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JEL Classification: D82, D86, G21, G32

Keywords: Credit rationing, upfront fee, prepayment risk, performance-pricing, cancellation fee

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June 25, 2021

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1 Introduction

Lenders of commercial and industrial (C&I) loans charge a fixed spread to compensate for borrower default risk and various loan fees to cover origination costs and contractual option features. For example, in credit lines, borrowers pay a periodic fee for the option to delay drawdown of the loan commitment.[1] In this paper, we present a novel theoretical and empirical analysis of a different option: the right to prepay the loan without penalty. Inclusion of a penalty-free prepayment option is unique to bank loans as corporate bonds regularly impose a penalty in the form of a call premium for prepaying the debt prior to maturity (Asquith and Mullins, 1991). For C&I term loans, we show that about half of the institutional tranches (tranche B and lower) and as much as 90% of tranche A include this option. The near-absence of loan cancellation fees in tranche A possibly reflects a widespread concern that this fee will invite costly bargaining with the bank's high-value clients after an improvement in their credit rating. The evidence in Roberts and Sufi (2009) and Roberts (2015), which shows that borrowers often demand a *lowering* of the loan rate early in the loan term, further supports this bargaining concern.[2]

In our theoretical setting, it is also the bank's *ex post* high-quality borrowers that end up exercising the penalty-free prepayment option. Following loan origination, borrowers receiving positive (non-contractible) information about their project payoffs prepay to receive a lower loan rate. Since this prepayment erodes the average credit quality of the bank's borrower pool, the bank requires a compensation up front. We show that a combination of an upfront fee and a *lowering* of the loan spread, determined jointly at the time of loan origination, solves the bank's participation constraint. A further insight from our model is that compensating the bank for the prepayment option by raising the loan spread at origination increases the prepayment risk—possibly to the point of causing credit rationing. The reason for this credit rationing differs from that of Stiglitz and Weiss (1981), where the bank's concern is opportunistic risk-shifting by the borrower, and the resolution is loan collateral.

The main testable prediction of our theory is that lenders will charge a relatively high upfront fee to borrowers with high prepayment-risk. While we develop the theory in the context of term loans, we also extend the analysis to credit lines and loans with performance-pricing. In performance-sensitive

[1]Thakor, Hong, and Greenbaum (1981), Thakor (1982), Boot, Thakor, and Udell (1987) and others argue that, because this drawdown option insures the borrower against future increases in the spot-market rate, the commitment fee will be increasing in borrower downside risk. This argument receives empirical support by Berg, Saunders, and Steffen (2016).

[2]The greater the distance between lenders and their clients, the lower the risk of *ex post* bargaining. While tranche A loan facilities are held by commercial banks with relatively close relationship to borrowers, tranche B and below are held by more distant institutional lenders, with the greatest distance to the investors in corporate bonds.

debt (PSD), spreads are contractually adjusted in response to certain changes in borrower performance measures. Therefore, PSD to some extent compensates for the *ex post* reclassification of borrowers that in our model triggers exercise of the prepayment option. Interestingly, our theory predicts that *both* spread-increasing and spread-decreasing PSD lower prepayment risk and hence the minimum upfront fee required to solve the credit rationing problem. This prediction differs from the more traditional hypothesis that the main purpose of spread-increasing PSD is to alleviate concerns with borrower agency issues (Asquith, Beatty, and Weber, 2005; Manso, Strulovici, and Tchistyi, 2010). It also differs from the hypothesis in Berg, Saunders, and Steffen (2016) that spread-decreasing PSD increases the value of the drawdown option in credit lines and hence upfront fees.

Our empirical analysis of the upfront fee is based on 8,000 C&I term-loan and credit-line facilities issued by U.S. public firms over the period 1987–2018, from WRDS Thomson Reuters LPC Dealscan. The upfront fees in these loans are economically significant. They average 73 basis points (bps) in term loans (139 bps in credit lines), with fees in the top quartile averaging as much as 199 bps (median 200 bps). While most other fees are specified in the loan contract, upfront fees appear in a separate fee letter and are often *not* made public. In our empirical analysis, we account for this self-selection in the reporting of the upfront fee in company SEC filings through a Heckman-type selection model (Heckman, 1979) using an expanded sample of 31,000 C&I loans.

The value of the prepayment option is driven by the likelihood that the borrower will receive positive news after loan origination, or its upside potential. We estimate this potential using several different empirical proxies, including borrower stock return volatility and cash-flow volatility. The prepayment risk also increases with the borrower's cost of obtaining a new loan in the market, which we measure through the size of the loan syndicate and the firm's prior relationship with the bank. To increase test power, we normalize and combine these variables into a prepayment risk index, where each variable enters with its theoretically motivated sign.

The empirical analysis produces five distinct results. Most important, upfront fees are positively associated with our proxies for loan prepayment risk—both individually and in the form of an index. Second, also as predicted, upfront fees are on average lower in credit lines than in term loans. Third, the merger intensity in the industry of the borrower, which is exogenous to any specific loan at origination, has a positive impact on upfront fees. This impact is interesting because acquisitions often trigger prepayment of the target's debt obligations. Moreover, since there is empirical evidence that high-quality firms are more likely to become targets than low-quality firms (Eckbo, 2014), takeovers tend to increase the prepayment risk of borrowers with relatively high upside potential—precisely the borrower-type requiring upfront fees in our model. Also, there is no particular reason to expect an industry merger wave to increase the cost of originating and syndicating C&I loans. Therefore, while the positive association of upfront fees and industry merger intensity supports our model prediction, loan origination cost is an unlikely alternative channel for this fee association.

Fourth, also consistent with our theory, upfront fees are on average lower in PSD than in fixed-spread term loans. More specifically, relative to loans without performance pricing, both spread-decreasing PSD and spread-increasing PSD are associated with *lower* upfront fees. Finally, focusing on a subsample of credit lines, we show that our prepayment-risk index is uncorrelated with the all-in-spread-undrawn (AISU, the periodic fee on the undrawn loan amount). These five empirical results all support our theory that the bank uses the upfront fee as compensation for the prepayment option in C&I loans.

Turning to the extant empirical evidence on upfront fees, Ivashina (2009) reports that upfront fees are uncorrelated with the default risk of the lead bank's loan portfolio, which leaves open the possibility that upfront fees are used to compensate for borrower upside potential, as our theory predicts. On the other hand, in their study of credit lines, Berg, Saunders, and Steffen (2016) find that upfront fees increase with stock return volatility and infer that the upfront fee compensates for downside risk through the drawdown option. However, because the return volatility does not separate downside risk from upside potential, an alternative inference of their evidence is that the upfront fee instead compensates for the prepayment option, as we predict. Overall, the main contribution of this paper is to show both theoretically and empirically that the upfront fee is the *only* fee used to compensate the bank for the penalty-free prepayment option in C&I loans.

The rest of the paper is organized as follows. Section 2 develops our theoretical predictions, while the empirical test strategy and sample selection are described in sections 3 and 4, respectively. The results of our cross-sectional analysis are found in section 5, while Section 6 concludes the paper.

2 Loan pricing when prepayment is penalty-free

In this section, we present a two-part bank compensation for including a penalty-free prepayment option in the loan contract that satisfies the bank's participation constraint in a competitive credit market. We assume that all agents (bank and borrower) are risk-neutral and symmetrically informed at the time of loan origination. The borrower subsequently receive private information affecting its creditworthiness. This dynamic learning occurs after investing the loan amount and observing how the value of the investment project develops. While *ex post* high-quality borrowers strategically prepay or renegotiate to lower the loan rate, low-quality borrowers do not, which is why the bank must be compensated up front for including the put option in the loan contract.[3]

2.1 Model structure

There are two risk-neutral agents—the firm (borrower) and the bank (lender)—and one risky investment project to be financed by the bank. 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 of one dollar at time $t = 0$ and it generates a stochastic payoff at $t = 1$ that is either H>1 or zero. The firm wants to finance the investment with a loan that may be prepaid without penalty at time $t = \theta$ prior to the maturity at $t = 1$. At time $t = 0$, 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 term loan.

At $t = \theta$, the firm receives a public, non-contractible signal about the project's expected payoff at $t = 1$. This signal could be new information about the outcome of R&D, customer demand, or competing products. With probability p, the signal reveals that the payoff will be H with certainty. Thus, conditional on a "high" signal, the project is risk-free. Otherwise, with probability $1 - p$, the signal is "low" and the likelihood of the high payoff is only $q < 1$. Therefore, at time $t = 0$, the probability of the high outcome is $s \equiv p + (1 - p)q$, henceforth labelled the project's "success probability".[4] The firm borrows and invests only if the project NPV is positive, i.e., only if $sH - 1 > 0$. Moreover, we assume that $qH < 1$, so that the project NPV is negative conditional on a low signal. Finally, a feasible loan contract also requires $1 + r \leq H$, that is, the loan payment cannot be larger than the maximum payoff of the project itself.

[3] Our 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 by Hendel and Lizzeri (2003) in the context of individual life insurance contracts. In Thakor and Udell (1987) and Shockley and Thakor (1997), the bank uses the two-part fee structure (commitment and utilization fees) in credit lines to screen borrower types sufficient to produce a separating equilibrium. The type of *ex post* dynamic learning effects modelled here can exist even if the initial contracting results in separating equilibria. 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] In the following, we will focus on the comparative statistics of s.

This restriction ensures that the *ex post* low-quality firm does not abandon the project at time $t = \theta$.

As per the time line summarized in Figure 2, at time $t = 0$, the firm and the bank are symmetrically informed about the expected payoff. It is only later (at time $t = \theta$) that the firm receives a signal and gains an informational advantage relative to the bank. However, the bank rationally determines the loan rate r so as to break even, taking into account that the borrower may prepay based on the information received at time $t = \theta$. While this prepayment is penalty-free, we assume that the firm incurs a cost $\alpha > 0$ to negotiate a replacement loan in the credit market (possibly with another bank). We add this assumption to allow for the possibility that the firm may self-select to *not* prepay even if the signal at $t = \theta$ is high.[5] While not critical to our argument about credit rationing, it is empirically interesting to allow for this outcome as well.

With this setup, following the signal at $t = \theta$, the firm prepays the loan only if the interest payment remaining on the loan exceeds the cost of a new loan. The firm's condition to refinance is therefore

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

By inspection of this equilibrium condition, for a given loan rate r, refinancing depends on the time θ when the firm receives the private signal and the refinancing cost α. To ensure that prepayment is relevant in our model, we assume that $\frac{\alpha}{1-\theta} \leq H - 1$.

2.2 Prepayment risk and credit rationing

We are interested in the equilibrium loan pricing as a function of the project's success probability s. The results can be summarized in the following proposition.

Proposition 1: *For a sufficiently low success probability s, the penalty-free prepayment option causes credit rationing.*

The proof of Proposition 1 is driven by the following simple intuition: First, the equilibrium loan rate r increases with project default risk. However, given the firm's refinancing condition (Eq. 1), since a higher loan rate *increases* the firm's incentive to prepay, it further increases the rate required for the bank to break even in expectation. In other words, if the bank is worried about early repayment by its *ex*

[5] Conditional on a high signal, the original loan rate r exceeds the firm's opportunity loan rate of zero (the risk-free rate). Thus, unless $\alpha > 0$, the firm always prepays following a high signal. Note that the bank does not necessarily capture α.

post high-quality borrowers, raising the loan rate at the time of loan origination only worsens the bank's problem, ultimately resulting in lending being infeasible: hence, credit rationing.

For a more formal proof, let r^* denote the equilibrium loan rate at which the borrower optimally does *not* exercise the prepayment option, *regardless* of the private signal at time $t = \theta$. Moreover, let r^{**} denote the equilibrium rate consistent with prepayment taking place following a high signal. Note that the range of the success probability is $s \in [1/H,\ 1]$, where the lower bound of this range reflects that the risk-neutral firm invests only if the expected payoff is positive (NPV>0). The range of s can be divided into four regions, I-IV, separated by three boundaries s_1, s_2 and s_3.

In the following, we first derive the three boundaries. We then show that r^* exists in Region I and II ($s \in [s_2,\ 1]$), while r^{**} exists in Region II and III ($s \in [s_3,\ s_1]$). Finally, we show that credit rationing occurs in Region IV ($s \in [1/H,\ s_3]$), as in this region there exists no feasible interest rate that is acceptable to both the bank and the borrower. Figure 3 illustrates the model solution using a simple numerical example. The figure shows how the equilibrium loan rate varies with the success probability s (the parameter values used for the figure are $\alpha = 0.8$, $\theta = 0.1$, $H = 4.5$, and $q = 0.2$).

Intuitively, for a sufficiently high s (low default probability), the equilibrium loan rate is low enough 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 loan rate r^* and there is no prepayment. The bank's participation or break-even condition $s(1 + r) = 1$ implies

$$r^* = \frac{1 - s}{s}, \tag{2}$$

which, when combined with the firm's incentive to not prepay (Eq. 1), yields

$$s > s_2 \equiv \frac{1 - \theta}{1 - \theta + \alpha}. \tag{3}$$

In Figure 3, we see that r^* exists in Region I and II when $s \in [s_2,\ 1]$, and is always below the incentive constraint of the borrower (Eq. 1).

Given the high success probability s in Region I, r^* is the only equilibrium loan rate. This is because no break-even interest rate is high enough to meet the firm's refinancing condition in Eq. (1). However, in Region II where $s_2 < s < s_1$, there exists a second equilibrium. In this equilibrium, the bank finances the project while recognizing that the firm may exercise the prepayment option at $t = \theta$ after receiving a high signal. Since prepayment occurs in this second equilibrium, the bank's break-even constraint is

$$p(1 + \theta r) + (1 - p)q(1 + r) = 1. \tag{4}$$

The first term in Eq. (4) is the bank's expected payoff when the signal is high, in which case the firm prepays the loan and the bank receives $1 + \theta r$, where θr is the interest accrued up to time θ. The second term is the bank's expected payoff $q(1 + r)$ conditional on a low signal, when the firm holds the loan to maturity.

Combining the bank's break-even constraint (Eq. (4)) with the firm's incentive constraint (Eq. 1), we derive the equilibrium loan rate with prepayment as

$$r^{**} = \frac{1 - s}{s - p(1 - \theta)} \tag{5}$$

and

$$s_1 = \frac{(1 - \theta)(1 + p\alpha)}{1 - \theta + \alpha}. \tag{6}$$

Obviously $r^{**} > r^*$ and $s_1 > s_2$.

In Region II, r^* and r^{**} are both equilibrium loan rates in the sense that the lender breaks even with either of them. That is, the bank can choose a loan rate r^* that will never be prepaid or a loan rate r^{**} that will be refinanced at $t = \theta$ following a high signal. However, the equilibrium with r^* dominates the equilibrium with r^{**} because the former saves the refinancing cost α, which is a deadweight cost.

At the threshold s_3 in Region III, r^{**} becomes so high that it is limited by $r^{**} \leq H - 1$ (the feasible loan contract, represented by the upper horizontal line in the figure). Combining Eq. (4) with $r^{**} \leq H - 1$ yields

$$s_3 = \frac{1}{H}\Big[1 + p(1 - \theta)(H - 1)\Big]. \tag{7}$$

In Region III, the only equilibrium rate is r^{**}, which will be refinanced following a high signal. For certain parameter values, $s_3 < s_2$, ensuring the existence of Region III.[6] Note that the model does not require $s_3 < s_2$ or the existence of Region III: whether or not $s_3 < s_2$ holds, the region with $s < \min(s_3, s_2)$ is

[6] Formally, the requirement for Region III to exist (or for $s_3 < s_2$) is $H > (\frac{1}{1-\theta} - p)/(\frac{1}{1-\theta+\alpha} - p)$, which is for example feasible for a sufficiently high H.

characterized by the credit rationing in Proposition 1.

Finally, in Region IV, where $s < s_3$, there is no equilibrium loan contract that can finance the positive NPV project in the model. This is because the loan rate necessary to compensate the bank for the high default risk and prepayment risk exceeds the feasible loan rate, $r < H - 1$. Hence, in this region, credit is rationed.

2.3 Resolving credit rationing with an upfront fee

In this section, we show how an upfront fee solves credit rationing. Since the upfront fee effectively prepays part of the interest on the loan, it allows the bank to reduce the loan rate and still break even. The results are also illustrated in Figure 4, where we use the same parameter values as in Figure 3.

Proposition 2: *There exists an upfront fee that resolves the credit rationing problem in Proposition 1.*

There are two equilibria with an upfront fee that can solve the credit rationing problem. In the first equilibrium, a properly set upfront fee y^* lowers the loan rate r^* sufficiently to avoid prepayment (the lower horizontal line in Figure 4), while in the second equilibrium the upfront fee y^{**} lowers the rate r^{**} sufficiently to make the loan contract feasible but with prepayment.

To prove Proposition 2, start with a loan contract that won't be refinanced after observing a high signal. Denote this contract as (y, r_y), where y is the upfront fee and r_y is the interest rate. Adding the upfront fee y changes the bank's break-even condition from Eq.(2) to

$$s(1 + r_y) + y = 1 \tag{8}$$

Here, we assume that the firm borrows 1, while it pays the upfront fee y out of its own pocket. Alternatively, we can assume that the firm borrows $1 + y$, and pays y to the bank as an upfront fee. Although the two assumptions generate the same conclusion, the former simplifies the mathematical analyses.

The upfront fee is to reduce the bank's break-even interest rate and hence induce the firm not to prepay. As the maximum interest rate for the firm not to prepay is $r_y^* = \frac{\alpha}{1-\theta}$, combining with Eq. (8), we have the *minimum* equilibrium upfront fee y^*:

$$y^* = 1 - s - \frac{s\alpha}{1 - \theta} \tag{9}$$

The upfront fee y^* allows an otherwise credit-rationed borrower to obtain a loan at the rate r_y^* that will not be refinanced at $t = \theta$.

While the above contract with y^* solves the credit rationing problem by completely eliminating prepayment, there exists another contract associated with prepayment after observing a high signal, which can also solve the credit rationing problem. With an upfront fee y and loan prepayment following a high signal, the bank's break-even constraint is

$$p(1 + \theta r_y) + (1 - p)q\big(1 + r_y\big) + y = 1 \tag{10}$$

For an equilibrium with prepayment, the maximum interest rate is $r_y^{**} = H - 1$, so the minimum upfront fee is

$$y^{**} = 1 - sH + p(1 - \theta)(H - 1) \tag{11}$$

The upfront fee of y^{**} allows the otherwise credit-rationed borrower to obtain a loan that will be refinanced at $t = \theta$ following a high signal.

Note that $\partial y^*/\partial s < 0$ and $\partial y^{**}/\partial s < 0$, so the required upfront fee increases with the project's *ex-ante* default probability $1 - s$.

2.4 Extension to performance-sensitive debt

Performance pricing is a widely used debt feature. In the period 1980–2017, 25% of all syndicated term loans issued by public U.S. firms and 4% of term loans issued by private firms had performance-linked loan pricing (Thomson SDC Platinum's Global New Issuance database). While the interest rate in the analysis above is structured as a fixed spread over a floating benchmark (LIBOR or prime), PSD allows the spread to vary with measures of borrower performance, such as credit rating or debt-to-cash-flow ratios. This suggests that PSD will reduce prepayment risk.

Proposition 3: *When the signal about project quality is contractible, PSD lowers prepayment risk and therefore the upfront fee in Proposition 2.*

To mimic PSD, suppose the above term loan rate is adjusted at $t = \theta$ to reflect the content of the signal. Because the project has negative NPV conditional on the low signal ($qH < 1$), the loan rate cannot be adjusted upward enough to completely capture project risk at $t = \theta$. Thus, PSD reduces, but does not fully resolve, the credit rationing problem and an upfront fee is still required for low values of s.

For brevity, consider the equilibrium contract (y^*, r_y^*) in Region IV, with a loan rate that precludes prepayment. PSD can be interest-increasing, interest-decreasing, or both. A PSD contract with both pricing grids now specifies three interest rates, r, r_h and r_l, where r is the original loan rate. The two latter rates, r_h and r_l, are the adjusted rates following a high and low signal, respectively, and $r_h < r < r_l$. The bank's break-even constraint is

$$p\big[1 + \theta r + (1-\theta) r_h\big] + (1-p)q\big[1 + \theta r + (1-\theta) r_l\big] + y = 1. \tag{12}$$

Because the loan rate is reduced after a high signal, the firm's incentive to prepay is now $r_h(1-\theta) > \alpha$. Since $r_h < r$, the likelihood of prepayment is lower for PSD. Note that also an interest-increasing PSD contract will reduce prepayment risk. This is because an increase in the loan rate after a low signal, $r_l > r$, will lower the initial equilibrium rate, so $r^*_{psd} < r^*$ (and $r^{**}_{psd} < r^{**}$), hence reducing prepayment risk. Performance pricing is tantamount to shifting the equilibrium loan curves r^* and r^{**} in Figure 3 and 4 downward, which causes the boundaries s_2 and s_3 to shift to the left.

To simplify further, let's assume $r = r_h$ and $r_l = r_h + \epsilon$, where $\epsilon > 0$, so the contract adjusts the rate upwards only. That is, the loan rate increases with ϵ after a low signal.[7] Combining Eq. (12) with the firm's incentive not to refinance yields the minimum upfront fee y^*_{psd}

$$y^*_{psd} \equiv 1 - s - \frac{s\alpha}{1-\theta} - (s-p)(1-\theta)\epsilon \tag{13}$$

Since $(s-p)(1-\theta)\epsilon > 0$, it follows that $y^*_{psd} < y^*$. That is, the PSD contract lowers the upfront fee required to solve the credit rationing problem. Moreover, while not shown here, $y^{**}_{psd} < y^{**}$, so performance pricing lowers the required upfront fee also for the equilibrium contract with prepayment that solves credit rationing in Region IV.

[7] With $r = r_l = r_h + \epsilon$, the PSD contract is interest-decreasing. With $r = r^*$, $r_l = r_h + \epsilon$, and $0 < r_l - r^* < \epsilon$, the PSD contract is both interest-increasing *and* interest-decreasing.

2.5 Extension to credit lines

Finally, in our setting, the primary difference between a term loan and a credit line is that the latter gives the option to delay the drawdown of the loan amount. Credit line contracts specify a menu of fees, which may be used to compensate the bank for this drawdown option: facility fee (annual fee paid on the entire committed amount regardless of usage), commitment fee (annual fee on unused portion of the loan), and upfront fee (one-time fee paid at loan closing).[8] Since the first two fees are paid annually over the term of the loan, a prepayment automatically terminates these fees. Therefore, raising the facility or commitment fees creates the same problem as when raising the loan rate: it increases the prepayment risk faced by the bank. Hence, as for term loans, the upfront fee is the only fee that can compensate the bank for the penalty-free prepayment option.

The following is an intuitive extension of the optimal upfront fee to a credit line. Suppose the firm is uncertain as to the exact timing of the project start-up, so it asks the bank for a credit line instead of a term loan. Moreover, assume that, while a delayed project start-up also delays the signal about project quality, the final payoff will still occur at time $t = 1$. 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 figures 3 and 4 from $r > \alpha/(1-\theta)$ to $r > \alpha/(1-\gamma-\theta)$, which lowers the required upfront fee y^*. In sum:

Proposition 4: *A credit line offers the option to delay project start, which lowers the equilibrium upfront fee relative to a term loan.*

3 Empirical test strategy

The central empirical prediction of the theory in Section 2 is that the upfront fee is increasing in loan prepayment risk. We test this prediction using the following cross-sectional baseline regression for a sample of N loans:

$$UpfrontFee_i = \beta_0 + \beta_1(Prepayment\ Risk_i) + \Gamma'\mathbf{X_i} + \mathbf{FE} + \epsilon_i \quad i, = 1, ..., N. \tag{14}$$

[8] Facility and commitment fees are mutually exclusive. The practice is for facility fees to be applied to investment-grade borrowers, while the bank charges a commitment fee to below-investment grade clients (Berg, Saunders, and Steffen, 2016).

UpfrontFee is the natural logarithm (log) of the upfront fee, measured in bps. *Prepayment Risk* is a proxy for the likelihood that the borrower will prepay, while **X** is a vector of characteristics capturing borrower credit risk and hence loan spreads and loan origination costs. **FE** is a vector of fixed effects. All variables are defined in Table 1. Our main theoretical prediction is $\beta_1 > 0$.

3.1 The prepayment risk index

Our main empirical proxy for a loan's prepayment risk, *Prepayment Risk Index*, combines five variables as follows:

$$\begin{aligned} PrepaymentRisk\ Index_i \equiv\ & Z(Return\ Volatility_i) + Z(Cash\ Flow\ Volatility_i) \\ & -Z(Relationship\ Intensity_i) - Z(Number\ of\ Lenders_i) \\ & +Z(Bond\ Spread_i). \end{aligned} \tag{15}$$

Z indicates that the variable is standardized with its cross-sectional mean and standard deviation (measured at the time of loan origination). Combining the five variables into a single index has two main benefits: (1) It allows us to constrain the sign of each variable in a way that is *a priori* consistent with its contribution to prepayment risk. (2) It eliminates the impact of multi-collinearity between the variables. However, for completeness, we also show the unconstrained coefficient estimates of the five variables in the analysis below.

To motivate the two first components of *Prepayment Risk Index*, recall that the borrower's prepayment of the loan is caused by a positive shock to firm performance. The variables *Return Volatility* and *Cash Flow Volatility* are two (correlated) proxies for the likelihood of receiving this positive shock. *Return Volatility* is the borrower's monthly stock return volatility measured over twelve months just prior to the loan-origination month. *Cash Flow Volatility* is the variance over the past eight quarters of the borrower's earnings before interests, taxes, depreciations and amortizations (EBITDA) scaled by the book value of total assets.

Next, recall from Section 2 that the prepayment risk is decreasing in the borrower's cost of refinancing the loan in the credit market (the parameter α in Eq. 1). The two variables *Relationship Intensity* and *Number of Lenders* are intended to capture this effect. The literature on relationship banking argues that banks tend to develop superior information about their borrowers, which may increase the borrower's costs of switching to another lender.[9] Assuming a bank's information about a borrower increases with each new loan, we define *Relationship Intensity* 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). 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 hence the higher the renegotiation costs (Bolton and Scharfstein, 1996; Brunner and Krahnen, 2008).

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 (not seasonally adjusted, in logs).[10] 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). While this particular type of refinancing is outside of our model, it may empirically contribute to the cross-sectional variation in the prepayment risk facing the bank—hence, we include it in *Prepayment Risk Index*.

3.2 Control variables in the baseline regression

Recall that, in our theoretical framework (Proposition 2), 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 $\mathbf{X}$ and instead includes firm and loan characteristics that may drive the counterfactual spread.[11] That is, the characteristics in $\mathbf{X}$ are intended to control for the cross-sectional variation in the credit risk $(1 - s)$ that underlie this unobservable spread. 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 $\mathbf{X}$ are largely exogenous to the upfront fee.

The vector $\mathbf{X}$ 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*

[9] E.g., Sharpe (1990), Rajan (1992), Sufi (2007), Bharat, Dahiya, Saunders, and Srinivasan (2011), and Mosk (2018).
[10] The bond spread data are from https://fred.stlouisfed.org/series/AAAFFM.
[11] In Section 5.4, we demonstrate that adding AISD to the baseline regression does not affect our main conclusion.

(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 use rating as a proxy for the firm being less constrained (Farre-Mensa and Ljungqvist, 2016).[12]

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 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).[13] The fifth fixed effect is loan purpose: general, recapitalization, and acquisition, as categorized in Carey, Post, and Sharp (1998).[14]

4 Sample selection and description

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

[12] 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.

[13] 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.

[14] 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.

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 12/2018.[15] 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.[16] 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 5 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. In contrast to term loans, after

[15]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).

[16]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.

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 5 also shows the annual average AISD. As shown 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. Figure 6 further shows that the level of the upfront fee increases exponentially in the AISD decile, in particular in term loans (Panel A).

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. 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 cost. 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.[17]

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

[17]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.

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.[18] 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.

[18] 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.

4.3 Univariate test statistics

Table 3 shows univariate test statistics. 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*.

Panel B of Table 3 splits the loan samples based on performance-pricing. As shown, the average 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. In sum, the evidence in Table 3 show a positive correlation between upfront fees and our empirical proxies for prepayment risk, as predicted by our model.

4.4 Correcting for the self-selection in fee reporting

Upfront fees (also called arrangement fees or participation 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 loan amount paid out. 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). This raises a concern with a potential self-selection in the reporting of fees, which may bias the coefficient estimates in the cross-sectional regression Eq. 14.

To address this concern, we implement a Heckman (1979) two-step self-selection model with the following first-step probit estimation:

$$Y_i = a + b(Distance\ to\ NY) + \mathbf{FE_i^h} + e_i, \quad i = 1, ..., N^h, \tag{16}$$

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 second-step OLS regressions for the upfront fee.

5 Upfront fees and prepayment risk: Cross-sectional tests

In this section, we show the OLS estimates from the 2^{nd} step regression of Eq. (14), where the first step estimates the Inverse Mill's Ratio for self-selection in the borrower's decision to publicly disclose the upfront fee (Eq. 16). We first estimate the impact on upfront fees of the prepayment-risk index, followed by the impact of the contemporaneous merger activity in the industry of the borrower. We then turn to performance-sensitive debt, and end the analysis with robustness tests.

5.1 Impact of 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. (15). *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 hypothesis 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. 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 loan 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 is 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). While this incentive to prepay falls outside our model where market spreads are time-invariant, this type of prepayment risk is also relevant to the bank.

Turning to the prepayment risk index in columns (4)-(6), which combines the five individual proxies for prepayment risk (Eq. 15), it receives a positive and highly significant coefficient estimate in all three regressions, as predicted. In columns (3) and (6), the dummy variable *Credit Line* receives a negative and significant coefficient, also as predicted (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. While not tabulated, the coefficient estimate for

Prepayment Risk is positive and highly significant also when the index is replaced by an indicator for above-median prepayment risk. Further, 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.[19]

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 is 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 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 have lower origination costs and therefore 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 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, hence 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 a relatively low prepayment risk—hence the lower upfront fee. Finally, *Security* receives a positive and significant coefficient estimate, similar to Ivashina (2009). As lenders tend to demand collateral from high-credit risk borrowers, origination costs are also higher as reflected in higher upfront fees.

The sign and significance of the coefficient estimates in columns (3) and (6), which pool the term loans and credit lines, are typically consistent with those reported for the two loan types individually. The exception to this is *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 decline in loan size, indicating that loan origination costs have a fixed component. Moreover, loan origination costs are likely higher for long-lived

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

loans—hence the positive coefficient estimate in the pooled regressions.[20]

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 Prepayment risk and industry dynamics

Recall that, in our model, prepayment risk is caused by borrowers' upside potential, which is the likelihood of a positive signal about the project payoff. To generate exogenous variation in this prepayment risk—and therefore in upfront fees—we use merger activity in the industry of the borrower. This instrument identifies shocks to loan prepayment risk as corporate takeovers often trigger prepayment or restructuring of the target's debt obligations. Moreover, since extant evidence indicates that high-quality firms are more likely to become targets than low-quality firms (Eckbo, 2014), the merger shock tends to hit the prepayment risk of borrowers with relatively high upside potential—precisely the borrower-type requiring upfront fees in our model. Also, since the industry merger shock is unlikely to affect borrower credit quality and therefore loan origination costs, it satisfies the exclusion restriction for a valid instrument.

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, these 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 *Industry M&A Intensity* and *High M&A Intensity* receive positive and statistically significant coefficient estimates both in term loans and credit lines. Note also that *Prepayment Risk Index* continues to receive a positive and significant coefficient of a similar magnitude as in Table 4. Further,

[20] The parameter θ in our model—the time lapse between loan origination and the arrival of the signal about the project's payoff—does not address loan maturity.

in columns (5) and (6), the indicator *Credit Line* retains its magnitude and negative sign after adding merger intensity. This evidence strongly supports our theory that upfront fees are used to compensate the bank for the penalty-free prepayment option.

As an alternative 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. In other words, 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 sales growth in the future, i.e., the higher is the *ex ante* prepayment risk. Adding support to this argument, the two star-index variables receive positive and significant coefficient estimates in five of the six regression models.

In sum, upfront fees tend to be higher for borrowers in industries with relatively high M&A intensity and high upside growth potential, where the prepayment risk is also higher. It is also worth pointing out that this positive relation between upfront fees and industry dynamics is not easily explained by alternative cost-based hypotheses, in which upfront fees only compensate for the bank's cost of originating the loan.

5.3 Performance-sensitive debt (PSD)

In PSD, the otherwise fixed interest spread in term loans and credit lines is contractually adjusted to reflect changes in borrower quality over the term of the loan. As explained in connection with Proposition 3 in Section 2.4, this contractual spread adjustment allows the bank to lower the *initial* loan spread, which in turn helps to solve the credit rationing problem. Thus, Proposition 3 predicts that upfront fees are lower for performance-sensitive debt than for fixed-spread loans.

We test Proposition 3 in columns (1), (3) and (5) of Table 6. As shown, the coefficient estimates for PSD are all negative and highly significant. Moreover, in columns (2), (4), and (6), the coefficients for spread-decreasing and spread-increasing PSD are negative and significant at the 1% and 10% levels, respectively. Also important, our central variable *Prepayment Risk Index* continues to receive positive and significant coefficient estimates in all regressions. This shows that the impact of PSD attenuates the pervasive impact of prepayment-risk on upfront fees, as predicted. Moreover, the indicator *Credit Line* in columns (5) and (6) receives negative coefficient estimates of an almost identical magnitude to those in our baseline regressions (columns 3 and 6 of Table 4).

In our model, Proposition 3 proves that performance pricing lowers the upfront fee for both interest-increasing and decreasing grid adjustments. Our prediction that upfront fees will be lower also for spread-decreasing PSD is opposite to the prediction presented by Berg, Saunders, and Steffen (2016), who hypothesize higher upfront fees in these loans (their Hypothesis 3, p. 1371). The different predictions is due to a focus on two fundamentally different types of risks facing the bank. While we posit that upfront fees compensate the bank for prepayment risk, which is lower in spread-decreasing PSD than in fixed-spread loans, Berg, Saunders, and Steffen (2016) propose that upfront fees compensate for drawdown risk, which is higher in spread-decreasing PSD.

Berg, Saunders, and Steffen (2016) find that upfront fees are on average of a similar magnitude in PSD with spread-decreasing grids as in loans without performance pricing (their Table V). However, expanding the PSD analysis to our cross-sectional regression, the evidence in Table 6 is consistent with our Proposition 3. Specifically, relative to loans without performance pricing, we show that upfront fees are significantly lower in PSD with spread-decreasing grids. Note also that, while Berg, Saunders, and Steffen (2016) perform a univariate analysis, the results in Table 6 control for *Prepayment Risk Index* as well as the controls in **X**, **FE** and the Inverse Mills Ratio. In sum, Table 6 supports our theory that banks use the upfront fee to compensate for the prepayment option but not the drawdown option.[21]

5.4 Additional robustness tests

In this section, we provide three robustness checks on the impact of our prepayment risk index. Beginning with Table 7, the variable *Option Upside Potential* replaces our prepayment risk index as a determinant of the upfront fee. While the latter is computed using *ex post* measures of the borrower's upside potential, *Option Upside Potential* is a forward-looking measure based on option prices. It is measured using call option prices traded on a subsample of 2,522 term loan and credit line facilities, using data from Option Metrics, 1997-2018. For each borrower, among the options trading on the loan origination date, we select the call option where (1) the exercise price is closest to the stock price and (2) has a maturity closest to 180 days.[22] For this call option, *Option Upside Potential* is the average daily ratio of the option price to

[21]The evidence in Panel B of Table V in Berg, Saunders, and Steffen (2016) indicates that banks use the AISU to compensate for the drawdown option in credit lines: AISU is higher for PSD-decreasing grids relative to credit lines without performance pricing.

[22]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 underlying stock's closing price over the month leading up to the loan origination date.

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

Second, as discussed in Section 3.2, 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 robustness check on the impact of our prepayment risk index. As expected, the coefficient estimates for AISD are positive and highly significant. Importantly, adding AISD does not affect the sign or significance of *Prepayment Risk Index*. Moreover, the coefficient estimates for *Prepayment Risk Index* are only slightly lower than in Table 4. Also, credit lines continue to have lower upfront fees than term loans. Overall, this evidence indicates that prepayment risk is strongly reflected in the upfront fee and *not* subsumed by AISD.

Third, recall from Section 2.5 that, as for the loan spread, using AISU to compensate the bank for prepayment risk in credit lines may lead to credit rationing of high-risk borrowers. This is because raising the spread and/or the AISU increases the prepayment risk of *ex post* high-quality borrowers. Therefore, we do not expect our prepayment risk index to help explain the cross-sectional variation in AISU. To test this argument, we replace the upfront fee with AISU as the dependent variable in columns (4) and (5) of Table 8. In column (4), the loan sample consists of all credit lines in the expanded sample with a commitment or facility fee, while Column (5) imposes the additional requirement of an upfront fee being reported. Again, the coefficient on AISD is positive and highly significant. More important, *Prepayment Risk Index* receives a statistically insignificant coefficient in both columns. Taken together, the evidence that upfront fees but not AISU are correlated with the prepayment risk index confirms our argument that the upfront fee is the only fee used to compensate lenders for the penalty-free prepayment option.

The evidence in Table 8 also helps clarify the conclusions of extant studies addressing the role of upfront fees in C&I loans. First, Ivashina (2009) finds that the upfront fee is independent of the standard

the call prices.

deviation of the lead bank's loan-portfolio default probability. This suggests that upfront fees compensate lenders for loan origination costs and not for downside credit risk. On the other hand, Berg, Saunders, and Steffen (2016) find that upfront fees increase with return volatility, which they attribute to compensation for the drawdown option in credit lines.[23] However, since return volatility does not separate downside from upside risk, it leaves open the possibility that the upfront fee instead prices the penalty-free prepayment option, as our theory proposes. Our finding that the prepayment-risk index is positively correlated with the upfront fee and, at the same time, uncorrelated with AISU supports this key proposition. Moreover, it suggests that the upfront fee is the *only* fee used to compensate for the prepayment option.

6 Conclusion

Over the past three decades, half of the institutional tranches in C&I loans (tranche B and lower), and as much as 90% of the loan facilities in tranche A, which are typically held by commercial banks, allow for penalty-free prepayment. We present a novel theoretical and empirical analysis of how loan spreads and upfront fees combine to compensate lenders for including this penalty-free prepayment option. While this option eliminates the potential for costly *ex post* bargaining, it invites exercise by high-quality clients, which erodes the average quality of the bank's remaining pool of borrowers. We show that compensating the bank for this option by raising the loan rate increases prepayment risk and may result in credit rationing. However, combining a properly scaled upfront fee with a *lowering* of the loan rate satisfies the bank's participation constraint and thus solves credit rationing.

The main prediction of our theory is that the higher the borrower's prepayment risk at the time of loan origination, the higher the upfront fee required to support the penalty-free prepayment option. We test this fundamental proposition using a sample of 8,000 C&I term loans and credit lines issued by U.S. public firms, 1987–2018. The empirical tests collectively support our main model prediction as upfront fees are shown to be increasing in our proxies for prepayment risk, which include a prepayment risk index and a forward-looking measure of the upside potential implied by option prices. Also as predicted, upfront fees are lower in credit lines than in terms loans, and lower for both spread-decreasing and spread-increasing PSD, which reduces the *ex post* adverse reclassification of borrowers that give rise to the need

[23] "Taken together, our results suggest that higher volatility of stock returns and profitability are associated with higher upfront fees and a higher AISU, consistent with the hypothesis that lenders demand greater compensation if borrowers are more likely to draw down their credit lines." (Berg, Saunders, and Steffen, 2016, p.1371).

for charging upfront fees.

Also interesting, we use industry-level M&A intensity to identify exogenous variation in the loan prepayment risk. Since takeover targets typically prepay their debt, and since high-quality firms are more likely to become targets than low-quality firms, this exogenous variation speaks directly to our theoretical model. We show that upfront fees are significantly increasing in industry M&A intensity as well—an effect that is unlikely to be explained by changes in loan origination costs. In sum, our evidence supports that upfront fees are used to cover not only direct transaction costs of loan origination but also to satisfy lenders' participation constraints when loan contracts include a 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).

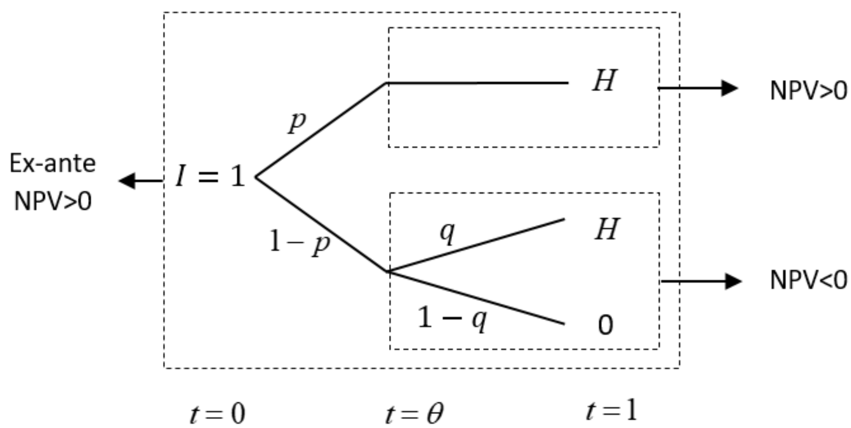


Figure 2: **Time line of the model**

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.

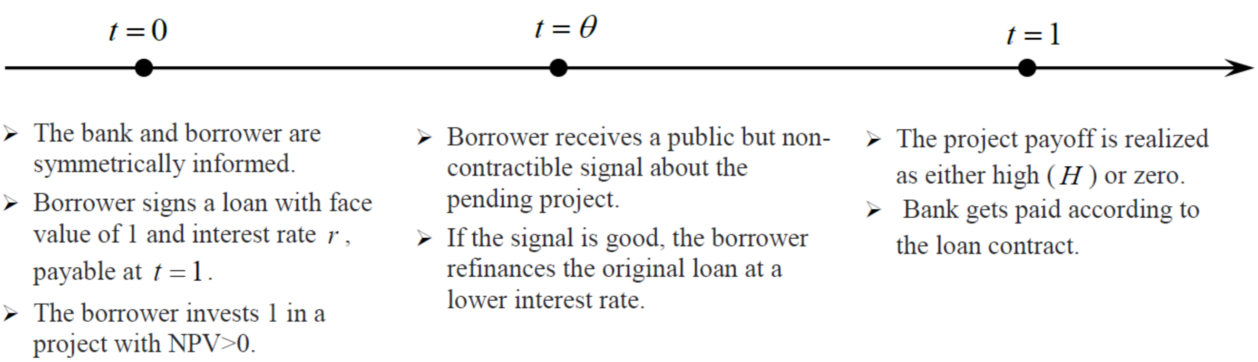


Figure 3: **Equilibrium loan rates and credit rationing without upfront fees**

This figure shows how the equilibrium loan rates of the two contracts vary with the project's success probability s. The two horizontal lines show the firm's incentive to prepay, $r > \alpha/(1-\theta)$, and the feasible loan contract, $r < H - 1$. In Region I ($s > s_1$), the equilibrium contract has loan rate r^* and will not be refinanced. In Region II ($s_2 < s < s_1$), there are two equilibria. The project can be financed at loan rate r^* with no prepayment or r^{**} with prepayment and refinancing at time $t = \theta$ following a good signal. In Region III ($s_3 < s < s_2$), the loan rate is r^{**} with prepayment risk. In Region IV ($s < s_3$), project risk is so high that prepayment risk induces credit rationing. For $s < 1/H$, the project has $NPV < 0$ and will not be undertaken. The parameter values used for the figure are $\alpha = 0.8$, $\theta = 0.1$, $H = 4.5$, and $q = 0.2$.

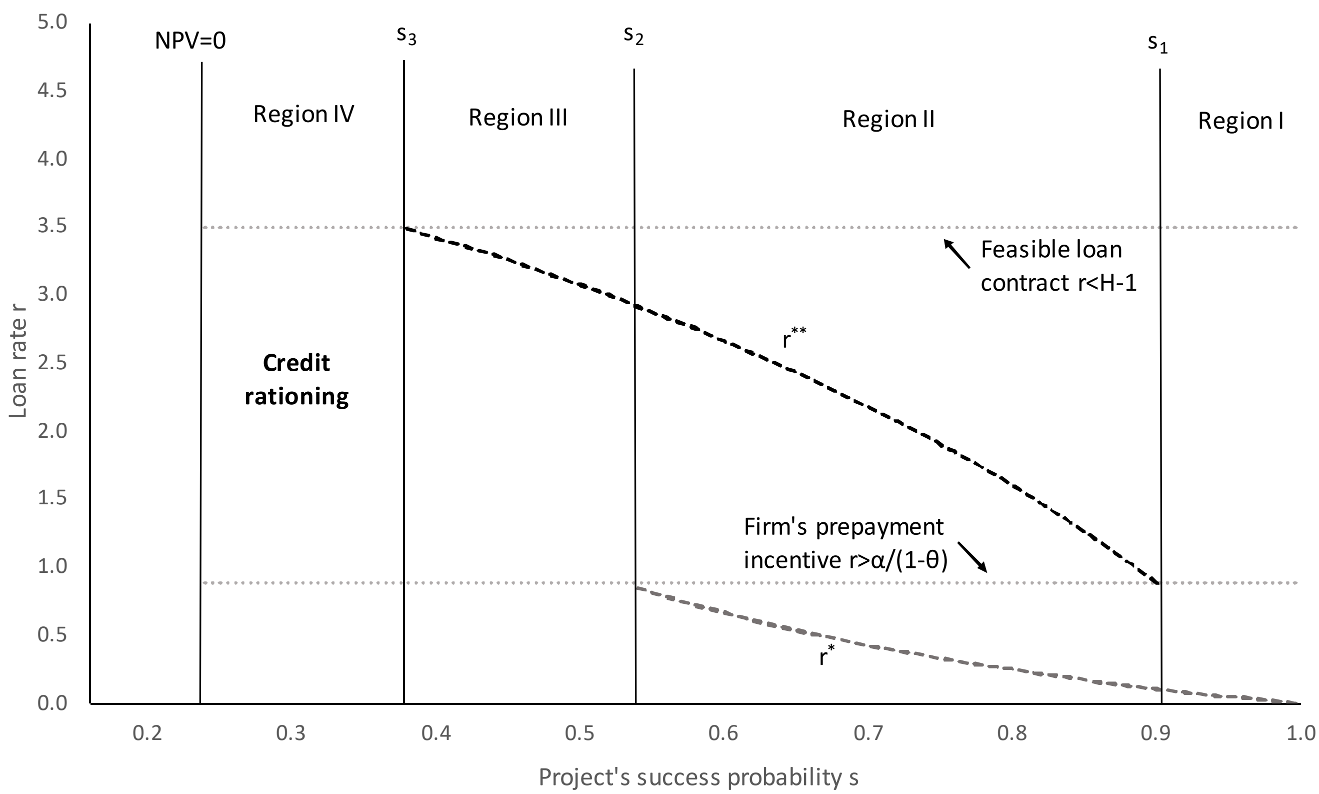


Figure 4: **Equilibrium loan rates and upfront fees that resolve credit rationing**

This figure shows how the credit-rationing problem illustrated in Figure 4 illustrated can be resolved by adding an upfront fee y^* associated with loan rate r_y^* or a fee y^{**} associated with r_y^{**}. The parameter values used for the figure are $\alpha = 0.8$, $\theta = 0.1$, $H = 4.5$, and $q = 0.2$.

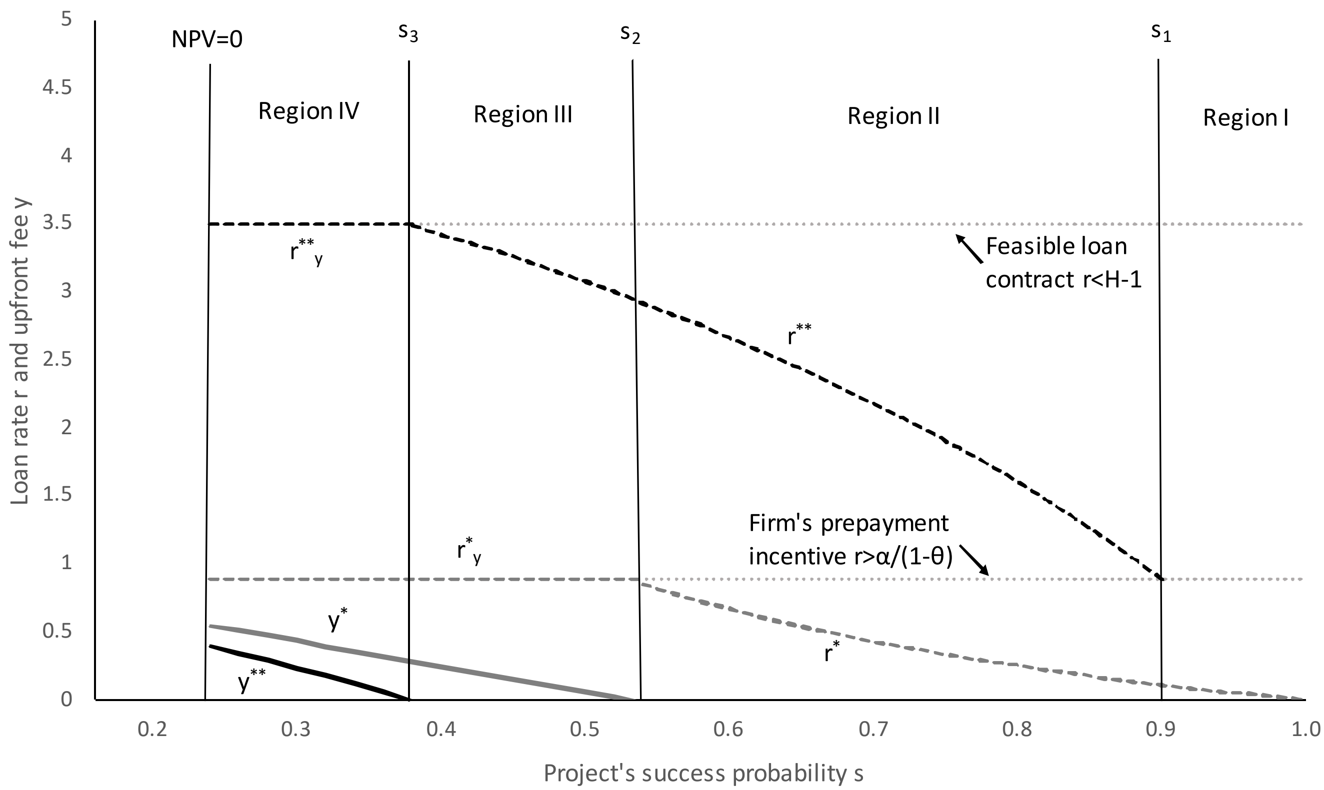
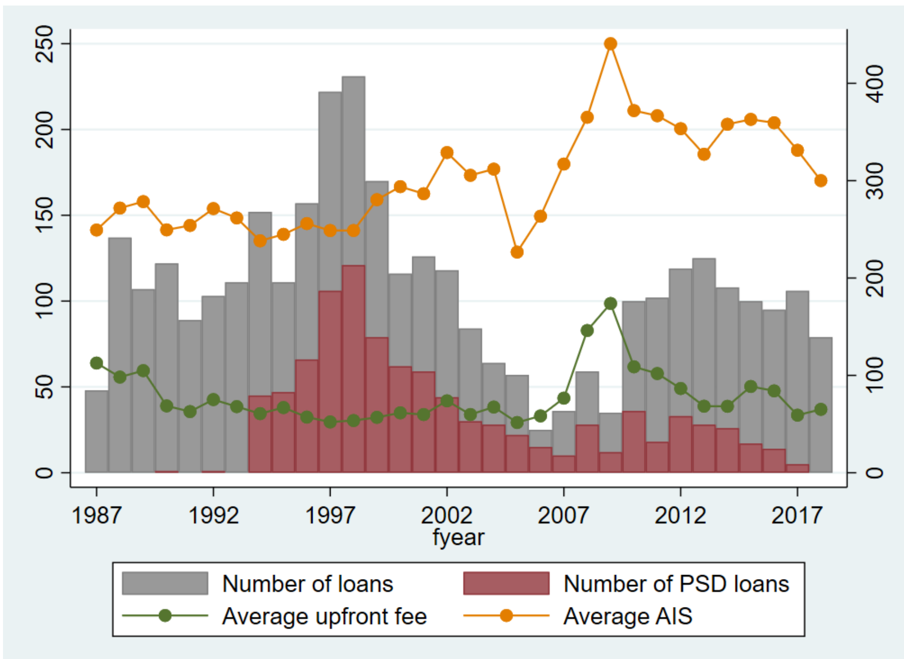


Figure 5: **Annual distribution of sample loans, performance pricing, and fees**

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

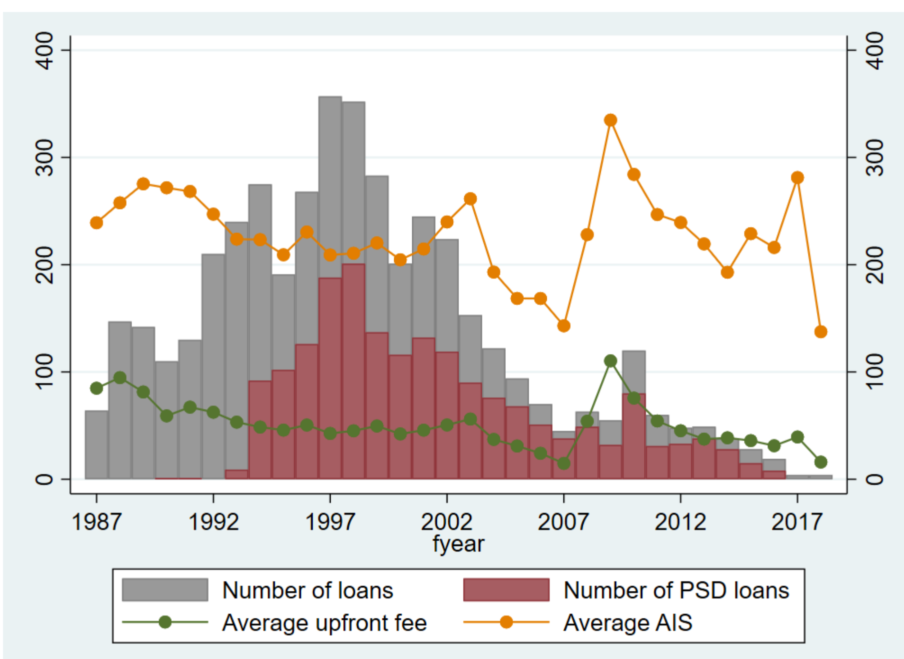
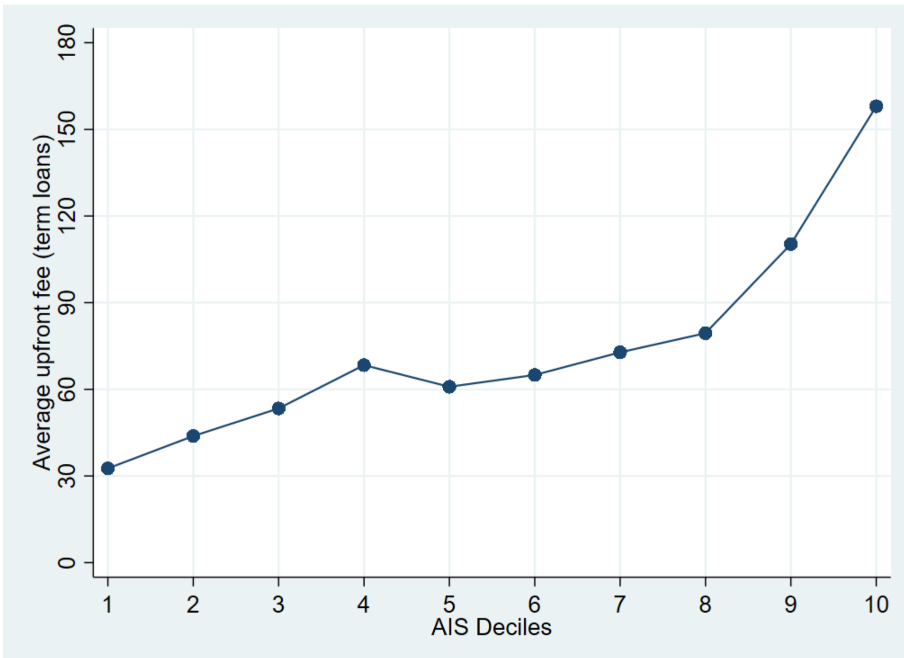


Figure 6: **Distribution of the upfront fee**

The figure shows the average upfront fee by the all-in-spread (AIS) decile. 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: Average upfront fees by AIS decile in the sample of term loans



B: Average upfront fees by AIS decile in the sample of credit lines

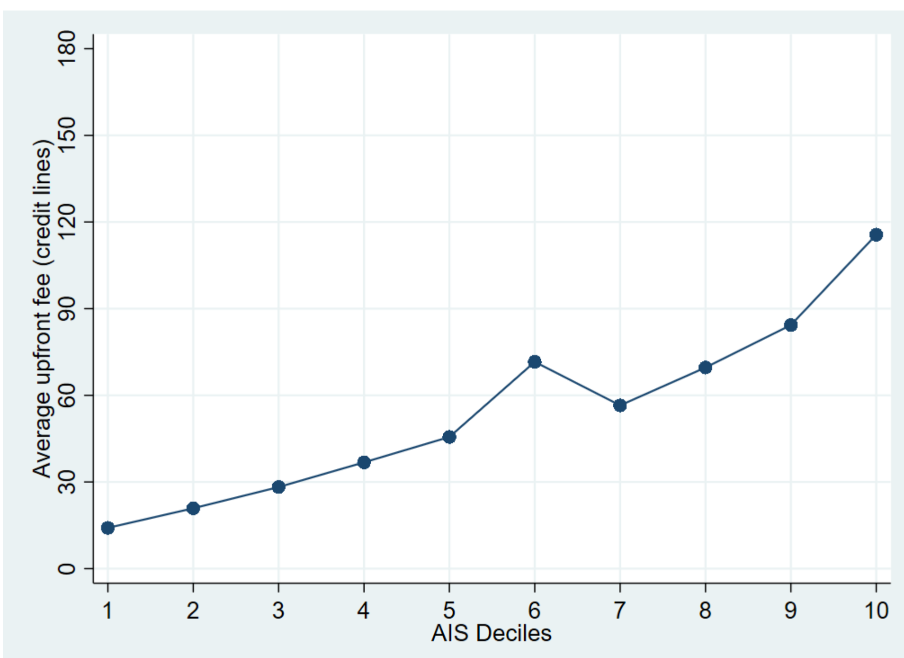


Table 1: Variable definitions

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 prepay-ment risk		High prepay-ment risk		Difference in mean	Low prepay-ment risk		High prepay-ment 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. (14), 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. (15), 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. (14), 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. (14), 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. (14), 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: Robustness tests: 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. (14), 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. (15), 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