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

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Abstract

This paper investigates the pricing of bank loans relative to capital market debt. The analysis relies on a novel sample of syndicated loans matched with bond spreads from the same firm on the same date. After accounting for seniority, banks earn an economically large premium relative to the market price of credit risk. To quantify the premium, I apply a structural model that accounts for priority structure, prices the firm's bonds, and matches expected losses in default. I find that the average loan premium is equal to half of the all-in-drawn spread in a sample of secured term loans to non-investment-grade firms. This is the first direct evidence of firms' willingness to pay for the unique qualities of bank loans and raise questions about the nature of competition in the loan market.

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The two primary sources of debt for public corporations are bank loans and bonds issued in the public debt markets. The academic literature offers a number of theories on the interaction of private and public debt markets (e.g., Diamond (1991), Rajan (1992), Chemmanur and Fulghieri (1994), Park (2000), Carey and Gordy (2016)) and empirical evidence on cross-sectional and time-series variation in quantities of loans and bonds issued (e.g., Faulkender and Petersen (2006), Rauh and Sufi (2010), Becker and Ivashina (2014)). However, there is less research on 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 bank 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 dataset consisting of new loan facilities and secondary bond market quotes from the same firm on the same date. This approach provides a clean comparison of 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 banks are senior to bondholders 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 1 presents evidence from Moody's Ultimate Recovery Database on bankruptcies of firms with both loans and bonds outstanding at the time of default from 1995 to 2013. The average recovery rate for loans is 84%, with most loans recovering principal and accrued interest at the end of bankruptcy, whereas the average recovery of senior unsecured bonds

[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 the issue of external validity in Section 1.

[2]While loans to non-investment-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. There was an unsecured loan in only 8.4% of the 308 default events in Moody's Ultimate Recovery Database from 1995 to 2013 that involved both loans and bonds. Besides seniority, there are many other differences in the cash flows and economic features of loans and bonds that I discuss in this paper.

is 38%. 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 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 cross-default provisions are in place, so the relative spreads on bonds and loans depend only on their expected losses given default. Table 1 reports that the unconditional expected loss given default for senior unsecured bonds is more than three times higher than the expected loss given default for secured term loans. Therefore, the Duffie and Singleton (1999) model predicts that bond spreads should be at least three times as large as loan spreads.[3]

Figure 1 visually summarizes the relative pricing of corporate bonds and loans, uncovering facts that have not been reported previously in the literature. The top panel plots bond and loan spreads relative to the LIBOR swap curve as non-parametric functions of distance-to-default (Bharath and Shumway (2008)) and the bottom panel plots the ratio of the spreads. The sample contains new loans with secondary market quotes for 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.

On 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

[3]The expected loss given default in Duffie and Singleton (1999) is under the risk-neutral measure, whereas Table 1 provides an estimate of the physical expectation. The current discussion is for illustration and may be affected by systematic risk in recoveries. Section 3.3 discusses the risk premium on recoveries necessary to explain the pricing of loans.

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

distance-to-default is zero. When the firm is far from default, the loan and bond spreads are similar, which seems consistent with most bank loans being unsecured when the firm is in good standing. However, Table 1 shows that the bank is rarely unsecured in the event of default, which likely results from renegotiation of loan terms as the firm's creditworthiness deteriorates (Roberts and Sufi (2009), Rauh and Sufi (2010)). Accounting for the bank's senior position conditional on default, the similar pricing of loans and bonds for healthy firms is puzzling. Panel B of Figure 1 shows that the ratio of bond spreads to loan spreads is significantly lower than three in all rating categories. Strikingly, the loan and bond spreads of investment-grade firms are statistically indistinguishable. Assuming bonds are competitively priced, this implies that banks earn a substantial premium relative to the credit risk they bear.

To quantify the magnitude of the premium, I apply a structural model of credit risk. This analysis focuses on a subsample of the data containing term loans secured by a first lien and senior unsecured bonds, so seniority is 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 alternative 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 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 142 and 172 bps lower than the average all-in-drawn spread of 279 bps in the subsample of secured term loans. Put differently, 48% to 61% 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 the loan premium. For robustness, I apply the reduced-form default-intensity approach from Duffie and Singleton (1999) and find quantitatively similar estimates to the results of the structural model.

One question is whether this premium results from mispricing of seniority in general or something specific about the loan market. To address this issue, I analyze a separate sample of secondary market quotes for secured and unsecured bonds of the same firm on the same date. Interestingly, the evidence on secured and unsecured bonds conforms closely to the Duffie and Singleton (1999) prediction that relative credit spreads depend on the ratio of expected losses given default. This contrasts starkly with the evidence on loan and bond spreads, supports the ability of existing models of credit risk to price seniority, and suggests the loan premium is specific to the loan market.

Why does the bank earn a premium relative to the market price of credit risk? I cannot definitively identify the mechanism underlying the loan premium, but I am able to rule out some explanations and provide support for others. Regression analysis of the loan premium indicates that it is related to future costs of renegotiation and the firm's need for financing, but unrelated to the provision of revolving credit or the size of the loan.[5]

The main implication of these findings is that firms are willing to pay a high cost to borrow from a bank, paying a higher rate than implied by the bank's exposure to credit risk. By revealed preference, firms must place a high value on bank services other than the simple one-time provision of debt capital. To my knowledge, this paper is the first to quantify the

[5] In addition to this evidence, the structure of loan cash flows seems inconsistent with the 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 the up-front fee is usually paid only to the lead arranger. Berg, Saunders, and Steffen (2016) show that up-front fees are higher for loans to borrowers with high volatility, consistent with it serving as compensation for monitoring. Unfortunately, data on up-front fees are unavailable for most loans in my sample.

value of bank services using the firm's willingness to pay for bank loans. The finding of a economically large loan premium builds on the literature that uncovers the value of bank specialness indirectly (e.g., Fama (1985), James (1987)). I should note that borrowing from banks does not actually cost more than issuing unsecured bonds in terms of interest expense. However, the cost is high relative to the capital market price of the risk borne by banks, which implies that either the loan premium reflects the cost of bank services or banks earn rents. The second possibility is supported by evidence of imperfect competition in deposit markets (e.g., Drechsler, Savov, and Schnabl (2017)), concentration among lead arrangers of syndicated loans (Schwert (2018)), and institutional barriers to joining loan syndicates, but the integrated nature of the syndicated loan market is an obstacle to uncovering the effects of competition on loan pricing.

Several earlier papers study the effects of specific loan terms or lender characteristics on loan spreads.[6] However, all of these papers study variation in pricing *within* the loan market. This paper is the first to introduce a clean comparison of the relative pricing of loans and bonds that controls for firm and time unobservables.[7] It also contributes to the corporate bond literature by showing that the priority structure of secured and unsecured bonds is priced according to the Duffie and Singleton (1999) framework.

This paper sheds light on the literature studying the choice between public and private debt (e.g., Diamond (1991), Denis and Mihov (2003), Hackbarth, Hennessy, and Leland (2007)) by showing that bank financing involves excess costs relative to bond financing, after accounting for differences in seniority. It also helps explain the finding in Faulkender and Petersen (2006) that bank-dependent firms have significantly lower leverage than firms

[6]For example, 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), and Schenone (2010) study informational rents; Lim, Minton, and Weisbach (2014) focus on non-bank tranches; Dougal et al. (2015) and Murfin and Pratt (2017) find overweighting of information from past loans; Murfin and Petersen (2016) study seasonality; and Botsch and Vanasco (2017) show that banks learn about borrower quality over time.

[7]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.

with access to the bond market, which is consistent with firms facing a higher cost per unit of credit risk when borrowing from banks. Finally, this paper relates to the literature showing that contracting frictions are resolved by making the bank senior to bondholders (e.g., Diamond (1993), Welch (1997), Park (2000), Gornall (2017)). My findings suggest that banks capture some of the surplus generated by this arrangement.

The remainder of the paper is organized as follows. Section 1 describes the construction of the sample. Section 2 outlines an extension of the Merton (1974) model and estimates counterfactual loan spreads under the model. Section 3 explores potential explanations for the loan premium. Section 4 concludes.

1 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 start date of the loan. The advantage of this construction is that it eliminates the impact of unobservable firm, time, and firm-time factors that could correlate with credit risk and the pricing of debt. This 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.

However, it is important to recognize the limitations of this approach. 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 access (Faulkender and Petersen (2006)), so external validity is a key concern. The top panel of Figure 2 shows that loans to non-rated firms, who do not have bond market access, are priced at slightly higher spreads conditional on credit risk than rated firms, who are eligible for inclusion in my sample. Intuitively, firms without bond market access have weaker bargaining power with banks due to their worse outside options. Thus, it is reasonable to expect that the loan pricing effects uncovered in my analysis are larger in magnitude for non-rated firms.

The sample consists of firms deciding to borrow from a bank rather than issuing a new bond, so there is also potential for selection within the subset of 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 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 taking out a new loan in the current month are similar, conditional on credit risk, to the spreads of firms not taking a new loan.[8] With regard to financial health, the vast majority of sample firms have positive equity returns and operating profits prior to the loan. These firms continue to have access to the bond market, with 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 and there were barely any new loans during the crisis. Overall, this evidence suggests that it is appropriate to draw general conclusions about the relative pricing of loans and bonds from my analysis.

1.1 Sample Construction

Table 2 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 origina-

[8]The Internet Appendix presents similar figures with new loan borrowers identified by the presence of a new loan in the six months before or after the bond spread observation or the existence of an outstanding loan originated anytime in the past.

tion from Compustat.[9] Following the corporate finance literature, I exclude loans to financial firms (SIC 6000-6999), utilities (SIC 4900-4999), quasi-public firms (SIC above 8999) from the sample. I restrict the sample to U.S. dollar denominated loans with non-missing 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 loans. I require the all-in-drawn spread be relative to London Interbank Offered Rate (LIBOR), which is the standard base rate for corporate loans. I restrict the sample to revolving credit facilities and term loans, dropping leases, letters of credit, and other less common loan types. I exclude commercial paper backup loans because they are rarely drawn. I exclude debtor-in-possession loans because their issuers are in default at the time of origination. Finally, 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.[10] To ensure the loan and the bond are issued by the same corporate entity, I check by hand that the six-digit CUSIP matches have the same company name in the respective datasets. 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 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 that were part of 1,383 loan packages obtained by 606 firms totaling $1.8 trillion in capacity.[11]

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

[10] These quote prices are available from 1997 to 2016 and form the basis for Bank of America's bond indices. In academic research, these data are used by Schaefer and Strebulaev (2008) and Feldhutter and Schaefer (2018).

[11] Note that here and throughout the paper I define the loan package as all facilities with the same start

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. 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 from two sources on the firm's debt structure at the quarter-end immediately before the origination date. First, Capital IQ provides detailed capital structure data from 2002 to 2016, 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 worse 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. The restricted sample consists of 199 loans to 115 firms totaling $127 billion in volume.

1.2 Sample Characteristics

Table 3 reports summary statistics on the sample. Panel A describes the full sample and Panel B describes the restricted sample for the structural model. The firms in the sample all have access to the public debt markets, so they are generally large, profitable, and have substantial tangible assets. There is significant cross-sectional variation in capital structure and debt structure. Consistent with Rauh and Sufi's (2010) finding that firms with tiered debt structure tend to be 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 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

date, rather than using the package identifiers in DealScan. Berlin, Nini, and Yu (2017) use a similar approach to identify related loans.

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 non-rated. Along these lines, the loans are larger and have lower credit spreads than the typical loan in the universe. The bank syndicates include more lenders and the largest banks are more likely to serve as lead arranger or participate as lenders in the syndicate. The distribution of borrower industries in the sample 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 worthwhile to keep 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 receive smaller loans than the firms in the full sample. Almost all of the observations are from 2003 to 2007 and 2011 to 2016, periods of expansion in syndicated lending. The typical firm has a debt structure consisting of 39% bank debt and 61% capital market debt prior to origination of the secured term loan. All but two of the firms in the sample have bank debt outstanding prior to origination.[12] 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. One-sixth of the loans are classified as covenant light, which means the loan lacks maintenance covenants typically included in loan contracts to protect creditors.[13]

1.3 Determinants of Bond and Loan Credit Spreads

As a first step to understanding the relative pricing of corporate bonds and bank loans, I explore the cross-sectional determinants of their credit spreads. Table 4 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 the most basic observable credit risk variables: leverage, asset volatility, maturity, and credit rating. Each column to the right adds more variables that are 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 4 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 largely explained by observable creditworthiness.

There are interesting differences in the correlations among credit spreads and other firm

[12]Firm characteristics in Table 3 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.

[13]For more information on the covenant light loans and the institutional term loan market, I refer the reader to Becker and Ivashina (2016) and Berlin, Nini, and Yu (2017). Covenant light loans are identified from the DealScan market segment table, rather than from observations with missing data on covenants. Berlin, Nini, and Yu (2017) hand collect covenant data from term loan contracts and find that this approach accurately identifies covenant light term loans.

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. On the other hand, 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 2 circumvents this issue by focusing only on secured term loans.

Surprisingly, the ratio of bank debt to total debt has an insignificant coefficient in both regressions.[14] 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 spreads at origination, while the relative proportions of bank and bond debt have no effect.

2 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 allows me to obtain loan-level quantitative estimates of how the bond market would price loan cash flows, taking firm-specific circumstances into account without

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

requiring a full term structure of credit spreads. Second, it offers a framework in which to understand 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 paper. 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, 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.[15]

[15] 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 non-price 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.

In this section, I outline the model and apply it to the data to quantify the loan premium. First, I describe the model and its application to the data. Next, I discuss the sensitivity of model estimates to parameter inputs. Then, I calibrate the treatment of recoveries to match empirical evidence. Finally, I report estimates from the calibrated model specification that suggest banks earn a large premium relative to the loan spreads implied by the bond market.

2.1 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 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:

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

where

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

The value of junior debt is:

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

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 $y_S = \frac{1}{T}\ln\left(K_S/D_S\right)$ and $y_J = \frac{1}{T}\ln\left(K_J/D_J\right)$, respectively, because they are modeled as zero-coupon securities.

The model setup involves some simplifying assumptions that merit explanation. First, the firm can only default 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.[16] 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 σ implied by the bond spread and use this volatility to value the loan under the model. Equations (2) and (4) describe one-to-one relations between the value of debt and the asset volatility, so it is straightforward to solve numerically for the implied volatility by setting the difference between the observed credit spread and the zero-coupon spread in the model to zero.[17] I define the loan premium as the difference between the observed all-in-drawn spread and the loan spread under the model.

2.1.1 Treatment of Recoveries

An important shortcoming of the Merton (1974) 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.[18] I use two alternative approaches to address this problem. The first approach involves a proportional firm-level bankruptcy cost, while the second approach draws the firm-level recovery from a random distribution calibrated to

[16]The Internet Appendix shows that the results are robust to alternative approaches to measuring debt structure and the value of assets.

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

[18]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.

match empirical recoveries.

The bankruptcy cost specification follows the 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 α 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:

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

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 $\frac{K_S}{1-\alpha} > K_S + K_J$ 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:

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

where d_1 and d_2 are defined as in equation (5). The choice of α 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.[19] However, the qualitative conclusions of my analysis are robust to a wide range of bankruptcy cost parameters.

As an alternative to the bankruptcy costs model, which still relies on the left-tail distri-

[19]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.

bution 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 (2006)), but does not offer a closed-form solution for the value of debt. Therefore, I 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 1 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 0.55 and standard deviation of 0.26. Figure 3 shows the effect of allocating a fairly symmetric distribution of firm-level recoveries according to absolute priority, with term loans recovering principal and accrued interest in most defaults. 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.

2.1.2 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 value of the loans 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 underwriting fees and underpricing (Cai, Helwege, and Warga (2007)) that the firm would incur to issue a new bond.[20] For the subset of bonds in my sample with data on fees and transaction prices after issuance, the mean gross spread and initial return are each about 1.5%, implying a total bond issuance cost of 3%.[21] 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, 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 the par value at any time, often with a penalty if prepayment occurs in the first year or two after issuance. This feature offers valuable flexibility to borrowers who want to adjust their capital structure or undertake a significant investment without paying a change of control 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 an at-the-money European swaption under the Black model, using the trailing one-year volatility of bond spreads scaled by the current ratio of loan and bond spreads to proxy for the volatility of the loan spread.[22] After obtaining the value of callability

[20]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 loans are issued at par because data on original issue discounts are missing for most loans in DealScan. Berg, Saunders, and Steffen (2016) find the mean (median) up-front fee for term loans is 0.80% (0.50%) of face value. Bruche, Malherbe, and Meisenzahl (2017) 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. The Internet Appendix reports estimates that account for these features of loans.

[21]The magnitude of underpricing is substantially higher than the average levels reported by Cai, Helwege, and Warga (2007) and Nagler and Ottonello (2017), 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.

[22]See the Internet Appendix for a detailed exposition of the valuation procedure. The exact procedure involves pricing a set of swaptions with expirations at each year before maturity and the length of the underlying credit spread swap equal to the remaining maturity at that expiration, then taking the maximum price in this set as the approximate value of callability. 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

for each loan, I add it to the face value of the loan and compute the yield-to-maturity of a non-callable 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 non-callable 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 could 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 loans are contracts that involve more paperwork and longer settlement times. I model the illiquidity of loans as a heightened discount rate $r + \lambda$ for lenders relative to the discount rate r used to price bonds. This approach follows the characterization in Duffie and Singleton (1999), who model illiquidity as a fractional carrying cost that is 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 (2016)). To assess the relative liquidity of loans I obtain data from Thomson-Reuters LSTA containing secondary market quotes for 68 out 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). Therefore, I set the liquidity parameter λ 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.

so I do not account for them. Ignoring these restrictions leads to overvaluation of the prepayment option and underestimation of the loan premium.

2.1.3 Model Comparative Statics

Before presenting the estimates from the calibrated model, it is important to understand how modeling assumptions and the measurement of parameters affect the results. Figure 4 presents the results of 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.

The top-left panel of Figure 4 shows the effects of shifting the value of assets by 25% in either direction. This has little effect on the estimated loan premium because the calibration of the asset volatility from the bond spread largely offsets any mismeasurement of the value of assets. 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 with the face value of senior debt, considering large shifts of -50% to +150%. The effects are slightly larger here, but a similar dynamic is at play, preventing mismeasurement of debt structure from having outsize effects on the model estimates. In this case, an upward shift in senior debt reduces asset coverage for the loan but also increases total leverage, which reduces the asset volatility and the likelihood of very low realizations of firm value that impair the senior creditors. These comparative statics show the robustness of my empirical approach and are encouraging in light of the difficulty of precisely estimating the market value of assets and the model's simplification of potentially complex debt structures.

The second row shows the importance of the assumptions about recovery rates for loan pricing in the model. The middle-left panel shows that the loan premium is non-linearly decreasing in the bankruptcy cost, with a steeper slope at higher values of α. The statistics on debt structure in Table 3 Panel B, showing 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 directly decreases the expected payoff of the loan. The middle-right panel 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.

While 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 set the mean loan premium to zero.[23] Overall, these results suggest a cautious approach to interpreting the estimates of the loan premium, given the importance of recovery assumptions, but also provide strong support for the existence of a loan premium.

The bottom row of Figure 4 provides some evidence on the additional model features discussed in Section 2.1.2. 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% discussed in Section 2.1.2 is associated with a large loan premium, and this cost must exceed 24% to explain the pricing of loans.

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 sample construction and pricing approach, the liquidity discount is relative to the pricing of corporate bonds from the same firm, so it must reflect transaction costs rather

[23]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.

than costs of information asymmetry. Given the similarity between the observable bid-ask spreads for term loans and corporate bonds, it is unlikely that illiquidity is a primary driver of the loan premium.

2.1.4 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 value bonds and loans. For robustness, I consider a simple alternative approach based on Duffie and Singleton (1999), who show that under 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 only depend on relative losses in default. Based on the empirical evidence in Table 1, I assume that L is 16% for loans and 65% 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.[24] 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.[25]

The implicit assumption underlying the reduced-form approach is that the risk premium

[24]If anything, the bottom panel of Figure 3 suggests that the recoveries of loans are higher in the later part of my sample period, when most of the loans in the restricted sample are originated.

[25]It is difficult to assess the historical frequency of absolute priority deviations between senior and junior creditors without reviewing detailed plans of reorganization because many loans are secured by specific collateral and therefore only senior to the extent the collateral is sufficient to fund repayment. In the recovery sample described in Table 1, deviations from absolute priority occur in at most one-quarter of default events, under the assumption that loans are strictly senior to bonds. However, in most of these cases the magnitude of the transfer from senior to junior creditors is small.

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 both loans and bonds under my sample construction. In Section 3.3, I consider the possibility that the recovery risk premium is higher for loans than for bonds.

2.2 Estimates of the Loan Premium

Table 5 summarizes the estimates of risk-neutral default probabilities, counterfactual loan spreads, and the loan premium under the structural model. Appendix B describes the computation of default probabilities and expected recoveries in the Merton (1974) framework. The specifications used here account for both the costs of bond issuance and the value of the loan prepayment option described in Section 2.1.2. 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 107 bps, which is 172 bps lower than the average all-in-drawn spread in the sample. Excluding either the cost of bond issuance or the value of prepayment increases the loan premium by about 20 bps, which suggests it is important to account for these features but that they are unlikely to account for a large fraction of the loan premium. The loan premium is an economically significant 61% of the mean all-in-drawn spread, equivalent to $24 million in annual interest expense or 3% 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 5 simulates the pricing model using a firm-level recovery distribution calibrated to match the empirical distribution in Table 1. This model leads to a higher mean loan spread of 137 bps and a lower loan premium of 142 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 48% of the average spread being a premium over the bond-implied spread, which equates to \$19 million or 2% of EBITDA for the average borrower.

Moving on to the quantities that underly the loan premium in the structural model, Panel A reports an average risk-neutral default probability of 25% 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 (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 1, 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. Firm-level average recoveries are in a tight range around the 50% mean of the simulated distribution. Expected loan and bond recoveries are closer to their respective empirical means in Table 1 than in the bankruptcy cost specification, but the same concern remains about the pricing of recoveries.

Panel C reports estimates of the loan premium from the reduced-form qL model. Rather than specifying the distribution of firm value or recoveries, this model takes the historical average recoveries from Table 1 and assumes that the ratio of risk-neutral expected losses is the same as the historical ratio, which equates to assuming 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 assumption. The results from this model are in line with the estimates from the structural model, with a mean loan premium of 144 bps, equivalent to 52% of the all-in-drawn spread.

Figure 5 plots the loan spreads generated by the three models. The plot in Panel A is similar to Figure 1, containing non-parametric 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 before and consistent with the results in Table 5, 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 and appears to be larger for riskier firms.

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 my sample period. It is important to note that since the data consist of new loan originations, most of the observations occur during economic expansions and there are few loans during the financial crisis. The main takeaway from the time series plot is that the loan premium fluctuates with movements in the bond market but is economically large in all years of the sample.

To sum up, the model estimation shows that loan spreads are significantly higher than implied by the pricing of corporate bonds from the same firm. Both specifications of recoveries in the structural model and the reduced-form model 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. However, this conclusion should be taken with a grain of salt because the quantitative estimates depend heavily on the specification of recovery rates. In the next section, I consider the possibility that the bond market offers inadequate information about the pricing of tail risks and estimate the the risk premium on recoveries necessary to reconcile the pricing of loans.

2.2.1 Pricing Tail Risks

The results in the previous section show that the structural model generates expected loan recoveries that are only slightly below the historical averages in Table 1, 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 to Coval, Jurek, and Stafford (2009) in their analysis of senior CDX tranches. Specifically, I value the loan payoffs in the range below the face value of senior debt at zero, so any state in which the bond recovers zero is associated with a payoff of zero for the loan. Since state prices cannot be below zero, this sets a floor on the value of the loan if the range in which the bond has positive payoff is correctly priced. Under this condition, the value of the loan in the model with bankruptcy costs is:

$$D_{S,\alpha} = K_S e^{-rT} \Phi(d_{2,S}), \tag{9}$$

where $d_{2,S}$ is defined as in equation (7). The bottom rows of Panels A and B in Table 5 show that the structural model generates spreads much closer to the observed all-in-drawn spreads under this extreme pricing assumption. This is supportive of the notion that banks earn a premium over the market price of credit risk, as it is hard to fathom 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 1. 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 recovery risk premium, I assume a level of risk-neutral expected loss given default for the bond, back out the risk-neutral default probability by dividing the bond spread by that loss given default, then recover the risk-neutral loss given default implied by the loan spread.

Figure 6 reports estimates of the loan recovery risk premium as a function of the bond recovery risk premium. Even under the counterfactual assumption that bond recoveries have high payoffs in poor economic states, which implies a bond recovery risk premium less than one, the observed pricing of the average loan implies a recovery risk premium around four. On the contrary, the time-series evidence in Panel B of Figure 3 suggests that bond recoveries are low during economic downturns, so the bond recovery risk premium should be above one. In that range, the loan recovery risk premium exceeds four, which means a physical expected loss given default of 16% corresponds to a risk-neutral expected loss given default above 64%, which would fall in the bottom 10% of realized recoveries in the bottom panel of Table 1. While it is difficult to fully rule out the possibility that the high level of loan spreads is driven by a risk premium, the evidence presented here suggests that an extreme price of recovery risk is necessary to match the observed pricing of loans.

2.2.2 Robustness

The quantitative analysis of loan pricing relies on a simple and transparent model. However, simplicity comes at the cost of potentially missing key economic or institutional features that affect the pricing of loans. The estimated loan premium depends on both the assumptions underpinning the model as well as accurate measurement of the model parameters. Therefore, it is important to understand how mismeasurement of parameters or unmodeled features of the loan market 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 often unreported by DealScan, while the latter need not be reported in public filings. 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 (2015)) and many contain amortization features, so effective maturity may be shorter than contractual maturity. In the presence of an upward sloping term structure credit spreads, this implies that my model underestimates the loan premium. Relatedly, the ordering of maturities in the loan-bond pair can affect their relative pricing (Bao and Hou (2017)). For the 36% of loans maturing after their matched bonds, the median percentage of the loan spread attributable to the estimated premium is 56% under the simulated recovery specification, which is qualitatively similar to the median of 45% for loans maturing before their matched bonds. Along the same lines, results for the four-fifths of observations with a callable bond are quantitatively similar to the results for noncallable bonds.[26] Overall, it does not seem that mismeasurement of maturity structure has a meaningful impact 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 1 should alleviate many concerns about external validity, but to go further, the Internet Appendix presents model estimates for the full bond-loan sample, including unsecured term loans and revolving credit facilities. Although this

[26]Note that the definition of noncallable bonds includes bonds with make-whole provisions, which allow the firm to prepay the bond at a small premium to the net present value of future coupon and principal payments, because this option has negative net present value.

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.

3 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. First, I use data on secured bonds to determine whether the findings are due to general mispricing of seniority by models of credit risk. Next, I explore the determinants of the loan premium by estimating cross-sectional regressions of the premium on firm and loan characteristics. Finally, I discuss the potential explanations for the findings and their implications.

3.1 Is This about Banks or Seniority?

The results presented thus far indicate that banks earn significantly higher credit spreads on new loan originations than implied by their position in the firm's priority structure of debt and the pricing of credit risk in the corporate bond market. However, it is unclear from the preceding analysis whether the premium is specific to banks or the finding results from broader mispricing of seniority in the market. In this section, I construct a paired sample of secured and unsecured bonds from the same issuer to investigate how seniority is priced within the corporate bond market.

The sample of secured bonds is from the Bank of America Merrill Lynch quote data that provided bond spreads for 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 less than two years, with each bond having at least three years to maturity and one year to the next call date. I confirm that the secured bond is senior secured and the unsecured bond is senior unsecured using data from Mergent FISD. Most 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 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 4,590 observations from 1997 to 2016. The observations are concentrated towards the end of the sample period, with three-quarters of observations occurring between 2009 and 2016, likely due to improved secured creditor rights under the Bankruptcy Abuse Prevention and Consumer Protection Act of 2005.

Figure 7 presents a bar chart analogous to Panel B of Figure 1 for secured and unsecured bonds.[27] The chart reveals a relation between secured and unsecured bond spreads that contrasts with the relation between loan and bond spreads. The ratio of unsecured and secured bond spreads is around the unconditional mean of 1.44 and flat across rating categories, consistent with the predictions of the qL framework of Duffie and Singleton (1999) described earlier in this paper. Table 1 shows that the average recoveries for secured and unsecured bonds are 60% and 38%, respectively. Under the qL framework, the predicted ratio of unsecured and secured bond spreads is $0.62/0.40 = 1.55$, which is very close to the ratio observed in Figure 7.[28] In contrast, the recoveries to bank debt are significantly higher in the event of default, but the loan-to-bond spread ratio is significantly different from the predicted ratio of three for all but the most distressed issuers and indistinguishable from one for investment-grade firms. These results suggest that the loan premium is specific to loans and does not result from mispricing of seniority in corporate debt markets.

[27]Figure 7 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.

[28]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.

3.2 Cross-Sectional Determinants of the Loan Premium

The results in the previous sections suggest that the loan premium 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, there are a number of other differences between bank loans and bonds that could explain the loan premium. Banks overcome information asymmetry by screening firms before providing credit and monitoring borrowers to ensure repayment. Banks also provide valuable flexibility to firms through revolving lines of credit and the ability to renegotiate contract terms at relatively low cost.[29]

To provide evidence on potential explanations of the loan premium, Table 6 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 4 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. The loan premium is increasing in the pre-origination leverage of the borrower. This is consistent with the picture in Figure 5 and suggests that the premium as a fraction of the all-in-drawn spread is fairly stable across the

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

credit spectrum.

The loan premium is smaller for more profitable firms, which means firms that experience operating losses pay a larger premium to access bank credit. Although the summary statistics in Table 3 indicated that the typical firm in the sample is in good financial health, the profitability coefficients in Table 6 suggest that firms pay a higher premium when they are in greater need of financing. However, the coefficients on trailing stock return and the fraction of debt maturing in the next year are insignificant, so this does not appear to be a first-order determinant of the premium.

The coefficients on the indicator for performance pricing are negative, consistent with the firm paying up-front for future costs of renegotiation on loans without these provisions. Roberts (2015) shows that loans are renegotiated every nine months on average, so this is potentially an important consideration for firms and members of the loan syndicate. The regressions contain other covariates associated with the likelihood of renegotiation and its associated costs, including the firm's asset volatility, the loan's maturity, and the number of lenders in the syndicate. The coefficients on these covariates are all statistically insignificant, so it is difficult to conclude that the loan premium primarily serves to compensate the bank for future renegotiation. This makes sense in light of the fact that the firm pays a fee each time a loan is renegotiated.

Interestingly, the loan premium is smaller when the loan package includes a revolving line of credit. This is inconsistent with the hypothesis that the loan premium reflects cross-subsidization for the provision of revolving credit. If anything, this result supports the opposite notion that the bundling of the term loan with revolving credit reduces the cost of the term loan tranche.

Finally, Table 6 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 4. The lack of scale economies suggests that either the bank is not strictly passing through fixed costs to the borrower or the costs being passed through are strictly variable in nature. Given that most of the loans in this sample are syndicated widely to banks as well as non-bank institutional investors, it is difficult to pin down the exact cost function of the bank. Nevertheless, this finding suggests that it is unlikely the loan premium reflects the pass-through of costs from banking activities that have a fixed cost component, such as information production from screening and monitoring the borrower.

While the results in Table 6 offer some evidence on factors that could explain the loan premium, it is worth emphasizing 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 as long as model noise is uncorrelated with the explanatory variables. 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 features of the firm-bank relationship. Further research is necessary to fully understand the factors driving loan pricing and the split of surplus between borrowers and lenders.

3.3 Discussion

The empirical analysis in this paper offers strong evidence that banks earn significantly higher rates than implied by the pricing of credit risk and liquidity in the capital markets. Returning to the question posed in this paper's title, this does not imply that borrowing from banks costs more than issuing public debt because the capital market counterfactual from the model may not be available in reality. Indeed, Figure 1 shows that the costs of bank and bond credit are similar for investment-grade firms, while for non-investment-grade firms borrowing from a bank is less costly because the bank is senior to bondholders in the event of default. Therefore, borrowing from banks not inconsistent with the firm manager's objective of minimizing interest expense to maximize cash flows.

Nevertheless, the finding of a large premium relative to the cost per unit of credit risk in the capital markets implies that either firms receive valuable services from banks in addition to the one-time provision of debt capital, or banks earn economic rents by lending to firms. The former case receives some support from the regression analysis in Table 7, but it is difficult to pin down a specific service the bank offers that can explain the premium. There is some evidence that less profitable firms, who may be in greater need of funding, pay higher rates. However, the firms in this sample are mostly profitable and have access to bond markets, and loans for the purpose of major transactions are excluded from the sample, so it is unlikely that the bank's ability to provide funding quickly is critical for the typical sample firm. The bank's ability to offer financial flexibility does not seem to be a first-order factor, as evidenced by the insignificant loadings on asset volatility and syndicate size and the negative association with the provision of revolving credit. The lack of a correlation with loan size raises doubts about the premium reflecting the bank's costs of information production, which should have a fixed component.

The possibility that banks earn rents leads to fewer predictions on the association between loan pricing and firm characteristics and is difficult to justify in this setting. For instance, it is unlikely that relationship holdup (Rajan (1992)) drives the loan premium in this sample because the firms are relatively unconstrained, with access to the public debt markets, and most of the loans have multiple lead arrangers.[30] On the other hand, past literature shows that local banking markets are imperfectly competitive, with banks earning higher markups in concentrated areas (Drechsler, Savov, and Schnabl (2017)). Although the syndicated loan market is an international market, it is characterized by high concentration, with a handful of banks serving as lead arrangers on the majority of loans (Schwert (2018)), so it is plausible

[30] James (1987) shows that the stock market reaction to new loan announcements is positive, consistent with the loan generating surplus for the firm. 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 it is unsurprising that the market reaction is muted. Nevertheless, it supports the notion that the loan premium is not driven by bank holdup. Consistent with James (1987), I find that abnormal returns around new loans to firms without outstanding bonds are significantly positive.

that these banks exert market power. Conversations with practitioners on both sides of the syndicated loan market suggest that they perceive the market to be highly competitive. Without a natural experiment to test the effects of concentration on loan pricing, it would be speculative to conclude that the findings in this paper are driven by imperfect competition. However, this explanation cannot be ruled out and is an important avenue to explore in future research.

Finally, the results in this paper highlight the importance of understanding the role of bank financing for large firms. Much of the banking literature focuses on smaller firms with more severe information asymmetry, but large firms are also reliant on bank financing and are critical to aggregate economic performance. Rauh and Sufi (2010) show that "fallen angels" migrating from investment-grade to non-investment-grade tend to adopt a tiered debt structure with secured bank loans and unsecured bonds. Indeed, data from Capital IQ on non-financial firms for the years 2012 to 2016 indicate that 93% of non-investment-grade bond issuers have outstanding loans. The theory literature suggests many benefits of this arrangement (e.g., Diamond (1993), Welch (1997), Park (2000), Gornall (2017)), while the empirical literature provides evidence that cross-monitoring by banks is associated with lower bond yields (e.g., Datta, Iskandar-Datta, and Patel (1999), Houston, Lin, and Wang (2014)). Although the literature has not established that a bank relationship is necessary for non-investment-grade firms to issue public debt, the financing choices of firms suggest that to be true. Therefore, the loan premium may be justified by firms' inability to access the bond market without paying up for a bank loan.

4 Conclusion

This paper shows that credit spreads in the syndicated loan market are significantly higher than implied by the capital market pricing of the risk borne by lenders. 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 with the pricing of corporate bonds in the secondary market that is unaffected by unobservable firm-time effects. The structural model accounts for the priority structure of debt, the lender's exposure to losses in default, and secondary market illiquidity. My analysis concludes that in a sample of non-investment-grade term loans, approximately half of the average loan spread is attributable to factors other than credit and liquidity as priced in the bond market.

The main implication of this finding is that firms are willing to pay a high cost to borrow from a bank, offering the bank a senior claim at a substantially higher yield than implied by the bond market. Therefore, firms must place a high value on bank services other than the one-time provision of debt capital. The evidence in this sample suggests the premium is related to ease of renegotiation, while the financing choices of non-investment-grade bond issuers in the broader universe suggest that bank relationships are necessary to facilitate public debt issuance. However, it is unclear whether the loan premium reflects the cost of providing bank services or banks earn rents lending to firms. More research is necessary to understand the pricing of loans, the nature of competition in the loan market, and the role of banks in the financing of large firms.

Appendix A: Variable Definitions

Loan Characteristics

All-in-drawn spread: credit spread over LIBOR paid on drawn amounts, including the 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.

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, σ is asset volatility, and maturity is $T = 1$.

Trailing stock return: return on the firm's stock over the year prior to 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 the previous quarter's operating income before depreciation to book assets.

Short-term debt/total: ratio of drawn bank loans 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.

Appendix B: Calculation of Expected Recoveries

Under the Merton (1974) model, the value of the firm is distributed log-normally:

$$\ln V_T \sim N\left(\ln V_0 + \left(r - \frac{1}{2}\sigma^2\right)T, \sigma^2 T\right).$$

For ease of notation, let $\mu = \left(r - \frac{1}{2}\sigma^2\right)T$, $\Sigma = \sigma\sqrt{T}$, and $K_{Total} = K_S + K_J$. The probability that the firm defaults on its debt at time T is:

$$P\left(V_T \leq K_{Total}\right) = \Phi\left(\frac{\ln(K_{Total}) - \mu}{\Sigma}\right), \tag{10}$$

the probability senior debt is impaired is:

$$P\left(V_T \leq K_S\right) = \Phi\left(\frac{\ln(K_S) - \mu}{\Sigma}\right),$$

and the probability the firm defaults but senior debt is made whole is:

$$P\left(K_S \leq V_T \leq K_{Total}\right) = P\left(V_T \leq K_{Total}\right) - P\left(V_T \leq K_S\right).$$

Conditional on the firm defaulting, the recovery on senior debt is $\min\left(1, \frac{V_T}{K_S}\right)$ and the recovery on junior debt is $\min\left(1, \max\left(0, \frac{V_T - K_S}{K_J}\right)\right)$. To make the derivation explicit and reduce the amount of notation in each equation, I break the expected recovery calculation into steps.

The expected payoff to senior debt, conditional on the firm defaulting and senior debt being impaired, is:

$$E\left[D_S | V_T \leq K_S\right] = \frac{e^{\mu + \frac{1}{2}\Sigma^2} \Phi\left(\frac{\ln(K_S) - \mu - \Sigma^2}{\Sigma}\right)}{P\left(V_T \leq K_S\right)}.$$

Then the expected payoff to senior debt, conditional on the firm defaulting, is:

$$E\left[D_S | V_T \leq K_{Total}\right] = \frac{P\left(K_S \leq V_T \leq K_{Total}\right) + P\left(V_T \leq K_S\right) E\left[D_S | V_T \leq K_S\right]}{P\left(V_T \leq K_{Total}\right)}.$$

The first term in the numerator reflects the state in which the firm defaults and senior debt is paid in full and the second set of terms reflects the state in which senior debt is impaired.

The expected payoff to junior debt, conditional on the firm defaulting and the senior debt being made whole, is:

$$E\left[D_J | K_S \leq V_T \leq K_{Total}\right] = \frac{e^{\mu + \frac{1}{2}\Sigma^2} \left[\Phi\left(\frac{\ln(K_{Total}) - \mu - \Sigma^2}{\Sigma}\right) - \Phi\left(\frac{\ln(K_S) - \mu - \Sigma^2}{\Sigma}\right)\right]}{P\left(K_S \leq V_T \leq K_{Total}\right)} - K_S,$$

Then the expected payoff to junior debt, conditional on the firm defaulting, is:

$$E\left[D_J | V_T \leq K_{Total}\right] = \frac{P\left(K_S \leq V_T \leq K_{Total}\right) E\left[D_J | K_S \leq V_T \leq K_{Total}\right]}{P\left(V_T \leq K_{Total}\right)}.$$

The numerator only contains one set of terms, reflecting the state in which the firm defaults and senior debt is paid in full, so there is a recovery for junior creditors.

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Tables

Table 1: 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 1995 and 2013, excluding debtor-in-possession loans and firms in the financial and utilities industries. Panel A includes all defaults with both loans and bonds outstanding. Panel B 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. Deviations from absolute priority are identified as defaults in which secured loans were impaired and unsecured bonds received a non-zero recovery. The amount of the deviation is computed using the absolute priority waterfall and scaled by the defaulted amount of the loans. The bottom three rows of Panel B report statistics on recoveries for defaulted loans in the restricted sample of loans and bonds described in Section 1.1.

Panel A: All Defaults with Loans and Bonds Outstanding

	Mean	StDev	p10	p50	p90	Defaults
Firm-level recovery	0.52	0.26	0.17	0.50	0.90	302
All loan types	0.84	0.26	0.40	1.00	1.00	302
Line of credit	0.87	0.25	0.44	1.00	1.00	280
Term loan	0.78	0.30	0.30	1.00	1.00	194
All bond types	0.33	0.30	0.01	0.24	0.81	302
Senior secured	0.60	0.32	0.17	0.59	1.00	76
Senior unsecured	0.38	0.33	0.01	0.31	1.00	151

Panel B: Defaults with First-Lien Term Loans and Senior Unsecured Bonds

	Mean	StDev	p10	p50	p90	Defaults
Discounted Ultimate Recovery Rates						
Firm-level recovery	0.55	0.26	0.18	0.59	0.90	89
First-lien term loan	0.84	0.28	0.32	1.00	1.00	89
Senior unsecured bond	0.35	0.33	0.01	0.26	0.93	89
Trading Prices 30 Days after Default						
First-lien term loan	0.69	0.30	0.21	0.75	0.99	31
Senior unsecured bond	0.29	0.27	0.01	0.22	0.61	31

Table 2: Sample Construction

This table summarizes the construction of the sample. The starting point is the intersection of DealScan and Compustat from 1997 to 2016 with the loan denominated in U.S. dollars and non-missing 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.

Selection Criteria	Loan Facilities	Packages	Firms	Amount ($ Bil.)
DealScan-Compustat (1997 to 2016)	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

Table 3: Summary Statistics

This table reports summary statistics on the full sample in Panel A and the restricted sample of secured term loans for the structural model in Panel B. Variables are defined in Appendix A. All variables except credit spreads and indicators 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	StDev	p10	p50	p90	Obs.
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
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

Panel B: Restricted Sample

	Mean	StDev	p10	p50	p90	Obs.
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
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

Table 4: 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 Appendix A. *Log(Assets)* is the log of the firm's quasi-market assets. Loans with missing data for *Secured Loan* are assumed to be unsecured in this table. *S&P Rating FEs* are based on the firm's long-term issuer rating. 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(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
2-digit SIC FEs		X	X		X	X
Adj. 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

Table 5: 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 $L_S = 0.16$ and $L_J = 0.65$. Model spreads are calculated by numerically estimating implied asset volatility using the bond spread as the zero-coupon junior credit spread in the model, then using that asset volatility to compute the zero-coupon 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. Appendix B describes the computation of risk-neutral quantities in the model.

Panel A: Bankruptcy Cost Specification

	Mean	StDev	p10	p50	p90
Estimates of the Loan Premium					
All-in-drawn spread (bps)	279	122	163	275	425
Model spread (bps)	107	74.8	26.2	94.5	204
Loan premium (bps)	172	103	66.4	158	299
excl. issue costs	193	101	92.2	178	315
excl. prepayment	199	112	83.7	180	345
Economic Magnitudes					
Fraction of loan spread	0.61	0.24	0.30	0.63	0.90
Interest expense ($MM)	24.1	43.0	0.60	10.7	44.2
Fraction of EBITDA	0.03	0.04	0.001	0.02	0.06
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)	297	184	86.0	264	549
Loan premium (bps)	-18.8	165	-222	-25.8	180

Panel B: Simulated Recovery Specification

	Mean	StDev	p10	p50	p90
Estimates of the Loan Premium					
All-in-drawn spread (bps)	279	122	163	275	425
Model spread (bps)	137	72.6	50.5	131	232
Loan premium (bps)	142	115	22.1	125	277
excl. issue costs	155	109	49.4	138	286
excl. prepayment	167	124	47.7	148	315
Economic Magnitudes					
Fraction of loan spread	0.48	0.27	0.13	0.51	0.81
Interest expense ($MM)	19.0	35.5	0	8.14	44.8
Fraction of EBITDA	0.02	0.04	-0.001	0.01	0.05
Risk-Neutral Model Quantities					
Probability of default	0.32	0.13	0.17	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	0.65	0.80	0.94
Expected bond recovery	0.24	0.11	0.10	0.22	0.38
Floor Pricing of Tail Risk					
Model spread (bps)	306	167	102	296	529
Loan premium (bps)	-27.2	170	-226	-29.5	172

Panel C: Reduced-Form Approach

	Mean	StDev	p10	p50	p90
Estimates of the Loan Premium					
All-in-drawn spread (bps)	279	122	163	275	425
Model spread (bps)	136	69.2	62.2	121	243
Loan premium (bps)	144	75.3	72.8	134	227
excl. issue costs	161	75.5	90.1	152	243
excl. prepayment	170	83.8	88.4	160	253
Economic Magnitudes					
Fraction of loan spread	0.52	0.14	0.34	0.53	0.67
Interest expense ($MM)	20.6	31.7	0.80	9.88	40.1
Fraction of EBITDA	0.02	0.04	0.001	0.02	0.05

Table 6: 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 Appendix A. *Log(All-in-Drawn)* 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. *Log(Lender Count)* is the logarithm of the number of lead arrangers and participants in the syndicate. All ratios and estimates are winsorized at the 1% level. 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.

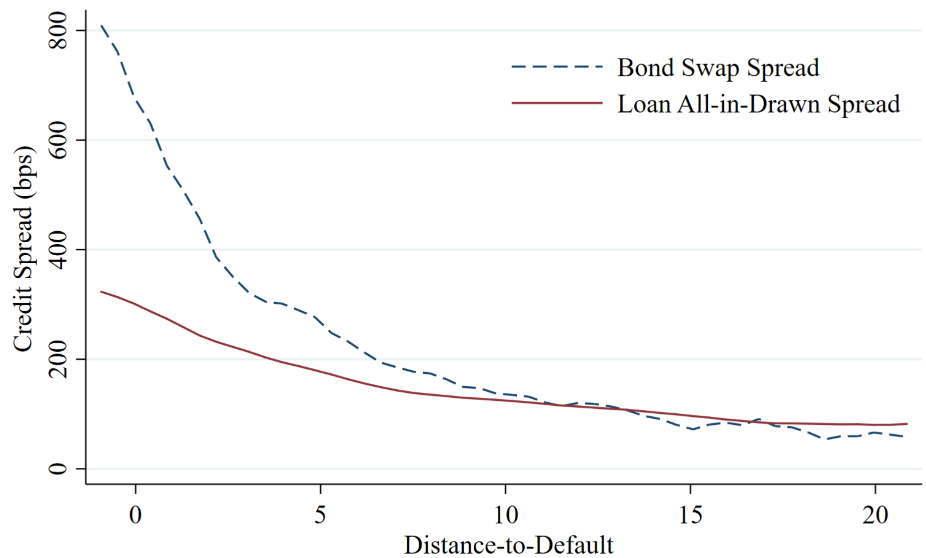
		Log(Premium)		
Dependent variable:	Log(All-in-Drawn)	Bankruptcy Cost	Random Recovery	Reduced-Form
Quasi-market leverage	1.38**	1.05**	0.68*	0.52**
	[6.39]	[5.18]	[2.18]	[2.79]
Asset volatility	1.07*	0.70	0.79	0.70
	[2.25]	[1.31]	[0.97]	[1.70]
Loan maturity	-0.02	-0.02	0.11*	-0.01
	[-0.78]	[-0.66]	[2.50]	[-0.47]
Log(Loan amount)	-0.02	-0.02	-0.03	0.02
	[-1.11]	[-0.54]	[-0.73]	[0.93]
Profitability	-1.08	-1.59*	-1.76	-1.32*
	[-1.52]	[-2.45]	[-1.96]	[-2.35]
Trailing stock return	-0.09	-0.04	-0.09	-0.04
	[-1.72]	[-0.80]	[-1.27]	[-0.95]
Short-term debt/total	-0.38	-0.08	-0.34	-0.12
	[-1.21]	[-0.18]	[-0.50]	[-0.38]
Asset market-to-book	0.10	0.17**	0.09	0.08
	[1.53]	[2.74]	[0.96]	[1.39]
Log(Lender count)	-0.03	-0.03	0.01	-0.03
	[-1.36]	[-0.79]	[0.23]	[-1.10]
Term loan B	0.16*	0.05	-0.02	0.14*
	[2.34]	[0.71]	[-0.20]	[2.58]
Revolver in package	-0.06	-0.11	-0.24**	-0.06
	[-1.59]	[-1.85]	[-2.87]	[-1.80]
Performance pricing	-0.07	-0.19**	-0.23*	-0.06
	[-1.48]	[-2.76]	[-2.49]	[-1.33]
Year FEs	X	X	X	X
Adj. R^2	0.67	0.42	0.33	0.41
Within R^2	0.63	0.42	0.38	0.43
Observations	146	146	146	146

Figures

Figure 1: Loan and Bond Spreads as Functions of Credit Risk

This figure reports bond and loan credit spreads and the ratio of spreads as functions of credit risk. Variables are defined in Appendix A. Panel A contains non-parametric 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 reports 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.

Panel A: Non-Parametric Regressions of Spreads on Distance-to-Default



Panel B: Bar Chart of the Spread Ratio by Rating Category

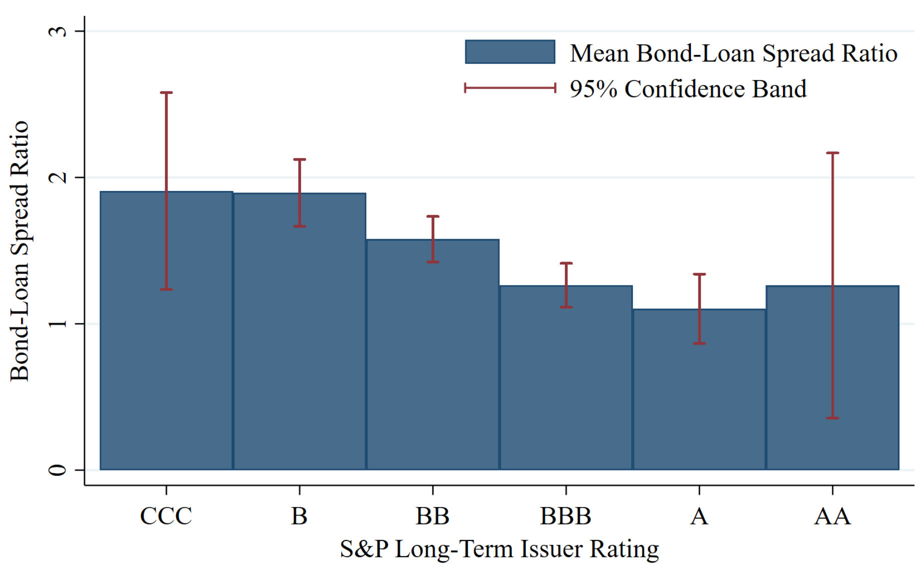
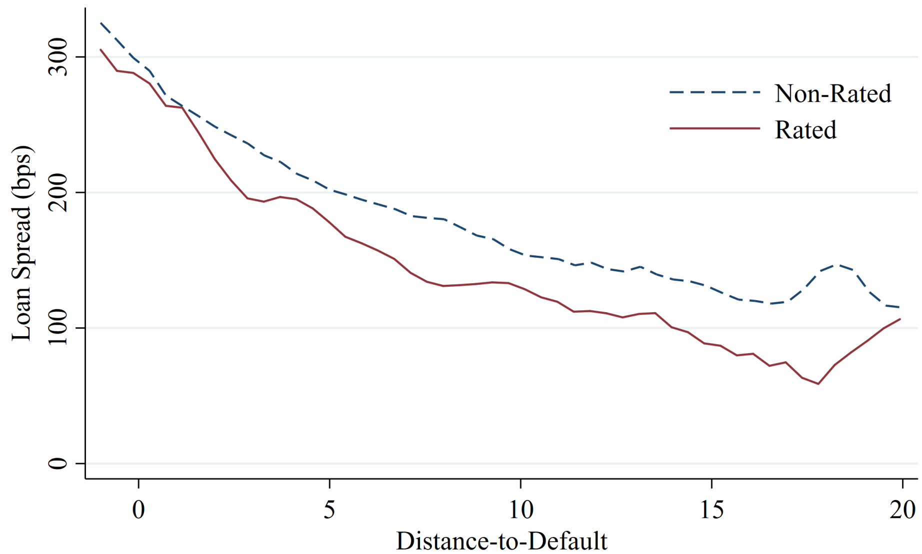


Figure 2: Comparison with Out-of-Sample Loan and Bond Spreads

This figure reports 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 Appendix A. Panel A plots non-parametric regressions of loan all-in-drawn spreads on distance-to-default using a rectangular kernel, splitting the DealScan-Compustat sample into rated and non-rated firms, that do and do not have access to the public debt markets, respectively. Panel B plots non-parametric 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.

Panel A: Loan Spreads of Rated and Non-Rated Firms



Panel B: Bond Spreads of Firms with and without New Loans

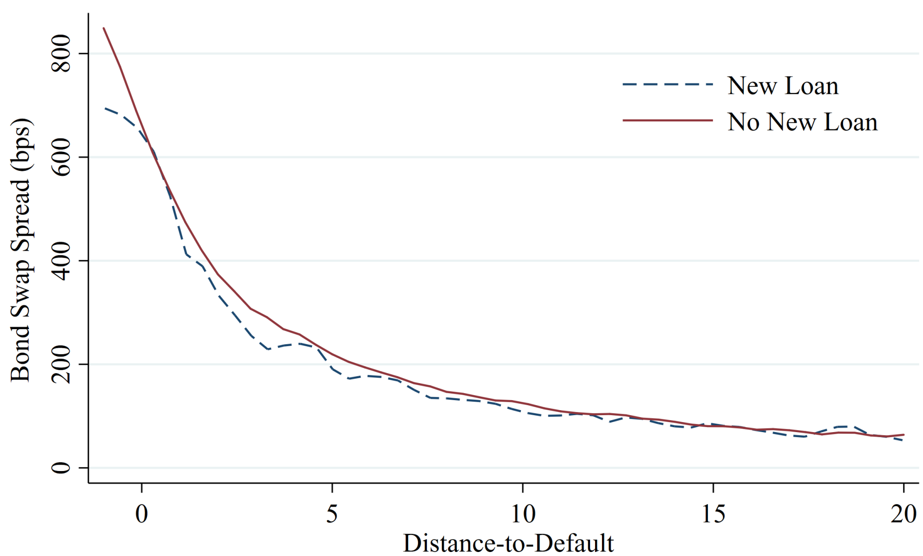
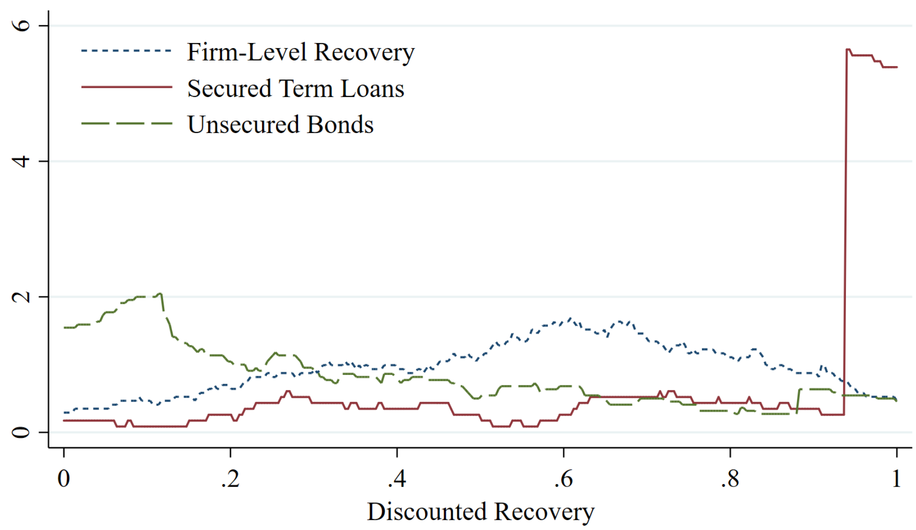


Figure 3: Secured Term Loan and Unsecured Bond Recovery Rates

This figure reports information about the distribution of recoveries for term loans secured by a first lien and senior unsecured bonds. Data are from Moody's Ultimate Recovery Database. The sample includes cases involving public firms rated by Moody's that filed for bankruptcy between 1995 and 2013 and had both loans and bonds outstanding at the time of default. Firms in the financial and utilities industries are excluded. 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 court-determined recovery rates, using 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. Panel A reports kernel density estimates of firm-level, loan, and bond recoveries. Panel B plots the time series of average recoveries by year, with bars for the number of defaults each year.

Panel A: Kernel Density Estimates



Panel B: Time Series of Average Recoveries

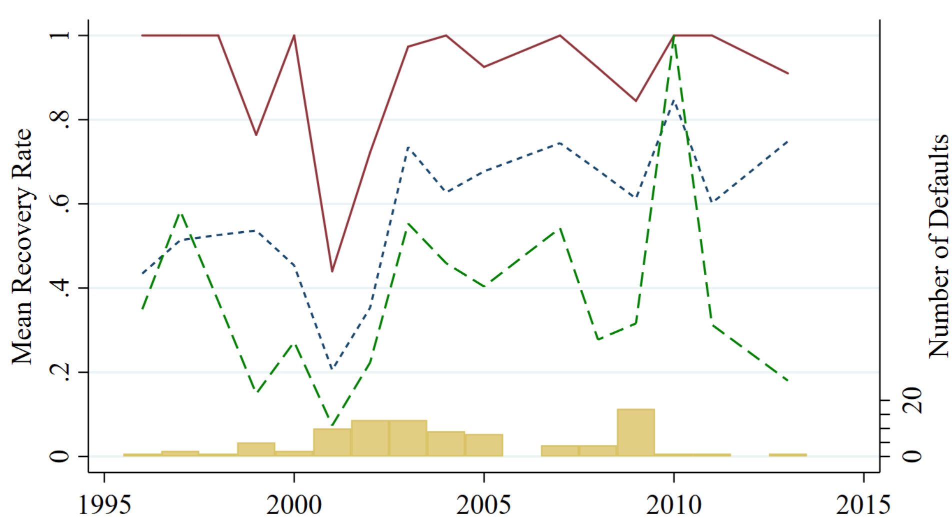


Figure 4: Model Comparative Statics

This figure reports comparative statics 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 liquidity discount, and the fixed cost of bond issuance. All of the plots are based on the model with bankruptcy costs described in Section 2.1.1, except for middle-right panel that shows the effect of varying the mean of the simulated recovery distribution.

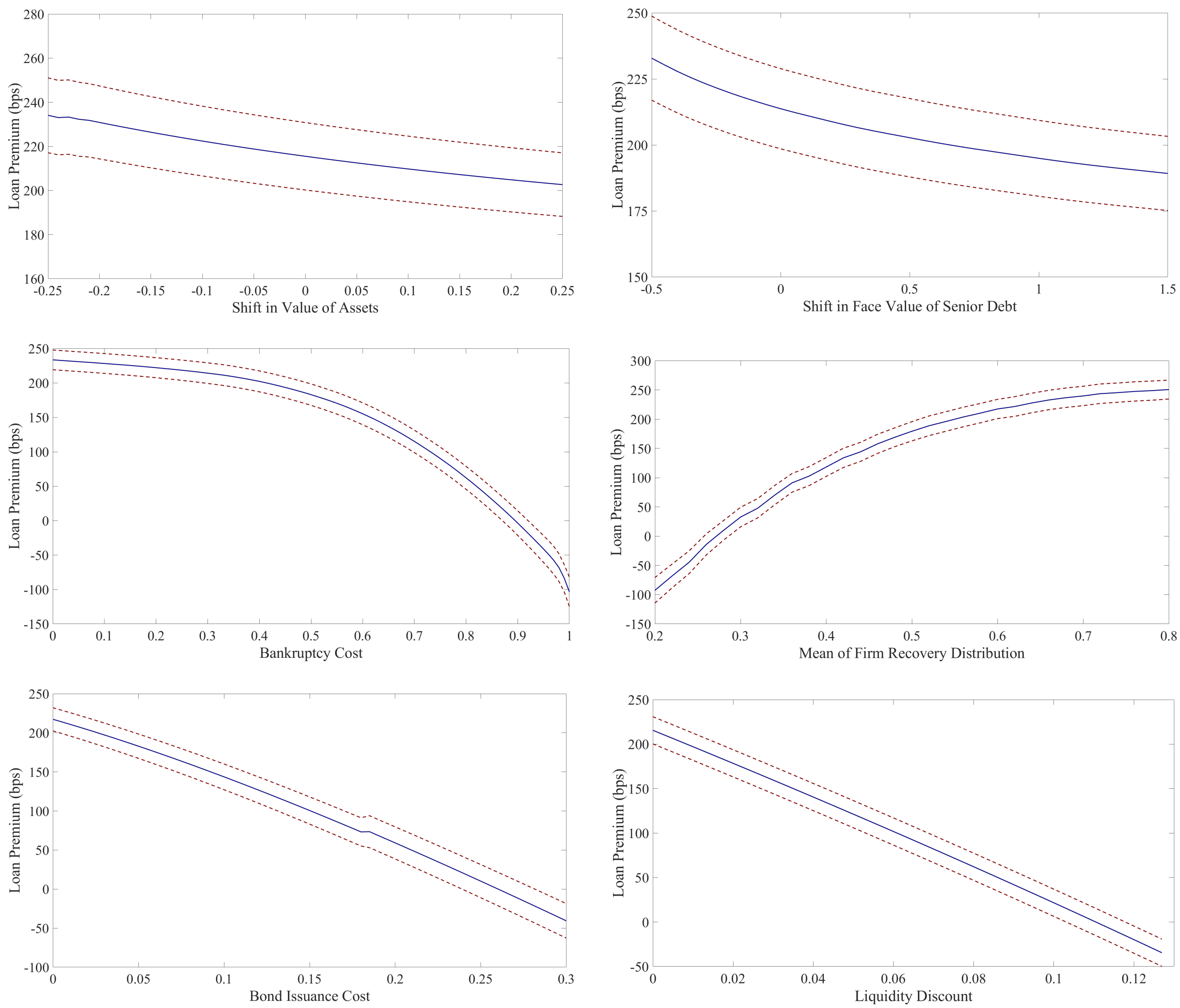
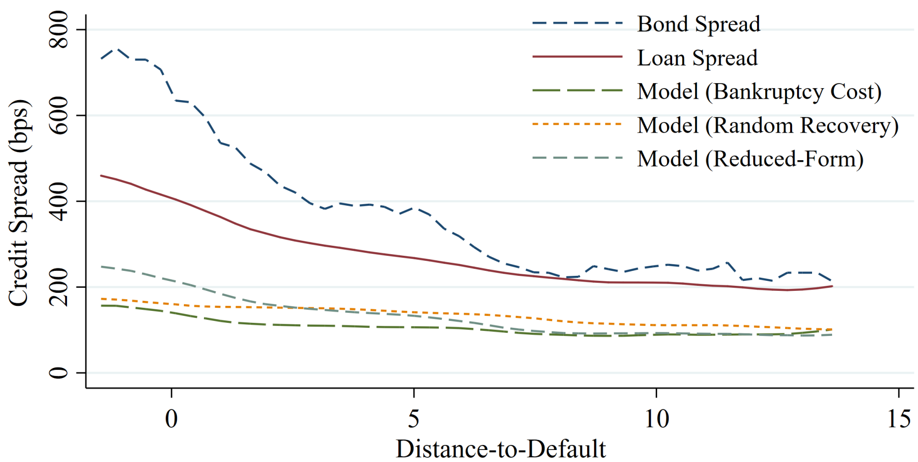


Figure 5: Estimates of Loan Spreads under the Model

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 2.1.1. Reduced-form model spreads are based on the qL model described in Section 2.1.4. Panel A reports non-parametric 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.

Panel A: Non-Parametric Regressions on Distance-to-Default



Panel B: Time Series of Average Spreads

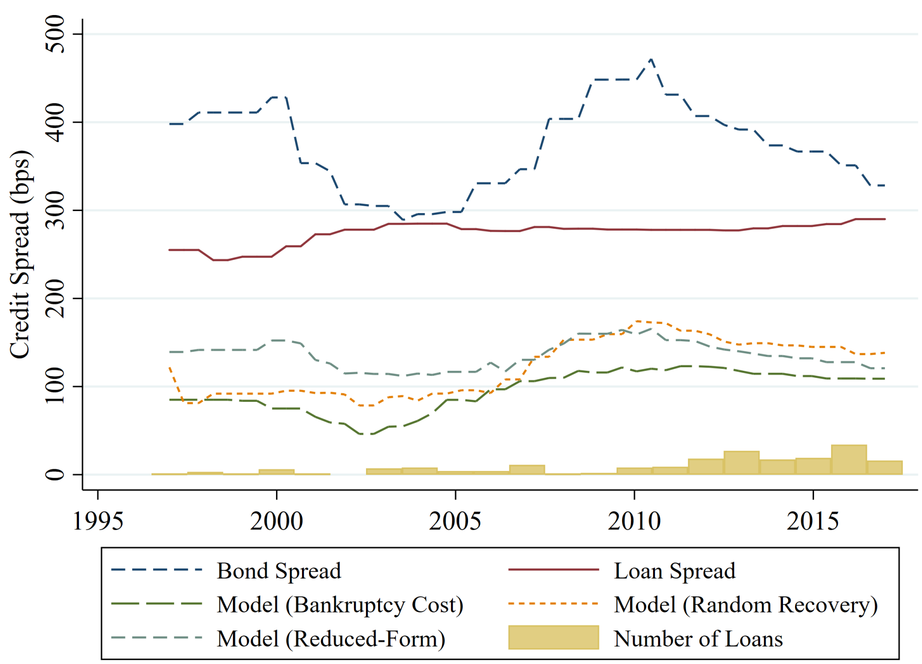


Figure 6: Estimates of the Loan Recovery Risk Premium

This figure reports estimates of the loan recovery risk premium as a function of the bond recovery risk premium. The recovery risk premium is defined as the ratio of risk-neutral expected loss given default to physical expected loss given default. I estimate this risk premium using the result from Duffie and Singleton (1999) that the credit spread of a risky zero-coupon bond equals qL. For each observation in the sample, I compute the risk-neutral default probability from bond spreads assuming a level of risk-neutral expected loss given default for the bond, then I compute the risk-neutral expected loss given default for the paired loan. Expectations of loss given default under the physical measure are from Table 1, which shows that loans lose 16% and bonds lose 65% on average in default. The plot reports the mean loan recovery risk premium with a confidence band at each level of the bond recovery risk premium.

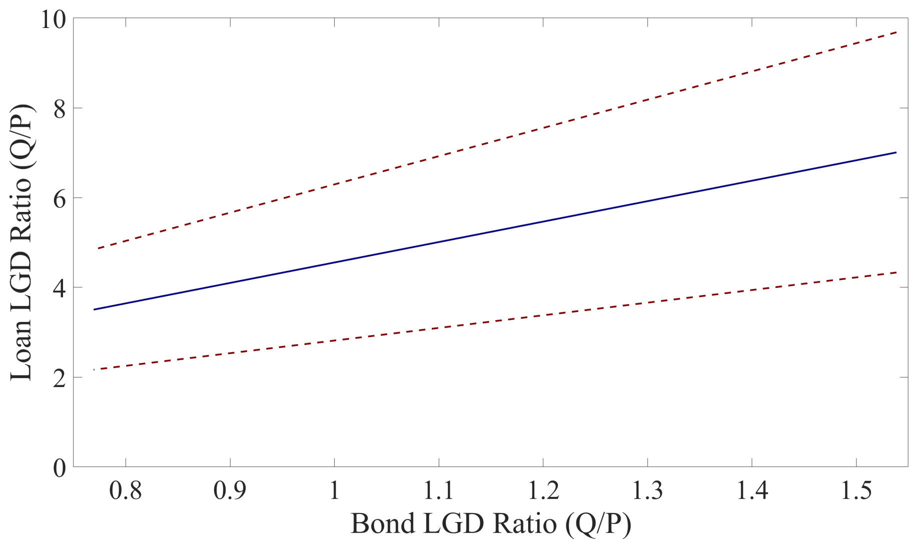


Figure 7: Ratio of Unsecured to Secured Bond Spreads by Credit Rating

This figure reports 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. There are 4,590 observations from 91 firms in the sample 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.