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"Upfront fees and prepayment risk in bank loans"

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Upfront fees and prepayment risk in bank loans*

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Abstract

We present new, large-sample evidence on commercial and industrial loans, which allow borrowers to prepay without penalty. In a simple theoretical framework, after receiving a private non-contractible signal, *ex-post* high-quality firms strategically refinance. We show that the prepayment option may trigger credit rationing, which an upfront fee can resolve. Empirical tests show that upfront fees increase with prepayment risk, consistent with the model. Moreover, fees are higher after an exogenous shock to prepayment risk, instrumented with industry merger activity. Upfront fees are also lower for performance-sensitive debt and credit lines, as predicted.

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1 Introduction

US commercial and industrial (C&I) loans stipulate a fixed interest rate spread over a floating (risk-free) base rate to compensate the lender for default risk. The spread is conventionally determined under the assumption that the loan is held until maturity, with an exogenous default probability. However, borrowers typically have the option to prepay the loan without penalty.[1] Using a simple contracting model, we show that this option substantially complicates loan pricing. The problem is that, when credit risk is not fully contractible *ex ante*, the option induces *ex post* strategic loan prepayment, which lowers the bank's expected return on the loan. A central result is that the bank cannot always capture the value of the prepayment option by raising the initial loan spread, as it exacerbates the adverse prepayment risk. We show, however, that a properly scaled upfront fee can solve this contracting problem. We follow up with large-sample empirical tests of the model's predictions for the cross-sectional variation in upfront fees.

While the theoretical banking literature often focuses on separating equilibria, in which the bank can correctly identify the borrower type *ex ante*,[2] we instead assume that firms do not know their type at the time of loan origination. Specifically, borrowers invest the loan and only later receive private information about the quality of the investment project and thus their own credit risk. We invoke this assumption primarily to generate theoretical predictions that explicitly involve loan prepayment risk. We know from extant research that prepayment risk is empirically important. In particular, Roberts and Sufi (2009) and Roberts (2015) document that 90% of long-term loan contracts are renegotiated prior to maturity and the renegotiations tend to occur early in the loan term. These renegotiations appear to be strategic as they are typically initiated by firms demanding better terms.[3]

From a theoretical perspective, models that produce separating equilibria with renegotiation-proof debt contracts cannot make predictions about systematic renegotiation activity. For example, in Boot et al. (1987), high credit spreads induce risk shifting. While an upfront fee may help control for this adverse incentive, they derive an equilibrium with a first best loan contract, which itself is renegotiation proof. In other important theoretical work, Thakor and Udell (1987) and Shockley and Thakor (1997) use

[1] The pro-rata tranche (A), which is held by commercial banks, typically has no prepayment penalty. Term loan institutional tranches (B and lower) sometime have cancellation fees, which are a form of prepayment penalty.

[2] Chan and Kanatas (1985), Boot et al. (1987), Thakor and Udell (1987), Chari and Jagannathan (1989), and Shockley and Thakor (1997).

[3] Corporate bonds are also often refinanced prior to the due date. The fixed bond coupon creates refinancing incentives in response to changing market conditions. Xu (2018) finds that high-risk issuers refinance to extend bond maturity.

the two-part fee structure (commitment and utilization fees) in credit lines to perfectly screen borrower types, again leaving no formal role for subsequent renegotiations. In our setting, the bank and firm are initially symmetrically informed and firms dynamically learn about their credit quality. Hence, strategic prepayment becomes economically relevant and, as we show, can be mitigated with an upfront fee.

In our setting, increasing the credit spread at loan origination may not fully compensate the bank for the deterioration of the loan portfolio resulting from strategic prepayments. A higher spread increases the incentive for high-quality borrowers to prepay, which worsens the pool *ex post*. For loans with high prepayment risk *ex ante*, the penalty-free prepayment option leads to credit rationing unless the bank finds a non-price mechanism to compensate for providing this option. Our model identifies a properly calibrated upfront fee as such a mechanism. The fee permits the bank to lower the credit spread and thus reduce prepayment risk to the point where the bank breaks even.[4]

Our model can also be applied to performance-sensitive debt (PSD), where the credit spread is adjusted automatically in response to changes in borrower quality (indicated by, e.g., a change in credit rating) over the term of the loan. This loan rate adjustment in itself reduces prepayment risk—whether by lowering the rate for high-quality firms or increasing the rate for low-quality firms. Hence, PSD lowers the required upfront fee in our model. Performance pricing is a common feature of C&I loans (Asquith et al., 2005; Manso et al., 2010; Tchistyi et al., 2011). However, while earlier work largely views PSD as a solution to borrower agency issues, our focus is on PSD as a device to mitigate prepayment risk.[5]

We examine the model predictions with a sample of almost 7,000 C&I term loans and credit lines. The upfront fee is economically significant in these loans. It averages about 80 basis points (bps) of the face value, or about one-third of the all-in-spread (the annual cost), of a term loan. Since loan contracts do not state the specific purpose of the upfront fee, however, empirical identification is an issue. Upfront fees could also be used to cover loan origination costs (Ivashina, 2009) and perhaps even to capture economic rents (Schwert, 2018). Our empirical strategy is to use the cross-sectional variation in the upfront fee to examine predictions that help distinguish our prepayment risk compensation arguments from the more traditional views of the fee.

Specifically, our model predicts that the upfront fee is increasing in loan prepayment risk and is lower

[4]Alternatively, as in Stiglitz and Weiss (1981), the bank can reduce the credit risk by requiring loan collateral. However, collateral involves screening, monitoring, and repossession costs (Berger et al., 2011b) and may be a costly way to control prepayment risk. We control for collateral in the empirical analysis below.

[5]Asquith et al. (2005) also suggest that interest-decreasing PDS may counteract loan prepayment.

for credit lines (than for term loans) and for PSD (than for loans without performance pricing provisions). We test the predictions by constructing a prepayment risk index, which combines several different proxies for prepayment risk. The proxies include measures of firm performance volatility and refinancing costs, which are negatively related to prepayment risk. They also include the market-wide spread at the time of origination, since loans issued when spreads are relatively high are more likely to be refinanced.

The data supports all three predictions. The upfront fee increases with our measures of prepayment risk and is on average lower in credit lines and loans with performance pricing. We also find that the upfront fee is increasing in the exogenous takeover threat within the industry of the borrower. Since a takeover often triggers loan prepayment for the target firm and high-quality firms are more likely to be acquired, this finding further supports the basic interpretation of the upfront fee as a mechanism to mitigate prepayment risk.

Finally, why not impose a prepayment penalty rather than an upfront fee? Dunn and Spatt (1985) and Mayer et al. (2013) argue that a prepayment penalty may be welfare improving in the context of fixed-rate mortgages. Their focus is, however, on household welfare, where an objective is to make credit available to low-income households. We instead focus on under-investment in positive net present value (NPV) projects due to credit rationing. In a corporate loan setting, a prepayment penalty is likely to invite costly bargaining over the penalty *ex-post.* It is worth noting that corporate bonds look more like mortgages, in the sense that they tend to have fixed rates and prepayment penalties. Bank loans, on the other hand, typically allow firms to refinance without imposing penalties. It is unclear whether a properly calibrated upfront fee dominates a prepayment penalty as a way to regulate the bank's concern with loan prepayment risk, or whether penalty-free loan prepayment is driven by other considerations. This is an important questions that we leave for future research to address.

In the following, Section 2 describes the model and our strategy for testing the resulting empirical hypotheses. Sections 3 and 4 provides the data and empirical evidence. Section 5 discusses the evidence more broadly, while Section 6 concludes the paper.

2 Loan pricing with prepayment risk

This section presents a simple model of C&I loan pricing with penalty-free prepayment. As indicated in the introduction, since our main focus is on the bank's concern with adverse selection due to *ex post* strategic loan prepayments, we assume that credit risk is not perfectly contractible *ex ante*. One can think of the model as pertaining to the residual non-contractible credit risk after the bank has applied its usual screening devices. The contracting parties are initially symmetrically informed with respect to this residual credit risk.

Strategic loan prepayment activity arises *ex post* because, after the borrower invests the loan amount, it receives non-contractible information about the project's payoff. If the information indicates that the initial loan spread exceeds the conditional market rate, the borrower refinances the loan (marking to market). The bank's problem is that the borrower choose not to prepay if the information indicates that the opportunity rate is higher than the current loan rate. We first show that this adverse reclassification of the borrower pool could lead to credit rationing. We then show that a properly scaled upfront fee can restore an equilibrium with lending.

2.1 Model setup

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 any time 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 $t = 1$. 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 $q < 1$. Thus, at time $t = 0$, the probability of the high outcome is $s \equiv p + (1 - p)q$, henceforth the project's success probability. The firm borrows and invests only if its expected profit $E(\pi) = sH - 1 > 0$, i.e., when project NPV>0. Moreover, we assume that $qH < 1$, so the project has a conditional negative NPV following the low signal. The firm and the bank are symmetrically informed about the expected payoff at time $t = 0$. The bank determines the loan rate r so as to break even, taking into account that the borrower may prepay at time $t = \theta$. A feasible loan contract that is acceptable to the bank also requires that $1 + r \leq H$.

While prepayment is penalty free, so the bank does not receive any compensation, we assume that the firm incurs a costs $\alpha > 0$ to negotiate a replacement loan in the credit market. We add this assumption to allow for the possibility that the firm may self-select to *not* prepay. While not critical to our argument about credit rationing, it is empirically interesting to allow for this outcome as well. The firm prepays the loan if and only if:

$$r(1-\theta) > \alpha. \tag{1}$$

Following the signal at $t = \theta$, the left-hand side of Eq. (1) is the interest payment remaining on the loan. The original loan rate r exceeds the firm's opportunity loan rate of zero (the risk-free rate) conditional on a high signal. Thus, for a given loan rate r, prepayment is more likely the earlier the firm receives the private signal (the lower is θ) and the lower is the refinancing cost α.

2.2 Prepayment risk and credit rationing

We are interested in equilibrium loan pricing as a function of the project's success probability:

Proposition 1: *For a sufficiently low success probability s and without an upfront fee, the penalty-free prepayment option causes credit rationing.*

The proof is driven by the partial derivative $\partial r(s)/\partial s < 0$, implying that the loan rate r increases with project default risk. Intuitively, since a higher loan rate increases the firm's incentive to prepay under Eq. (1), it further increases the rate required for the bank to break even in expectation, ultimately resulting in lending being infeasible (credit rationing).

Panel A of Figure 3 illustrates how the equilibrium loan rate varies with s over the range $s \in [1/H,\ 1]$. The lower bound of this range, indicated by the vertical line to the left in the figure, reflects that the risk-neutral firm invests only if the expected payoff is positive ($NPV > 0$). The four regions in Figure 3 are separated by the boundaries s_1, s_2, s_3 (the three vertical lines to the right of the line for $NPV = 0$). We derive these boundaries below.

The rate r^* denotes an equilibrium loan rate that is sufficiently low for the borrower optimally not to exercise the prepayment option, regardless of the private signal at time $t = \theta$. Moreover, r^{**} denotes the higher equilibrium rate consistent with prepayment taking place following a high signal. The two rates, which both are shown in the figure, are separated by the horizontal line for the firm's incentive to prepay as stated in Eq. (1).

For high values of s, the equilibrium loan rate is sufficiently low for the firm to never exercise the prepayment option, regardless of the private signal. In this case, the bank finances the project at the loan rate r^* and there is no prepayment. This occurs in Region I and Region II, for $s \geq s_2$. The bank's break-even condition, $s(1+r) = 1$, combined with the firm's incentive to not prepay (Eq. 1), yields

$$r^* = \frac{1-s}{s} \quad \text{and} \quad s_2 = \frac{(1-\theta)(1+p\alpha)}{1-\theta+\alpha}. \tag{2}$$

Given the high success probability 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). In Region II, however, 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

$$p(1+\theta r) + (1-p)q(1+r) = 1. \tag{3}$$

The first term in Eq. (3) 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 Eq. (3) and the firm's incentive to prepay in Eq. (1), yields

$$r^{**} = \frac{1-s}{s-p(1-\theta)} > r^* \quad \text{and} \quad s_1 = \frac{1-\theta}{1-\theta+\alpha} > s_2. \tag{4}$$

In Region II, r^* and r^{**} are both equilibrium loan contracts in the sense that the lender breaks even with either of those two loan rates. That is, the bank can choose a loan rate r^* that will never be prepaid or a rate r^{**} that will be refinanced at $t = \theta$ following a high signal.

In Region III, where $s_3 \leq s < s_2$, the rate r^* is too high to avoid triggering prepayment and the only equilibrium rate is r^{**}, which will be refinanced following a high signal. At the threshold s_3, the rate r^{**} becomes so high that it is limited by the feasible loan contract $r^{**} < H - 1$ acceptable to the bank (the upper horizontal line). Combining Eq. (3) with the feasible loan contract yields

$$s_3 = \frac{1}{H}\Big[1 + p(1-\theta)(H-1)\Big] < s_2. \tag{5}$$

In Region IV, where $s < s_3$, there is no equilibrium loan contract with a prepayment option that can finance a positive NPV project. This is because the loan rate necessary to compensate the bank for the high default risk and prepayment risk exceeds the rate feasible for the bank. Proposition 1 refers to this region, where credit is rationed.

Panel B of Figure 3 shows how the introduction of the upfront fee y can resolve 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.

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

There are two ways an upfront fee can mitigate credit rationing. The upfront fee y^* lowers the loan rate r^* sufficiently to avoid prepayment (the lower horizontal line in Figure 3), while the fee y^{**} lowers the rate r^{**} sufficiently to make the loan contract feasible (the upper horizontal line).

To prove Proposition 2, start with the credit rationing caused by the loan rate r^* (Region III and Region IV). Adding an upfront fee y changes the bank's break-even condition to $s(1 + r_y) + y = 1$. Combined with the firm's incentive to prepay in Eq. (1), this yields an equilibrium with no prepayment, loan rate r_y^* and upfront fee y^*:

$$r_y^* = \frac{1 - s - y^*}{s} = \frac{\alpha}{1-\theta} \quad \text{and} \quad y^* = 1 - s - \frac{s\alpha}{1-\theta} = s(r^* - r_y^*). \tag{6}$$

That is, 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 $t = \theta$.

Next, we show that the upfront fee y^{**} resolves the credit rationing associated with r^{**} in Region IV. With a fee and loan prepayment following a high signal, the bank's break-even constraint is

$$p(1 + \theta r) + (1-p)q\big(1 + r\big) + y = 1. \tag{7}$$

For a high-risk firm with $s < s_3$ to receive the loan in an equilibrium with prepayment, the rate must also satisfy $1 + r_y^{**} \leq H$, yielding

$$r_y^{**} = H - 1 \quad \text{and} \quad y^{**} = \frac{1-s}{s - p(1-\theta)} - (H-1) = r^{**} - r_y^{**}. \tag{8}$$

Thus, an upfront fee of y^{**} allows the otherwise credit-rationed borrower to obtain a loan that may be refinanced at $t = \theta$. By inspection and as shown in the figure, $y^* > y^{**}$. Also, $\partial y^*/\partial s < 0$ and $\partial y^{**}/\partial s < 0$, so the required upfront fee increases with the project's *ex-ante* default rate $1 - s$.

In Region IV, how can the firm accept to pay a fee of y^{**} and the rate r_y^{**} that combined exceed $H-1$, seemingly leaving nothing for the firm from the project's payoff? The answer lies in the prepayment option. If the firm receives a high signal at time θ, it will prepay the loan and refinance at a rate of zero. In this case, conditional on a high signal, the firm's expected profit π_h is

$$\pi_h = H - 1 - y^{**} - r_y^{**}\theta - \alpha = r_y^{**}(1-\theta) - \alpha. \tag{9}$$

Since the firm will refinance after a high signal, it follows that $\pi_h > 0$. If the signal is low, however, the firm will default at $t = 1$ independent of the project payoff and the conditional expected profit $\pi_l = 0$. The firm's expected profit at $t = 0$ is therefore $E(\pi) = p\pi_h > 0$, and the firm will borrow at the loan contract (y^{**}, r_y^{**}) and invest.[6]

2.3 Extensions: performance-sensitive debt and credit lines

Performance pricing is a widely used debt feature. In the period 1980–2017, 25% of all syndicated term loans issued by public US 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.

[6] In Region IV, the firm could alternatively fund the project with the loan contract (y^*, r_y^*), which will not be refinanced.

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

$$p\big[1 + \theta r + (1-\theta) r_h\big] + (1-p)q\big[1 + \theta r + (1-\theta) r_l\big] + y = 1. \tag{10}$$

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 an interest-increasing PSD contract will also 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 downwards, which causes the boundaries s_2 and s_3 to shift to the left.[7]

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.[8] Combining Eq. (10) with the firm's incentive not to refinance yields the minimum upfront fee y^*_{psd}

$$y^*_{psd} \equiv 1 - s - \frac{s\alpha}{1-\theta} - (s-p)(1-\theta)\epsilon \tag{11}$$

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.

Finally, in our setting, the primary difference between a term loan and a credit line is that the latter

[7] While Asquith et al. (2005) point out that interest-decreasing performance pricing can be used to mitigate prepayment risk, they do not make this observation for interest-increasing loan contracts.

[8] 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.

gives the option to delay the draw-down of the loan amount. Thakor and Udell (1987) and Shockley and Thakor (1997) focus on how the bank can use this delayed draw-down feature to separate borrower types. In this paper, the flexibility to postpone the draw-down may be valuable to the firm if the investment opportunity is held up. To formalize the implication for the equilibrium upfront fee, suppose delaying the investment also delays the signal about project quality with a time period γ, where $0 < \gamma < 1 - \theta$, so the project payoff continues to occur at $t = 1$. The firm's incentive to refinance is now $r(1 - \gamma - \theta) > \alpha$. This effectively shifts upward the firm's prepayment incentive in Figure 3 from $r > \alpha/(1-\theta)$ to $r > \alpha/(1-\gamma-\theta)$, which lowers the required upfront fee y^*:

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

2.4 Empirical test strategy

To summarize, for a given project default risk $(1-s)$ and the borrower's prepayment incentive $(\alpha/(1-\theta))$, propositions 1-4 show how loan pricing (the loan spread r and upfront fee y) responds to the penalty-free prepayment option. Propositions 1 and 2 imply that, when default risk is sufficiently high (Regions III and IV of Figure 3), an upfront fee of y^* or y^{**} is required to avoid credit rationing. Moreover, in these regions, the model predicts that the required upfront fee is increasing in the default risk. Also, the required fee is predicted to be lower in loans with performance pricing (Proposition 3) and revolving credit lines (Proposition 4).

The main objective of our empirical analysis is to identify whether the cross-sectional variation in upfront fees reflects the bank's concern with adverse selection caused by the penalty-free prepayment option. Possible alternative hypotheses to our propositions 1-4 include the use of upfront fees to compensate for loan origination costs or to extract economic rents. Upfront fees may, however, also cover loan origination costs or rents. That notwithstanding, absent a theory for why loan origination costs or rents should be increasing in loan prepayment risk *per se*, evidence in favor of our main theoretical proposition cannot easily be explained by such alternative hypotheses.

For a given loan contract, the upfront fee y lowers the loan spread r. In principle, identifying this conditionally negative correlation requires the unobservable counterfactual credit rationing outcome. Instead, we control for the unconditional (cross-sectional) correlation between y and r. In the cross-section of loans, y and r are determined simultaneously as functions of firm-specific risk variables, such that $Cov(y, r_y) > 0$. The empirical analysis below strongly confirms this positive correlation in the data.

Our empirical strategy is to separate our firm-specific risk variables into two categories. The first category are risks traditionally thought to drive r. The second category represents the type of loan prepayment risk behind y, as modelled above. This yields a generic cross-sectional regression specification of the following form:

$$UpfrontFee = \beta_0 + \beta_1 Prepayment\ Risk + \Phi \mathbf{X} + \epsilon, \tag{12}$$

where the vector $\mathbf{X}$ contains firm and loan characteristics thought to capture the loan spread r. We use several different proxies for *Prepayment Risk* that capture the borrower's prepayment incentive through the signal at θ and the refinancing costs α. Our theory predicts $\beta_1 > 0$. We test the additional predictions of lower upfront fees in PSD and revolving credit lines by simply adding indicators for performance pricing and credit lines to Eq. 12.

Finally, we use merger waves as an exogenous shock to the prepayment risk. The idea is that loans granted in periods with high merger activity in the industry of the borrower carry greater prepayment risk. The reason is that acquirers often refinance the debt of target firms and high-quality firms are more likely to become targets (Betton et al., 2008). Thus, high industry takeover activity increases the likelihood that firms which *ex post* turn out to be of high quality prepay their loans.

3 Data and variable construction

3.1 Data

Since the model applies generally to bank loans, we perform the empirical analysis on both C&I term loans and credit lines. The loan information is from the WRDS Dealscan database.[9] We select all loans in US dollars issued by US public firms between 01/1987 and 12/2016. The loan information is merged with Compustat quarterly through the Dealscan-Compustat linking table on WRDS (see Chava and Roberts (2008) for details on the construction of the data). 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

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

lines. This leave 49,425 loan facilities.

Practitioners we have talked to claim that most, if not all, bank loans have an upfront fee (also called arrangement fee or participation fee). The fee is charged either as a one-time fee, paid at the closing of the transaction, or in the form of an original issue discount (OID), where the principal exceeds the paid out amount. Upfront fees are written in a fee letter, separate from the loan agreement. Importantly, while other material loan terms must be disclosed to the public, the fee letter is often kept confidential (Taylor and Sansone, 2006). As a result, a large fraction of the loans in Dealscan have missing fee information. In our sample selection, we require the upfront fee to be non-missing.

When a syndicated loan includes both a term loan and a revolving credit line, the upfront fee is charged on the total loan amount. However, Dealscan records the fee, if available, only for the credit line. Thus, if the upfront fee is missing and the loan has a credit line, we assign the same upfront fee to the term loan. This adds fee information for 292 term loans. Finally, we require non-missing values in Dealscan and Compustat for all variables used in the cross-sectional analysis below. This yields a final sample of 6,865 loan facilities, consisting of 2,861 term loans and 4,004 credit lines in 4,732 unique loans issued by 2,908 unique firms. Two-thirds (3,192) of the sample loans have only one facility, of which 912 are term loans and 2,280 are credit lines, and 1,186 sample loans have both a term loan and a credit line. We conduct our empirical analysis at the facilities level.

Syndicated loans are often structured into several tranches. Commercial banks tend to invest in tranche A (the pro-rata tranche), while tranches B and lower (the institutional tranches) are bought by institutional investors, such as insurance companies, pension funds, mutual funds, hedge funds, and collateralized loan obligations (CLOs). The tranches represent the priority order in bankruptcy, and lower tranches in general pay a somewhat higher interest rate spread. Of the term loans in our sample, 2,015 (70%) are tranche A, 756 (26%) are tranche B, and 90 (3%) are tranche C or lower. There are no such tranches in credit lines.

3.2 Variable construction

All variables are defined in Table 1. The dependent variable, *UpfrontFee*, is the natural logarithm (log) of one plus the upfront fee, measured in basis points (bps). The key explanatory variable, *Prepayment Risk*, is a measure for the borrower's prepayment risk that triggers credit rationing in the absence of an upfront fee. We use several different proxies for this risk, all of which are exogenous to the actual prepayment fee in the loan.

In the model, prepayment risk is higher the greater the likelihood that the firm's performance subsequently improves. Empirically, however, the upside potential of a project is typically highly correlated with the downside risk. The first two measures for prepayment risk therefore capture the volatility of the borrower's past performance. *Return Volatility* is the standard deviation of the firm's daily stock returns in the 12 months preceding loan origination. *Cash Flow Risk* is the variance in the firm's earnings before interest tax, depreciation and amortization (EBITDA) in the past eight quarters, divided by the book value of total assets.[10]

The model further predicts that the borrower's incentive to prepay decreases with the cost of refinancing the loan (Eq. 1). Our third measure for prepayment risk captures the refinancing cost through the past relationship between the bank and the borrower. Relationship banks have superior information about the firm, increasing the adverse selection costs of switching to other lenders (Sharpe, 1990; Rajan, 1992; Mosk, 2017). We follow Dahiya et al. (2003) and Sufi (2007) and search all prior loans of a borrower in DealScan. *Relationship Bank* is equal to one if the firm previously borrowed from at least one of the lead banks in the past five years. We further capture the refinancing cost with *NumLenders*, defined as log of the number of lenders in the loan syndicate. A larger number of lenders increases the complexity of the contracting process and hence renegotiation costs (Bolton and Scharfstein, 1996; Brunner and Krahnen, 2008).

The last proxy for prepayment risk captures the time-varying pricing of credit risk. Our loan observations are spread across time (1987–2016). Intuitively, firms borrowing when credit spreads are relatively high are likely to optimally refinance their loans if spreads subsequently decline. In contrast, loans originated in periods of relatively low credit spreads are less likely to be prepaid. Our fifth measure for prepayment risk is therefore *Bond Spread*, defined as log of Moody's Bb Corporate Bond rate minus the monthly Federal Funds rate in bps.

Finally, we combine the five individual prepayment risk proxies into *Prepayment Risk Index*. The index is a linear combination of the normalized values $Z_i = (x_i - \mu_x)/\sigma_x$ of *Return Volatility*, *Cash Flow Risk*, *Relationship Bank*, *NumLenders*, and *Bond Spread*, where μ_x is the average and σ_x the standard deviation of each variable, and the two measures for renegotiation costs enters the index with a negative

[10] Asquith et al. (2005) use the average stock return volatility at the 3-digit standard industry classification (SIC) level to capture exogenous variation in prepayment risk. While not reported here, our results are robust to their definition of performance volatility.

sign. The higher *Prepayment Risk Index*, the higher is the expected upfront fee.

The regressions further include a vector **X** of firm and loan characteristics that capture the fundamental credit risk of the firm. The firm characteristics are *Market-to-Book* ((market value of equity+total debt)/total assets), *Leverage* (total debt/(total debt+market value of equity)), *Profitability* (earnings before interest, tax, depreciation and amortization (EBITDA)/total assets), *Tangibility* (property, plant, and equipment (PPE)/total assets), *Z-Score* (Z-score as defined by Altman (1968)), and *Rated* (a dummy variable indicating that the firm is rated by Standard and Poor, S&P). All variables are winsorized at the 1st and 99th percentiles.

The loan characteristics in **X** are *Relative Loan Size* (the ratio of the loan amount and book value of total assets), *Maturity* (log of loan maturity in months), *Security* (a dummy indicating that the loan is secured), and loan purpose. Following Carey et al. (1998), we group the loan purpose into four categories: general purposes, recapitalization, acquisition, and other. The vector **X** includes dummy variables for the first three loan purposes. Whereas the upfront fee is set at the end of the syndication process, the loan characteristics in **X** are set at the beginning of the process (Ivashina, 2009).

If institutional investors are concerned that the loan will be repaid quickly, they may require a cancellation fee. A typical cancellation fee has 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. Thus, cancellation fees are effectively a prepayment fee with limited life. Since the cancellation fee indicates that institutional lenders deem prepayment risk to be relatively high, the vector **X** includes the dummy variable *Cancellation Fee*. There are rarely cancellation fees in loan tranche A, which is owned by commercial banks. The vector **X** also includes a dummy, *ITL*, indicating institutional loan tranches (B and lower vs. tranche A).

The regressions further include year dummies, to control for potential time trends, and industry fixed effects at the 2-digit SIC code level. Ross (2010) documents that the ten largest banks collectively arrange over 85% loans in the US. To control for possible lead-bank fixed effects, we include dummies for the ten largest banks by lending frequency.

3.3 Sample description

Panel A of Figure 4 plots the total number of term loans and the number of loans with performance pricing. The number of term loans peaks in 1997-1998, with a drop in the loan frequency in 2004–2009.

As shown, performance pricing starts appearing in 1994.[11] Moreover, in our sample, the relative use of performance pricing is lower after the financial crises.

The figure further plots the annual average upfront fee and the AIS, which is the sum of the loan interest spread and annual fees. The average upfront fee is relatively stable around 80 bps, with somewhat higher fees in the beginning of the sample period and during the tight credit markets in 2007–2009. The annual loan cost averages about 200 bps in the 1990s, to increase in the 2000s and reaching a peak above 400 bps in 2009. As shown in the figure, the average upfront fee and AIS are positively correlated.

Panel B illustrates the same statistics for the sample of credit lines. In contrast to term loans, the number of new credit lines remain low after the financial crises, a majority of which have performance pricing. Again, upfront fees and AIS peak in 2009, but are otherwise somewhat lower than in term loans.

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). Panel A reports summary statistics for the key variables of interest, none of which are logged in this table. The average upfront fee is 74 bps or $1.9 million in term loans, with a median of 50 bps or $0.32 million. Credit lines have somewhat lower upfront fees, with a mean and median of 53 bps and 35 bps, respectively. While the typical upfront fee could be compensation for origination costs, the right tail of fees are too high to reasonably cover only such costs. Although not reported in the table, one-third of the upfront fees in term loans (19% in credit lines) exceed 100 bps and almost 10% of the fees (4% in credit lines) exceed 200 bps. The top percentile of fees exceed 380 bps or $25 million. For example, Solutia Inc. paid an upfront fee of $108 million (500 bps) for a $1.2 billion loan in February 2008 and the fee for Western Digital Corp. was $112.5 million (300 bps) for a $3.2 billion loan in April 2016. These high upfront fees lend support to our proposition that they could play a role in mitigating prepayment risk.

As further shown in Panel A, the two measures for firm performance volatility, *Return Volatility* and *Cash Flow Risk*, average 11.5% and 1.3%, respectively, for term loans. Turning to the proxies for renegotiation costs, 45% of the term loans are issued with at least one relationship bank as lead arranger (*Relationship Bank*) and there are on average 6.6 (median 3) banks in the loan syndicate. The mean value of *Bond Spread* is 289 bps (282 bps in credit lines), suggesting that the majority of loans are held by relatively risky borrowers. Overall, it appears that credit lines have slightly higher prepayment risk than term loans, with an average *Prepayment Risk Index* of 0.20 vs –0.28.

[11] We verify the absence of PSD prior to 1994 in the SDC New Issuance of Syndicated Loans database.

Panel A also provides information on performance pricing, where the interest rate is tied to the development of certain financial measures. Almost one-third (29%) of the term loans have performance pricing: 12% with an interest-increasing pricing grid and 26% with an interest-decreasing grid. Thus, almost two-thirds ((0.29-0.12)/0.29=0.59) of the PSD contracts in term loans adjust the loan rate upwards only, while one-tenth ((0.29-0.26)/0.29=0.10) adjust the loan rate downwards only and one-third (1-0.10-0.59=0.31) 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 36% with a down-grid.

Panel B of Table 2 lists summary statistics for the firm characteristics in $\mathbf{X}$. The average term loan borrower has total assets of $2.5 billion (median $488 million) and a market leverage of 0.39 (median 0.38), suggesting that it is relatively highly leveraged. 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 0.32, and a Z-score of 1.6. Four out of ten borrowers have an S&P credit rating. Firms with credit lines have slightly lower mean leverage (0.30) and profitability (0.02), and consequently higher Z-score (2.15).

Turning to Panel C, the average term loan amounts to $253 million (median $75 million), with an AIS of 294 bps (median 275 bps). The mean term loan maturity is about five years (62 months) at issuance and a large majority of loans (82%) are secured. Credit lines have somewhat lower average AIS (230 bps), shorter maturity (38 months), and are less frequently secured (68%). There is a cancellation fee in 22% of the sample term loans and conditional on having a cancellation fee, the average penalty for term loan repayment within one year is 154 bps (median 100 bps). In term loans with a cancellation fee, the upfront fee averages 103 bps, so the cancellation fee is almost 1.5 times the upfront fee in size. Cancellation fees are less common in credit lines (12% of the revolvers have cancellation fees), but higher when present (mean 193 bps). Finally, 30% of the term loan facilities represent an institutional tranche (ITL). There are no institutional tranches in credit lines.

4 Empirical analysis

This section presents the results of the empirical analysis. We first provide a univariate analysis and then turn to cross-sectional tests of our model.

4.1 Univariate tests

Table 3 examines the implications of the hypotheses in the univariate. The first five columns use the sample of term loans, while the last five columns use the sample of credit lines. Panel A addresses Proposition 2 by reporting the average and median upfront fee across high and low values of different measures for prepayment risk. The sample is split into below (Low) and above (High) median *Return Volatility*, *Cash Flow Risk*, and *Bond Spread*, and into high and low renegotiation costs based on *Relationship Bank* and the size of the bank syndicate (more than three vs. fewer participating banks). Columns (5) and (10) report the difference in the mean upfront fee across loans with high and low prepayment risk. As shown in the table, the upfront fee is consistently higher for loans with greater prepayment risk. The difference is significant at the 1%-level for all measures except *Cash Flow Risk* in term loans.

Panel A further shows a split of the loan facilities into below and above median *Prepayment Risk Index*. The average fee is 19 bps higher in term loans and 22 bps higher in credit lines for borrowers with high vs. low *Prepayment Risk Index*, again consistent with the model. Both differences are significantly different from zero at the 1% level.[12]

Panel B of Table 3 sorts the sample loans based on performance-pricing. As shown, the average upfront fee is 53 bps in term loans with performance-sensitive loan rates (PSD=1) and 82 bps in term loans with a fixed spread (*PSD*=0). The difference is 29 bps and 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. Again, the difference in mean is highly significant. Thus, as predicted, upfront fees and performance pricing are negatively correlated in the univariate.

4.2 Upfront fees and prepayment risk

To test our model in the cross-section of term loans, we estimate Eq. (12) using an ordinary least squares (OLS) regression. Table 4 shows the coefficient estimates when prepayment risk is captured by the five individual proxies *Return Volatility* (column 1), *Cash Flow Risk* (column 2), *Relationship Bank* (column 3), *NumLenders* (column 4), and *Bond Spread* (column 5), as well as when added jointly (columns 6-7). All regressions include the control variables in $\mathbf{X}$ (firm and loan characteristics, loan purpose dummies, and industry and year fixed effects). The exception is columns (5) and (7), which exclude year fixed

[12]Sorting loans into quartiles or quintiles of prepayment risk, the fee increases monotonically with *Prepayment Risk Index*.

effects since they largely subsume the market conditions reflected in *Bond Spread*. Standard errors are clustered at the firm level.

As shown in the table, when entered individually, the coefficient estimates for all five prepayment risk proxies are highly significant (p<0.01) and have the predicted sign. That is, $\beta_1 > 0$ for *Return Volatility*, *Cash Flow Risk*, and *Bond Spread*, and $\beta_1 < 0$ for *Relationship Bank* and *NumLenders*. When added jointly in column (7), all prepayment risk proxies but *Cash Flow Risk* remain significant at the 1% level.

Using the last column, a one standard-deviation increase in *Return Volatility* and *Cash Flow Risk* from the mean increases the upfront fee by 7.7% and 4.4%, respectively. That is, a change from the 25th to the 75th percentile of return volatility increases the upfront fee from 3.2% to 11.2%. The positive coefficient for *Bond Spread* suggests that upfront fees tend to be higher in periods of high credit spreads, when the likelihood of subsequent prepayment due to improved market conditions is relatively high. The economic magnitude of this effect is sizeable, with an average increase in the upfront fee of 18% for a one standard-deviation increase in the spread of Bb-rated bonds (Column 7).

Our model predicts that refinancing costs, which are higher in loans from a relationship bank and increase with the size of the bank syndicate, lower prepayment risk and hence the required upfront fee. The negative coefficient reported in Table 4 supports this conjecture. Economically, the upfront fee is on average 14% lower in loans from relationship banks and it drops by 0.9% when adding one bank to the average term loan syndicate of seven banks (column 7).

While consistent with the model predictions, the negative coefficient estimate for *Relationship Bank* in Table 4 is particularly interesting as it fails to support the notion that upfront fees represent a form of monopoly rent extraction by the bank. Recall that adverse selection costs from switching are particularly high for relationship banks. Thus, rent extraction, if any, should be more severe in loans from relationship banks, implying a positive coefficient for *Relationship Bank*, which the negative coefficient for *Relationship Bank* rejects.

Turning to the control variables, the upfront fee increases with firm leverage and decreases with profitability. Highly levered and unprofitable firms have greater default risk and hence higher prepayment risk. Alternatively, the credit risk assessment might be more onerous for firms with relatively high credit risk, increasing the cost component of the upfront fee. Table 4 also shows that the upfront fee is increasing in the relative size of the loan. A possible explanation is that firms pay more attention to relatively large loans, making it more likely that they initiate a renegotiation if their financial situation improves.

The upfront fee further decreases with loan maturity and tends to be higher for secured loans. Both coefficients have counterintuitive signs. All else equal, the potential gains from refinancing increase with time to maturity, therefore increasing prepayment risk. Moreover, collateral reduces the downside risk and hence interest spreads and prepayment risk. However, as shown by Ivashina (2009), average loan spreads are higher for secured loans, suggesting that collateral is more prevalent in riskier loans and may in itself capture greater prepayment risk.

Cancellation Fee enters with a positive and significant coefficient ($p<0.01$). Since prepayment penalties are a substitute to upfront fees, *ceteris paribus*, the upfront fee should decline with the cancellation fee. However, there is evidence that institutional investors tend to require a cancellation fee in loans with high perceived risk of prepayment. Thus, we treat *Cancellation Fee* as a proxy for high loan prepayment risk. Finally, the upfront fee tends to be lower for institutional tranches (vs. the pro-rata tranche) of terms loans. From column (7), the average upfront fee is 42% higher in loans with a cancellation fee and 12% lower for an institutional tranche.

Table 5 shows the coefficient estimates from OLS regression of equation Eq. (12) for the sample of 4,004 credit lines. Again, all five proxies for prepayment risk enter with highly significant coefficients and signs consistent with our model. When entered jointly in column (7), all five prepayment risk proxies now remain significant at the 1% level. The adjusted R^2 is higher for the sample of credit lines (0.315 in column (7) vs. 0.187 for term loans).

As before, *Leverage* enters with a significantly positive coefficient and *Profitability, Security*, while *Cancellation Fee* generate significantly negative coefficients. However, the sign has flipped for both *Relative Size* and *Maturity.* In the sample of credit lines, the upfront fee is decreasing in relative loan size and increasing in time to maturity. Moreover, the negative coefficient for *Z-score* is now highly significant. It is possible that Z-score reflects financial constraints (Sufi, 2009), which may increase prepayment risk.

4.3 Upfront fees in credit lines

We test Proposition 4 in Table 6. The table uses *Prepayment Risk Index*, which combines the individual measures of prepayment risk from Table 4. In columns (2),(4), (7), and (8), the prepayment risk index is replaced with *High Prepayment Risk*—a dummy variable that indicates that the loan has a prepayment risk (an index value) above the sample median. In the first two columns, the sample is term loans, while it is credit lines in the next two columns. To test whether upfront fees are lower in credit lines, the last four columns use the combined sample of all 6,865 loans and include the dummy variable *CreditLine*. All control variables in **X** are included in the regressions, but suppressed for expositional purposes.

The coefficient estimate β_1 for prepayment risk is again positive and highly significant ($p<0.01$) in all specifications, whether using the index itself or the indicator for high prepayment risk. Thus, our model predictions again receive broad support. Moreover, consistent with Proposition 4, the coefficient for *Credit Line* is negative and highly significant. It shows that upfront fees are on average 16% lower in credit lines than in term loans (column 6). The regressions further include an interaction variable between *Credit Line* and *Prepayment Risk Index* (column 6) or *High Prepayment Risk* (column 8). Neither interaction variable is significant, suggesting that the effect of prepayment risk on the upfront fee otherwise is the same across credit lines and term loans.

In Proposition 2, the prepayment risk is a function of the first-best loan rate, r^*, i.e., the equilibrium loan rate absent the prepayment option. Ideally, the regression model for the upfront fee should control for r^*. However, this loan rate is unobservable and we therefore use the vector X of control variables to control for r. Moreover, the upfront fee and the loan price are jointly determined at the end of the loan origination process (Ivashina, 2009; Mosk, 2017). It is therefore possible that the prepayment risk index captures information that is effectively subsumed by the all-in-spread. To examine if our prepayment risk index affects the upfront fee beyond the information already captured by AIS, Table 7 adds *AIS* (log of AIS in bps) to the regression models in Table 6.

As shown in Table 7, all inferences hold when adding AIS. The coefficient estimates for *Prepayment Risk Index* and *High Prepayment Risk* are still positive and highly significant ($p<0.01$), although of somewhat smaller magnitude than in Table 6. Moreover, credit lines have on average lower upfront fees than term loans (6% in column 6) and, again, the effect of prepayment risk on the fee is not significantly different between the two loan types (columns 6 and 8). The coefficient for AIS itself is positive and highly significant. Upfront fees are increasing in the interest spread on the loan, likely because a higher spread reflects greater default risk. Overall, the regression results provide strong support for our model predictions that upfront fees increase with prepayment risk and are lower in credit lines.

In unreported results, we further include an interaction variable between *AIS* and the prepayment risk index. The idea is that banks may chose to increase the interest spread to compensate for prepayment risk as an alternative to the upfront fee. The opportunity to substitute between the AIS and the fee, however, is limited for loans with already high spreads. If loan-spreads are a substitute to fees in loans with relatively low spread, the interaction variable should generate a positive coefficient. Regressions show that the interaction variable is insignificant, however, providing no support for such a substitution effect. We also examine whether there is a non-linear effect of the prepayment risk index on the upfront fee, but find no such effect.

4.4 Upfront fees and performance-pricing

Proposition 3 predicts that upfront fees are lower for performance-priced debt. As discussed above, PSD are loan contracts that adjust the interest spread ex-post to reflect changes in borrower quality. Table 8 reports the coefficient estimates from OLS regressions, which examine the effect of performance pricing on upfront fees. The sample is term loans in the first three columns, credit lines in the next three columns, and the combined sample in the last three columns. Columns (1), (4), and (7) examine the effect of any type of performance-pricing (up or down), captured by the dummy variable PSD.

As expected, the coefficient for PSD is negative and highly significant (p<0.01). After controlling for prepayment risk and the control variables in $\mathbf{X}$, the inclusion of performance-pricing is associated with a 6% lower upfront fee on average (column 7). Our model further predicts that prepayment risk is reduced under any type of performance pricing, whether the grid is interest increasing or decreasing. To test this implication, we replace PSD with two indicators that classify PSD according to the nature of the pricing grid: $PSD_{Increasing}$ and $PSD_{Decreasing}$.

As shown in Table 8, $PSD_{Decreasing}$ enters with a negative and highly significant coefficient (p<0.01). That is, loans that adjust the interest rate downward after an improvement in credit quality have lower upfront fees of on average 14% (column 9). The coefficient for $PSD_{Increasing}$ is negative and significant for the combined sample (column 8) and for term loans (column 2), but insignificant for the subsample of credit lines (column 5). Thus, performance pricing reduces the average upfront fee in term loans, regardless of the type of pricing grid, while the effect in credit lines may be limited to loans with an interest-decreasing grid. Overall, the evidence in Table 8 supports Proposition 3, which states that upfront fees are lower for PSD—whether the grid provides for interest decreases or increases—than for loans without performance pricing.

4.5 Merger waves as an exogenous shock to prepayment risk

A potential concern with our prepayment risk index is that it contains firm and loan characteristics that are correlated with credit risk not captured by the loan rate. We now address this concern by identifying a truly exogenous source of prepayment risk: the likelihood of a takeover during the loan contract period. As discussed above, the likelihood that high-quality firms become targets and prepay their loans is higher in industries with high takeover activity.

We follow Maksimovic et al. (2013) and identify industry-specific merger waves. For each 3-digit SIC industry i, we compute in each year t the ratio between the total M&A volume (MA_{it}) from the SDC Platinum Merger & Acquisition database and the total assets (TA_{it}) of all firms in the industry from Compustat. *Merger Wave Volume* is defined as $(MA_{it}/TA_{it} - \mu_i)/\sigma_i$, where μ_i and σ_i are the time-series average and standard deviation, respectively, of MA_{it}/TA_{it} for industry i, 1987–2016. We compute a similar measure *Merger Wave Count*, which compares the number of acquisitions (from SDC) to the number of firms in the industry (from Compustat), as well as two dummy variables *High M&A Volume* and *High M&A Count* indicating the top quartile of years with the highest M&A activity.

The results from regressions that estimate the model in Eq. (12) are presented in Table 9. The sample is term loans in the first two columns, credit lines in the next two columns, and the combined sample of all loans in the last four columns. Besides the four M&A variables capturing the exogenous shock to prepayment risk, the regressions include *Prepayment Risk Index* and *Credit Line*, as well as all control variables in the vector $\mathbf{X}$. The exception is year fixed effects, which are excluded since they subsume any merger wave pattern. As before, standard errors are clustered at the firm level.

Again, the coefficient β_1 for *Prepayment Risk Index* is positive in all regression models and the coefficient β_2 for *Credit Line* is negative, both significant at the 1% level. Importantly, consistent with our model, all four measures for industry merger activity enter the regressions with positive and significant signs. That is, upfront fees tend to be higher when the borrower is in an industry with high M&A activity, where prepayment risk is higher. This supports our inferences above that prepayment risk is a critical driver of the upfront fee.

5 Discussion: alternatives to upfront fees

In our model, the bank uses an upfront fee to reduce the impact of adverse selection associated with penalty-free loan prepayment. However, the bank may also use a substitute contractual mechanisms such collateral and even switch to an *ex post* prepayment penalty. Why use an upfront fee instead of such alternative mechanisms? Are there other examples of contracting in which agents rely on an upfront fee to solve adverse selection associated with a dynamic learning environment? While answering these fundamental contract design questions goes well beyond the purpose of this paper, the following comments are relevant for the broader issues.

First, as to collateral, which is common in loan contracts (Berger et al., 2011a), note that securing the loan in the firm's assets carries its own costs. In particular, lenders incur costs associated with screening, monitoring and repossessing the pledged assets (Berger et al., 2011b). Moreover, the value of the collateral often falls short of the bank's claim upon default (Franks and Torous, 1994; Bris et al., 2006). Thus, for some borrowers, collateral may be more costly than an upfront fee when it comes to addressing the credit rationing problem modelled here.

A second alternative to an upfront fee is to switch the loan contract to an *ex post* prepayment penalty. When considering this alternative, note that the upfront fee represents a form of a prepayment penalty that is paid by all borrowers ip front, regardless of type. In contrast, an *ex post* penalty is paid conditionally on the type signal received at time θ, which raise issues of time-inconsistency (Kydland and Prescott, 1977). Specifically, forcing the *ex post* high-quality borrower to pay a prepayment penalty may hurt the bank's relationship with precisely the type of client firms it wants to retain.

Moreover, some borrowers prepay for reasons other than related to the loan rate *per se*. For example, the arrival of new investments or acquisition opportunities may require refinancing due to binding loan covenants. An *ex post* prepayment penalty may well be welfare reducing if it reduces the firm's incentive to respond to new and evolving business opportunities. As in Hart and Moore (1994), who discuss the value of firm-specific human capital for the value of an owner-manager's corporate assets, an inefficient *ex post* penalty may itself cause a reduction in the value of the bank's collateral.

How about an *ex post* prepayment penalty that is contingent on the specific reason for the prepayment? If properly specified, it could allow firms to make strategic changes, reducing the likelihood that the prepayment is viewed by the bank as a play on improved market rates. However, to our knowledge, we do not see these types of contingencies in practice. This is true even for mortgages, which are often prepaid due to an easily verified household relocation. For C&A loans, verification is much harder in general, and so making the *es post* prepayment penalty conditional on specific reasons for the prepayment seem even less attractive than for mortgages.

In contrast to C&I term loans, corporate bonds typically do not offer penalty-free prepayment. It is standard for a callable bonds to preclude calls during the first half of the bond's term. Again, this may not be a problem for the large, mature companies that rely on the bond market for funding. However, it is plausible that firms relying on bank loans do so at least in part because they value the penalty-free prepayment option. Bank-loan financing is relatively common among smaller, high-growth firms—precisely the type of companies that value being able to quickly respond to changing business opportunities.

Finally, the health insurance market presents an interesting alternative setting characterized by dynamic learning and one-sided commitment, much as in our C&I loan setting. In health insurance markets, information about an individual's health emerges gradually over time. Moreover, the insured customer may terminate the insurance contract without a penalty, while the insurer cannot. Hendel and Lizzeri (2003) show that the equilibrium insurance contracts involve front-loading of premiums to reduce consumers' incentive to terminate the contract and hence lower reclassification risk.

6 Conclusion

A penalty-free prepayment option is valuable for the borrower, allowing early repayment or renegotiation of loan terms following positive borrower-specific news. The problem for the bank, however, is that prepayments and loan renegotiations both erode the value of the loan portfolio *ex post*. In this paper, we provide a theoretical and empirical analysis of how banks combine the loan interest with a properly scaled upfront fee to help compensate for this prepayment risk. Our model assumes that borrowers are symmetrically informed at the time of loan origination. As a result, the bank offers a single loan contract to all potential borrowers. As some borrowers receive new and positive information about their investment project payoffs, they strategically repay or refinance the loan. Conversely, *ex post* low-quality borrowers hold on to their loans and some default.

In equilibrium, the initial contract terms must account for this *ex post* reclassification process that adversely affects the average quality of the bank's remaining pool of borrowers. We show in Proposition

1 that raising the original loan rate may not solve the bank's problem. A higher credit spread makes it more likely that high-quality borrowers prepay ex post. When default risk is sufficiently high, the bank fails to capture the full interest payment on the loan no matter how high it sets the spread. We show in Proposition 2 that one solution for the bank is to charge an upfront fee and reduce the interest rate. That is, a properly scaled upfront fee charged to all borrowers may suffice to support the penalty-free prepayment option.

We investigate the proposition that upfront fees are increasing in prepayment risk using a sample of nearly 7,000 C&I term loans and credit lines issued by US public firms, 1987–2016. The upfront fees are often substantial and average as much as 250 basis points in the top quartile of the fee distribution. We produce several empirical results that collectively support the notion that upfront fees help compensate for prepayment risk in bank loans. Upfront fees are increasing in borrower performance volatility and the market-wide loan spread, and lower when refinancing costs appear to be higher, consistent with our model predictions. Moreover, upfront fees are lower in credit lines, also as predicted.

We identify performance-sensitive term loans, where credit spreads are automatically reset up or down in response to performance changes. In Proposition 3, our model predicts a lower upfront fee because performance-sensitive debt reduces the adverse reclassification that occur when only the high-quality borrowers repay or renegotiate the term loan. With performance-sensitive debt, spreads are automatically reseat for both high-quality and low-quality borrowers ex post, lowering the reclassification risk. Consistent with our model, we find that upfront fees are lower for performance-sensitive debt, after controlling for prepayment risk.

We also use merger activity in the industry of the borrower to identify exogenous variation in borrower prepayment risk. The idea is that *ex post* high-quality borrowers are more likely to become a target and prepay the loan. The merger literature is flush with empirical evidence that target firms tend to be of relatively high quality. Thus, merger activity is a powerful instrument for prepayment risk by *ex post* high-quality borrowers. Consistent with the model, upfront fees are significantly increasing in industry M&A activity.

While these empirical results support our model interpretation of upfront fees, they are difficult to square with the alternative hypothesis that upfront fees simply cover the fixed costs of loan origination. For example, our finding that upfront fees increase with the market-wide loan spread is surprising from the perspective of an origination-cost hypothesis. Moreover, it is difficult to appeal to costs of loan origination to explain why the upfront fee is lower for performance-sensitive debt and higher in periods of intensive merger activity.

Finally, why an upfront fee and not an *ex post* prepayment penalty? While answering this difficult question goes beyond the purpose of this paper, note that a prepayment penalty could give rise to costly *ex post* bargaining over the same penalty. Thus, it may create a form of time inconsistency that is not present for an upfront fee. This is particularly true in our model where the borrower who wants to prepay has been revealed as high quality and thus is likely to face valuable outside options at that point. It is also worth pointing out that an upfront fee may constitute a more efficient solution to the bank's problem as it does not give rise to under-investment: regardless of their type *ex post*, all borrowers pay the same fee upfront.

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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).//

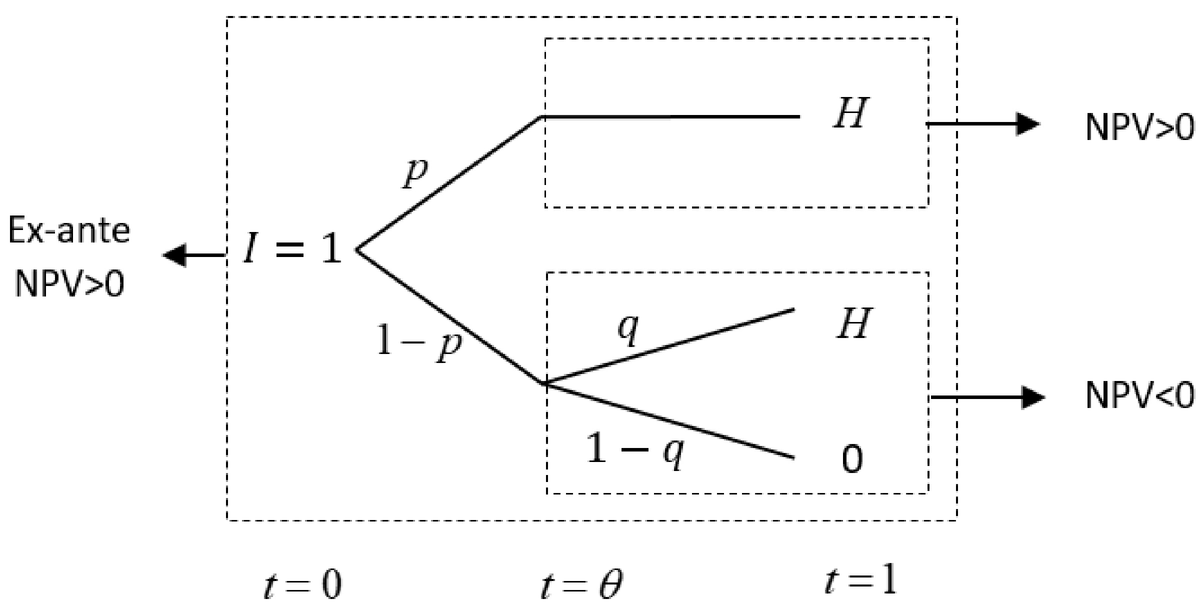


Figure 2: **Time line of the model**

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.

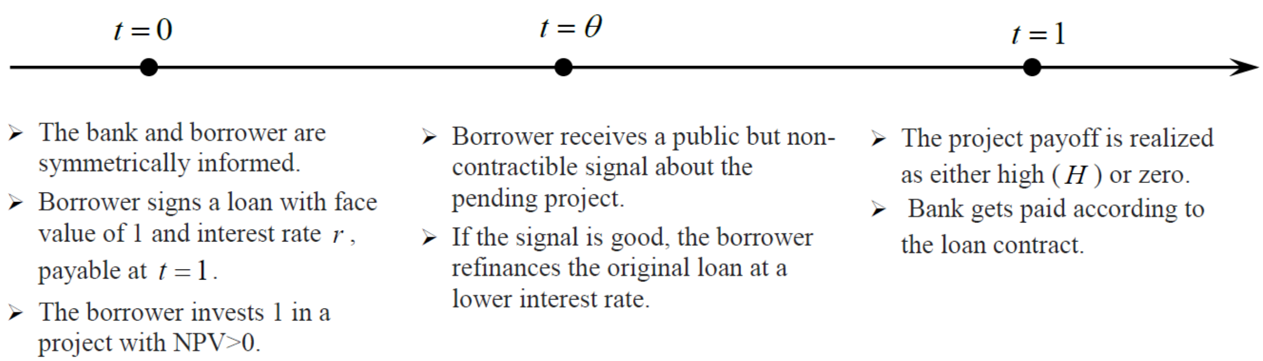
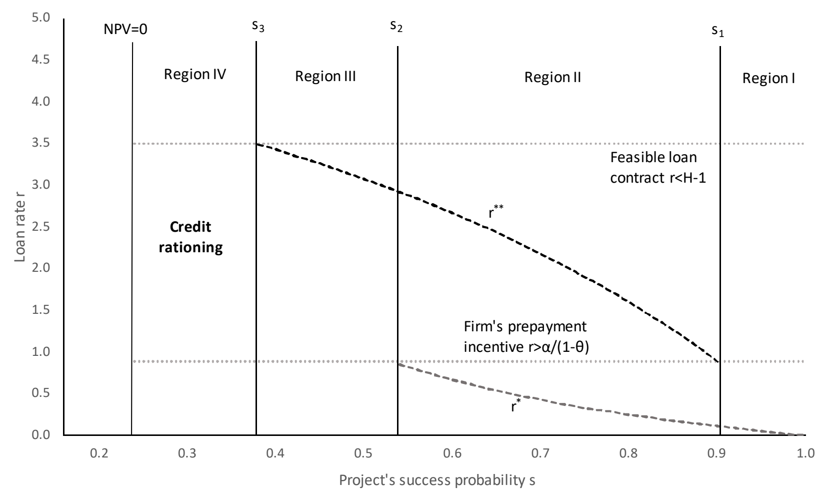


Figure 3: **Project success probability, equilibrium loan rates and upfront fees**

Panel A 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. Panel B shows how credit rationing can be resolved by adding an upfront fee y^* associated with loan rate r^*_y or a fee y^{**} associated with r^{**}_y. 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 $q = 0.2$.

A: Equilibrium loan rates and credit rationing without upfront fee



B: Equilibrium loan rates and upfront fees that resolve credit rationing

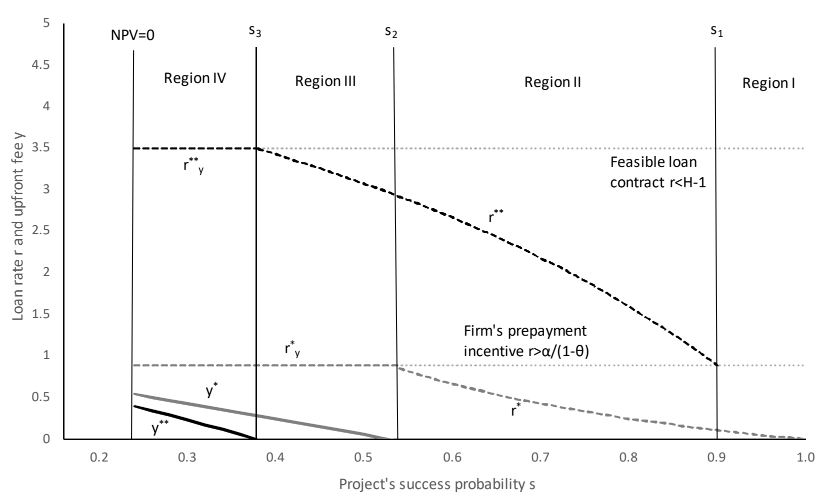
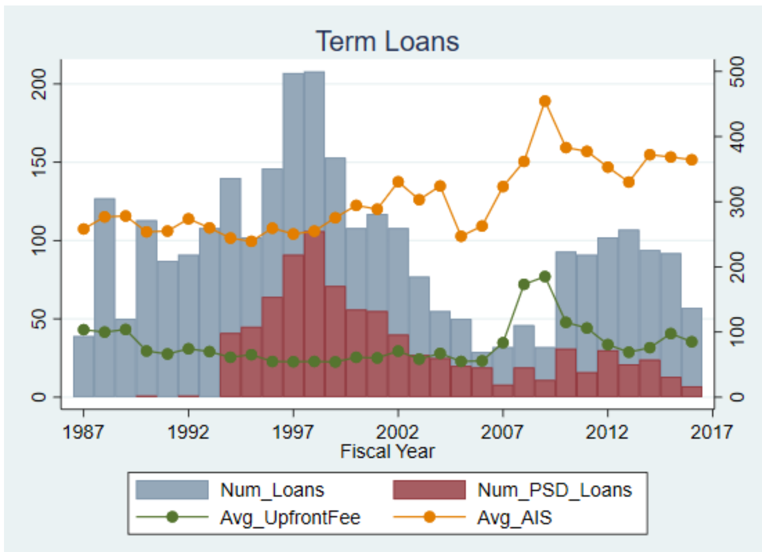


Figure 4: **Distribution of sample loans, performance pricing, and annual average fees**

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 2,861 term loan facilities in Panel A and 4,004 credit lines facilities in Panel B. The data are Commercial & Industrial loans issued by US public firms, 1987–2016, from Dealscan. We exclude loans to regulated and financial industries, and require data on all explanatory variables used in the regressions.

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



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

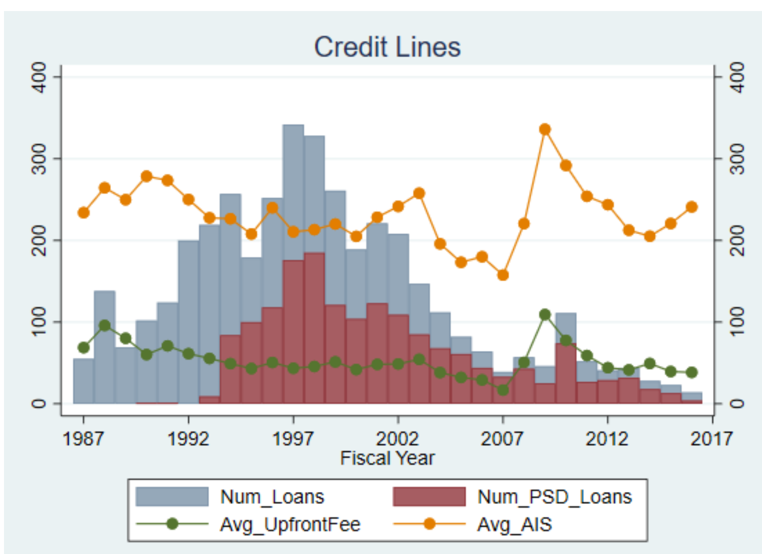


Table 1: Variable definitions

The table defines the variables used in the empirical analyses and lists the data source. D=Dealscan and C=Compustat. All logs are natural logarithms.

Variable	Definition	Source
A: Upfront fee, prepayment risk, and performance pricing		
Upfront Fee	Log of the upfront fee in basis points (bps).	D
Return Volatility	The standard deviation of the firm's stock return over the past 12 months.	C
Cash Flow Risk	Variance of EBITDA (*oibdpq*) over the past 8 quarters/Total Assets.	C
Relationship Bank	Indicator that firm borrowed from same lead arranger in the past 5 years.	D
NumLenders	Log of the number of lenders of the loan facility.	D
Bond Spread	Log of Moody's Bb corporate bond rate net of the monthly Federal Funds rate in bps.	FRED
Prepayment Risk Index	Equal-weighted index containing *Return Volatility*, *Cash Flow Risk*, *Relationship Bank*, *NumLenders*, and *Bond Spread*. Each variable is standardized with its cross-sectional mean and standard deviation, $Z_i = (i - \mu_i)/\sigma_i$, and *Relationship Bank* and *NumLenders* enter with a negative sign.	
High Prepayment Risk	Above median values of *Prepayment Risk Index*.	
PSD	Loan facilities with performance-pricing.	D
$\text{PSD}_{Decreasing}$	Loan facilities with interest decreasing performance-pricing.	D
$\text{PSD}_{Increasing}$	Loan facilities with interest increasing performance-pricing.	D
M&A Count	Quarterly industry merger wave at the 3-digit SIC code level in numbers, computed following Maksimovic et al. (2013).	SDC,C
M&A Volume	Quarterly industry merger wave at the 3-digit SIC code level in $ volume.	SDC,C
High M&A Count	Top quartile of quarterly industry merger activity in numbers.	SDC,C
High M&A Volume	Top quartile of quarterly industry merger activity in $ volume	SDC,C
B: Firm characteristics		
Total Assets	Log of book value of assets [*atq*].	C
Market-to-book	(Market value of Equity+Total Debt)/Total Assets $[(atq - (atq - ltq + txditcq) + (prccq * cshoq))/atq]$.	
Leverage	Total Debt/(Total Debt+Market Value of Equity) $[(dltt + dlc)/(dltt + dlc + prcc_f * csho)]$.	C
Profitability	EBITDA/Total Assets [*oibdpq*/*atq*].	C
Tangibility	PP&E/Total Assets [*ppentq*/*atq*].	C
Z-Score	Altman's Z-Score $= 1.2 * ((actq - lctq)/atq) + 1.4 * (req/atq) + 3.3 * (piq/atq) + 0.6 * ((prccq * cshoq)/ltq) + 0.999 * (saleq/atq)$.	C
Rated	Firms with an S&P credit rating.	C
C: Loan characteristics		
Credit Line	Indicates that the loan facility is a credit line (vs. term loan).	D
AIS	Log of the all-in-spread (AIS) of the loan facility in bps.	D
Relative Loan Size	Loan Amount/Total Assets.	D,C
Maturity	Log of the maturity of the loan facility in months.	D
Security	Indicator for secured loans.	D
Cancellation Fee	Indicator that the loan facility has a cancellation fee.	D
ITL	Institutional term loans, i.e., facilities that are tranche B or lower.	D
Loan Purpose	Indicators for the following loan purposes: General purposes (working capital, general corporate purposes), Recapitalization (debt repayment/consolidation, recapitalization, debtor-in-possession loan), Acquisition (general or specific acquisition program, LBO loans), and Other.	D

Table 2: Summary statistics

The table shows summary statistics for the sample of 2,861 term loans (columns 1-4) and 4,004 credit lines (columns 5-8) issued by US public firms, 1987–2016. The data are Commercial & Industrial loan facilities from Dealscan. We exclude firms in regulated and financial industries, and require information on all explanatory variables used in the empirical analysis. Variables are as defined in Table 1, except no variable is logged 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)	2,861	73.92	50.00	70.73	4,004	52.55	35.00	55.06
Upfront Fee (in $ million)	2,861	1.91	0.32	4.12	4,004	0.89	0.14	2.60
Return Volatility	2,861	11.49	11.39	3.83	4,004	11.94	11.88	3.95
Cash Flow Risk	2,861	1.32	0.84	1.45	4,004	1.80	1.11	1.93
Relationship Bank	2,861	0.45	0.00	0.50	4,004	0.40	0.00	0.49
NumLenders	2,861	6.64	3.00	8.46	4,004	6.69	2.00	8.79
Bond Spread (in bps)	2,861	288.82	296.00	138.15	4,004	281.90	240.00	143.40
Prepayment Risk Index	2,861	-0.28	-0.35	2.56	4,004	0.20	0.24	2.91
PSD	2,861	0.29	0.00	0.46	4,004	0.42	0.00	0.49
$\text{PSD}_{Increasing}$	2,861	0.12	0.00	0.33	4,004	0.24	0.00	0.43
$\text{PSD}_{Decreasing}$	2,861	0.26	0.00	0.44	4,004	0.36	0.00	0.48
B: Firm Characteristics								
Leverage	2,861	0.39	0.38	0.24	4,004	0.30	0.26	0.24
Total Assets	2,861	2,507	488.1	6,239	4,004	2,579	259.1	8,454
Market-to-book	2,861	1.57	1.31	0.91	4,004	1.71	1.34	1.10
Profitability	2,861	0.03	0.03	0.03	4,004	0.02	0.03	0.04
Tangibility	2,861	0.32	0.25	0.23	4,004	0.31	0.23	0.24
Z-Score	2,861	1.59	1.09	2.44	4,004	2.15	1.45	2.97
Rated	2,861	0.43	0.00	0.50	4,004	0.34	0.00	0.47
C: Loan Characteristics								
AIS (in bps)	2,861	294.06	275.00	137.92	4,004	230.40	225.00	130.72
Loan Amount (in $ million)	2,861	252.71	75.00	454.14	4,004	224.75	45.00	491.62
Relative Loan Size	2,861	0.19	0.13	0.19	4,004	0.23	0.18	0.20
Maturity (in month)	2,861	62.41	60.00	23.59	4,004	38.48	36.00	21.84
Security	2,861	0.82	1.00	0.38	4,004	0.68	1.00	0.46
Cancellation Fee (dummy)	2,861	0.22	0.00	0.42	4,004	0.12	0.00	0.33
Cancelation Fee (in bps)	642	154.44	100.00	99.66	493	192.63	200.00	114.82
ITL	2,861	0.30	0.00	0.46				

Table 3: Univariate analyses

The table reports the mean and median upfront fee in bps across high and low values of prepayment risk (Panel A) and loan facilities with and without performance pricing (Panel B). For *Relationship Bank* and PSD, prepayment risk is low (high) when the variable takes the value of one (zero). For Number of Lenders, prepayment risk is low (high) when $NumLenders > 3$ ($NumLenders \leq 3$). Columns (5) and (10) list the difference in the mean upfront fee. ***, **, and * indicate significance at the 1%, 5%, and 10% level respectively, using a standard t-test. The sample is 2,861 term loans (columns 1-4) and 4,004 credit lines (columns 5-8) issued by US public firms, 1987–2016. The data are Commercial & Industrial loan facilities from Dealscan. We exclude firms in regulated and financial industries, and require information on all explanatory variables used in the empirical analysis. The variables are as defined in Table 1, except no variable is logged in this table.

Sample	Term Loans					Credit Lines				
Prepayment Risk:	Low		High		Diff.	Low		High		Diff.
	Mean (1)	p50 (2)	Mean (3)	p50 (4)	(5)	Mean (6)	p50 (7)	Mean (8)	p50 (9)	(10)
A: Sample split by low vs. high prepayment risk										
Return Volatility	8.33	8.68	14.64	14.27		8.68	8.99	15.19	14.81	
Upfront Fee	66.17	50.00	81.68	58.57	15.51***	41.89	25.00	63.20	50.00	21.31***
Cash Flow Risk	0.49	0.49	2.15	1.52		0.63	0.64	2.97	2.20	
Upfront Fee	72.12	50.00	75.72	50.00	3.60	47.59	25.00	57.50	37.50	9.90***
Relationship Bank	1.00	1.00	0.00	0.00		1.00	1.00	0.00	0.00	
Upfront Fee	69.57	50.00	77.51	50.00	7.94***	44.24	25.00	57.99	38.89	13.74***
Number of Lenders	≥ 3		<3			≥ 3		<3		
Upfront Fee	69.87	50.00	77.49	50.00	7.62***	45.37	25.00	57.98	38.33	12.61***
Bond Spread	165.55	163.00	412.36	411.00		154.70	161.00	410.77	417.00	
Upfront Fee	66.89	50.00	81.00	50.00	14.14***	49.10	26.62	56.04	37.50	6.94***
Prepayment Risk Index	-2.38	-2.15	1.82	1.64		-2.18	-1.98	2.58	2.19	
Upfront Fee	64.43	50.00	83.42	58.42	18.99***	41.38	25.00	63.70	50.00	22.33***
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	53.50	48.21	82.44	50.00	28.95***	40.36	25.00	61.42	41.81	21.06***

Table 4: Upfront fees and prepayment risk in term loans

The table shows the coefficient estimates from ordinary least squares (OLS) regressions for *Upfront Fee*. The explanatory variables are various proxies for prepayment risk, firm and loan characteristics, and loan purpose, bank, industry and year fixed effects. The sample is 2,861 Commercial & Industrial term loan facilities issued by US public firms, 1987–2016, from Dealscan. We exclude firms in regulated and financial industries, and require information on the explanatory variables used in the empirical analysis. All variables are defined in Table 1.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Proxies for prepayment risk:							
Return Volatility	0.03***					0.03***	0.02***
	(5.58)					(4.65)	(4.17)
Cash Flow Risk		0.05***				0.03**	0.03*
		(3.33)				(2.39)	(1.77)
Relationship Bank			-0.18***			-0.14***	-0.14***
			(-4.20)			(-3.18)	(-3.03)
NumLenders				-0.08***		-0.04*	-0.07***
				(-3.85)		(-1.83)	(-2.90)
Bond Spread					0.19***		0.19***
					(5.28)		(5.56)
Firm characteristics:							
Market-to-Book	0.05	0.04	0.07**	0.06*	0.03	0.04	0.02
	(1.40)	(1.29)	(2.19)	(1.94)	(0.83)	(1.37)	(0.52)
Leverage	0.34***	0.43***	0.46***	0.44***	0.54***	0.39***	0.48***
	(2.94)	(3.78)	(4.06)	(3.86)	(4.63)	(3.34)	(4.05)
Profitability	-2.03***	-2.21***	-2.47***	-2.41***	-2.10***	-1.76***	-1.32**
	(-3.18)	(-3.47)	(-3.92)	(-3.78)	(-3.18)	(-2.78)	(-1.98)
Tangibility	-0.13	-0.14	-0.14	-0.16	-0.22*	-0.14	-0.26**
	(-1.13)	(-1.20)	(-1.21)	(-1.36)	(-1.80)	(-1.18)	(-2.11)
Z-Score	-0.02	-0.01	-0.02*	-0.02	-0.02	-0.02*	-0.02*
	(-1.58)	(-1.14)	(-1.66)	(-1.64)	(-1.35)	(-1.71)	(-1.82)
Rated	0.02	0.01	0.02	0.06	0.00	0.07	0.11*
	(0.38)	(0.17)	(0.32)	(1.16)	(0.04)	(1.38)	(1.92)
Loan characteristics:							
Relative Loan Size	0.27**	0.24**	0.25**	0.29***	0.44***	0.25**	0.43***
	(2.45)	(2.16)	(2.31)	(2.67)	(4.07)	(2.34)	(4.05)
Maturity	-0.00***	-0.00***	-0.00***	-0.00***	-0.00***	-0.00***	-0.00***
	(-3.00)	(-3.40)	(-3.79)	(-3.49)	(-3.84)	(-2.70)	(-2.76)
Security	0.46***	0.48***	0.48***	0.47***	0.40***	0.44***	0.36***
	(8.35)	(8.52)	(8.64)	(8.53)	(7.18)	(7.95)	(6.49)
Cancellation Fee	0.38***	0.40***	0.39***	0.37***	0.44***	0.35***	0.42***
	(7.44)	(7.76)	(7.57)	(7.18)	(8.61)	(6.93)	(8.27)
ITL	-0.14***	-0.13***	-0.13**	-0.15***	-0.14***	-0.13***	-0.12**
	(-2.83)	(-2.58)	(-2.44)	(-2.93)	(-2.72)	(-2.63)	(-2.27)
Loan Purpose FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	2,861	2,861	2,861	2,861	2,861	2,861	2,861
Adjusted R^2	0.243	0.234	0.237	0.236	0.164	0.251	0.187

Table 5: Upfront fees and prepayment risk in credit lines

The table shows the coefficient estimates from ordinary least squares (OLS) regressions for *Upfront Fee*. The explanatory variables are various proxies for prepayment risk, firm and loan characteristics, and loan purpose, bank, industry and year fixed effects. The sample is 4,004 Commercial & Industrial credit line facilities issued by US public firms, 1987–2016, from Dealscan. We exclude firms in regulated and financial industries, and require information on the explanatory variables used in the empirical analysis. All variables are defined in Table 1.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Proxies for prepayment risk:							
Return Volatility	0.04***					0.04***	0.04***
	(8.32)					(6.99)	(8.37)
Cash Flow Risk		0.05***				0.04***	0.04***
		(4.98)				(3.63)	(3.95)
Relationship Bank			-0.20***			-0.15***	-0.19***
			(-6.06)			(-4.59)	(-5.60)
NumLenders				-0.14***		-0.09***	-0.10***
				(-6.83)		(-4.55)	(-5.00)
Bond Spread					0.21***		0.21***
					(8.07)		(8.09)
Firm characteristics:							
Market-to-Book	0.06***	0.06***	0.08***	0.08***	0.06***	0.05**	0.03
	(2.93)	(2.67)	(3.76)	(3.97)	(3.01)	(2.39)	(1.59)
Leverage	0.66***	0.75***	0.76***	0.73***	0.89***	0.72***	0.83***
	(7.36)	(8.28)	(8.24)	(8.03)	(9.56)	(8.02)	(9.20)
Profitability	-2.09***	-1.85***	-2.43***	-2.30***	-2.57***	-1.37***	-1.08**
	(-4.88)	(-4.14)	(-5.72)	(-5.47)	(-5.92)	(-3.18)	(-2.48)
Tangibility	-0.17*	-0.19*	-0.19*	-0.19*	-0.13	-0.17*	-0.14
	(-1.75)	(-1.96)	(-1.92)	(-1.88)	(-1.24)	(-1.78)	(-1.46)
Z-Score	-0.03***	-0.03***	-0.04***	-0.04***	-0.03***	-0.03***	-0.03***
	(-4.50)	(-3.83)	(-4.85)	(-5.27)	(-4.37)	(-4.46)	(-4.44)
Rated	-0.08*	-0.10**	-0.08*	0.02	-0.11**	0.04	0.07
	(-1.80)	(-2.19)	(-1.94)	(0.41)	(-2.39)	(0.96)	(1.56)
Loan characteristics:							
Relative Loan Size	-0.36***	-0.43***	-0.35***	-0.31***	-0.41***	-0.36***	-0.42***
	(-4.34)	(-5.01)	(-4.25)	(-3.70)	(-4.65)	(-4.38)	(-4.94)
Maturity	0.01***	0.01***	0.01***	0.01***	0.01***	0.01***	0.01***
	(7.91)	(7.49)	(6.82)	(8.50)	(6.06)	(9.18)	(9.52)
Security	0.53***	0.58***	0.58***	0.54***	0.56***	0.49***	0.45***
	(14.32)	(15.53)	(15.73)	(14.17)	(14.54)	(13.02)	(12.05)
Cancellation Fee	0.46***	0.47***	0.45***	0.41***	0.44***	0.38***	0.31***
	(9.33)	(9.74)	(9.24)	(8.21)	(8.62)	(7.64)	(6.10)
Loan Purpose FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	4,004	4,004	4,004	4,004	4,004	4,004	4,004
Adjusted R^2	0.341	0.330	0.332	0.335	0.270	0.354	0.315

Table 6: Upfront fees and the prepayment risk index

The table shows the coefficient estimates from ordinary least squares (OLS) regressions for *Upfront Fee*. The explanatory variables are *Prepayment Risk Index* (*PR Index*), *High Prepayment Risk* (*High PR*), their interactions with *Credit Line*, firm and loan characteristics, and loan purpose, bank, industry and year fixed effects. The sample is 2,861 term loans (columns 1-2), 4,004 credit lines (columns 3-4), and the total sample of 6,865 loans (columns 5-8). The data are Commercial & Industrial loan facilities issued by US public firms, 1987–2016, from Dealscan. We exclude firms in regulated and financial industries, and require information on the explanatory variables used in the empirical analysis. All variables are defined in Table 1, and the firm and loan characteristics are from Table 4.

Sample	Term loans		Credit lines		All loans			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Proxies for prepayment risk:								
Prepayment Risk Index	0.07***		0.10***		0.08***	0.08***		
	(7.32)		(11.26)		(11.75)	(9.36)		
Credit Line*PR Index						0.00		
						(0.60)		
High Prepayment Risk		0.31***		0.37***			0.33***	0.31***
		(7.06)		(9.27)			(9.64)	(7.27)
Credit Line*High PR								0.03
								(0.72)
Control variables:								
Credit Line					-0.16***	-0.16***	-0.17***	-0.18***
					(-6.67)	(-6.68)	(-6.98)	(-5.76)
Firm characteristics	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Loan characteristics	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Loan Purpose FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	2,861	2,861	4,004	4,004	6,865	6,865	6,865	6,865
Adjusted R^2	0.250	0.248	0.353	0.344	0.324	0.324	0.316	0.316

Table 7: Upfront fees, the prepayment risk index, and AIS

The table shows the coefficient estimates from ordinary least squares (OLS) regressions for *Upfront Fee*. The explanatory variables are *Prepayment Risk Index* (*PR Index*), *High Prepayment Risk* (*High PR*), their interactions with *Credit Line*, and the all-in-spread (*AIS*), firm and loan characteristics, and loan purpose, bank, industry and year fixed effects. The sample is 2,861 term loans (columns 1-2), 4,004 credit lines (columns 3-4), and the total sample of 6,865 loans (columns 5-8). The data are Commercial & Industrial loan facilities issued by US public firms, 1987–2016, from Dealscan. We exclude firms in regulated and financial industries, and require information on the explanatory variables used in the empirical analysis. All variables are defined in Table 1, and the firm and loan characteristics are from Table 4.

Sample	Term loans		Credit lines		All loans			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Proxies for prepayment risk:								
Prepayment Risk Index	0.04***		0.04***		0.04***	0.04***		
	(3.74)		(4.69)		(5.05)	(4.75)		
Credit Line*PR Index						-0.01		
						(-1.24)		
High Prepayment Risk		0.20***		0.18***			0.16***	0.15***
		(4.66)		(4.77)			(4.99)	(4.38)
Credit Line*High PR								-0.06
								(-1.45)
Control variables:								
AIS	0.62***	0.63***	0.76***	0.77***	0.72***	0.72***	0.73***	0.74***
	(11.88)	(12.32)	(22.92)	(23.84)	(23.19)	(23.24)	(24.08)	(24.16)
Credit Line					-0.06***	-0.06***	-0.06***	-0.03
					(-2.63)	(-2.61)	(-2.64)	(-1.08)
Firm characteristics	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Loan characteristics	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Loan Purpose FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	2,861	2,861	4,004	4,004	6,865	6,865	6,865	6,865
Adjusted R^2	0.333	0.335	0.475	0.475	0.433	0.433	0.432	0.432

Table 8: Upfront fees and performance-pricing

The table shows the coefficient estimates from ordinary least squares (OLS) regressions for *Upfront Fee*. The explanatory variables are PSD, $PSD_{Increasing}$, $PSD_{Decreasing}$, *Prepayment Risk Index*, firm and loan characteristics, and loan purpose, bank, industry and year fixed effects. The sample is 2,861 term loans (columns 1-3), 4,004 credit lines (columns 4-6), and the total sample of 6,865 loans (columns 7-9). The data are Commercial & Industrial loan facilities issued by US public firms, 1987–2016, from Dealscan. We exclude firms in regulated and financial industries, and require information on the explanatory variables used in the empirical analysis. All variables are defined in Table 1, and the firm and loan characteristics are from Table 4.

Sample	Term loans			Credit lines			All loans		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Performance pricing and proxies for prepayment risk:									
PSD	-0.17***			-0.15***			-0.16***		
	(-3.70)			(-3.97)			(-4.84)		
$\text{PSD}_{Increasing}$		-0.14**			-0.06			-0.10***	
		(-2.40)			(-1.42)			(-2.76)	
$\text{PSD}_{Decreasing}$			-0.16***			-0.14***			-0.14***
			(-3.31)			(-3.64)			(-4.21)
Prepayment Risk Index	0.06***	0.07***	0.06***	0.09***	0.09***	0.09***	0.08***	0.08***	0.08***
	(6.49)	(6.97)	(6.57)	(10.70)	(11.15)	(10.70)	(10.89)	(11.39)	(10.99)
Control variables:									
Credit Line							-0.14***	-0.15***	-0.15***
							(-5.96)	(-6.38)	(-6.19)
Firm characteristics	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Loan characteristics	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Loan Purpose FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	2,861	2,861	2,861	4,004	4,004	4,004	6,865	6,865	6,865
Adjusted R^2	0.254	0.251	0.253	0.357	0.354	0.356	0.328	0.325	0.327

Table 9: Upfront fees and M&A industry waves

The table shows the coefficient estimates from ordinary least squares (OLS) regressions for *Upfront Fee*. The explanatory variables are various M&A industry wave measures, *Prepayment Risk Index*, firm and loan characteristics, and loan purpose, bank, industry and year fixed effects. The sample is 2,861 term loans (columns 1-2), 4,004 credit lines (columns 3-4), and the total sample of 6,865 loans (columns 5-8). The data are Commercial & Industrial loan facilities issued by US public firms, 1987–2016, from Dealscan. We exclude firms in regulated and financial industries, and require information on the explanatory variables used in the empirical analysis. All variables are defined in Table 1, and the firm and loan characteristics are from Table 4.

Sample	Term loans		Credit lines		All loans			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Proxies for prepayment risk:								
M&A Count	0.00*		0.00***		0.00***			
	(1.66)		(2.94)		(2.87)			
M&A Volume		0.00**		0.00**		0.00***		
		(1.99)		(2.37)		(2.77)		
High M&A Count							0.10***	
							(2.62)	
High M&A Volume								0.09**
								(2.38)
Prepayment Risk Index	0.07***	0.07***	0.10***	0.10***	0.08***	0.09***	0.09***	0.09***
	(7.71)	(7.70)	(11.45)	(11.52)	(11.93)	(11.95)	(11.91)	(11.90)
Control variables:								
Credit Line					-0.16***	-0.16***	-0.16***	-0.16***
					(-6.80)	(-6.82)	(-6.75)	(-6.78)
Firm Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Loan Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Loan Purpose FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	2,861	2,861	4,004	4,004	6,865	6,865	6,865	6,865
Adjusted R^2	0.233	0.233	0.336	0.336	0.309	0.308	0.309	0.308