Bank Compensation for the Penalty-Free Loan-Prepayment Option: Theory and Tests

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September 2022

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Abstract

Commercial and industrial bank loans typically include an option to prepay the loan *without penalty* (zero cancellation fee). We present a first analysis of how banks must be compensated for this option. Borrowers use the loan to fund investment projects and subsequently receive non-contractible information about project payoff. As high-quality borrowers self-select to prepay, the credit-quality of the bank's borrower pool deteriorates. Hence, to avoid credit rationing, the bank must be compensated upfront with a minimum upfront fee combined with a lower loan spread. The upfront fee dominates the alternative of a cancellation fee as the latter gives rise to opportunistic ex post bargaining with the bank's preferred clients. Large-sample tests, which include exogenous industry-level variation in loan prepayment risk, confirm that upfront fees increase with prepayment risk and are lower in credit lines and loans with performance-sensitive pricing, as predicted.

Keywords: bank loans, prepayment, credit rationing, upfront fee, performance-pricing

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Abstract

Commercial and industrial bank loans typically include an option to prepay the loan *without penalty* (zero cancellation fee). We present a first analysis of how banks must be compensated for this option. Borrowers use the loan to fund investment projects and subsequently receive non-contractible information about project payoff. As high-quality borrowers self-select to prepay, the credit-quality of the bank's borrower pool deteriorates. Hence, to avoid credit rationing, the bank must be compensated upfront with a minimum upfront fee combined with a *lower* loan spread. The upfront fee dominates the alternative of a cancellation fee as the latter gives rise to opportunistic ex post bargaining with the bank's preferred clients. Large-sample tests, which include exogenous industry-level variation in loan prepayment risk, confirm that upfront fees increase with prepayment risk and are lower in credit lines and loans with performance-sensitive pricing, as predicted.

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1 Introduction

When providing commercial and industrial (C&I) loans, banks charge a fixed spread to compensate for the borrower's default risk and a variety of loan fees (Berg, Saunders, and Steffen, 2016). Fees paid upfront are traditionally viewed as payment for loan origination costs (associated with evaluation of borrower credit quality), while other fees are used to cover the lender's cost of granting the borrower various contractual option features. For example, a much-analyzed option feature is the right to delay drawdown of the loan commitment. As theorized by Thakor (1982) and others,[1] because this drawdown option insures the borrower against future increases in the spot-market rate, the bank must be compensated with a periodic commitment fee on the undrawn amount.

In this paper, we focus on another important option: the right to prepay the bank loan. Some borrowers prepay the loan to lower the firm's leverage ratio. Other borrowers move the loan to a competing lender with more favorable terms or threaten to use the prepayment option to force loan renegotiation with the current lender. While issuers of corporate bonds uniformly rely on an ex post loan cancellation fee to compensate for early repayment, lenders of C&I loans overwhelmingly choose a zero cancellation fee.[2] Our main objective is to understand the pricing of what we label the *penalty-free prepayment option*. While commonly observed, this option has not previously been addressed in the literature on C&I loans.

The paper has two parts, one theoretical and one empirical. The theoretical analysis derives the minimum upfront fee for a competitive bank to accept a penalty-free prepayment option in the loan contract. We assume that lenders and borrowers are symmetrically informed at the time of loan origination, and borrowers use the loan to fund valuable investment projects. Following project startup, however, borrowers receive non-contractible credit-related information about the project's expected payoff. Good news improve the borrower's credit quality and may trigger prepayment

[1] See also Thakor and Udell (1987), Boot, Thakor, and Udell (1987), and Shockley and Thakor (1997).

[2] In our large sample of term loans, borrowers in more than ninety percent of loans held by commercial banks (the pro-rata tranche A) have the right to prepay the loan without any ex post penalty, while about half of the loans held by institutional lenders (tranche B) specify penalty-free prepayment.

to lower the loan spread. On the other hand, following bad news, the borrower continues with the loan, which is now priced below the market rate. This ex post adverse selection in the loan continuation decision, which causes a deterioration in the quality of the bank's borrower pool, is supported by the evidence in Roberts and Sufi (2009) and Roberts (2015). They find that, when renegotiating their loans, borrowers often demand a *lowering* of the loan rate. While covenant violations also trigger loan renegotiations (Chava and Roberts, 2008; Nini, Smith, and Sufi, 2012), they typically result in higher loan spreads.[3]

We use this framework to derive four sets of testable implications. First and foremost, we show that a competitive bank must price the penalty-free prepayment option using two instruments: the loan rate and a minimum upfront fee that is increasing in the borrower's prepayment risk. The minimum upfront fee is necessary because raising the loan rate further *increases* their prepayment risk—possibly to the point of causing credit rationing for borrowers with high risk of loan prepayment. Interestingly, this credit rationing problem differs from that of Stiglitz and Weiss (1981), where the bank is concerned with ex post opportunistic risk-shifting by the borrower.[4] While Stiglitz and Weiss (1981) resolve their credit rationing problem by requiring loan collateral, the solution in our model is an upfront fee.

Second, we extend the analysis to the pricing of penalty-free prepayment options in credit lines and performance-sensitive debt (PSD).[5] While Asquith, Beatty, and Weber (2005) do not examine loan fees, they hypothesize that rate-increasing PSD is motivated by bank-concerns with borrower risk shifting, while rate-decreasing PSD is motivated by prepayment risk. Our pricing model does not require moral hazard to motivate rate-increasing PSD as both spread-increasing

[3]The assumption of ex ante symmetrically informed agents combined with dynamic learning is also used by Boot, Thakor, and Udell (1987) in the context of the drawdown option in credit lines and Hendel and Lizzeri (2003) in the context of individual life insurance contracts. The type of ex post dynamic learning effects modelled here can exist even if the initial contracting results in separating equilibria, as modelled by Thakor and Udell (1987) and Shockley and Thakor (1997). That is, one can think of our model as pertaining to the residual non-contractible credit risk after the bank has applied its usual screening devices.

[4]Boot, Thakor, and Udell (1987), who model the pricing of credit lines, also identify a potential credit rationing problem due to moral hazard.

[5]See, e.g., Asquith, Beatty, and Weber (2005) and Manso, Strulovici, and Tchistyi (2010) for analyses of PSD. During our sample period, 25% of all syndicated term loans issued by public U.S. firms had performance-linked loan pricing (Refinitiv SDC Platinum's Global New Issuance database).

and spread-decreasing PSD lower prepayment risk. Hence, the minimum upfront fee is predicted to be lower for PSD than for standard loans. A similar prediction holds for upfront fees in credit lines, where borrowers also use the prepayment option to initiate renegotiation of loan terms.

Third, also important, we show that (i) bank-compensation for the penalty-free prepayment option *must* come in the form of an upfront fee (not a periodic comment fee), and (ii) banks *must* use a periodic commitment fee (not an upfront fee) to compensate for the drawdown option in credit lines. Intuitively, raising periodic loan payments such as the interest rate and the commitment fee at the time of loan origination only increases the prepayment risk and, hence, exacerbates the credit rationing problem. In contrast, in our setting, the penalty-free prepayment option is fairly priced through the upfront fee. As to the drawdown option, since only the commitment fee varies over time with the undrawn amount, it constitutes a more efficient form of compensation for the drawdown risk.

Fourth, while our model framework assumes the existence of a penalty-free prepayment option, it nevertheless provides a reasonable intuition for when banks are likely to prefer this option over an ex-post cancellation fee: Since the prepayment option is exercised by ex post high-quality borrowers, a cancellation fee may be time-inconsistent (Kydland and Prescott, 1977). That is, it may not be enforceable ex post as it triggers bargaining with precisely the type of clients that a relationship bank would like to keep in its portfolio. In contrast, the upfront fee effectively eliminates such costly bargaining over the prepayment penalty with these high-quality borrowers.

In support of our time-inconsistency argument, recall that institutional lenders of tranche-B C&I loans specify an ex post prepayment penalty more often than do the more relationship-oriented bank-lenders in tranche A. The more distant tranche-B lenders most likely have less to lose from the ex post bargaining than do tranche-A lenders. Also, for corporate bonds, where lenders are numerous and distant—making it particularly costly for the borrower to initiate loan renegotiations (Bolton and Scharfstein, 1996; Sufi, 2007; Brunner and Krahnen, 2008)—the debt contracts typically include a call premium (Asquith and Mullins, 1991).

The major task of our empirical analysis is to show that, in addition to loan origination costs, the upfront fee—and this fee alone—compensates for the penalty-free prepayment option. As our theoretical model clarifies, to correctly price this option, the bank must separate borrowers with high upside potential—high prepayment-risk borrowers—from borrowers with high downside (credit) risk. The former type of risk drives the value of the penalty-free prepayment option (and hence the upfront fee), and the latter drives higher fee-compensation for the bank's loan origination costs (and the value of the drawdown option in credit lines). Berg, Saunders, and Steffen (2016), while not addressing this separation, present evidence that loan fees are increasing in borrower stock return volatility. However, since stock return volatility reflects both upside potential and downside risk, this evidence is not sufficient to conclude that upfront fees compensate for the penalty-free prepayment option.

To help identify prepayment risk per se, we implement a novel test strategy that controls for a number of proxies for credit risk and loan renegotiation costs. Rather than following the usual procedure of allowing unconstrained estimation of the regression parameters, we combine the variables used as proxies for borrower prepayment risk into a prepayment-risk index. This avoids issues of multi-collinearity and allows us to constrains the variables to enter with their theoretically predicted sign.

Also novel, we use industry-level M&A activity as an instrument for exogenous variation in prepayment risk. We know from the merger literature that corporate acquisitions increase the likelihood of prepayment of the target's debt obligations (Harford, Klasa, and Walcott, 2009; Uysal, 2011). Moreover, since high-quality firms are more likely to become targets than are low-quality firms (Betton, Eckbo, and Thorburn, 2008; Dessaint, Eckbo, and Golubov, 2021), it follows that increased industry-level takeover activity tends to increase the within-industry prepayment risk of borrowers with relatively high upside potential—precisely the borrower-type requiring upfront fees in our model. This instrument also helps separate the impact of prepayment-risk variation on upfront fees from variation in loan origination costs—the other major component of the upfront fee.[6]

[6]Corporate takeovers tend to coinsure the target's debt obligations (Billett, King, and Mauer, 2004). Hence, if anything, a positive shock to industry-level M&A activity predicts lower—not higher—loan origination costs.

We perform our empirical tests on a sample comprising almost 8,000 C&I loan facilities that report the upfront fee. The source of this data is WRDS Thomson Reuters LPC Dealscan from the period 1987 through 2018. The upfront fee is economically significant, averaging 73 basis points (bps) in term loans (52 bps in credit lines), with fees in the top quartile averaging as much as 198 bps (median 200 bps). Importantly, we account for the fact that, while most fees are specified in the loan contract and reported by the firm, the upfront fee itself is stated in a separate fee letter, which is often withheld from the public. Using a two-stage least-squares (2SLS) estimation, we implement a Heckman (1979) self-selection model to control for the endogenous fee-reporting decision.

Our main finding is that upfront fees are positively associated with prepayment risk and increases in industry-level merger intensity. Also as predicted, upfront fees are lower in credit lines than in term loans, and lower for PSD than for standard loans. Moreover, we show that the commitment fee (AISU) in credit lines is uncorrelated with our prepayment-risk index, which confirms our theoretical prediction that banks are compensated for the penalty-free prepayment option with the upfront fee *alone*. Finally, we show that our main finding is robust to using a forward-looking measure of prepayment risk computed using stock return volatilities derived from option prices.

In sum, our model with dynamic learning is the first to explain why lenders of C&I loans overwhelmingly prefer to include a penalty-free prepayment option rather than charging an ex post loan cancellation fee, and that this option must be compensated by an upfront fee that is increasing in the borrower's prepayment risk. As predicted, our empirical results support that upfront fees are increasing in proxies for prepayment risk and are lower for credit lines and PSD. The component of the total observed upfront fee that we argue covers the penalty-free prepayment option comes, of course, in addition to the usual compensation for the lender's loan origination costs.

2 A two-part loan pricing model

In this section, we first show the credit rationing problem arising from the inclusion of a penalty-free prepayment option in a term loan contract. We then derive the minimum upfront fee necessary to avoid credit rationing, followed by extensions of the analysis to PSD and credit lines. We end the section using the model intuition to suggest why banks may prefer to include a penalty-free prepayment option in the loan contract instead of an ex post prepayment penalty (a non-zero cancellation fee).

2.1 Model setup

(1) **Time-line**: There are two risk-neutral agents—a firm and a bank—and one risky investment project to be financed with a bank loan. Figure 1 shows the project's payoff structure and Figure 2 summarizes the time-line of events. There are three dates, $t = 0$, $t = \theta$, and $t = 1$, where $0 < \theta < 1$. The project requires an investment outlay of $I = 1$ at time $t = 0$, which the firm must borrow, and it generates a stochastic payoff at $t = 1$ that is either H> 1 or zero. The bank loan of 1 matures at $t = 1$ but can be prepaid without penalty at time $t = \theta$.

(2) **Dynamic learning**: At time $t = 0$, the firm and the bank are symmetrically informed. The bank either agrees to lend 1 at the loan rate r or it refuses to extend a loan (credit rationing). For simplicity, we assume a risk-free rate of zero, so the loan rate $r > 0$ represents the fixed default spread on the loan. At time $t = \theta$, however, the firm receives a public non-contractible signal about the project's expected payoff. The signal contains new information about project fundamentals (e.g., the outcome of R&D, customer demand, competing products, etc). With probability p, a high signal reveals that the payoff will be H with certainty and the project is risk-free. With probability $1-p$, the signal is low and the likelihood of the high payoff is q. We assume $qH < 1$ so the bank expects a loss after a low signal. The ex ante probability of receiving H—the project's success probability—is therefore $s \equiv p + (1-p)q$. The firm borrows and invests only if the project NPV is positive, i.e., if $sH - 1 > 0$.

(3) **Prepayment decision**: Following a positive signal at $t = \theta$, the firm prepays the loan if the interest payment remaining on the loan exceeds the cost of a new loan. The firm pays $\alpha > 0$ to verify and convey to the market its improved credit quality, where the new loan rate for the high-quality firm is zero. The cost α, which is not paid to the bank and effectively is financed by the loan-rate reduction, represents a deadweight loss from the loan acquisition process at time $t = \theta$. Hence, following the high signal, the borrower prepays only if

$$r(1-\theta) > \alpha \quad \text{or} \quad r > \frac{\alpha}{1-\theta}. \tag{1}$$

To ensure that the high signal induces prepayment for feasible loan contracts that satisfy Eq. (1), we assume $\alpha < (H-1)(1-\theta)$. The right-hand side of this inequality is the borrower's cost of keeping a loan with a loan rate of $H-1$ until maturity.

2.2 The credit rationing problem

We first consider equilibrium loan pricing as a function of the project's success probability s when the bank cannot utilize an upfront fee y to compensate for the prepayment risk:

Proposition 1 (credit rationing): *Absent an upfront fee ($y^* = 0$), including a penalty-free prepayment option in the loan contract results in credit rationing for project success probabilities $s < s^*$.*

Proof: At time $t = 0$, the competitive bank prices the loan so as to break even, taking into account that the ex post high-quality borrower may prepay at time $t = \theta$. The bank's break-even constraint absent an upfront fee is

$$p(1+\theta r) + (1-p)q(1+r) = 1. \tag{2}$$

In Eq. (2), $1 + \theta r$ is the bank's payoff when the signal is high, where θr is the interest accrued up to time $t = \theta$ when the firm prepays the loan. Moreover, $q(1+r)$ is the bank's expected payoff conditional on the low signal, as the firm continues the loan until maturity. These two payoffs are weighted by their respective probabilities p and $1-p$. Solving Eq. (2) for the loan rate yields

$$r^*_{s>s^*,y^*=0} = \frac{1-s}{s-p(1-\theta)}. \tag{3}$$

The rate r^* is an equilibrium loan rate provided the bank's promised payment, $1+r$, does not exceed the firm's cash flow H. Combining the upper boundary of a feasible loan contract, $r \leq H-1$, with Eq. (3) yields the values $s \geq s^*$ for which r^* is the equilibrium loan rate:

$$s^* = \frac{1}{H}\Big[1+p(1-\theta)(H-1)\Big]. \tag{4}$$

For $s < s^*$, there is no equilibrium loan rate that satisfies both the bank's break-even condition and the feasible loan-contract condition. Since the firm requires $sH > 1$ (positive NPV), the firm is credit rationed for $\frac{1}{H} < s < s^*$. To complete the proof, the existence of r^* is also limited by $s > s^{**}$, where

$$s^{**} = \frac{(1-\theta)(1+p\alpha)}{1-\theta+\alpha} > s^*, \tag{5}$$

which follows from equating Eq. (3) with the prepayment condition Eq. (1). For $s > s^{**}$, the loan rate in Eq. (3) is too low to satisfy Eq. (1) and, hence, it never triggers prepayment.[7] ■

Figure 3 illustrates the region $\frac{1}{H} < s < s^*$ where the firm is credit rationed. For the firm to borrow and invest, the expected cash flow sH must exceed the bank-financed investment amount $I = 1$. The horizontal line $H-1$ is the upper boundary for a feasible loan contract, and the

[7] For theoretical completeness, note that for $s > \hat{s}$, there exists a second equilibrium loan rate $\hat{r}$ that is sufficiently low for the firm not to exercise the prepayment option regardless of the private signal at time $t = \theta$. In this case, the bank finances the project at the equilibrium loan rate $\hat{r}$, and there is no prepayment. The bank's break-even condition $s(1+r) = 1$ now implies

$$\hat{r}_{s>\hat{s},\hat{y}=0} = \frac{1-s}{s},$$

which, when combined with the firm's incentive to not prepay, yields the following lower boundary $\hat{s}$ for $\hat{r}_{s>\hat{s},\hat{y}=0}$:

$$\hat{s} = \frac{1-\theta}{1-\theta+\alpha}.$$

The existence of this second equilibrium does not alter the testable empirical implications of our model.

equilibrium loan rate is r^*, which only exists when $r^* < H - 1$, or $s^* < s < \overline{s}$.

2.3 Resolving credit rationing with an upfront fee

In this section, we introduce an upfront fee y paid by the borrower. For notational simplicity (without affecting model predictions), we assume that the borrower has sufficient internal funds to pay y up front and borrows $I = 1$ as before.

Proposition 2 (two-part loan pricing): *There exists a minimum upfront fee $y^* > 0$ that in combination with the loan rate solves the credit rationing problem for $s < s^*$. The two-part loan price $(y^*, r^*_{s<s^*,y*>0})$ allows the bank to recover the expected loss of interest from prepayment.*

Proof: With an upfront fee y, the bank's break-even constraint changes to

$$p(1 + \theta r) + (1 - p)q\big(1 + r\big) + y = 1. \tag{6}$$

For $s < s^*$, the upper boundary on a feasible loan contract limits the equilibrium loan rate to the following maximum:

$$r^*_{s<s^*,y^*>0} = H - 1. \tag{7}$$

Substituting this maximum loan rate into Eq. (6) yields the following minimum upfront fee y^* to satisfy the bank's break-even constraint:

$$y^* = \underbrace{p(1-\theta)(H-1)}_{\text{Prepayment risk}} + \underbrace{(1 - sH)}_{\text{Credit risk}}, \tag{8}$$

where $y^* > 0$ for $s \in (\frac{1}{H}, s^*)$. The two-part loan price $(y^*, r^*_{s<s^*,y*>0})$ allows the bank to break even and the otherwise credit-rationed borrower to obtain a loan that will be prepaid at $t = \theta$ following the high signal. ■

By inspection of Eq. (8), the minimum required upfront fee increases with the prepayment risk (the bank's expected loss of interest from prepayment) and credit risk (where $sH - 1$ is the project's NPV).

2.4 Extension to performance-sensitive debt

Suppose the signal received at time $t = \theta$ is contractible. Consider a PSD contract with penalty-free prepayment and where the loan rate is adjusted up or down following the signal. Relative to the standard contract underlying Proposition 2, PSD lowers the borrower's incentive to exercise the penalty-free prepayment option after the high signal and increases the bank's compensation after the low signal. Because the bank cannot raise the rate sufficiently to break even following a low signal, the PSD contract reduces but does not fully resolve the credit rationing problem. Hence, while lower than for the standard debt contract, an upfront fee is still required to compensate for the penalty-free prepayment option:

Proposition 3 (performance-sensitive debt): *A PSD contract that can be prepaid without penalty requires a minimum upfront fee that is lower than in the standard debt contract in Proposition 2.*

Proof: To compare a PSD contract to the standard contract, let r denote the initial loan rate and r_h and r_l the adjusted loan rates following a high and low signal, respectively, at time $t = \theta$, where $r_h \leq r \leq r_l$. Recall that, in the standard loan contract in Proposition 2, the equilibrium loan rate is $r^*_{s<s^*,y*>0} = H - 1$, which is also the maximum feasible rate. Hence, in a PSD contract with $r = r^*_{s<s^*,y*>0}$, the loan rate cannot be raised following a low signal, so $r_l = r$. Moreover, recall that in the standard contract, when the borrower exercises the penalty-free prepayment option, the rate is reset to zero. In the PSD contract, however, the bank specifies $0 < r_h < \frac{\alpha}{1-\theta}$ without inducing prepayment (see Eq. 1 above). With $r_l = r$, the bank's break-even condition is therefore

$$p\Big[1 + \theta r + (1 - \theta)r_h\Big] + (1 - p)q(1 + r) + y = 1. \tag{9}$$

Comparing Eq. (9) with Eq. (6), the difference is in the square bracket: with PSD, the bank receives not only the interest payment of θr until the high signal but also $(1 - \theta)r_h$ thereafter.

This extra interest payment following the high signal lowers the minimum upfront fee in a PSD contract that solves the credit rationing problem. While this proof is focusing on rate-decreasing PSD, the proposition also holds for rate-increasing PSD. ■

2.5 Extension to credit lines

In our analysis, the key difference between a term loan and a credit line is that only the latter provides the option to delay the drawdown of the loan. This leads to the following proposition:

Proposition 4 (credit lines): *The required minimum upfront fee is lower for credit lines than for term loans.*

Proof: Suppose the firm commits to the investment project at time $t = 0$ but postpones project start-up. To match the project funding to this delay, the firm selects a credit line instead of a term loan at time $t = 0$. Suppose delaying the start-up also postpones the signal about project quality so there is no adverse selection in the drawdown decision. Let γ denote the signal delay, where $0 < \gamma < 1 - \theta$. The firm's incentive to refinance is now $r(1 - \gamma - \theta) > \alpha$. Ceteris paribus, this shifts upward the firm's prepayment incentive in Figure 3 from $r > \alpha/(1-\theta)$ to $r > \alpha/(1-\gamma-\theta)$, which lowers the required upfront fee y^*. In other words, while the firm commits at $t = 0$ to a loan with face value 1, the risk of prepayment is lower due to the delayed signal, which in turn lowers the minimum required upfront fee to avoid credit rationing.[8]■

2.6 Informal extensions: optimal fee design

Berg, Saunders, and Steffen (2016) hypothesize that upfront fees compensates for the drawdown option in credit lines. However, a simple extension of our theory suggests otherwise:

Lemma 1 (loan-fee separation): *The upfront fee (1) is the only fee that can compensate for the penalty-free prepayment option and (2) does not compensate for the drawdown option in credit*

[8] An alternative intuition is that, in credit lines, the average drawn amount will be lower than the face value of the loan, hence, lowering the expected interest loss from prepayment.

lines.

Motivation: As to prediction (1), recall that the commitment fee ends when the loan is prepaid. It therefore suffers from the same problem as the loan rate: increasing the commitment fee ex ante just raises the borrower's incentive to prepay the loan (leading to credit rationing in Proposition 1 above). Hence, the only fee that can compensate for the penalty-free prepayment option is the upfront fee. As to prediction (2), since the commitment fee varies over time with the undrawn amount, it is a more efficient payment mechanism for the drawdown option than the upfront fee. Hence, the commitment fee dominates the upfront fee as compensation for the drawdown risk.

Our model framework also suggests an explanation for why it may be optimal to include a penalty-free prepayment option rather than an ex post cancellation fee in the loan contract (a nonzero exercise price in the prepayment option):

Lemma 2 (cancellation fee): *A relationship bank prefers a penalty-free prepayment option to an ex post cancellation fee that triggers a costly renegotiation.*

Motivation: Recall that all agents are symmetrically informed ex ante. Hence, there is no adverse selection at the time of loan origination and the penalty-free prepayment option is fairly priced through the upfront fee. On the other hand, an ex post cancellation fee is likely to be time-inconsistent in the sense of Kydland and Prescott (1977) and, hence, not renegotiation proof. Moreover, since only the ex post high-quality borrowers prepay to obtain a lower rate, forcing these borrowers to pay a cancellation fee may damage the bank's relationship with its preferred clients. From the borrower's point of view, the upfront fee (paid by all borrowers) is lower than the corresponding ex post cancellation fee (paid by the ex post high-quality borrowers). Moreover, since the upfront fee is a sunk cost at $t = \theta$, it does not affect the borrower's subsequent investment decisions.[9] Hence, both the bank and the firm may prefer to compensate the bank for prepayment

[9] A cancellation fee may induce the firm to under-invest at $t = \theta$. For example, following the high signal, the borrower may be looking at undertaking a corporate acquisition that requires refinancing (Becher, Griffin, and Nini, 2021). In this case, the cancellation fee lowers the firm's incentive to accept the acquisition opportunity. Or, the cancellation fee may lower an owner-manager's incentive to keep investing in firm-specific human capital (Hart and Moore, 1994).

using an upfront fee rather than a cancellation fee.[10] ■

We next turn to a large-sample empirical examination of the main cross-sectional model predictions using data on upfront fees in C&I loans.

3 Empirical test strategy

In this section, we first specify the reduced-form regression model used to test our main theoretical predictions. We then motivate our selection of firm- and loan-specific variables used to generate our prepayment-risk proxy and controls for borrower credit risk.

3.1 Reduced-form regression model

The main cross-sectional prediction to be tested is stated in Proposition 2 and shown explicitly in Eq. (8): The minimum upfront fee y^* increases with prepayment risk (the bank's expected loss of interest from prepayment) and the project's credit risk (driven by the success probability s). Our measure of loan-specific prepayment risk is the composite index *Prepayment Risk Index*, which consists of a set of variables motivated in Section 3.2 below. Hence, Proposition 2 predicts $\beta_1 > 0$ for the following cross-sectional regression in a sample of N loans:

$$Upfront\ Fee_i = \beta_0 + \beta_1 Prepayment\ Risk\ Index_i + \Gamma' \mathbf{X_i} + \mathbf{FE} + \lambda_i + \epsilon_i \qquad i, = 1, ..., N, \tag{10}$$

where *Upfront Fee* is the natural logarithm of the observed upfront fee.[11] The vector $\mathbf{X}$ of control variables, shown and motivated in Section 3.2, is designed to capture borrower credit risk, while $\mathbf{FE}$ is a set of fixed effects. Moreover, λ is the Inverse Mill's ratio correcting for the self-section in the reporting of upfront fees that we discuss in Section 4.4 below.

[10] Dunn and Spatt (1985) and Mayer, Piskorski, and Tchistyi (2013) argue that, in fixed-rate mortgages, a cancellation fee may improve household welfare and dominate an upfront fee, which may constrain low-income households from obtaining a mortgage. This welfare analysis is not relevant in the context of C&I loans.

[11] Upfront fees are one-time fees paid at the closing of the transaction, sometimes in the form of an original issue discount (OID), where the principal exceeds the paid out loan amount. We use the upfront fee in logs due its skewed empirical distribution.

Propositions 3 and 4 are tested by including dummy variables indicating whether the loan contract is a PSD or a credit line, and where both dummies are predicted to enter with a negative sign. Moreover, to examine Lemma 1—that only the upfront fee compensates the bank for prepayment risk—we replace *Upfront Fee* with the logarithm of the all-in-spread undrawn (AISU) as the dependent variable in Eq. (10). Lemma 1 predicts that AISU is uncorrelated with *Prepayment Risk Index*.

Finally, note that Lemma 2—that relationship banking increases the use of the penalty-free prepayment option rather than an ex post prepayment penalty—does not require a regression test. It is readily examined by comparing the frequency of the penalty-free prepayment option in tranche A and tranche B bank loans, as well as in corporate bonds, all of which differ in the distance between the lender and the borrower and, hence, in the lending relationship.

3.2 Motivating the prepayment-risk index Z

The variable *Prepayment Risk Index* is constructed as follows (variable definitions in Table 1):

$$\begin{aligned} Prepayment\ Risk\ Index_i \equiv\ & Z(Return\ Volatility_i) + Z(Cash\ Flow\ Volatility_i) \\ & - Z(Relationship\ Intensity_i) - Z(Number\ of\ Lenders_i) \\ & + Z(Bond\ Spread_i). \end{aligned} \tag{11}$$

The function Z standardizes each variable with its cross-sectional mean and standard deviation (measured at the time of loan origination). While we also show the unconstrained coefficient estimates of the five variables (Table 4 below), combining them into an index has two main benefits: First, it allows us to constrain the sign of each variable to be consistent with basic economic intuition (discussed below). Second, it eliminates the impact of multi-collinearity between the variables. Moreover, the standardization Z prevents the index parameter estimate to be unduly affected by the different variable sizes.

By way of motivation, recall that the borrower's decision to prepay the loan is triggered by a positive shock to firm performance. The first two variables of the *Prepayment Risk Index* are (correlated) proxies for this upside potential: *Return Volatility* is the borrower's monthly stock return volatility measured over twelve months prior to the loan-origination month. The second variable, *Cash Flow Volatility*, is the variance of the borrower's earnings before interests, taxes, depreciation and amortization (EBITDA) over the past eight quarters scaled by the book value of total assets.

While volatility per se does not separate upside potential from downside risk, the additional three variables do help uniquely identify prepayment risk. First, *Relationship Intensity* and *Number of Lenders* capture variation in borrowers' cost of refinancing the loan in the credit market (the parameter α in Eq. 1). *Relationship Intensity* is defined as the number of loans obtained by the firm from the lead bank over the past five years (with multiple lead banks, we use the highest loan frequency from any of these banks). This variable captures the notion that the bank's information about the borrower increases with the number of loans and, hence, strengthens the banking relationship. We argue that the stronger the relationship, the higher the borrower's costs of switching to another lender and the lower the incentive to prepay.

Our second measure of the refinancing cost, *Number of Lenders*, is the number of lenders in the loan syndicate (in logs). The larger the syndicate, the more complex the contracting process and the higher the renegotiation costs (Brunner and Krahnen, 2008). Hence, prepayment risk should decline with the size of he syndicate. However, it is conceivable that loan origination costs are higher for larger syndicates and drive a positive association with upfront fees.

The fifth variable, *Bond Spread*, is intended to control for time-variation in the market price of credit risk. It is defined as the monthly spread between Moody's seasoned Aaa corporate bond rate minus the Federal Funds rate.[12] Loans issued in periods with relatively high market-wide spreads are more likely to be refinanced than loans issued when spreads are low (Xu, 2018).[13] In contrast, the drawdown risk is lower for loans issued in periods with high market-wide spreads, since the value of the drawdown option falls with a decline in market rates. Therefore, restricting

[12]The spread data are from https://fred.stlouisfed.org/series/AAAFFM.

[13]Since the incentive to refinance based on changes in the market price of credit risk does not require private information, this type of refinancing falls outside of our model but is included to help explain the empirical variation in prepayment risk.

Bond Spread to have a positive sign in the *Prepayment Risk Index*, as we do, ensures that this variable captures prepayment risk only (and not drawdown risk).

3.3 Choice of control variables X for credit risk

Recall that, in our theoretical framework, the upfront fee is a function of the unobservable (counterfactual) equilibrium loan spread absent an upfront fee (r^*). This counterfactual loan spread is *not* the observed all-in-spread drawn (AISD, the loan spread plus annual fees on the drawn amount), which is determined jointly with the fee itself. Our baseline regression therefore excludes AISD from the vector **X** and instead includes firm and loan characteristics that may drive the counterfactual spread.[14] That is, the characteristics in **X** are intended to control for the cross-sectional variation in the credit risk that underlie this unobservable spread (the second term, $1 - sH$, in Eq. 8) and which may drive the loan origination costs also compensated with the upfront fee. Note also that, as demonstrated empirically by Mosk (2018), the loan origination process involves bargaining over the upfront fee and loan spread *after* the non-price loan characteristics (loan size, maturity, collateral, etc.) have been determined. This sequential bargaining process means that the non-price loan characteristics in **X** are largely exogenous to the upfront fee.

The vector **X** contains a total of 12 firm and loan characteristics. The seven firm characteristics are *Firm Size* (log of total assets), *Market/Book* ((total debt+market value of equity)/total assets), *Leverage* (total debt/(total debt+market value of equity)), *Profitability* (EBITDA/total assets), *Tangibility* (property, plant, and equipment (PPE)/total assets), *Z-Score* (Z-score as defined by Altman (1968)), and *Rated* (a dummy variable indicating that the firm is rated by Standard and Poor, S&P). The empirical literature on financial constraints uses rating as a proxy for the firm being less constrained (Farre-Mensa and Ljungqvist, 2016).[15]

The five loan characteristics in **X** are *Loan Size* (the ratio of loan amount to total assets) and *Maturity* (log of loan maturity in months), and the three dummy variables *Security* (indicating that

[14] In the empirical analysis below, we demonstrate that adding AISD to the baseline regression does not affect our main conclusions.

[15] All variables are winsorized at the 1st and 99th percentiles. Replacing EBITDA/total assets with EBITDA/debt or EBITDA/interest expense—other common measures of credit risk—does not change any of our conclusions.

the loan is collateralized), *Institutional Term Loan* (the term loan facility is tranche B or lower), and *Cancellation Fee*. The cancellation fee is an ex post prepayment penalty—tantamount to an exercise price in the prepayment option—which is primarily included in loans sold to institutional investors. Recall that, while our theory assumes that prepayment is penalty-free, it does not rule out the possibility of a positive exercise price in the prepayment option. For a given borrower, a cancellation fee lowers the upfront fee (they are substitutes). In the cross-section of borrowers, however, the predicted sign of *Cancellation Fee* is ambiguous as varying degrees of relationship banking give rise to different ex post bargaining costs over the cancellation fee.

The vector **FE** includes five different types of fixed effects. The first three are year, state, and industry fixed effects at the 2-digit Standard Industrial Classification (SIC) code level. The fourth is lead-bank fixed effects, indicating the ten largest banks by lending frequency, as discussed by Ross (2010).[16] The fifth fixed effect is loan purpose: general, recapitalization, and acquisition, as categorized in Carey, Post, and Sharp (1998).[17]

4 Selection of loan facilities and sample characteristics

4.1 Selection of loan facilities

A loan package (or loan deal) can consist of both a term loan and a credit line. The term loan is often structured into different tranches, where lower tranches pay higher spreads. Commercial banks typically participate in tranche A (the pro-rata tranche), while the lower tranches (the institutional tranches) are held by institutional investors, such as insurance companies, pension funds, mutual funds, hedge funds, and collateralized loan obligations (CLOs). We use loan data from Dealscan and select all loans in U.S. dollars issued by U.S. public firms between 01/1987 and

[16]In the Dealscan database, the ten largest banks arrange more that 85% loans in the U.S. Identifying the largest banks using dollar lending volume generates an almost identical list.

[17]Our inferences are robust to replacing the bank and year fixed effects with a bank-year fixed effect, which controls for the possibility that upfront fees respond to changing competition among banks over time.

12/2018.[18] Dealscan contains information on the individual loan facilities, i.e., at the level of a term loan tranche or a credit line, and indicates if they belong to the same loan package.

The loan information is merged with Compustat-CRSP Merged (CCM) through the Dealscan-Compustat linking table on WRDS (see Chava and Roberts (2008) for details on the construction of the data up to 2010, after which we match manually). We eliminate borrowers in regulated and financial industries (2-digit SIC codes 40-45, 49, 60-69, and 99) and restrict the sample to term loans and credit lines, for a total of 44,963 loan facilities. We further require non-missing values in Dealscan and CCM for all explanatory variables in the vector $\mathbf{X}$ in our cross-sectional analysis below, which results in a sample of 31,109 loan facilities (10,138 term loans and 20,971 credit lines)—referenced below as the expanded sample.

Three-quarters (23,284) of the loan facilities in the expanded sample do not report an upfront fee. Our final sample with non-missing upfront fee information totals 7,825 loan facilities: 3,414 term loans and 4,411 credit lines in 5,381 unique loan packages issued by 3,119 firms, 1987-2018. Two-thirds (3,645) of these loan packages have only one facility, of which 1,175 are term loans and 2,470 are credit lines, while one-third (1,736) have both a term loan and a credit line.[19] We conduct the empirical analysis at the facility level. Of the term loans in our sample, 66.4% are tranche A, 30.2% are tranche B, and 3.4% are tranche C or lower. Credit lines typically belong to tranche A.

4.2 Borrower and loan characteristics

Panel A of Figure 4 plots the distribution over time of the 3,414 term loans in the final sample. The number of sample loans peaks in 1997-1998, with a drop in the loan frequency in 2004–2009. As shown (and verified by the SDC New Issuance of Syndicated Loans database), there is little performance pricing prior to 1994. Also, the relative use of PSD in term loans drops after the financial crises. Panel B illustrates the same statistics for the final sample of 4,411 credit lines.

[18] Dealscan contains 50%-75% of all U.S. C&I loans into the early 1990s, with coverage increasing to 80%-90% in 1992–2002 (Carey and Nini, 2007).

[19] In 407 of the loan packages that include both a term loan and a credit line, Dealscan records the fee for the credit line only. For these cases, we assign the upfront fee in the credit line to the term loan as well.

In contrast to term loans, after the financial crisis, the number of new credit lines remains low and most have performance pricing. The figure further plots the annual average upfront fee. In term loans, the upfront fee is relatively stable around 60 bps in the 1990s, reaches a peak of 175 bps in the tight credit markets of 2009, and falls back to about 85 bps in the post-crisis years (2012-2018). In credit lines, upfront fees peak in 2009 and are generally lower than in term loans.

Turning to loan rates, Figure 4 also shows the annual average AISD. In Panel A, AISD in term loans averages about 250 bps in the 1990s, increases in the early 2000s, and peaks at 440 bps in 2009. As the figure indicates, the average upfront fee and AISD are positively correlated. At the individual loan level, the correlation coefficient is 0.43 in term loans and 0.44 in credit lines. Recall that, for a given loan, loan spreads and upfront fees are substitutes. However, in the cross-section, loan origination costs increase in credit risk and hence the loan spread, which may explain the positive correlation coefficient in our sample.

Table 2 reports sample summary statistics for the variables used in the empirical analysis, split by term loans (the first four columns) and credit lines (the last four columns). All variables are defined in Table 1. However, for expositional clarity, none of the variables are transformed using logs in this table. Panel A lists statistics for the key variables of interest. The average upfront fee in term loans is 73 bps or \$2.1 million, with a median of 50 bps or \$0.43 million. Consistent with Proposition 4, credit lines have somewhat lower upfront fees, with a mean and median of 52 bps and 34 bps, respectively.

The substantial right tail of the fees is interesting as it suggests that the upfront fee may reflect more than just a compensation for origination costs. Although not reported in the table, about one-third (31.0%) of the upfront fees in term loans (19.1% in credit lines) exceed 100 bps and 8.9% of the fees exceed 200 bps (4.1% in credit lines). The average upfront fee in the top-quartile of the fee distribution is 198.1 bps (median 200 bps) for term loans and 138.2 bps (median 110.3 bps) for credit lines. The top percentile of fees exceed 302.6 bps or \$23 million.[20]

Turning to the prepayment risk proxies, *Return Volatility* averages 14 (median 12) in term

[20]For example, Solutia Inc. paid an upfront fee of \$108 million (500 bps) for a \$1.2 billion loan in February 2008 and the upfront fee for Western Digital Corp. was \$112.5 million (300 bps) for a \$3.2 billion loan in April 2016.

loans and 15 (median 13) in credit lines. *Cash Flow Volatility* is also lower in term loans than in credit lines, with an average of 1.2 (median 0.8) versus 1.7 (median 1.0). As to the proxies for renegotiation costs, the average borrower of a term loan has used the same lead bank 0.9 times in the past five years (*Relationship Intensity*) and has 7.2 participating banks in the loan syndicate (*Number of Lenders*). The mean value of *Bond Spread* is 215 bps in term loans and 206 bps in credit lines.

Panel A further shows that about one-quarter (28%) of the term loans have performance pricing: 12% with an interest-increasing pricing grid and 25% with an interest-decreasing grid. Of the PSD contracts in term loans, a majority adjusts the loan rate downwards only, while one-tenth adjust the loan rate upwards only and one-third adjust the interest rate both up and down. Performance pricing is more common in credit lines, with 42% of revolvers having adjustable rates: 24% with an up-grid and 37% with a down-grid.

Panel B of Table 2 reports summary statistics for the firm characteristics in **X**. The average term-loan borrower has total assets of $2.8 billion (median $650 million) and a market leverage of 0.39 (median 0.37), suggesting that it is relatively highly leveraged (Graham and Leary, 2011). Moreover, it has a market-to-book ratio of 1.6, a return on assets (*Profitability*) of 3%, a ratio of PPE to total assets (*Tangibility*) of 0.31, and a Z-score of 1.5. Four of ten borrowers have an S&P credit rating. Firms with credit lines have a lower mean leverage (0.31) and a higher Z-score (2.1) than firms with term loans.

Finally, Panel C of Table 2 provides descriptive statistics for the loan facilities themselves. The average term loan has an AISD of 293 bps (median 275 bps) and a loan amount representing 19% of the firm's total assets (median 13%). The mean term loan maturity is about five years (63 months) at issuance and a majority of loans (83%) are secured. Credit lines have somewhat lower average AISD (228 bps), shorter maturity (39 months), and are less frequently secured (68%). 26% of term loans and 12% of credit lines have a cancellation fee. Conditional on having a cancellation fee, the average penalty for loan repayment in the first year is 142 bps (median 100 bps) in term loans and 190 bps (median 200 bps) in credit lines.[21] The indicator *Institutional Term Loan* represents the one-third of the term loan facilities that are tranche B or lower. While not tabulated, 53% of the institutional term loans in our sample have a cancellation fee, compared to only 13% of the pro-rata tranches in term loans (tranche A) and 12% of the credit lines.

4.3 Univariate statistics

Before turning to the multivariate regressions below, Table 3 shows univariate statistics that address propositions 2 and 3: Ceteris paribus, higher prepayment risk implies higher upfront fees and PSD implies lower upfront fees. The first five columns use the sample of term loans, while columns (6) to (10) use the sample of credit lines. Panel A addresses Proposition 2 by reporting the average and median upfront fee across high and low levels of prepayment risk for the five individual measures (*Return Volatility, Cash Flow Volatility, Relationship Intensity, Number of Lenders, Bond Spread*) as well as *prepayment-risk index*, split by the median. For each of these measures, columns (5) and (10) report the difference in the mean upfront fee across loans with high and low prepayment risk, and its significance.

Consistent with Proposition 2, the average upfront fee is significantly higher for loans with greater prepayment risk. The difference is statistically significant at the 1% level for all five measures in the sample of term loans and four of the five measures in the sample of credit lines (for *Bond Spread* the difference is significant a the 5% level). Focusing on *prepayment-risk index*, the average upfront fee is 60 bps in term loans with low prepayment risk and 86 bps in term loans with high prepayment risk, with a fee-difference of 26 bps. For credit lines, the upfront fee averages 42 bps in loans with low prepayment risk and 63 bps for high-prepayment-risk loans, with a difference of 21 bps. While not reported in the table, the upfront fee increases monotonically when sorting the loans into quintiles of *prepayment-risk index*. In sum, this evidence suggests a positive relation between upfront fees and prepayment risk, as predicted by our model.

Panel B of Table 3 splits the loan samples based on performance-pricing. As shown, the average

[21] A typical cancellation fee has a shorter life than the loan and decreases over time. For example, it would pay lenders 2% if the loan is repaid within one year and 1% if repaid within two years.

upfront fee is 52 bps in term loans with performance-sensitive loan rates (PSD=1) and 81 bps in term loans with a fixed spread (*PSD*=0). The difference of 29 bps is significant at the 1% level. In credit lines, the average upfront fee is 40 bps and 61 bps across loans with and without PSD, respectively, with a highly significant difference of 21 bps. Hence, consistent with Proposition 3, this evidence suggests that upfront fees are lower in PSD than in loans without performance pricing.

4.4 Addressing self-selection in fee reporting

To control for the self-selection in the reporting of upfront fees, we perform a 2SLS estimation. The first stage accounts for the choice of self-reporting the upfront fee. The upfront fee is generally determined at the facility level and documented in a fee letter, which is separate from the loan agreement itself. Consultations with investment bankers suggest that most, if not all, C&I loans have an upfront fee. However, while other material loan terms must be disclosed to the public, a majority of firms choose to keep the fee letter confidential (Taylor and Sansone, 2006).

We address the potential issue of self-selection in the reporting of the upfront fee using the following probit model in the first step of the 2SLS estimation:

$$Y_i = a + b(Distance\ to\ NY) + \mathbf{FE_i^h} + e_i, \qquad i = 1, ..., N^h, \tag{12}$$

where Y_i takes a value of one if Dealscan reports an upfront fee and zero otherwise. *Distance to NY* is log of the distance between the firm's headquarter and New York City (Coval and Moskowitz, 1999), and the vector $\mathbf{FE^h}$ include year-, industry-, bank- and state-fixed effects. The regressor is intended to capture the degree of bank competition, with banks located further from New York facing less competition. If lenders that face a high degree of bank competition put pressure on borrowers not to disclose the upfront fee, we expect the estimate of b to be positive. This prediction is borne out by the estimation: $\hat{b} = 0.011$ (p-value of 0.03) for the expanded sample of 31,109 loan facilities. Therefore, we include the Inverse Mill's Ratio from step one in all our 2SLS estimations of the impact of prepayment risk on upfront fees, captured by λ in Eq (10).

5 Do upfront fees increase with prepayment risk?

In this section, we report the second step of 2SLS estimation of equation Eq. (10).

5.1 Upfront fees and the prepayment-risk index

Table 4 shows the parameter estimates for term loans (columns 1 and 4), credit lines (columns 2 and 5) and the full sample of loans (columns 3 and 6). All regressions include the firm- and loan characteristics in $\mathbf{X}$ and the fixed effects in $\mathbf{FE}$, while the full sample regressions also include a dummy for credit lines. The first three columns show the coefficient estimates for each of the five individual variables in *Prepayment Risk Index*, while the next three use the index itself. Standard errors are clustered at the firm level.

The coefficient estimates for *Return Volatility*, *Cash Flow Risk* and *Relationship Intensity* are statistically significant at the 1% level across term loans and credit lines. Moreover, the coefficient signs are all of the sign given these variables in our construction of *Prepayment Risk Index* in Eq. (11). *Return Volatility* and *Cash Flow Risk* have positive signs, which is consistent with our proposition that borrower upside potential increases the value of the penalty-free prepayment option and therefore the upfront fee.

Moreover, the negative sign of *Relationship Intensity* is consistent with the notion that relationship banks tend to develop superior information about the borrower, increasing the borrower's adverse selection cost of switching to other lenders. In terms of our model, this increases the parameter α, which decreases the value of the prepayment option and the upfront fee. For the term loans in Column (1), *Number of Lenders* further supports this argument as it receives a statistically significant and negative coefficient estimate: larger syndicates make it more costly to renegotiate (i.e., higher α) and therefore lower the value of the prepayment option.

Also, since loan origination costs increase in the size of the loan syndicate, the negative relation between the upfront fee and the number of lenders fails to support the notion that upfront fees compensate for loan origination costs only. Rather, the negative coefficient suggests that the negative effect of renegotiation costs on the upfront fee outweighs the positive effect on loan origination costs of increasing the syndicate size. For the credit lines in Column (2), *Number of Lenders* is positive but statistically significant at the 10% only, suggesting that the bargaining issue may be less important for credit lines.

Next, consider the positive and highly significant coefficient estimate for *Bond Spread*, the spread of Baa-rated corporate bonds. It suggests that upfront fees tend to be higher in periods with high credit spreads, when the likelihood of subsequent prepayment due to improved market conditions is also relatively high (Xu, 2018). Hence, the positive sign is consistent with upfront fees compensating for the penalty-free prepayment option.

Turning to columns (4)–(6), *Prepayment Risk Index*, which combines the five individual proxies for prepayment risk, receives a positive and highly significant coefficient estimate in all three regressions, consistent with Proposition 2. While not tabulated, the coefficient estimate is positive and highly significant also when the index is replaced by an indicator for above-median prepayment risk. Moreover, in columns (3) and (6), the dummy variable *Credit Line* receives a negative and significant coefficient, as predicted by Proposition 4. Since a credit line offers the option to delay drawdown, the expected interest-bearing loan amount is lower than for term loans, which lowers the value of the prepayment option and hence the upfront fee. Furthermore, interacting *Credit Line* with *Prepayment Risk Index* or the high-prepayment risk indicator generates statistically insignificant coefficients, suggesting that the marginal impact of prepayment risk on the upfront fee is similar across credit lines and term loans.[22]

The firm and loan characteristics in Table 4 are included to control for cross-sectional variation in loan origination, administration, and syndication costs, some of which are likely covered by the upfront fee. Among the firm characteristics, *Leverage* and *Profitability* are associated with, respectively, higher and lower upfront fees in both term loans and credit lines. Since highly levered

[22]Restricting the sample to the 1,736 loan packages with both a credit line and a term loan yields the same inference.

and unprofitable firms have greater default risk, they also have greater origination costs. As for *Leverage*, firms with higher risk of bankruptcy measured using *Z-Score* pay higher upfront fees, while larger firm size and asset tangibility tend to imply relatively lower origination costs and, accordingly, lower upfront fees.

Turning to the loan characteristics, recall from Table 2 that some loan facilities include a cancellation fee. In the cross-section, *Cancellation Fee* receives a positive and significant coefficient estimate. Recall also from Section 4.2 that the use of a cancellation fee is largely concentrated to the institutional term-loan tranches (B and lower). Since these syndicated loans tend to have greater credit risk, loan origination costs are also likely to be higher than for the tranche-A facilities, possibly explaining the positive correlation between *Cancellation Fee* and the upfront fee. Notice also the negative coefficient estimate for the dummy variable *Institutional Term Loans*, which indicates tranche B or lower. Given the inclusion of *Cancellation Fee*, *Institutional Term Loans* picks up term loan facilities *without* a cancellation fee and, therefore, with a relatively low prepayment risk; hence, the relatively low upfront fee. Finally, *Security* receives a positive and significant coefficient estimate, as in Ivashina (2009). Because banks tend to demand collateral from high credit-risk borrowers, these loans tend to have high origination costs as reflected in higher upfront fees.

The sign and significance of the coefficient estimates in columns (3) and (6), which pool term loans and credit lines, are generally consistent with those reported for the individual loan types. The exceptions are the coefficient estimates for *Loan Size* and *Maturity* where, in term loans, the upfront fee increases with loan size and decreases with loan maturity, while the opposite result emerges for credit lines. However, using the pooled regression to resolve this contradiction, upfront fees are declining in loan size, indicating a fixed component in the loan origination costs, and increasing in maturity, implying higher loan origination costs for longer-lived loans.

In the following, we include the control variables in $\mathbf{X}$ in the regressions while suppressing the individual coefficient estimates for expositional simplicity. Our main empirical focus is the association between upfront fees and various measures of prepayment risk. We begin with the impact of exogenous variation in prepayment risk caused by industry merger activity.

5.2 Adding exogenous variation in prepayment risk

Corporate takeovers often trigger prepayment or renegotiation of the target's debt obligations. Moreover, extant evidence indicates that high-quality firms are more likely to become targets than low-quality firms (Eckbo, 2014). Thus, within our model framework, high industry merger intensity increases the industry-level prepayment risk and, therefore, upfront fees. Moreover, since high industry-level merger activity is unlikely to directly affect borrower credit quality, it is unlikely to also increase loan origination costs. In this section, we therefore add the merger intensity in the industry of the borrower as an explanatory variable for exogenous variation in the upfront fee.

In Panel A of Table 5, the variable *Industry M&A Intensity* is defined as log of the annual dollar value of the total M&A activity in the borrower's 3-digit SIC industry announced in the year of the loan origination. It is measured across all completed and pending deals of U.S. targets in the Refinitiv SDC Platinum M&A database (SDC). *Industry M&A Intensity* is added to our baseline model (columns 4–6 in Table 4), which itself includes the loan-specific prepayment-risk index. Since we measure merger intensity at the industry level, the regressions do not include industry fixed effects. *Industry M&A Intensity* is used in the even-numbered columns of Table 5, while *High M&A Intensity*—a dummy indicating above-median values of the industry merger intensity—are included in the odd-numbered columns. We expect upfront fees to be increasing in both industry merger variables.

Table 5 shows that both *Industry M&A Intensity* and *High M&A Intensity* receive positive and statistically significant coefficient estimates both in term loans and credit lines, as predicted. Note also that *Prepayment Risk Index* continues to receive a positive and significant coefficient of a similar magnitude as in Table 4. Further, in columns (5) and (6), the indicator *Credit Line* retains its magnitude and negative sign after adding merger intensity.

As an alternative industry measure of the upside potential we use *Industry Star Index* and the indicator variable *High Star Index* for above-median values in Panel B of Table 5. This variable is defined as the past three years' average sales growth rate of the fastest-growing firm (the industry star) in the borrower's 3-digit SIC industry net of the industry average sales growth. We argue that the likelihood of receiving firm-specific positive news is relatively high in industries where the leading (star) company has done particularly well—here in terms of sales growth. Since firms in the same industry share product characteristics and technology, good news that results in high sales growth for one firm may spill over to other (rival) firms. Hence, the greater the sales growth of the star firm in the borrower's industry, the greater the likelihood that also the borrower will experience high growth, and the higher is the borrower's prepayment risk. Like *Industry M&A Intensity*, variation in *Industry Star Index* is exogenous to the individual borrower.

Panel B of Table 5 shows that *Industry Star Index* receives a statistically significant coefficient in both Column (3) (credit lines) and Column (5) (all loans). Moreover, replacing *Industry Star Index* with *High Star Index* in the even-numbered columns produces positive and highly significant coefficient estimates. As before, *Prepayment Risk Index* enters with a positive and highly significant coefficient estimate. In sum, both the industry M&A activity and the industry star index help explain the variation in upfront fees above and beyond the prepayment-risk index itself, supporting our theory that upfront fees are used to compensate the bank for the penalty-free prepayment option.

5.3 Performance-sensitive debt

Table 6 tests the prediction of Proposition 3 that upfront fees are lower in PSD, whether the grid increases or decreases the loan rate. In the first row of the table, columns (1), (3) and (5) show that the coefficient estimate for the PSD dummy variable is negative and highly significant for both term loans and credit lines. In other words, PSD lowers the upfront fee as predicted. Notice also that, in all specifications, *Prepayment Risk Index* receives positive and significant coefficient estimates, indicating that prepayment risk helps explain the variation in upfront fees beyond the PSD.

The even-numbered columns in Table 6 separate the impact of rate-decreasing and rate-increasing PSD pricing grids on the upfront fee. The coefficient estimate for the variable *PSD-Decreasing* is negative and highly significant for both term loans and credit lines. The coefficient estimate for *PSD-Increasing* is also negative but significant at the 10% level only. We conclude that Table 6 supports Proposition 3.[23]

5.4 Using option prices to quantify borrower upside potential

In this section, we replace *Prepayment Risk Index* with a forward-looking measure based on option prices. The variable *Option Upside Potential* is estimated using call option prices from Option Metrics for a subsample of 2,522 term loan and credit line facilities, 1997-2018. For each borrower, we select the call option with (1) an exercise price closest to the stock price and (2) a maturity closest to 180 days among all options trading on the loan origination date.[24] *Option Upside Potential* is the average daily ratio of the call option price to the underlying stock's closing price over the month leading up to the loan origination date.

The odd-numbered columns in Table 7 include *Option Upside Potential*, while the even-numbered columns include the dummy variable *High Option Upside Potential*, indicating above-median values of the continuous variable. The explanatory variables are otherwise the same as in Table 4. As predicted, the coefficient estimate for *Option Upside Potential* is positive and highly significant for both term loans and credit lines, with a similar result for *High Option Upside Potential*. These results support our earlier inferences that upfront fees are increasing in prepayment risk, consistent with Proposition 2.

[23]Berg, Saunders, and Steffen (2016) also provide empirical evidence on upfront fees in PSD. However, they conclude in favor of their informal Hypothesis 3, which holds that fees are lower in spread-increasing PSD and (unlike our theory) *higher* in spread-decreasing PSD. The evidence in Table 6 fails to support this hypothesis.

[24]Options with a maturity exceeding 360 days and with a strike price that is 20% above or below the stock's closing price are eliminated. These restrictions help ensure that stock volatility is the primary driver of the cross-sectional variation in the call prices.

5.5 AISD, AISU, and the prepayment-risk index

As discussed in Section 3.3, our baseline regression excludes AISD because it does not represent the theoretical (counterfactual) spread in the absence of an upfront fee. However, since credit risk is the main driver of the loan spread, the first three columns of Table 8 add AISD to the baseline regression as a check on the impact of our prepayment-risk index. As expected, the coefficient estimate for AISD is positive and highly significant. More important, adding AISD does not affect the sign or significance of *Prepayment Risk Index*. In fact, the coefficient estimates for *Prepayment Risk Index* are only slightly lower than in Table 4. Moreover, credit lines continue to have lower upfront fees than term loans. Overall, this evidence indicates that prepayment risk is reflected in the upfront fee and not subsumed by the loan rate itself.

Next, we examine Lemma 1 further. Recall that it has two parts: (1) the upfront fee is the *only* fee that can compensate the bank for the penalty-free prepayment option, and (2) it does *not* compensate for the drawdown option in credit lines. The second part already receives support by the above evidence of a lower upfront fee in spread-decreasing PSD. Turning to part (1) of the lemma, we now regress AISU (commitment fee and facility fee) on our prepayment-risk index. Since, under the lemma, the commitment fee does not compensate for prepayment risk, we expect AISU to be statistically independent of *Prepayment Risk Index*. The coefficient estimates are shown in columns (4) and (5) of Table 8.[25] In column (4), the sample consists of all credit lines in the expanded sample with a commitment or facility fee, while Column (5) in addition requires an upfront fee to be reported. As before, the coefficient for AISD is positive and highly significant. So, like the upfront fee, the commitment fee is increasing in the loan rate. More importantly, consistent with part (1) of Lemma 1, *Prepayment Risk Index* receives a statistically insignificant coefficient in both columns.

[25] The two columns exclude *Inverse Mill's Ratio* as, in contrast to the upfront fee, the commitment fee is always reported in the loan contract itself. Hence, these regressions do not require an adjustment for endogenous self-reporting.

6 Why the preference for penalty-free prepayment?

Lemma 2 states that relationship banks prefer the penalty-free prepayment option to an ex post cancellation fee that may trigger costly renegotiation. In our sample, about 90% of the tranche A term loans and credit lines, and 50% of the tranche B term loans include penalty-free prepayment. This evidence directly supports Lemma 2: Tranche B loans are held by more distant institutional lenders, who have less to loose from ex post bargaining and, hence, view the alternative of imposing a cancellation fee as more beneficial.

The fact that corporate bonds nearly always trigger a penalty in the form of an ex post call premium is also consistent with Lemma 2. The reason is that, in our framework, there is little to be lost in terms of lending relationship between investors (the lenders) the bond issuers. Moreover, bond investors are so numerous that renegotiation may be prohibitively costly to organize (Bolton and Jeanne, 2007; Bradley and Roberts, 2015). Hence, both investors and bond issuers may prefer to structure the bond contract with an ex post fee (a call premium)—paid only when borrowers cancels the loan—over an upfront fee for the option to prepay, which is paid by all borrowers.

Also, from the borrower's viewpoint, a prepayment penalty is less likely to affect the investment incentives of large, mature companies that rely on the bond market for funding. In contrast, smaller high-growth firms—the type of companies that value being able to quickly respond to changing business opportunities—more often rely on bank loans. In the framework of Lemma 2, these smaller firms may prefer term loans in part because they value the penalty-free prepayment option.

Finally, a comment on debt collateral, which is outside of our theoretical framework. Since collateral lowers the credit risk of the firm, it also lowers the minimum upfront fee required to resolve credit rationing. However, since the value of any collateral falls when the firm receives the low signal, collateral may not suffice to provide a full recovery for the bank. Empirically, the value of the collateral often falls short of the bank's claim upon default (Bris, Welch, and Zhu, 2006). Hence, adding collateral does not necessarily eliminate the need for an upfront fee. Also, collateral comes with its own costs borne by the lender. These include costs associated with screening, monitoring and repossessing the pledged assets (Berger, Frame, and Ioannidou, 2011). Thus, for some borrowers, collateral may be more costly for the bank than charging an upfront fee.

7 Conclusion

We provide the first theoretical and empirical analysis of the *penalty-free* prepayment option that is used pervasively in C&I bank loans. In our two-part pricing model with dynamic learning, bank compensation for this option must be structured as an upfront fee to avoid credit rationing of borrowers with high prepayment risk. The reason is that the option is exercised by the bank's ex post high-quality clients, which causes a decline in the average quality of the bank's remaining pool of borrowers. This self-selection also helps explain why banks may prefer the penalty-free prepayment option to a loan cancellation fee: the latter invites costly ex post bargaining with the bank's preferred clients. This preference is absent in corporate bonds, where lending relationships are largely unimportant and borrowers pay a penalty for early prepayment.

We test the main theoretical prediction—that the upfront fee is increasing in the borrower's prepayment risk—using a large sample of term loans and credit lines, 1987–2018, and a novel two-stage least-squares estimation procedure addressing self-selection in the decisions to make the upfront fee available to the public. Moreover, to identify borrower upside potential, which drives prepayment risk, we construct an index that constrains the individual risk components to enter with their theoretically predicted sign and avoids concerns with multicolliniarity.

We find that, as predicted, upfront fees are significantly increasing in the prepayment-risk index. This conclusion is robust to using forward-looking (option-like) measures of loan prepayment risk, and to using the borrower's industry-level M&A intensity to identify exogenous variation in this risk. The latter identification exploits extant evidence that high-quality firms are more likely than low-quality firms to become targets, and that acquiring firms typically refinances the target's debt following a change of control. Upfront fees are significantly increasing in the industry-level

M&A intensity—an effect that is unlikely to be explained by changes in loan origination costs.

Also as predicted, upfront fees are lower in credit lines than in terms loans, and lower for PSD than standard debt as PSD reduces (but does not eliminate) the need to compensate the bank for the ex post reclassification of borrowers. Moreover, we show that the periodic commitment fee in credit lines is uncorrelated with prepayment risk. This supports our two-part loan pricing model in which the upfront fee is the *only* fee that can compensate the bank for the penalty-free prepayment option.

In sum, we provide the first theoretical and empirical rationale for why upfront fees in C&I bank loans cover not only direct loan origination costs but also a compensation for the penalty-free prepayment option.

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Figure 1: **Payoff structure of the project**

The figure shows the payoff structure of the project. There are three dates, $t = 0$, $t = \theta$, and $t = 1$, where $0 < \theta < 1$. At $t = 0$, the firm borrows 1 to invest in a project that generates a stochastic payoff of H or zero at $t = 1$. At $t = \theta$, the firm receives a non-contractible public signal about the quality of the project. With probability p, the signal is good and the project will generate payoff H with certainty. With probability $1 - p$, the signal is bad and the project will generate H with probability q. The firm invests only if project NPV>0 ex ante, i.e., if $s > 1/H$, where $s = p + (1 - p)q$ is the probability of project success (payoff H).

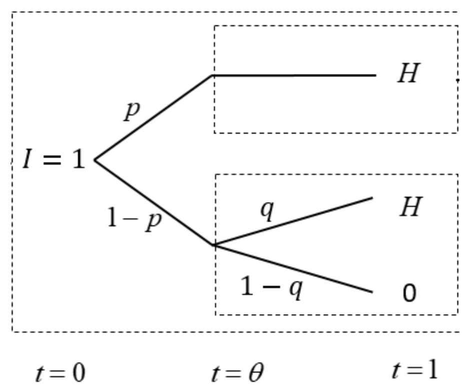


Figure 2: **Time line of the model**

The figure shows the time line of the model. At $t = 0$, the firm borrows and invests in a project with the payoff structure described in Figure 1. At $t = \theta$, the firm receives a signal about the quality of the project and decides whether to prepay the loan or not. At $t = 1$, the project payoff is realized and distributed between the bank and the firm.

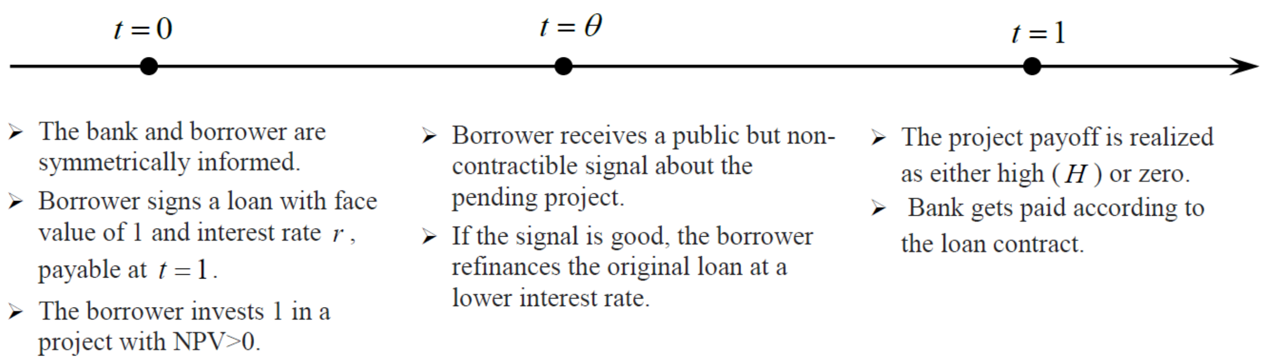


Figure 3: **Two-part pricing of term loans with penalty-free prepayment**

This figure shows how the maximum equilibrium loan rate r^* and the corresponding minimum upfront fee y^* as a function of the project's success probability s. The two horizontal lines show the firm's incentive to prepay, $r > \alpha/(1-\theta)$, and the upper boundary on the feasible loan contract, $r < H-1$. For $s < 1/H$, $NPV < 0$ and the project will not be undertaken. For $1/H < s < s^*$, the upfront fee y^* solves the firm's credit rationing problem. For $s > s^*$, the loan rate r^* is sufficiently high to compensate the bank for the penalty-free prepayment option. For $s > s^{**}$ the equilibrium loan rate r^* is so low as to make the option value zero for the borrower and the loan is never prepaid.

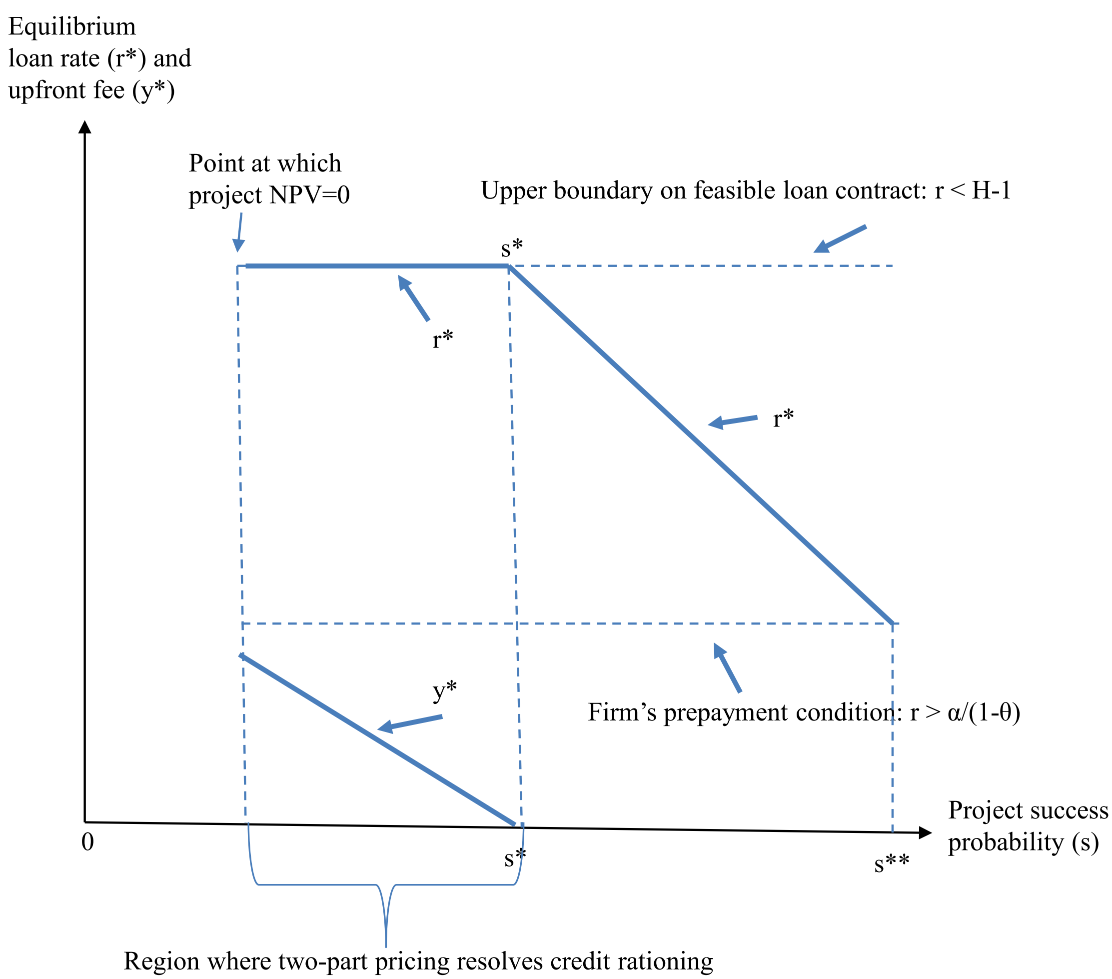
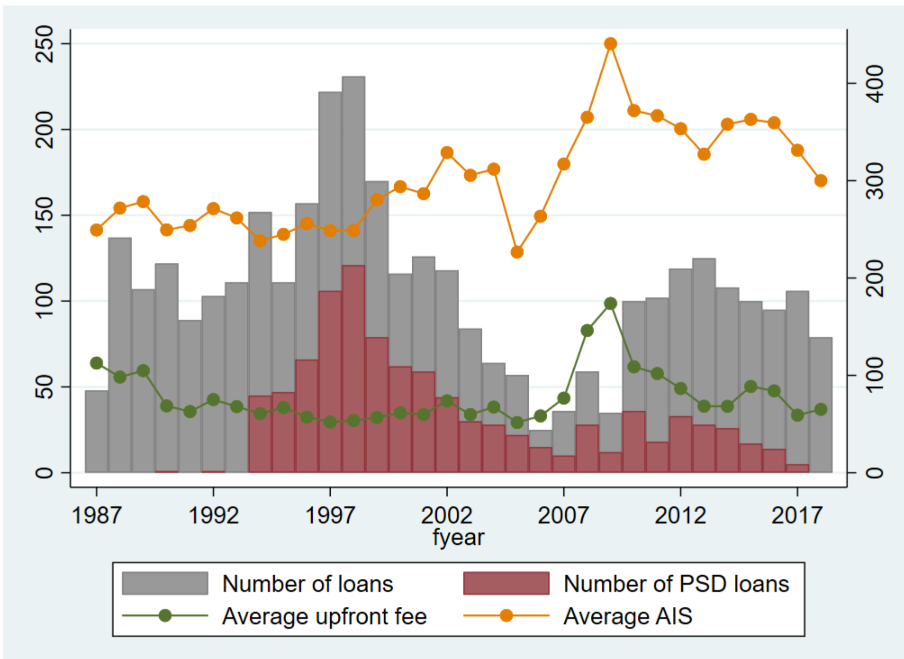


Figure 4: **Annual distribution of sample loans, performance pricing, and fees**

The figure shows the annual number (left y-axis) of total loan facilities and facilities with performance pricing in the sample. The two lines present the annual average upfront fee and all-in-spread in basis points (right y-axis). The sample is 3414 term loan facilities in Panel A and 4411 credit lines facilities in Panel B. The data are Commercial & Industrial (C&I) loans issued by US public firms, 1987–2018, from Dealscan. We exclude loans to regulated and financial industries, and require data on all explanatory variables used in the regressions.

A: Number of observations, performance pricing, and fees in the sample of term loans



B: Number of observations, performance pricing and fees in the sample of credit lines

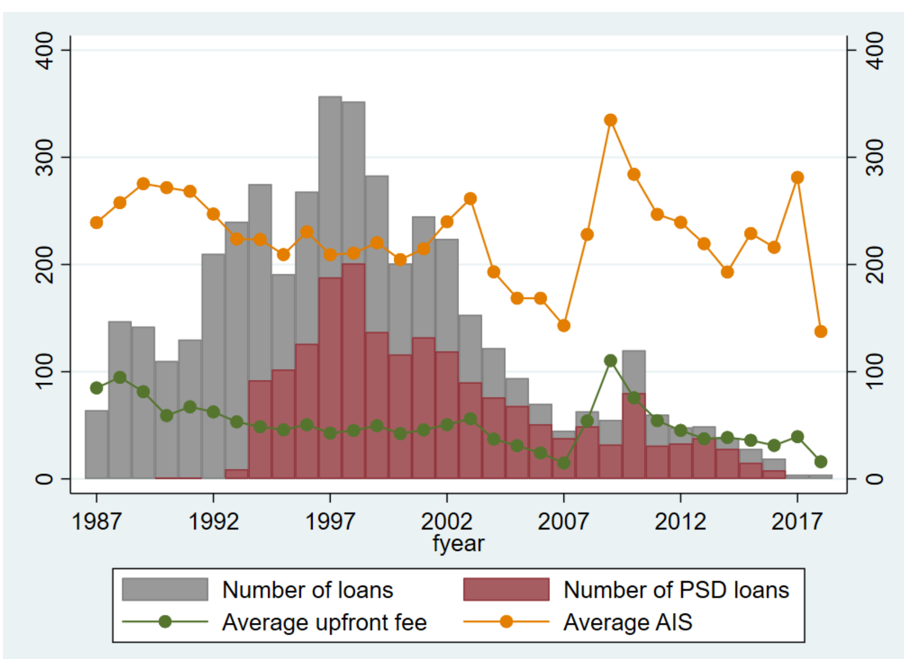


Table 1: Variable definitions

The table defines the variables used in the empirical analyses and lists the data source. CCM=Compustat-CRSP merged, D=WRDS Thomson Reuters LPC Dealscan, FRED=Federal Reserve Bank of St. Louis (https://fred.stlouisfed.org), OM=Option Metrics, and SDC=Refinitiv SDC Platinum. All logs are natural logarithms.

Variable name	Definition	Source
A: Proxies for prepayment risk		
Return Volatility	The borrower's monthly stock return volatility measured over twelve months just prior to the loan-origination month.	CCM
Cash Flow Volatility	Variance of EBITDA (*oibdpq*) over the past 8 quarters/total assets [*atq*].	CCM
Relationship Intensity	The number of loans borrowed from the lead bank by the firm over the past five years. If there are multiple lead banks, we use the highest loan frequency.	D
Number of Lenders	Log of the number of lenders in the bank syndicate.	D
Bond Spread	Log of the quarterly average of Moody's Seasoned Baa Corporate Bond Yield Relative to Yield on 10-Year Treasury Constant Maturity in bps.	FRED
Prepayment Risk Index	Equal-weighted index containing *Return Volatility*, *Cash Flow Volatility*, *Relationship Intensity*, *Number of Lenders*, and *Bond Spread*. Each variable is standardized with its cross-sectional mean and standard deviation, $Z_i = (i - \mu_i)/\sigma_i$, and *Relationship Intensity* and *Multiple Lenders* enter with negative signs.	
Option Upside Potential	The average daily ratio of the call option price to the underlying stock's closing price (S), computed over the month leading up to the loan origination date. We select the option with (i) a maturity closest to 180 days and <360 days and (ii) a strike price closest to S and within +/–20% of S at loan origination.	OM, CCM
Industry M&A Intensity	Log of the annual value of the total merger & acquisition (M&A) activity in the target's SIC3 industry. We select all complete and pending bids for U.S. targets.	SDC,CCM
Industry Star Index	The past three years' average sales growth rate of the fastest-growing firm minus the average in the SIC3 industry.	CCM
High	Prefix indicating above-median variable values.	
B: Firm characteristics		
Firm Size	Log of total assets [*atq*].	CCM
Market/Book	(Total debt+market value of equity)/total assets [*(dltt+dlc+prccq*cshoq) /atq*].	CCM
Leverage	Total debt/(total debt+market value of equity) [*(dltt+dlc)/(dltt+dlc+prccq* cshoq)*].	CCM
Profitability	Earnings before interest, taxes, depreciation, and amortization (EBITDA)/total assets [*oibdpq/atq*].	CCM
Tangibility	Property, plant and equipment/total assets [*ppentq/atq*].	CCM
Z-Score	Altman's Z-Score $[1.2*((actq-lctq)/atq)+1.4*(req/atq)+3.3*(piq/atq)+0.6*((prccq*cshoq)/ltq)+0.999*(saleq/atq)]$.	CCM
Rated	Indicator that the borrower is rated by Standard & Poors.	CCM
C: Loan fees, spreads, and other characteristics		
Upfront Fee	Log of the loan facility's upfront fee in basis points (bps).	D
Credit Line	Indicates that the loan facility is a credit line (vs. term loan).	D
PSD	Indicator that the loan facility has performance-pricing.	D
PSD-Increasing	Indicator that the loan facility has interest increasing performance pricing.	D
PSD-Decreasing	Indicator that the loan facility has interest decreasing performance pricing.	D
AISD	Log of all-in-spread drawn in bps = spread + annual fees on drawn amount.	D
AISU	Log of all-in-spread undrawn in bps = commitment fee + facility fee.	D
Loan Size	Ratio of the loan facility size to total assets [*atq*].	D, CCM
Maturity	Maturity of loan facility in months.	D
Security	Indicator that the loan is secured (vs. unsecured).	D
Institutional Term Loan	Indicator that a term loan facility is tranche B or lower.	D
Cancellation Fee	Indicator that the loan facility has a cancellation fee.	D
Loan Purpose FE	Indicators for the following loan purposes: (1) general purposes (working capital, general corporate purposes), (2) recapitalization (debt repayment, recapitalization, debtor-in-possession loan), and (3) acquisition.	D
Distance to NY	Log of the distance between the firm's headquarter and New York City, using latitude and longitude coordinates from https://simplemaps.com/data/us-cities and Eq. (1) in Coval and Moskowitz (1999).	CCM

Table 2: Sample summary statistics

The table shows summary statistics for the sample of 3513 term loans (columns 1-4) and 4524 credit lines (columns 5-8) issued by U.S. public firms in 1987–2018. The data are Commercial & Industrial (C&I) loan facilities from WRDS Thomson Reuters LPC Dealscan. We exclude firms in regulated and financial industries, and require information on all control variables used in the empirical analysis. The variables are as defined in Table 1, except we do not take the log of any variable in this table.

Sample	Term loans				Credit lines			
	N (1)	mean (2)	median (3)	std.dev. (4)	N (5)	mean (6)	median (7)	std.dev. (8)
A: Upfront Fee, Prepayment Risk, and Performance Pricing								
Upfront Fee (in bps)	3414	72.90	50.00	67.55	4411	52.45	33.75	54.62
Upfront Fee (in $ mill.)	3414	2.15	0.43	4.31	4411	0.94	0.15	2.58
Return Volatility	3414	14.01	12.01	7.90	4411	14.99	12.77	8.49
Cash Flow Volatility	3414	1.22	0.76	1.35	4411	1.67	1.02	1.76
Relationship Intensity	3414	0.94	0.00	1.29	4411	0.67	0.00	1.09
Number of Lenders	3414	7.21	4.00	9.91	4411	7.19	3.00	9.71
Bond Spread (in bps)	3414	214.74	207.20	60.66	4411	205.84	190.32	60.30
Prepayment Risk Index	3414	0.31	0.30	2.70	4411	0.89	0.72	3.03
Option Upside Potential	1247	11.25	9.95	5.27	1275	11.81	10.61	5.25
Industry M&A Intensity	3414	3599	1188	7044	4411	3501	968	6878
Industry Star Index	3329	2.10	1.50	2.01	4405	2.25	1.60	2.22
PSD	3414	0.28	0.00	0.45	4411	0.42	0.00	0.49
PSD-Increasing	3414	0.12	0.00	0.32	4411	0.24	0.00	0.43
PSD-Decreasing	3414	0.25	0.00	0.43	4411	0.37	0.00	0.48
B: Firm Characteristics								
Firm Size (in $ mill.)	3414	2861	654.7	6608	4411	2824	283	8865
Market/Book	3414	1.58	1.36	0.84	4411	1.70	1.37	1.01
Leverage	3414	0.39	0.37	0.23	4411	0.31	0.27	0.24
Profitability	3414	0.03	0.03	0.03	4411	0.02	0.03	0.04
Tangibility	3414	0.31	0.25	0.23	4411	0.30	0.24	0.23
Z-Score	3414	1.53	1.09	2.20	4411	2.09	1.44	2.69
Rated	3414	0.43	0.00	0.50	4411	0.35	0.00	0.48
C: Loan Characteristics								
AISD (in bps)	3414	293.21	275.00	134.92	4411	227.96	225.00	130.33
Loan Size	3414	0.19	0.13	0.19	4411	0.22	0.17	0.19
Maturity	3414	63.28	62.00	22.56	4411	39.06	36.00	21.84
Security	3414	0.83	1.00	0.38	4411	0.68	1.00	0.47
Cancellation Fee	3414	0.26	0.00	0.44	4411	0.12	0.00	0.32
Cancellation Fee (in bps)	892	141.89	100.00	89.36	521	189.67	200.00	117.46
Institutional Term Loan	3414	0.34	0.00	0.47	4411	0.00	0.00	0.00

Table 3: Univariate analysis of upfront fees across loans with high and low prepayment risk

The table reports the mean and median upfront fee in bps for loan facilities with high and low prepayment risk (Panel A) and loan facilities with and without performance pricing (Panel B). For *Relationship Intensity*, *Number of Lenders* and *PSD*, prepayment risk is low (high) when the variable takes a high (low) value. The sample contains 3414 C&I term loan facilities (columns 1-5) and 4411 C&I credit line facilities (columns 6-10) issued by U.S. non-regulated and non-financial public firms, 1987–2018, from Dealscan. Columns (5) and (10) report the difference in the mean upfront fee across loans with high vs. low prepayment risk. The variables are as defined in Table 1, except we do not take the log of any variable in this table. ***, **, and * indicate significance at the 1%, 5%, and 10% level respectively, using a standard t-test.

	Term loans					Credit lines				
	Low prepayment risk		High prepayment risk		Difference in mean	Low prepayment risk		High prepayment risk		Difference in mean
	mean (1)	median (2)	mean (3)	median (4)	(5)	mean (6)	median (7)	mean (8)	median (9)	(10)
A: Sample split by low vs. high prepayment risk										
Return Volatility	8.42	8.56	19.58	17.10		8.88	9.11	21.09	18.52	
Upfront Fee	63.94	50.00	81.87	56.50	17.93***	40.78	25.00	64.12	50.00	23.33***
Cash Flow Volatility	0.44	0.44	1.98	1.41		0.57	0.57	2.76	2.07	
Upfront Fee	69.99	50.00	75.81	50.00	5.82***	47.06	25.00	57.85	37.50	10.79***
Relationship Intensity	1.98	2.00	0.00	0.00		1.79	1.00	0.00	0.00	
Upfront Fee	64.56	50.00	80.41	51.01	15.85***	43.32	25.00	57.91	37.50	14.59***
Number of Lenders	14.21	10.00	1.78	1.00		14.31	10.00	1.37	1.00	
Upfront Fee	67.59	50.00	77.03	50.00	9.44***	46.13	25.00	57.62	37.50	11.48***
Bond Spread	165.68	165.00	263.92	258.74		159.00	159.19	252.90	244.54	
Upfront Fee	66.22	50.00	79.60	50.00	13.38***	50.65	27.27	54.26	37.50	3.61**
Prepayment Risk Index	-1.82	-1.49	2.44	1.97		-1.20	-1.51	3.29	2.74	
Upfront Fee	59.93	50.00	85.87	62.50	25.94***	41.71	25.00	63.20	50.00	21.49***
B: Sample split by performance pricing or not										
PSD	1.00	1.00	0.00	0.00		1.00	1.00	0.00	0.00	
Upfront Fee	52.08	45.00	80.96	50.00	28.88***	40.07	25.00	61.49	40.00	21.41***

Table 4: Regressing the upfront fee on the prepayment risk index

The table shows the OLS coefficient estimates for the determinants of *Upfront Fee* from the 2nd step regressions of Eq. (10), where the 1st step estimates the Inverse Mill's Ratio for self-selection in the borrower's decision to publicly disclose the upfront fee. The key explanatory variables are the individual components of the *Prepayment Risk Index*, defined in Eq. (11), in columns (1)-(3) and the index itself in columns (4)-(6). All variables are defined in Table 1. The sample is 3414 term loans (columns 1 and 4) and 4411 credit lines (columns 2 and 5), for a total of 7825 C&I loan facilities (columns 3 and 6) issued by U.S. non-regulated and non-financial public firms, 1987–2018, from Dealscan. All regressions include the firm and loan characteristics in **X**, the year, industry, loan-purpose, bank, and state fixed effects in **FE**, and an indicator for credit lines in columns (3) and (6). Standard errors are clustered at the firm level.

	Term loans (1)	Credit lines (2)	All loans (3)	Term loans (4)	Credit lines (5)	All loans (6)
Proxies for prepayment risk:						
Return Volatility	0.01***	0.01***	0.01***			
	(5.48)	(7.73)	(9.98)			
Cash Flow Volatility	0.03***	0.03***	0.03***			
	(2.61)	(3.77)	(4.36)			
Relationship Intensity	-0.08***	-0.06***	-0.08***			
	(-6.06)	(-4.76)	(-8.53)			
Number of Lenders	-0.04**	0.03*	-0.00			
	(-2.07)	(1.76)	(-0.18)			
Bond Spread	0.47***	0.05	0.20**			
	(3.23)	(0.41)	(2.16)			
Prepayment Risk Index				0.08***	0.07***	0.08***
				(9.97)	(9.41)	(14.01)
Credit Line			-0.16***			-0.16***
			(-6.55)			(-6.48)
Firm and loan characteristics:						
Firm Size	-0.00	-0.13***	-0.07***	0.01	-0.09***	-0.04***
	(-0.04)	(-8.44)	(-5.98)	(0.72)	(-6.67)	(-4.09)
Market/Book	0.03	0.03*	0.04***	0.03	0.05***	0.04***
	(1.42)	(1.94)	(2.59)	(1.29)	(2.73)	(2.97)
Leverage	0.50***	0.67***	0.60***	0.50***	0.68***	0.61***
	(5.40)	(8.91)	(10.38)	(5.69)	(9.21)	(10.76)
Profitability	-2.43***	-1.56***	-1.83***	-2.39***	-1.59***	-1.79***
	(-4.51)	(-4.05)	(-5.86)	(-4.66)	(-4.20)	(-5.81)
Tangibility	-0.05	-0.21**	-0.12**	-0.06	-0.21**	-0.13**
	(-0.54)	(-2.49)	(-2.00)	(-0.63)	(-2.56)	(-2.14)
Z-Score	-0.02*	-0.04***	-0.03***	-0.02**	-0.04***	-0.03***
	(-1.95)	(-5.25)	(-5.52)	(-2.09)	(-5.92)	(-5.90)
Rated	0.07	0.16***	0.13***	0.07*	0.17***	0.13***
	(1.56)	(4.06)	(4.38)	(1.75)	(4.40)	(4.73)
Loan Size	0.21**	-0.68***	-0.28***	0.25***	-0.58***	-0.22***
	(2.18)	(-8.33)	(-4.63)	(2.75)	(-7.36)	(-3.73)
Maturity	-0.00***	0.01***	0.00***	-0.00***	0.01***	0.00***
	(-3.74)	(9.87)	(5.14)	(-3.72)	(10.77)	(5.89)
Security	0.44***	0.46***	0.47***	0.45***	0.46***	0.48***
	(10.04)	(14.49)	(18.58)	(10.57)	(14.71)	(18.81)
Institutional Term Loan	-0.09**		-0.15***	-0.10**		-0.18***
	(-2.09)		(-4.02)	(-2.56)		(-4.82)
Cancellation Fee	0.34***	0.36***	0.37***	0.33***	0.34***	0.36***
	(8.07)	(8.39)	(12.69)	(8.24)	(7.88)	(12.20)
Other controls:						
Inverse Mill's Ratio	1.48	-0.27	1.14*	1.38	-0.18	1.10*
	(1.37)	(-0.25)	(1.71)	(1.35)	(-0.17)	(1.66)
Fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
N	3414	4411	7825	3414	4411	7825
Adjusted R^2	0.265	0.378	0.339	0.264	0.376	0.338

Table 5: Regressing the upfront fee on industry-based prepayment risk measures

The table shows the OLS coefficient estimates for the determinants of *Upfront Fee* from the 2nd step regressions of Eq. (10), where the 1st step estimates the Inverse Mill's Ratio for self-selection in the borrower's decision to publicly disclose the upfront fee. The key explanatory variables capturing exogenous variations in prepayment risk are *Industry M&A Intensity* (Panel A), defined as the value of merger and acquisition (M&A) transactions in the firm's SIC3 industry-year, and *Industry Star Index* (Panel B), defined as the past three years' average sales-growth rate of the fastest-growing firm in the SIC3 industry minus the average (Duchin et al., 2019). The prefix *High* indicate above-median variable values. The variables are defined in Table 1. The sample is 3414 term loans (columns 1-2) and 4411 credit lines (columns 3-4), for a total of 7825 C&I loan facilities (columns 5-6) issued by U.S. public firms, 1987–2018 (from Dealscan). We exclude firms in regulated and financial industries, and require information on all control variables used in the empirical analysis. All regressions include the firm and loan characteristics in **X**, the loan-purpose, bank, year, and state fixed effects in **FE**, and an indicator for credit lines in columns (5)-(6). Standard errors are clustered at the firm level.

	Term loans		Credit lines		All loans	
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Industry M&A Intensity						
Proxies for prepayment risk:						
Industry M&A Intensity	0.05**		0.04**		0.05***	
	(2.05)		(2.11)		(3.15)	
High M&A Intensity		0.06*		0.08***		0.08***
		(1.83)		(2.82)		(3.65)
Prepayment Risk Index	0.08***	0.08***	0.07***	0.07***	0.07***	0.07***
	(9.78)	(9.73)	(9.35)	(9.38)	(13.80)	(13.78)
Credit Line					-0.16***	-0.16***
					(-6.43)	(-6.39)
Control variables:						
Inverse Mill's Ratio	-0.24*	-0.22	-0.46***	-0.43***	-0.40***	-0.36***
	(-1.74)	(-1.58)	(-3.37)	(-3.16)	(-3.98)	(-3.56)
Firm and loan characteristics	Yes	Yes	Yes	Yes	Yes	Yes
Fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
N	3414	3414	4411	4411	7825	7825
Adjusted R^2	0.252	0.252	0.366	0.366	0.328	0.328
Panel B: Industry Star Index						
Proxies for prepayment risk:						
Industry Star Index	0.01		0.02**		0.02***	
	(1.50)		(2.52)		(3.07)	
High Star Index		0.09***		0.09***		0.10***
		(2.98)		(3.18)		(4.57)
Prepayment Risk Index	0.08***	0.08***	0.07***	0.07***	0.07***	0.07***
	(9.55)	(9.56)	(9.32)	(9.39)	(13.61)	(13.67)
Credit Line					-0.15***	-0.15***
					(-6.29)	(-6.25)
Control variables:						
Inverse Mill's Ratio	-0.24*	-0.24*	-0.45***	-0.42***	-0.39***	-0.36***
	(-1.71)	(-1.70)	(-3.34)	(-3.11)	(-3.88)	(-3.55)
Firm and loan characteristics	Yes	Yes	Yes	Yes	Yes	Yes
Fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
N	3329	3329	4405	4405	7734	7734
Adjusted R^2	0.254	0.255	0.366	0.366	0.329	0.330

Table 6: Regressing the upfront fee on the prepayment risk index and PSD indicators

The table shows the OLS coefficient estimates for the determinants of *Upfront Fee* from the 2nd step regressions of Eq. (10), where the 1st step estimates the Inverse Mill's Ratio for self-selection in the borrower's decision to publicly disclose the upfront fee. The key explanatory variables are *Prepayment Risk Index*, *PSD* (an indicator for performance priced debt), *PSD-Increasing* (indicating an increasing pricing grid), and *PSD-Decreasing* (indicating a decreasing pricing grid). All variables are defined in Table 1. The sample is 3414 term loans (columns 1-2) and 4411 credit lines (columns 3-4), for a total of 7825 C&I loan facilities (columns 5-6) issued by U.S. non-regulated and non-financial public firms, 1987–2018, from Dealscan. All regressions include the firm and loan characteristics in **X**, the year, industry, loan-purpose, bank, and state fixed effects in **FE**, and an indicator for credit lines in columns (5)-(6). Standard errors are clustered at the firm level.

	Term loans		Credit lines		All loans	
	(1)	(2)	(3)	(4)	(5)	(6)
Performance-sensitive debt:						
PSD	-0.18***		-0.10***		-0.14***	
	(-4.91)		(-3.16)		(-5.63)	
PSD-Increasing		-0.10*		-0.01		-0.05*
		(-1.86)		(-0.14)		(-1.81)
PSD-Decreasing		-0.13***		-0.09**		-0.09***
		(-3.07)		(-2.56)		(-3.50)
Proxies for prepayment risk:						
Prepayment Risk Index	0.08***	0.08***	0.06***	0.06***	0.07***	0.07***
	(9.34)	(9.11)	(9.02)	(9.03)	(13.36)	(13.38)
Credit Line					-0.15***	-0.15***
					(-5.95)	(-6.05)
Control variables:						
Inverse Mill's Ratio	1.44	1.48	-0.11	-0.15	1.19*	1.20*
	(1.38)	(1.37)	(-0.10)	(-0.14)	(1.77)	(1.78)
Firm and loan characteristics	Yes	Yes	Yes	Yes	Yes	Yes
Fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
N	3414	3414	4411	4411	7825	7825
Adjusted R^2	0.305	0.304	0.382	0.382	0.340	0.339

Table 7: Regressing the upfront fee on the option-implied prepayment risk

The table shows the OLS coefficient estimates for the determinants of *Upfront Fee* from the 2nd step regressions of Eq. (10), where the 1st step estimates the Inverse Mill's Ratio for self-selection in the borrower's decision to publicly disclose the upfront fee. The key explanatory variables are *Option Upside Potential*, defined as the average ratio of the daily call option price (from Option Metrics) to the underlying stock's closing price over the month prior to loan origination, and *High Option Upside Potential*, indicating above-median values of *Option Upside Potential*. All variables are defined in Table 1. Call option prices are available for 1247 term loans (columns 1-2) and 1275 credit lines (columns 3-4), for a total of 2522 C&I loan facilities (columns 5-6) issued by U.S. non-regulated and non-financial public firms, 1987–2018, from Dealscan. All regressions include the firm and loan characteristics in **X**, the year, industry, loan-purpose, bank, and state fixed effects in **FE**, and an indicator for credit lines in columns (5)-(6). Standard errors are clustered at the firm level.

	Term loans		Credit lines		All loans	
	(1)	(2)	(3)	(4)	(5)	(6)
Proxies for prepayment risk:						
Option Upside Potential	0.02***		0.02***		0.02**	
	(3.52)		(3.84)		(2.17)	
High Option Upside Potential		0.23***		0.13**		0.17*
		(3.98)		(2.31)		(1.81)
Credit Line					-0.22**	-0.22**
					(-2.05)	(-2.21)
Control variables:						
Inverse Mill's Ratio	-0.81	-0.60	-1.34	-1.34	-4.14	-3.90
	(-0.57)	(-0.43)	(-1.06)	(-1.06)	(-1.02)	(-1.02)
Firm and loan characteristics	Yes	Yes	Yes	Yes	Yes	Yes
Fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
N	1247	1247	1275	1275	2522	2522
Adjusted R^2	0.304	0.304	0.470	0.466	0.455	0.454

Table 8: AISD, AISU, and the prepayment risk index

Columns (1)-(3) show the OLS coefficient estimates for the determinants of *Upfront Fee* from the 2nd step regressions of Eq. (10), where the 1st step estimates the Inverse Mill's Ratio for self-selection in the borrower's decision to publicly disclose the upfront fee. Columns (4)-(5) show the coefficient estimates in OLS regressions for the all-in-spread undrawn (*AISU*), defined as the commitment fee plus the facility fee (on the unused amount). The key explanatory variables are the *Prepayment Risk Index*, defined in Eq. (11), and the all-in-spread drawn (*AISD)*, defined as the spread plus annual fees on the drawn amount. All variables are defined in Table 1. The sample is 3414 term loans (column 1) and 4411 credit lines (column 2), for a total of 7825 loan facilities (column 3) with reported upfront fees. Column (4) uses 12,795 credit line facilities in Dealscan with a commitment or facility fee, while column (5) also requires a reported upfront fee, limiting the sample to 3035 credit lines. The sample is C&I loan facilities issued by U.S. non-regulated and non-financial public firms, 1987–2018, from Dealscan. All regressions include the firm and loan characteristics in **X**, the year, industry, loan-purpose, bank, and state fixed effects in **FE**, and an indicator for credit lines in column (3). Standard errors are clustered at the firm level.

	Upfront Fee			AISU	
	Term loans (1)	Credit lines (2)	All loans (3)	Credit lines (4)	Credit lines (5)
Proxies for prepayment risk:					
Prepayment Risk Index	0.06***	0.04***	0.05***	-0.00	0.00
	(7.18)	(6.73)	(9.83)	(-0.06)	(0.39)
Credit Line			-0.08***		
			(-3.62)		
Control variables:					
AISD	0.67***	0.81***	0.77***	0.61***	0.53***
	(21.61)	(32.47)	(39.94)	(63.48)	(23.37)
Inverse Mill's Ratio	1.04	-0.95	0.22		
	(1.14)	(-0.94)	(0.40)		
Firm and loan characteristics	Yes	Yes	Yes	Yes	Yes
Fixed effects	Yes	Yes	Yes	Yes	Yes
N	3414	4411	7825	12,795	3035
Adjusted R^2	0.354	0.497	0.453	0.574	0.400

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