Active Lead Arrangers**

This table reports statistics on the prevalence of co-syndication among the eight most active lead arrangers in the sample of loans to firms with bonds outstanding. The sample contains 1,642 loans in the full sample for which information on syndicate members is available in DealScan. The Internet Appendix reports analogous statistics for the restricted sample. Each cell reports the fraction of loans for which the bank in the row and the column both serve as lead arranger, where the denominator is the number of loans arranged by the bank in the column header. The columns and rows do not sum to one because multiple lead arrangers are associated with most of the loans. The most active banks in the full sample are JPMorgan Chase (JPM), Bank of America (BAC), Citigroup (C), Wells Fargo (WFC), Barclays (BARC), Deutsche Bank (DB), Royal Bank of Scotland (RBS), and BNP Paribas (BNP). Lenders in DealScan are grouped by bank holding company using the link table from Schwert (2018).

| | All | JPM | BAC | C | WFC | BARC | DB | RBS | BNP |
|---|---|---|---|---|---|---|---|---|---|
| JPM | 0.62 | 1.00 | 0.65 | 0.72 | 0.66 | 0.85 | 0.78 | 0.74 | 0.83 |
| BAC | 0.52 | 0.54 | 1.00 | 0.50 | 0.73 | 0.72 | 0.66 | 0.61 | 0.72 |
| C | 0.35 | 0.41 | 0.34 | 1.00 | 0.29 | 0.59 | 0.50 | 0.51 | 0.62 |
| WFC | 0.28 | 0.29 | 0.39 | 0.22 | 1.00 | 0.39 | 0.35 | 0.31 | 0.32 |
| BARC | 0.14 | 0.19 | 0.20 | 0.24 | 0.20 | 1.00 | 0.48 | 0.33 | 0.45 |
| DB | 0.12 | 0.15 | 0.15 | 0.17 | 0.15 | 0.41 | 1.00 | 0.33 | 0.54 |
| RBS | 0.10 | 0.11 | 0.11 | 0.14 | 0.11 | 0.22 | 0.26 | 1.00 | 0.36 |
| BNP | 0.10 | 0.13 | 0.13 | 0.16 | 0.11 | 0.30 | 0.43 | 0.36 | 1.00 |
| Observations | 1,642 | 1,021 | 851 | 582 | 454 | 233 | 197 | 156 | 156 |

responsibility for selling the remaining stakes to other market participants.[36] Table VII reports statistics on co-syndication by the most active banks in the full loan-bond sample. The results reveal a striking amount of collaboration in this market. For example, JPMorgan Chase serves as co-arranger on at least two-thirds of the loans arranged by each of the top banks in my sample. The amount of co-syndication is closely related to bank size, but the overall picture is one of repeated cooperation among the main providers of capital in the loan market. To date, the academic literature offers little in terms of theory or empirical evidence on how competition functions in a market with syndication (Hatfield et al. (2018) is an exception), but the data in Table VII raise questions about the incentives for lead arrangers to undercut each other on price.[37] Ultimately, I view the question of competition in the loan market as an important avenue for future research.

[36] The structure of this market is similar to the market for initial public offerings (IPOs), which is the subject of inquiries about competition in earlier research (e.g., Chen and Ritter (2000)), with the distinction that arrangers in the loan market generally retain an economic stake in the issuance.

[37] Any model of price competition in this market must also account for the behavior of non-bank participants, who are important providers of capital but play a passive role in the syndicate. DealScan is uninformative about participant lenders because term loans are often re-sold immediately after origination.

## IV. Conclusion

This paper shows that credit spreads in the syndicated loan market are significantly higher than implied by the pricing of the same firm's bonds in the market. I arrive at this finding by applying a structural model of credit risk to a sample of new loans to firms with outstanding bonds. This unique sample construction provides a clean comparison of the pricing of loans and bonds that is unaffected by unobservable firm-time effects. My analysis concludes that in a sample of noninvestment-grade term loans, approximately half of the average loan spread is attributable to factors other than credit risk and liquidity as priced in the bond market.

Although this paper makes a specific contribution to the academic literature on corporate capital structure and the pricing of credit risk, it raises broader questions for future research. My findings imply that firms place a high value on bank services other than the one-time provision of debt capital, as evidenced by their willingness to borrow at a high risk-adjusted yield. Although I shed some light on possible explanations for the loan premium, more work is necessary to understand the surplus created by the provision of bank services and the extent to which the surplus is divided between banks and their clients.

Initial submission: May 14, 2018; Accepted: March 27, 2019
Editors: Stefan Nagel, Philip Bond, Amit Seru, and Wei Xiong

## Appendix: Variable Definitions

*Loan Characteristics*

All-in-drawn spread: spread over LIBOR paid on drawn amounts, including annual fee.
Facility amount: dollar amount of credit extended to the firm.
Maturity: number of years to the facility end date.
Term loan: indicator for term loans.
Term loan A: indicator for TL A facilities, which are repaid on an amortization schedule.
Term loan B: indicator for TL B facilities, which have minimal amortization before maturity.
Secured loan: indicator for secured loans.
Secured by all assets: indicator for loans secured by all of the firm's assets.
Revolver in package: indicator for loan packages including a revolving credit facility.
Performance pricing: indicator for loans including performance pricing provisions.
Lender count: number of lenders in the syndicate.
Lead arranger count: number of lead arrangers in the syndicate.
Participant count: number of participant lenders in the syndicate.

*Bond Characteristics*

Bond swap spread: option-adjusted bond yield minus the maturity-matched swap rate.
Face value: amount of principal to be repaid at maturity.
Maturity: number of years from the loan start date to bond maturity.
Years since issuance: number of years from the bond's offering date.
LIBOR swap rate: maturity-matched rate from the LIBOR swap curve.
Callable: indicator for bonds that are callable at a fixed price before maturity.

*Firm Characteristics*

Quasi-market assets: book debt plus equity market capitalization.
Quasi-market leverage: ratio of book debt to quasi-market assets.
Asset volatility: unlevered volatility of the trailing year of daily stock returns.
Distance-to-default: naive distance-to-default from Bharath and Shumway (2008),

$$DtD = \frac{\log(V/D) - (r - 0.5\sigma^2)T}{\sigma\sqrt{T}},$$

where $V$ is quasi-market assets, $D$ is short-term debt plus half of long-term debt, $r$ is the trailing one-year stock return, $\sigma$ is asset volatility, and maturity is $T = 1$.

Trailing stock return: return on the firm's stock over the year prior to the loan.
Subsequent stock return: return on the firm's stock over the year after the loan.
Asset market-to-book: ratio of quasi-market assets to book assets.
Asset tangibility: ratio of net property, plant, and equipment to book assets.
Profitability: ratio of previous quarter's operating income before depreciation to book assets.
Short-term debt/total: ratio of short-term debt to total debt.
Bank debt/total: ratio of drawn bank loans to total debt.
Secured debt/total: ratio of secured debt to total debt.
Undrawn capacity/debt: ratio of undrawn lines of credit to total debt.
S&P rating: long-term issuer rating from Standard and Poor's.

## REFERENCES


Almeida, Heitor, and Thomas Philippon, 2007, The risk-adjusted cost of financial distress, *Journal of Finance* 62, 2557–2586.

Bao, Jack, 2009, Structural models of default and the cross-section of corporate bond yield spreads, Working paper, University of Delaware.

Bao, Jack, and Kewei Hou, 2017, De facto seniority, credit risk, and corporate bond prices, *Review of Financial Studies* 30, 4038–4080.

Bao, Jack, Jun Pan, and Jiang Wang, 2011, The illiquidity of corporate bonds, *Journal of Finance* 66, 911–946.

Becker, Bo, and Victoria Ivashina, 2014, Cyclicality of credit supply: Firm level evidence, *Journal of Monetary Economics* 62, 76–93.

Becker, Bo, and Victoria Ivashina, 2017, Covenant–light contracts and creditor coordination, Working paper, Stockholm School of Economics.

Berg, Tobias, Anthony Saunders, and Sascha Steffen, 2016, The total cost of corporate borrowing in the loan market: Don't ignore the fees, *Journal of Finance* 71, 1357–1392.
Berndt, Antje, Rohan Douglas, Darrell Duffie, and Mark Ferguson, 2018, Corporate credit risk premia, *Review of Finance* 22, 419–454.
Bharath, Sreedhar T., and Tyler Shumway, 2008, Forecasting default with the Merton distance to default model, *Review of Financial Studies* 21, 1339–1369.
Black, Fischer, and John C. Cox, 1976, Valuing corporate securities: Some effects of bond indenture provisions, *Journal of Finance* 31, 351–367.
Botsch, Matthew, and Victoria Vanasco, 2019, Learning by lending, *Journal of Financial Intermediation* 37, 1–14.
Bruche, Max, Frederic Malherbe, and Ralf R. Meisenzahl, 2017, Pipeline risk in leveraged loan syndication, FEDS Working Paper No. 2017–048, Federal Reserve Board.
Cai, Nianyun, Jean Helwege, and Arthur Warga, 2007, Underpricing in the corporate bond market, *Review of Financial Studies* 20, 2021–2046.
Carey, Mark, and Michael B. Gordy, 2016, The bank as grim reaper: Debt composition and bankruptcy thresholds, Working paper, Federal Reserve Board.
Chava, Sudheer, and Michael R. Roberts, 2008, How does financing impact investment? The role of debt covenant violations, *Journal of Finance* 63, 2085–2121.
Chemmanur, Thomas J., and Paolo Fulghieri, 1994, Reputation, renegotiation, and the choice between bank loans and publicly traded debt, *Review of Financial Studies* 7, 475–506.
Chen, Hsuan-Chi, and Jay R. Ritter, 2000, The seven percent solution, *Journal of Finance* 55, 1105–1131.
Chodorow-Reich, Gabriel, and Antonio Falato, 2019, The loan covenant channel: How bank health transmits to the real economy, Working paper, Harvard University.
Coval, Joshua D., Jakub W. Jurek, and Erik Stafford, 2009, Economic catastrophe bonds, *American Economic Review* 99, 628–666.
Datta, Sudip, Mai Iskandar-Datta, and Ajay Patel, 1999, Bank monitoring and the pricing of corporate public debt, *Journal of Financial Economics* 51, 435–449.
Diamond, Douglas W., 1991, Monitoring and reputation: The choice between bank loans and directly placed debt, *Journal of Political Economy* 99, 689–721.
Diamond, Douglas W., 1993, Seniority and maturity of debt contracts, *Journal of Financial Economics* 33, 341–368.
Dobranszky, Peter, 2008, Joint modelling of CDS and LCDS spreads with correlated default and prepayment intensities and with stochastic recovery rate, Working paper, Finalyse SA.
Dougal, Casey, Joey Engelberg, Christopher Parsons, and Edward Van Wesep, 2015, Anchoring on credit spreads, *Journal of Finance* 70, 1039–1080.
Drucker, Steven, and Manju Puri, 2005, On the benefits of concurrent lending and underwriting, *Journal of Finance* 60, 2763–2799.
Duffie, Darrell, and Jun Liu, 2001, Floating-fixed credit spreads, *Financial Analysts Journal* 57, 76–87.
Duffie, Darrell, and Kenneth J. Singleton, 1999, Modeling term structures of defaultable bonds, *Review of Financial Studies* 12, 687–720.
Eom, Young Ho, Jean Helwege, and Jing-Zhi Huang, 2004, Structural models of corporate bond pricing: An empirical analysis, *Review of Financial Studies* 17, 499–544.
Fama, Eugene F., 1985, What's different about banks? *Journal of Monetary Economics* 15, 29–39.
Faulkender, Michael, and Mitchell A. Petersen, 2006, Does the source of capital affect capital structure? *Review of Financial Studies* 19, 45–79.
Feldhutter, Peter, Edith Hotchkiss, and Oguzhan Karakas, 2016, The value of creditor control in corporate bonds, *Journal of Financial Economics* 121, 1–27.
Feldhutter, Peter, and Stephen Schaefer, 2018, The myth of the credit spread puzzle, *Review of Financial Studies* 31, 2897–2942.
Glover, Brent, 2016, The expected cost of default, *Journal of Financial Economics* 119, 284–299.
Gornall, Will, 2018, Safe assets and dangerous liabilities: How bank-level frictions explain bank seniority, Working paper, University of British Columbia.

Gustafson, Matthew T., 2018, Inter-market competition and bank loan spreads: Evidence from the securities offering reform, *Journal of Banking and Finance* 94, 107–117.

Hale, Galina, and Joao A.C. Santos, 2009, Do banks price their informational monopoly? *Journal of Financial Economics* 93, 185–206.

Hatfield, John W., Scott D. Kominers, Richard Lowery, and Jordan M. Barry, 2018, Collusion in markets with syndication, Working paper, University of Texas.

Houston, Joel F., Chen Lin, and Junbo Wang, 2014, Does bank monitoring matter to bondholders? Working paper, University of Florida.

Huang, Jingzhi, and Ming Huang, 2012, How much of the corporate-Treasury spread is due to credit risk? *Review of Asset Pricing Studies* 2, 153–202.

Glenn Hubbard, R., Kenneth N. Kuttner, and Darius N. Palia, 2002, Are there bank effects in borrowers' costs of funds? Evidence from a matched sample of borrowers and banks, *Journal of Business* 75, 559–581.

Ivashina, Victoria, 2009, Asymmetric information effects on loan spreads, *Journal of Financial Economics* 92, 300–319.

Ivashina, Victoria, and Zheng Sun, 2011, Institutional demand pressure and the cost of corporate loans, *Journal of Financial Economics* 99, 500–522.

James, Christopher, 1987, Some evidence on the uniqueness of bank loans, *Journal of Financial Economics* 19, 217–235.

Kelly, Bryan, Gerardo Manzo, and Diego Palhares, 2016, Credit-implied volatility, Working paper, University of Chicago.

Lambertini, Luisa, and Abhik Mukherjee, 2017, Is bank capital regulation costly for firms? Evidence from syndicated loans, Working paper, Ecole Polytechnique Federale de Lausanne.

Leland, Hayne E., 1994, Corporate debt value, bond covenants, and optimal capital structure, *Journal of Finance* 49, 1213–1252.

Lim, Jongha, Bernadette A. Minton, and Michael S. Weisbach, 2014, Syndicated loan spreads and the composition of the syndicate, *Journal of Financial Economics* 111, 45–69.

Merton, Robert C., 1974, On the pricing of corporate debt: The risk structure of interest rates, *Journal of Finance* 29, 449–470.

Moody's Investors Service, 2006, Probability of default ratings and loss given default assessments for non-financial speculative-grade corporate obligors in the United States and Canada.

Moody's Investors Service, 2018, Annual default study: Corporate default and recovery rates, 1920–2017.

Murfin, Justin, and Mitchell A. Petersen, 2016, Loans on sale: Credit market seasonality, borrower need, and lender rents, *Journal of Financial Economics* 121, 300–326.

Murfin, Justin, and Ryan Pratt, 2019, Comparables pricing, *Review of Financial Studies* 32, 688–737.

Nagler, Florian, and Giorgio Ottonello, 2018, Structural changes in corporate bond underpricing, Working paper, Bocconi University.

Park, Cheol, 2000, Monitoring and structure of debt contracts, *Journal of Finance* 55, 2157–2195.

Rajan, Raghuram G., 1992, Insiders and outsiders: The choice between informed and arm's-length debt, *Journal of Finance* 47, 1367–1400.

Rauh, Joshua D., and Amir Sufi, 2010, Capital structure and debt structure, *Review of Financial Studies* 23, 4242–4280.

Roberts, Michael R., and Amir Sufi, 2009, Renegotiation of financial contracts: Evidence from private credit agreements, *Journal of Financial Economics* 93, 159–184.

Santos, Joao A.C., 2011, Bank corporate loan pricing following the subprime crisis, *Review of Financial Studies* 24, 1916–1943.

Santos, Joao A.C., and Andrew Winton, 2008, Bank loans, bonds, and information monopolies across the business cycle, *Journal of Finance* 63, 1315–1359.

Sarbu, Sorana, Claus Schmitt, and Marliese Uhrig-Homburg, 2013, Market expectations of recovery rates, Working paper, Karlsruhe Institute of Technology.

Schaefer, Stephen M., and Ilya A. Strebulaev, 2008, Structural models of credit risk are useful: Evidence from hedge ratios on corporate bonds, *Journal of Financial Economics* 90, 1–19.

Schenone, Carola, 2010, Lending relationships and information rents: Do banks exploit their information advantages? *Review of Financial Studies* 23, 1149–1199.

Schwert, Michael, 2018, Bank capital and lending relationships, *Journal of Finance* 73, 787–830.

Sufi, Amir, 2009, Bank lines of credit in corporate finance: An empirical analysis, *Review of Financial Studies* 22, 1057–1088.

Wallen, Jonathan, 2017, The effect of bank capital requirements on bank loans rates, Working paper, Stanford University.

## Supporting Information

Additional Supporting Information may be found in the online version of this article at the publisher's website:

**Appendix S1**: Internet Appendix.
**Replication code.**