Advances in Accounting 61 (2023) 100645

Contents lists available at ScienceDirect

Advances in Accounting

journal homepage: www.elsevier.com/locate/adiac

Cost stickiness and bank loan contracting☆

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ARTICLE INFO

Editor: Jared Moore

Keywords:
Cost stickiness
Information risk
Default risk
Loan spread
Bank loan contracting

ABSTRACT

This study examines whether and, if so, how borrowers' asymmetric cost behavior (i.e., cost stickiness) is factored into the price and non-price terms of bank loan contracts. We provide strong and reliable evidence that *ex-ante*, the loan spread increases with cost stickiness after controlling for other known determinants of loan contract terms. Moreover, we find that the effect is more pronounced for borrowers with higher default risk and higher information risk. This is consistent with borrowers' asymmetric cost behavior increasing lenders' uncertainty about the liquidation value of assets, and hence, lenders need to be compensated *ex-ante*. Additionally, we conjecture that higher cost stickiness may increase the need for *ex-post* monitoring. Consistent with this conjecture, we find some evidence that lenders impose tighter non-price terms on firms with stickier costs. This study integrates cost stickiness research with the banking literature by showing that banks incorporate borrowers' asymmetric cost behavior into loan contracting terms.

1. Introduction

A growing body of literature in management accounting has made significant progress toward understanding firms' asymmetric cost behavior (Anderson, Banker, & Janakiraman, 2003; Banker & Chen, 2006; Weiss, 2010). Notably, Anderson et al. (2003) refer to costs as being sticky if costs decrease, to a lesser extent, with sales decreases than they rise with equivalent sales increases. Since then, a number of studies have examined the implications of cost stickiness for earnings prediction and equity valuation (e.g., Banker, Byzalov, & Chen, 2013; Banker & Chen, 2006; Weiss, 2010). However, little is known about the role of this asymmetric cost behavior in the credit market. Particularly, creditors have an asymmetric payoff structure and hence should care greatly about a firm's cost asymmetry.[1] In this paper, we aim to fill this void by exploring whether a firm's cost behavior can inform lenders about its credit risk and consequently affect loan contracting terms.

We expect that cost stickiness is associated with a higher cost of debt for several reasons. First, stickier costs may result in greater earnings variability. A firm with stickier costs shows a greater decline in earnings when sales fall than a firm with less sticky costs. This greater decrease in earnings when sales fall increases the variability of the *ex-ante* earnings distribution. Consistent with this argument, Weiss (2010) finds that sticky cost behavior reduces the accuracy of analysts' earnings forecasts. This reduced earnings forecast accuracy, along with the increased earnings forecast dispersion, may increase the information risk related to reported earnings on the income statement. Second, greater earnings variability may introduce noise to the reported asset value, and thus deteriorate the precision of reported accounting numbers such as net asset values. Third, cost stickiness may also increase downside risk which translates into a higher default risk. In assessing credit quality of a loan application, lenders are interested in the likelihood that the firm will have enough net assets to service their loans by making periodic interest payments and paying the principal back at maturity. When the activity level declines, managers of firms with stickier costs are slower in cutting costs which results in lower cost savings. Hence, a firm's default risk increases as its expected sales and/or cash flows decrease.

☆ We appreciate feedback from Jared Moore (The Editor), Qiang Wu (The Associate Editor), two anonymous reviewers, Jay Lee, Albert Mensah, Jong C. Park, Byron Song, and participants of research workshops/seminars at City University of Hong Kong, and California State University Fullerton. All errors are ours.

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[1] For example, Interpharm Holdings entered renegotiation process with its creditor Well Fargo in 2008 after the firm's performance deteriorated. Wells Fargo specifically required the firm to develop a new operating plan focusing on reducing costs and other expenses in order to provide the firm with credit availability (See Unassociated Document (sec.gov)). This suggests that creditors actually do understand borrowers' operation strategy and consider that as a condition for providing credit. When conditions get worse and costs tend to become sticky, they would "advise" management to reduce operating costs.

https://doi.org/10.1016/j.adiac.2023.100645
Received 15 February 2022; Received in revised form 30 December 2022; Accepted 26 January 2023
Available online 8 February 2023
0882-6110/

On the other hand, there is evidence that investors fail to fully adjust their earnings estimation for the implication of cost structure (e.g., Banker & Chen, 2006; Bhojraj, Bloomfield, Jang, & Yehuda, 2021). Notably, Bhojraj et al. (2021) find that credit investors do not fully impound the implications of firms' operating leverage when pricing credit default swaps (CDS). Further, the extant literature leaves still unresolved whether observed cost stickiness reflects rational resource management or overspending due to agency problems (Banker & Byzalov, 2014). To the extent that cost stickiness is driven by managers' rational decisions to reduce adjustment costs, banks should not perceive these firms as risky. Therefore, the issue of whether and, if so, how cost stickiness affects bank loan pricing is ultimately an empirical question.

For our empirical tests, we construct a sample of 11,883 loan facility-year observations from 2735 firms over the sample period of 1992–2017. Our results show the following: First, we find that the loan spread is significantly higher for borrowing firms with stickier costs. Moreover, the impact of cost stickiness on loan spread is economically significant. Controlling for other factors that affect loan spread, we note that when cost stickiness decreases from the top decile to the bottom decile, the loan spread drops by 16.12 basis points (bps). This translates into annual savings in interest cost of 0.6 million for the average loan in our sample.[2] This result holds when we use alternative measures of cost stickiness. We interpret this finding as suggesting that cost stickiness exacerbates lenders' perceived uncertainty about the liquidation value of assets, which leads lenders to engage in the *ex-ante* screening of borrowers' credit risk based on their cost stickiness.

In addition to our main tests examining the impact of cost stickiness on bank loan contracting, we perform cross-sectional tests by identifying settings in which cost stickiness should have a greater impact on loan contract terms. The cost of debt is primarily determined by a borrower's credit risk, which includes default risk and information risk (Duffie & Lando, 2001). We conjecture that the strength of the relation between cost stickiness and loan terms is affected by both risks. Our first cross-sectional test examines the information risk. We find that the positive association between cost stickiness and loan spread is more pronounced for firms with higher information risk (as measured by higher analyst forecast dispersion). Second, we find that cost stickiness is associated with a greater increase in loan spread for firms with higher default risk (as measured by lower credit rating). Our cross-sectional analyses suggest that lenders view borrowers' cost behavior useful for assessing credit risk, and this usefulness stems from both default and information risks.

We further predict that cost stickiness may also facilitate the need for *ex-post* monitoring. To test this hypothesis, we investigate whether and how non-price terms vary according to the firm's cost stickiness. Consistent with our prediction, we find that cost stickiness is associated with more restrictive covenant terms. Specifically, we find that lenders are more likely to request collateral and impose more covenants for firms with stickier costs.

A potential limitation of the above findings is that managers may strategically manipulate cost behavior prior to loan financing. We argue that one unique feature of our setting is that bank loan contracting contains multiple terms that can be used for both *ex-ante* screening and *ex-post* monitoring. This makes borrowers' pre-contracting strategic behavior less likely and hence, at least partially mitigates concerns over potential endogeneity. To further alleviate concerns that our estimates might be biased due to the endogeneity of a firm's cost stickiness, we employ the Heckman (1979) two-stage treat-effect model, a propensity-score matching sample, and use a firm fixed effects regression model, and find that our inferences remain unchanged. However, we acknowledge that we may not fully rule out endogeneity concerns.

Our study makes several contributions to the existing literature. First, we contribute to the emerging literature on the economic consequences of cost stickiness. Prior research related to this area has thus far focused mainly on the equity market consequences or implications of cost stickiness for earnings prediction (Banker et al., 2013; Weiss, 2010; among others). One notable exception is Bhojraj et al. (2021); to see if credit investors price the firm's cost structure (or operating leverage) efficiently, they examine the impact of operating leverage on CDS pricing. Our study differs from Bhojraj et al. (2021) in the following ways. Our focus is on the private debt market consequences of *asymmetric cost behavior* (cost stickiness), while their focus is on the credit derivative market consequences of the *cost structure* (the composition of fixed and variable costs). CDS spread[3] reflects default risk of a firm referenced in CDS contracts, while loan contracting terms reflect both information risk and default risk of a borrowing firm (Kim, Song, & Stratopoulos, 2018; Kim, Song, & Zhang, 2011). As such, unlike Bhojraj et al. (2021) who focus on default risk, we provide insights into the impact of cost stickiness on both information risk and default risk. Finally, our study complements their study by providing evidence that cost stickiness may facilitate both *ex-ante* screening and *ex-post* monitoring of borrowers' credit risk.

A concurrent study by Chou, Louis, and Zhuang (2018) also examines the relationship between cost stickiness and the cost of public debt as opposed to private debt like bank loans. Chou et al. (2018) find that bond yield spreads increase with cost stickiness, which is consistent with our main analysis. However, one key difference between our study and Chou et al. (2018) is that their analysis focuses on the credit spread in the secondary bond market, whereas ours focuses on the cost of private debt in the primary bank loan market. Unlike investors in the bond market, banks have comparative advantages in accessing borrowers' inside information. Moreover, multifaceted features of loan contracts provide banks and other private lenders with a unique opportunity to assess not only the *direct* cost of cost stickiness (i.e., higher loan spreads), but also the associated *indirect* cost (i.e., tighter non-price terms).[4] We view the two studies as complementary in that they collectively provide evidence that a firm's asymmetric cost behavior can impact its cost of debt not only in the public debt market but also in the private debt market.

Second, our study complements and extends a long line of literature that investigates the determinants of private debt contracting (Ball, Bushman, & Vasvari, 2008; among others). Given the economic importance of private debt, a survey paper by Armstrong, Guay, and Weber (2010) calls for more research on banks' demand for and use of information. Unlike prior research that investigates financial reporting quality, various borrower characteristics or third party-initiated disclosures,[5] our study focuses on cost stickiness, which is not only an important factor influencing accounting numbers reported on a firm's financial statements but also reflects the outcome of managerial accounting decisions, namely resource adjustments and allocations under uncertainty about future sales and cash flows.

The paper proceeds as follows. In the next section, we provide institutional background, related research and develop hypotheses. We then explain our research design, describe sample selection and provide descriptive statistics. We next present the empirical results and report additional analyses. The final section concludes.

[2] The average amount of a loan facility is 386.31 million in our sample.

[3] CDS spread is viewed as insurance premium for default risk of a firm referenced in CDS contract (e.g., Call et al., 2009)

[4] For example, more restrictive covenants can limit flexibility in investment decisions which may increase the indirect cost of debt.

[5] For example, some prior studies examine the role of financial reporting quality (e.g., Bharath et al., 2008; among others). Other studies focus on various borrower characteristics, including political connection (Houston, Jiang, Lin, & Ma, 2014), customer concentration (Campello & Gao, 2017), IT reputation (Kim et al., 2018), and competition (Valta, 2012). Kim, Mensah, and Tang (2019) examine customer-generated product information on Twitter.

2. Literature review and hypotheses development

2.1. Background literature on cost stickiness

The traditional cost accounting classifies costs into two types – "fixed" and "variable". The implicit assumption is that the relation between cost and activity is symmetric for activity increases and decreases. In contrast, asymmetric cost behavior constitutes a new way of thinking about cost behavior. This alternative cost model recognizes that the underlying driving forces of cost behavior stem from resource adjustment and commitment decisions made by managers. In many cases, resource adjustment costs can be non-trivial. For example, dismissing employees entails severance payments and training costs for new workers. Because adjusting resource is costly, managers need to take into account both current activities and past resource levels which affect future adjustment costs. These considerations give rise to "sticky" or "anti-sticky" costs.

Anderson et al. (2003) provide the first empirical evidence that the fundamental assumption of a symmetric relation between costs and activity may not hold. Their study posits that costs are "sticky". That is, costs increase more when activity rises than they decrease when activity falls by an equivalent amount. The argument is that when sales decrease, managers curtail costs less than proportionately to retain slack resources. By contrast, since managers cannot accommodate a sales increase unless they add the required resources, costs increase proportionately. Consistent with this argument, Anderson et al. (2003) document the prevalence of sticky cost behavior for selling, general, and administrative costs.

Building on this fundamental insight of asymmetric managerial discretion, subsequent studies extend and enrich Anderson et al. (2003)'s prediction by documenting cost stickiness for additional cost categories including operating costs, COGS, labor costs, and advertising costs, for samples in other countries, and for industry-specific datasets (e.g., Balakrishnan & Gruca, 2008; Calleja, Steliaros, & Thomas, 2006; Cannon, 2014; Dierynck, Landsman, & Renders, 2012; Holzhacker, Krishnan, & Mahlendorf, 2015). Collectively, these studies provide strong and reliable evidence that many costs are sticky, on average.

Moreover, the asymmetric cost theory argues that the magnitude and the direction of asymmetry vary systematically across firms, industries, and time periods. Using the strength of employment protection legislation as a proxy for labor adjustment costs, Banker et al. (2013) find that cost stickiness is higher in countries with stricter employment protection, supporting the notion that the degree of cost stickiness is increasing in the magnitude of resource adjustment costs. Banker, Byzalov, Ciftci, and Mashruwala (2014) argue that an important determinant of cost asymmetry is the direction of prior period sales changes. They show a more complex pattern of asymmetric cost behavior that combines two opposing processes: *cost stickiness* conditional on a prior sales increase, and *cost anti-stickiness* conditional on a prior sales decrease. Extant literature also attributes cost stickiness, in part, to the agency problem. Chen, Lu, and Sougiannis (2012) suggest that managers' preference for empire building motivates them to maximize resources under their control, which induces greater cost stickiness. Kama and Weiss (2013) show that managers are more likely to cut slack resources excessively when sales decrease and when they face strong incentives to meet an earnings target for the current period. This will reduce cost stickiness below the efficient level.

Because earnings is a function of sales and costs, a better understanding of cost behavior has important implications for accounting research. There is another strand of the cost behavior literature that examines the economic consequences of cost stickiness. Banker and Chen (2006) show that a model that incorporates cost stickiness outperforms other earnings prediction models. Weiss (2010) examines how asymmetric cost behavior affects analysts' earnings forecasts and coverage priorities. He finds that firms with stickier cost behavior have less accurate analysts' earnings forecasts and lower analyst coverage than firms with less sticky cost behavior. Caylor and Lopez (2013) investigate whether a firm's cost behavior provides an explanation for the inefficiency in executive compensation contracts. Other studies investigate the extent to which financial statement users understand asymmetric cost behavior. For example, Banker, Byzalov, et al. (2014) provide evidence that investors and analysts do not fully incorporate information on cost stickiness into their earnings estimation and stock valuation.

A firm's asymmetric cost behavior constitutes an important element in financial reporting; its understanding facilitates a broad range of market participants (including capital market investors and creditors) to better digest the real underlying value of reported earnings on the income statement and that of net assets on the balance sheet. Given that earnings and asset value are two crucial value indicators about which credit investors are concerned, we predict that the cost stickiness should have an impact on the pricing of private debt in the credit market. Given the mixed evidence on the impact of cost stickiness for sophisticated and unsophisticated investors in the equity market, research on possible economic consequences of the cost stickiness for sophisticated credit investors such as banks can provide us with useful insights into the implications of the asymmetric cost behavior.

2.2. Hypotheses development

Watts and Zimmerman (1978, 1990) suggest that accounting information can play an important role in reducing the agency costs of debt that arise in the debt-contracting process. We expect that lenders incorporate a firm's cost behavior into loan contracting terms if this signal helps them develop more accurate beliefs about a firm's credit risk (Spence, 1973). We have several reasons to expect that greater cost stickiness is associated with a higher cost of debt.

First, firms with stickier costs have higher earnings variability. A firm with stickier costs shows a greater decline in earnings when sales fall, compared to a firm with less sticky costs. This greater decrease in earnings when sales fall increases the variability of future earnings, all else equal. Consistent with this argument, Weiss (2010) finds that sticky cost behavior reduces the accuracy of the analyst's earnings forecasts. Duffie and Lando (2001) develop a theory suggesting that lenders require compensation for imperfect information-related risk. One can therefore expect that banks would charge higher loan rates to borrowers with stickier costs to compensate for the increased information risk, to the extent that cost stickiness results in greater earnings variability,

Second, greater earnings variability induced by cost stickiness may also translate into uncertainty about the liquidation value of assets reported on the balance sheet, which leads to a decrease in the precision of reported accounting numbers. Less precise accounting numbers mean that credit investors such as banks have less reliable information to assess default risk and to determine compliance with debt covenants (Moore & Xu, 2018). This increase in information risk, also known as estimation risk (or the risk associated with estimating default risk using accounting numbers) brings about an increase in credit risk or a decrease in credit quality, thereby leading banks and other private lenders to charge a higher interest rate on loans to borrowing firms with stickier costs.

Third, cost stickiness may also increase downside risk which translates into a higher default risk. In assessing a potential loan, lenders are interested in the likelihood that the firm will have enough net assets to cover their loans in the event of default (Brasel, Hill, & Taylor, 2022). When the activity level declines, managers of firms with stickier costs are slower in curtailing costs which results in lower cost savings. Hence, a firm's default risk increases as its expected sales and/or the associated cash flows decrease.

However, this prediction does not necessarily hold for several reasons. First, it is not clear that creditors understand cost structure/behavior. For example, Bhojraj et al. (2021) find that credit investors do not efficiently impound the implications of firms' operating leverage when pricing credit default swaps. Second, the literature leaves still unresolved whether the observed cost stickiness reflects rational resource management or overspending due to agency problems (Banker & Byzalov, 2014). While many firms exhibit higher cost asymmetry for bad reasons, others may do so for good reason. For example, Bruggen and Zehnder (2014) provide evidence that cost stickiness increases with the proportion of equity-based compensation, consistent with "good" cost stickiness argument. To the extent that cost stickiness is driven by firms' rational decisions to reduce adjustment costs, banks should not perceive these firms as risky. As a result, the question of whether and how creditors influence cost behavior remains unclear a priori, and thus is ultimately an empirical issue.

To provide large-sample, systematic evidence on this unexplored issue, we propose and test our first hypothesis, stated in alternative form:

H1. : *All else being equal, cost stickiness is positively associated with loan spreads.*

To provide further insight into the impact of cost stickiness on loan spreads, we conjecture that the effect of cost stickiness on loan contracting terms is dependent on two risks. The first risk is the information risk. Cost stickiness increases the variability of future earnings, because it decreases earnings, to a greater extent, when sales decrease (as it decreases expense to a lesser extent) than it increases earnings when sales increase. As a consequence, lenders become more uncertain about the liquidation value of reported assets. As such, we should observe that this relation is greater for firms with higher information uncertainty. The second risk is the default risk. Cost stickiness may exacerbate downside risk which translates into a higher default risk. If so, we should observe that the association between cost stickiness and loan spread is greater for firms with higher default risk. The above discussion leads us to propose and test our second hypothesis below, stated in alternative form:

H2a. : *All else being equal, the association between cost stickiness and loan spreads is greater for firms with higher information risk.*

H2b. : *All else being equal, the association between cost stickiness and loan spreads is greater for firms with higher default risk.*

Cost stickiness has not only the *direct* impact on the cost of the bank loan (via its effect on loan interest rates) but also has the *indirect* impact on the loan cost via its effect on non-price terms such as covenant restrictions and collateral requirements. Much of the debt-contracting literature follows the agency-theoretic view of the firm that Jensen and Meckling (1976) articulate. The central premise underlying the Jensen-Meckling framework is that creditors are expected to demand higher interest rates as the compensation for the so-called agency costs of debt, that is, the agency costs associated with the manager's incentives to engage in actions that benefit shareholders at the creditors' expense. Smith and Warner (1979) emphasize that debt contracts typically include clauses and covenants that are based on observable outputs of the accounting system. To the extent that cost stickiness increases *ex-post* monitoring and renegotiation costs, lenders would impose more stringent covenant restrictions on borrowers, both in terms of the number of covenants included in the contract and the use of collateral. This leads us to propose and test our third hypothesis, stated in the alternative form:

H3. : *All else being equal, the number of covenants and the use of the collateral increase in cost stickiness.*

3. Research design

3.1. Firm-level cost stickiness

Our empirical strategy requires us to estimate cost stickiness at an individual firm level. To this end, we follow Weiss (2010) and measure our main stickiness variable, *Stickiness*, as follows:

$$Stickiness_{i,t} = log\left(\frac{\Delta COST}{\Delta SALE}\right)_{i,\overline{\tau}} - log\left(\frac{\Delta COST}{\Delta SALE}\right)_{i,\underline{\tau}} \tag{1}$$

where $\Delta SALE$ is the change in sales from *t*-1 to *t*; $\Delta COST$ measures the change in cost from *t*-1 to *t*.[6] Following Weiss (2010), we do not use observations with costs that move in opposite directions with sales. $\underline{\tau}$, $\overline{\tau}$ $\in\{t, \ldots, t\text{-}3\}$, where $\underline{\tau}$ is the most recent of the last four quarters with a decrease in sales and $\overline{\tau}$ is the most recent of the last four quarters with an increase in sales. *Stickiness* then measures the difference in the cost function slope between the two most recent quarters of the last four quarters where sales increase in one quarter and decrease in the other. If costs are sticky, then they decrease, to a lesser extent, when sales fall than they increase when sales rise by the same amount. A higher value of *Stickiness* represents more sticky cost behavior.

The second measure of cost stickiness for each firm in each quarter, denoted by *Dstick*, is an indicator variable that equals one for a firm-quarter that exhibits sticky cost behavior ($Stickiness \geq 0$) and zero for a firm-quarter that exhibits anti-sticky cost behavior ($Stickiness < 0$).

To make sure that our cost stickiness measure is not sensitive to the time window, we employ a third measure of stickiness. We first compute the ratio of change in total costs to change in sales using data from the most recent eight quarters, *t*-7 through *t*. We then estimate *Mstick* on a rolling basis as the difference between the mean of the quarterly cost function slope under upward adjustments and the mean of the quarterly cost function slope under downward adjustments. Therefore, the measure of *Mstick* accounts for upward adjustments and downward adjustments made over the past eight quarters and provides more insights into the "stickiness" of a firm's cost behavior over a longer window.

3.2. Empirical model

To evaluate the role of cost stickiness in bank loan contracting, we specify the following regression model:

$$\begin{aligned} LoanTerm_{t+1} = {} & \alpha_0 + \alpha_1 Cost\_Stickiness_t + \alpha_2 Loan\_Controls_t \\ & + \alpha_3 Borrower\_Controls_t + \alpha_4 Macroeco\_Controls_t \\ & + YearIndustryLoanFixedEffects + \varepsilon_{t+1} \end{aligned} \tag{2}$$

where the dependent variable, *LoanTerm*, represents one of the following loan contract terms, *AIS, Collateral, GenCov*, and *FinCov*. More specifically, *AIS* refers to the price term determined by the drawn all-in spread, which is computed as loan interest rates minus the London interbank overnight loan rates (LIBOR) plus upfront fees and annual fees, if any; *Collateral*, which refers to the likelihood of loan being collateralized, is an indicator variable that equals 1 if the loan is secured and 0 otherwise[7]; *GenCov* refers to the number of general covenants included in a loan contract; and *FinCov* refers to the number of financial covenants included in a loan contract.[8]

The main variable of interest, *Cost_Stickiness*, refers to one of our three proxies for cost stickiness, *Stickiness*, *Dstick* and *Mstick*. The coefficient on *Cost_Stickiness* captures the incremental difference in the cost of debt between the sticky cost firms (with $Stickness \geq 0$) and anti-sticky cost firms (with $Stickiness < 0$) after controlling for other known determinants of borrowing costs. Our first hypothesis, H1, translates as $\alpha_1 > 0$, suggesting that banks charge higher interest rates on loans to firms with stickier costs.

Loan_Controls, Borrower_Controls, and *Macroeco_Controls* refer to a set of loan-specific, borrower-specific, and macro-economic control variables,

[6] The change in cost from *t*-1 to *t* (i.e., $\Delta COST$) could be measured by changes in sales (i.e., $\Delta SALE$) minus changes in income before extraordinary items for the same period.

[7] Bharath et al. (2011) find a positive association between loan spreads and collateral requirements in debt contracts.

[8] Agency theory predicts a tradeoff between interest rates and covenant intensity (Jensen & Meckling, 1976; Smith & Warner, 1979).

respectively. Beginning with our loan-specific controls (*Loan_Controls*), we include the maturity of the loan (*LnMaturity*) and the loan size (*LnLoansize*). Prior research (e.g., Graham, Li, & Qiu, 2008) finds that borrowing costs are lower for loans of shorter maturity and larger amounts. We also control for the presence of a performance pricing grid (*PPricing*). Loans with performance pricing provisions may have different terms (e.g., Kim et al., 2011). We further control for the number of lenders participating in a loan deal (*NLenders*). Prior research finds that the structure of a loan syndicate influences the cost of borrowing (Ball et al., 2008).

In terms of borrower-specific characteristics (*Borrower_Controls*), we include a set of controls commonly used in the debt contracting literature (Bharath, Sunder, & Sunder, 2008; Graham et al., 2008; Kim et al., 2011). We first control for *Leverage* defined as the ratio of long-term debt to total assets. Firms with higher leverage ratios, all else equal, have higher default risk. Therefore, we expect these firms to face higher borrowing costs. We include *Profitability*, defined as the ratio of earnings before interests, taxes, depreciation, and amortization to total assets, because more profitable firms generally have lower default risk and thus can borrow at a lower cost. We also control for firm size (*Size*). Larger firms have easier access to more sources of external financing, and thus banks might have lower bargaining power over larger firms. We include the market-to-book ratio (*MTB*) to control for a firm's growth opportunities. On the one hand, higher growth opportunities might be positively associated with credit quality, and thus, banks might offer lower loan rates for higher-growth firms. On the other hand, higher-growth firms might also be associated with greater risk. In such a case, *MTB* should be inversely associated with credit quality.

To control for a firm's bankruptcy risk (*ZScore*), we use a modified Altman (1968) z-score, multiplied by minus one (−1) so that higher values indicate higher bankruptcy risk. *CFVolatility,* defined as the standard deviation of quarterly cash flows from operations over the twenty fiscal quarters prior to the loan initiation year scaled by the total assets, is used to proxy for uncertainty underlying the cash flow generating process. This proxy is expected to be positively associated with the cost of debt (Bharath et al., 2008; Graham et al., 2008). *Tangibility*, defined as the ratio of tangible assets to total assets, is also included in our model. Because banks can recover tangible assets in case of default, we expect firms with more tangible assets to have lower borrowing costs. *Rating* is the numerical value of S&P domestic long-term issuer credit rating from Compustat. For firms not rated by S&P, we follow Beatty, Weber, and Yu (2008) and estimate the ratings. We first regress debt ratings on assets, return on assets, leverage, dividend indicator, subordinated debt indicator, a loss indicator, industry, and year fixed effects. We then use the estimated coefficients from the above regression and the firm's financial data to compute a credit rating for each firm in each year. The computed rating values are winsorized at 1 and 24 to be consistent with the range of ratings reported in Compustat. The value of *Rating* decreases in credit quality. We also include *Opaque* to control for accounting quality. The prior literature shows that the cost of debt is higher for firms with lower accounting quality (Bharath et al., 2008; Francis, LaFond, Olsson, & Schipper, 2005; Kim et al., 2011).

In addition, we include two economy-wide variables, *CSpread* and *TSpread*, to control for the potential effects of macroeconomic conditions on loan contracting. *CSpread* is the difference between the AAA and BAA corporate bond yield, while *TSpread* is the difference between the ten-year and two-year Treasury-bill yields.

YearIndustryLoanFixedEffects refers to a set of year, industry, loan type, and loan purpose fixed effects. Industry fixed effects are based on two-digit SIC code. The Appendix provides detailed definitions of all of the variables included in our regression analyses.

4. Sample and descriptive statistics

4.1. Sample

We obtain our sample of bank loans from the Loan Pricing Corporation (LPC) DealScan database. The DealScan loan data are compiled for each loan package (also referred to as a deal). Each package contains one or more bank loans (also called facilities) with different price and non-price terms. We require that all loan facilities in our sample be senior debts. We also exclude bridge loans and non-fund-based facilities (e.g., letters of credit). We consider each facility as a separate observation because many loan characteristics vary across facilities.

Table 1
Sample selection and distribution.

Panel A: Sample Selection

	Firms	Loan (Facilities)
Loans to all firms in DealScan with the company identifying information to match with Compustat from 1992 to 2017	19,352	142,392
Less:		
Observations with missing loan spread data	(4071)	(42,374)
Observations with missing cost stickiness data	(6650)	(52,496)
Loans to firms in the financial sector (SIC 6000–6999) or in the utility sector (SIC 4000–4999)	(1868)	(10,918)
Observations with insufficient data for control variables	(4028)	(24,719)
Total observations	2735	11,883

Panel B: Distribution of Firms and Loan Facilities by Year

Year	Firms	Facilities	Year	Firms	Facilities
1992	4	10	2005	450	724
1993	80	117	2006	374	579
1994	261	402	2007	342	577
1995	254	393	2008	225	315
1996	325	490	2009	164	221
1997	339	526	2010	277	408
1998	309	528	2011	346	530
1999	325	553	2012	294	451
2000	349	578	2013	301	530
2001	405	629	2014	309	507
2002	398	613	2015	276	463
2003	434	683	2016	208	328
2004	433	653	2017	54	75
			Total	7536	11,883

Panel A of Table 1 outlines our sample selection process. We begin with a sample of 142,392 bank loans from 19,352 firms with Compustat identifier information from 1992 to June 30th, 2017. We next merge our sample of bank loans with the Compustat database. We exclude loans to financial firms (SIC codes: 6000–6999) and utility firms (SIC codes: 4000–4999) from our sample. Because our main variable of interest is the drawn all-in spread of the loan rate relative to the benchmark rate, i.e., London Inter-Bank Offer Rate (*LIBOR*), we exclude loans where information on the loan spread is missing as well as observations with insufficient data for our control variables. Our final sample comprises of 11,883 loans from 2735 firms over the period of January 1st, 1992 to June 30th, 2017.[9]

Panel B of Table 1 presents the distribution of our sample firms and loan facilities by year. As shown in the panel, the number of borrowers and loan facilities dramatically decreases during the financial crisis period of 2008–2009. In total, our sample consists of 7536 firm-years and 11,883 facility-years.

4.2. Descriptive statistics

Table 2 presents descriptive statistics. Panel A provides statistics across the loan-specific variables, while Panel B reports statistics for the

[9] Our sample period ends on June 30th, 2017 because the Dealscan-Compustat Link table goes to 8/2017 (Chava & Roberts, 2008).

Table 2
Descriptive Statistics.

Panel A: Loan-specific characteristics						
Variables	N	Mean	Std. Dev.	1st Quartile	Median	3rd Quartile
AIS (bps)	11,883	191.78	138.84	87.5	175	255
Maturity (months)	11,883	48.65	22.11	36	60	60
Loansize (millions)	11,883	386.31	843.29	50	150	400
Collateral	11,883	0.52	0.5	0	1	1
GenCov	11,883	3.76	2.83	1	3	6
FinCov	11,883	1.64	1.62	0	2	3
PPricing	11,883	0.45	0.5	0	0	1
NLenders	11,883	8.1	8.2	2	6	11

Panel B: Borrower-specific characteristics						
Stickiness	11,883	0.07	1.06	−0.25	0.02	0.36
D_Stick	11,883	0.54	0.50	0	1	1
M_Stick	8281	0.05	0.42	−0.06	0.03	0.16
Leverage	11,883	0.28	0.20	0.14	0.26	0.39
Profitability	11,883	0.14	0.08	0.10	0.14	0.18
Size	11,883	6.98	1.87	5.71	7.02	8.25
MTB	11,883	2.86	3.08	1.25	2.05	3.34
ZScore	11,883	−2.15	1.38	−2.8	−2.13	−1.48
CFVolatility	11,883	3.14	3.14	1.47	2.22	3.56
Tangibility	11,883	0.28	0.20	0.13	0.23	0.38
Rating	11,883	10.30	2.85	8	10.99	12
Opaque	11,883	1.64	6.44	0.15	0.31	0.90

Panel A presents the descriptive statistics of the loan characteristics. Panel B presents the descriptive statistics of firm characteristics for the loan observations used in our analyses. All variables are defined in the Appendix.

borrower-specific variables. As shown in Panel A, the mean and median of spread over *LIBOR* are 191.78 and 175 basis points (bps), respectively, with a standard deviation of 138.84 bps. For loans in our sample, the mean maturity is 48.65 months, while its median is 60 months. The mean (median) loan size is $386.31 million ($150 million). However the standard deviation is $843.29 million which indicates that our sample has a wide range of loan sizes. On average, 52% of the loans in our sample are secured with collateral with each loan having an average of 3.76 general covenants and 1.64 financial covenants. A performance pricing provision is contained in 45% of the loans. Most of the loans in our sample are syndicated and involve an average of 8.1 participating banks.

Descriptive statistics on borrower characteristics in Panel B show that the average firm in our sample is profitable with the mean of being 0.14 (*Profitability*). Firm size (*Size*) is reasonably distributed with a mean (median) of 6.98 (7.02) and a standard deviation of 1.87. Of the loans in our sample, the mean and median credit ratings are 10.30 and 10.99. This suggests that half of the loans are granted to firms that have an S&P Domestic Long-Term Issuer Credit Rating of BB+ or above. The average value of *Opaque* in our sample, a measure of financial reporting quality, is 1.64.

Table 3 presents the Pearson correlation matrix for the main variables used in our regression analysis. Our three measures of cost stickiness, *Stickiness*, *DStcik*, and *MStick*, are all significantly positively correlated with each other, suggesting that they capture the same underlying construct. Consistent with our predictions, we find that cost stickiness is significantly and positively correlated with *AIS*.[10] Though only suggestive of the underlying relation, this finding is consistent with the prediction in H1 that a firm's cost stickiness is positively associated with bank loan spread. Providing support to H3, cost stickiness is significantly and positively correlated with *Collateral*, *GenCov*, and *FinCov*. It should be noted, however, that it is premature to draw any conclusion from the univariate analysis, because other confounding factors can potentially drive the positive cost stickiness-loan term association. In the next section we therefore perform multivariate regression analyses to test our hypotheses.

5. Empirical results

5.1. Test of hypothesis 1

In Table 4, we examine the *direct* impact on the cost of bank loan via its effect on loan interest rates. The dependent variable is loan spread measured by drawn all-in spread (*AIS*) and the variable of interest is cost stickiness. In column 1, we report the results by using *Stickiness* as the main test variable. The coefficient on *Stickiness* is positive and statistically significant at the 5% level (coefficient = 4.2109; $t = 2.51$). Controlling for other factors that affect loan spread, we note that when *Stickiness* increases by one standard deviation (1.06), *AIS* increases by 4.5 basis points. Column 2 reports the results by using *Dstick* as the independent variable. As shown in Column 2, the coefficient on *Dstick* is positive and significant at the 1% level (coefficient = 5.8341; $t = 2.90$). All else being equal, loan spread is 5.8341 basis points higher on average for firms with sticky cost behavior. The cost stickiness effect is even stronger under Column 3, which reports the results when we measure cost stickiness using a longer time window. Specifically, the coefficient on *Mstick* is 11.2721 and statistically significant at the 1% level ($t = 3.06$). This suggests that a one standard deviation increase in cost stickiness corresponds to an increase in loan spread of 6.22 basis points. The results presented in Table 4 are in line with Hypothesis 1, suggesting that cost stickiness increases information uncertainty and hence banks tend to charge higher spread to firms with stickier costs. Moreover, the effect is not only statistically significant but also economically significant. For instance, the coefficient of *Stickiness* in Column 1 is 4.2109. Given the coefficient, the spread difference between the firm with the cost stickiness in the top decile and the firm with the cost stickiness in the bottom decile is 16.12 basis points.[11] Since the mean (median) *AIS* is 191.78 (175) bps, this difference represents 8.4% (9.2%) of the mean (median). Overall, the results in Table 4 are consistent with the prediction of Hypothesis 1.

Turning to the control variables, we find that the loan spread is negatively associated with the size of the loan, the presence of a performance pricing grid, the number of lenders, and firm profitability. The loan spread is positively associated with leverage, bankruptcy risk, and cash flow volatility. Our control variable results are broadly consistent with prior findings (Bharath et al., 2008; Bharath, Dahiya, Saunders, & Srinivasan, 2011; Graham et al., 2008; Kim et al., 2011).

5.2. Test of Hypothesis 2a

While H1 is concerned with the average association between cost stickiness and loan spread, H2a tests whether this relation is stronger for firms with higher information uncertainty. Specifically, we examine whether the observed positive association between cost stickiness and loan spreads is greater for firms with higher information risk. Dispersion of analysts' earnings forecasts has been widely used as a proxy for investors' uncertainty about a firm's underlying performance (Barron, Kim, Lim, & Stevens, 1998; Herrmann & Thomas, 2005; among others).

To empirically test the hypothesis, we use analysts' earnings forecast data from I/B/E/S. We measure analyst forecast dispersion as the

[10] An analysis of variance inflation factors suggests that none of the control variables has a variance inflation factor value >3.5, indicating that multicollinearity is not a serious concern.

[11] The cost stickiness in the bottom and the top deciles are −1.80 and 2.03 respectively. Since the coefficient of *Stickiness* is 4.2109, this suggests that the spread difference between high-stickiness firms and low-stickiness firms is 4.2109*(2.03-(−1.80)) = 16.12 bps.

Table 3
Correlation Matrix.

	AIS	*Stickiness*	*Dstick*	*Mstick*	*LnMaturity*	*LnLoansize*	*Ppricing*	*LnNlenders*	*GenCov*	*FinCov*	*Collateral*
AIS	1										
Stickiness	**0.036**	1									
Dstick	**0.023**	**0.573**	1								
Mstick	**0.046**	**0.710**	**0.452**	1							
LnMaturity	**0.132**	−0.009	−0.006	−0.019	1						
LnLoansize	**−0.373**	−0.011	−0.014	0.004	**0.126**	1					
Ppricing	**−0.203**	0.001	0.007	−0.005	**0.100**	**0.105**	1				
LnNlenders	**−0.326**	0.001	−0.015	0.006	**0.145**	**0.675**	**0.228**	1			
GenCov	**0.131**	**0.041**	**0.018**	**0.046**	**0.170**	0.005	**0.465**	**0.133**	1		
FinCov	**0.144**	0.018	−0.013	0.006	**0.028**	**−0.281**	**0.096**	**−0.137**	**0.367**	1	
Collateral	**0.518**	**0.023**	**0.029**	**0.033**	**0.136**	**−0.346**	−0.252	**−0.302**	**0.196**	**0.256**	1

	Leverage	*Profitability*	*Size*	*MTB*	*Defaultrisk*	*Cfvolatility*	*Tangibility*	*Rating*	*Opaque*
Leverage	1								
Profitability	**−0.070**	1							
Size	**0.038**	**0.088**	1						
MTB	**0.024**	**0.328**	**0.165**	1					
ZScore	**0.304**	**−0.364**	**0.020**	**−0.054**	1				
Cfvolatility	**−0.074**	**−0.094**	**−0.314**	**−0.038**	**−0.068**	1			
Tangibility	**0.154**	**0.146**	**0.071**	**−0.039**	**0.100**	**−0.133**	1		
Rating	**0.340**	**−0.350**	**−0.416**	**−0.202**	**0.279**	**0.159**	**−0.028**	1	
Opaque	**−0.034**	**−0.012**	0.012	**0.030**	**0.034**	**−0.024**	**−0.041**	**0.028**	1

Table 3 presents the Pearson correlation matrix of the selected variables. Bold text indicates statistical significance at the level of 0.05 or better. All variables are defined in Appendix A.

Table 4
Cost Stickiness and Loan All-in Spread.

	(1)		(2)		(3)	
	AIS		*AIS*		*AIS*	
VARIABLES	Coeff.	t-stat	Coeff.	t-stat	Coeff.	t-stat
Stickiness	4.2109**	(2.51)				
Dstick			5.8341***	(2.90)		
Mstick					11.2721***	(3.06)
Loan-Specific Characteristics						
LnMaturity	−4.5181	(−1.07)	−4.5397	(−1.08)	−2.7915	(−0.71)
LnLoansize	−22.0481***	(−10.10)	−22.0658***	(−10.10)	−23.1742***	(−11.57)
Ppricing	−20.3358***	(−7.49)	−20.3904***	(−7.41)	−19.4009***	(−6.26)
LnNlenders	−8.2328***	(−2.92)	−8.1881***	(−2.91)	−9.4839***	(−3.11)
Borrower-Specific Characteristics						
Leverage	61.1291***	(8.50)	60.9597***	(8.43)	71.4267***	(10.11)
Profitability	−134.8191***	(−4.81)	−135.2219***	(−4.81)	−131.0988***	(−3.55)
Size	−0.3080	(−0.17)	−0.2969	(−0.16)	1.5702	(0.84)
Mtb	−0.3836	(−0.98)	−0.3827	(−0.98)	−0.3489	(−0.67)
ZScore	3.7744***	(2.64)	3.7929***	(2.67)	1.8503	(1.40)
Cfvolatility	2.2267***	(3.68)	2.2083***	(3.66)	2.2117***	(3.33)
Tangibility	−14.1664	(−1.50)	−14.7227	(−1.55)	−15.1015	(−1.31)
Rating	9.1779***	(12.63)	9.1934***	(12.64)	8.4386***	(9.45)
Opaque	−0.1022	(−0.82)	−0.1022	(−0.83)	−0.1282	(−0.94)
Macroeconomic Factors						
Cspread	−0.2145	(−0.03)	0.0208	(0.00)	7.3381	(1.01)
Tspread	2.5007	(0.45)	2.2933	(0.41)	4.4850	(0.86)
Constant	617.4531***	(11.33)	613.5644***	(11.21)	586.6561***	(9.71)
Year FE	Yes		Yes		Yes	
Industry FE	Yes		Yes		Yes	
Loan Type FE	Yes		Yes		Yes	
Loan Purpose FE	Yes		Yes		Yes	
Observations	11,883		11,883		8831	
Adjusted R-squared	0.5560		0.5556		0.5529	

This table reports the analysis of the association between cost stickiness and bank loan all-in spread *(AIS)*. The t-statistics are based on standard errors clustered at the firm and year level. ***, **, and * represent two-tailed *p*-value significance levels of 0.01, 0.05, and 0.1 respectively. FE stands for Fixed Effects. All variables are defined in Appendix A.

standard deviation of all annual earnings forecasts in the year prior to loan initiation scaled by the beginning of the year stock price. We create a dummy variable, *Hi_InfoRisk*, that is set to one for firm-quarters in which analyst forecast dispersion is above the median of the distribution and zero otherwise. As earnings forecast data are not available for some firm-year observations, our sample size necessarily decreases. We test the relation between loan spread and all independent variables by including an interaction term for *Hi_InfoRisk* with the measure of stickiness.

Table 5 provides the results for H2a. Column 1 displays the results for our first measure of cost stickiness, *Stickiness*. As column 1 shows, the positive relation between loan spread and stickiness (*Stickiness*) is more pronounced for firm-quarters with higher analyst forecast dispersion because the coefficient estimate on *Stickiness*Hi_InfoRisk* is significantly positive. The estimated coefficient on *Stickiness* is insignificant, suggesting that cost stickiness has no significant impact on loan spread for firms with low information risk (*Hi_InforRisk* = 0). On the other hand, the coefficient on *Hi_InfoRisk* is positive and statistically significant. Column 2 shows the results for our second measure of cost stickiness, *Dstick*. Similar to the results in Column 1, we find that the coefficient on *Hi_InfoRisk* is positive and statistically significant. The coefficient estimate on *Dstick*Hi_InfoRisk* is positive but insignificant. When we use the third measure of cost stickiness, *Mstick* (Column 3), we find that the interaction term *Mstick*Hi_InfoRisk* is significantly positive at the 5% level.

In short, the results of Table 5 are consistent with the prediction in H2a that the positive association between cost stickiness and loan spreads is greater for firms with higher information uncertainty. These results suggest that banks differentiate borrowers by their information environment and take into account the costs of processing firm-provided information.

5.3. Test of Hypothesis 2b

To test H2b, we create a dummy variable, *Hi_DefRisk*, that is set to one for firm-quarters in which credit rating is below BB and zero otherwise. We test the relation between loan spread and all independent variables by including an interaction term for *Hi_DefRisk* with the measure of stickiness.

Table 6 provides the results for H2b. Column 1 displays the results for our first measure of cost stickiness, *Stickiness*. As shown in column 1, the positive relation between loan spread and stickiness is more pronounced for firm-quarters with higher default risk, as evidenced by a significant and positive coefficient estimate on *Stickiness*Hi_DefRisk*. Column 2 shows the results for our second measure of cost stickiness, *Dstick*. Similar to the results in Column 1, we find that the coefficient estimate on *Dstick*Hi_DefRisk* is positive and marginally significant.[12] When we use the third measure of cost stickiness, *Mstick* (Column 3), we find that the interaction term *Mstick*Hi_DefRisk* is significantly positive. In short, the results of Table 6 are, overall, consistent with the prediction in H2b that the positive association between cost stickiness and loan spreads is greater for firms with higher default risk.

5.4. Test of Hypothesis 3

We further examine the effect of cost stickiness on the non-price terms of a loan contract. Melnik and Plaut (1986) posit that a loan contract is a package of *n*-contractual terms, and banks offer the firm a trade-off between the price (i.e., loan spread) and various non-price terms, such as collateral requirements and restrictive covenants. Kim et al. (2011) argue that these different contractual terms can be combined to overcome information problems faced by the banks and to improve the efficiency in post-contractual monitoring.

Specifically, we investigate the effect of cost stickiness on collateral (*Collateral*), general covenant intensity (*GenCov*), and financial covenant intensity (*FinCov*). We re-estimate Eq. (2), exchanging the dependent variable, *AIS*, with each non-price term. Panel A of Table 7 examines the likelihood of including a collateral requirement in a loan contract using a probit model. We expect that firms with higher sticky costs are more likely to be subject to the collateral requirement. Among the three measures of cost stickiness, we find that the coefficients on all of them are positive and statistically significant. This finding is consistent with cost stickiness inducing the need for *ex-post* monitoring of asset values.

Panel B of Table 7 presents evidence on the indirect impact of cost stickiness on the cost of bank loan via its effect on the use of a general covenant. The dependent variable is the count of general covenants imposed by the loan agreement. The coefficients on all three measures of cost stickiness are positive and statistically significant at the 5% level or better. Using results in Column 2 as an illustration, the number of general covenants increases by 3% for firms with sticky cost behavior.[13]

Panel C of Table 7 provides the results for the relation between cost stickiness and the use of financial covenants. The dependent variable is the count of financial covenants included in a loan contract. We find that the coefficient on cost stickiness is positive and statistically significant at the 5% level *only* when we use *Stickiness* as the independent variable.

Overall, we find evidence of cost stickiness impacting the collateral requirements and the general covenant intensity. We note, however, that the results of financial covenant intensity are relatively weaker.[14] Taken together, the results in Table 4 and 7 support the notion that cost stickiness introduces more information uncertainty in estimating asset values, which, in turn, increases the risk of the loan. Therefore, lenders tend to increase loan spreads, and have loan being collateralized, as *ex-ante* (pre-contracting) screening, and tend to impose more restrictive covenants as *ex-post* (post-contracting) monitoring.

6. Additional tests

6.1. Variation in adjustment cost flexibility

Anderson et al. (2003) document that the degree of cost stickiness varies with the magnitude of resource adjustment cost. Further, they argue that adjustment cost is higher when firms rely more on internal resources such as assets and employees. If so, then we expect that the effect of cost stickiness on loan spread varies with the adjustment cost flexibility.

We measure adjustment cost flexibility using employee intensity (employee to sales revenue).[15] The high-intensity observations (alternatively, low adjustment cost flexibility observations) are those firm-quarters in which employee intensity is in the top third of its distribution. The low-intensity observations (alternatively, high adjustment cost flexibility observations) are those firm-quarters in which employee intensity is in the bottom third of its distribution.

Panel A of Table 8 provides the results. Column 1 displays the results for our first measure of cost stickiness, *Stickiness*. As shown in column 1, the estimated coefficient on *Stickiness* is insignificant for firms with lower employee intensity or higher adjustment cost flexibility. On the other hand, the coefficient of *Stickiness* is positive and significant at the 5% level for firms with higher employee intensity. The difference in coefficient magnitude between the high and low intensity samples is significant at the 10% level. Column 2 shows the results for our second

[12] The *p*-value is 0.105 for this estimate.

[13] As reported in Table 2, the average number of *GenCov* is about 3.76 for our sample. The coefficient of *Dstick* is 0.1253, suggesting that the use of a general covenant increases by 0.1253/3.76 = 0.033 for firms with stickier costs.

[14] Moreover, the results are not economically significant.

[15] We do not use asset intensity because the prediction can go either way. On the one hand, the loan spread will be higher due to higher adjustment cost. On the other hand, the loan spread may be lower because of higher asset value.

Table 5
Cross-Sectional Variation in the Association between Cost Stickiness and Loan Spread – Information Risk.

	(1)		(2)		(3)	
	AIS		*AIS*		*AIS*	
VARIABLES	Coeff.	t-stat	Coeff.	t-stat	Coeff.	t-stat
*Stickiness*Hi_InfoRisk*	5.8287**	(2.01)				
*Dstick*Hi_InfoRisk*			5.4892	(0.94)		
*Mstick*Hi_InfoRisk*					16.0779**	(2.15)
Stickiness	1.4887	(0.81)				
Dstick			1.8668	(0.52)		
Mstick					2.8825	(0.64)
Hi_InfoRisk	14.135***	(6.72)	11.580***	(3.64)	10.770***	(3.47)
Loan-Specific Characteristics						
LnMaturity	−2.7682	(−0.48)	−2.8835	(−0.51)	−2.0595	(−0.34)
LnLoansize	−21.5065***	(−7.75)	−21.5962***	(−7.78)	−23.2783***	(−8.25)
Ppricing	−18.0909***	(−6.64)	−18.0382***	(−6.50)	−17.4911***	(−5.52)
LnNlenders	−6.4368**	(−2.41)	−6.2922**	(−2.38)	−8.2310***	(−3.26)
Borrower-Specific Characteristics						
Leverage	53.9467***	(5.84)	53.2012***	(5.73)	66.3604***	(6.68)
Profitability	−139.7458***	(−5.11)	−139.7563***	(−5.12)	−155.8312***	(−3.58)
Size	−0.3458	(−0.16)	−0.3479	(−0.16)	1.3851	(0.56)
Mtb	0.1737	(0.38)	0.1480	(0.32)	0.3348	(0.53)
ZScore	2.5492	(1.32)	2.5935	(1.37)	2.0103	(1.05)
Cfvolatility	1.7523**	(2.54)	1.6942**	(2.42)	1.6781**	(2.10)
Tangibility	−12.4216	(−0.89)	−13.0520	(−0.92)	−14.9599	(−0.90)
Rating	8.6176***	(11.89)	8.6371***	(11.89)	8.0295***	(9.87)
Opaque	−0.1013	(−1.03)	−0.1008	(−1.04)	−0.1758	(−1.48)
Macroeconomic Factors						
Cspread	4.8096	(0.77)	5.1372	(0.84)	14.4632	(1.41)
Tspread	6.0323	(1.03)	5.8203	(0.99)	3.2755	(0.54)
Constant	517.5293***	(8.46)	525.8649***	(8.79)	590.2548***	(9.39)
Year FE	Yes		Yes		Yes	
Industry FE	Yes		Yes		Yes	
Loan Type FE	Yes		Yes		Yes	
Loan Purpose FE	Yes		Yes		Yes	
Observations	8990		8990		6249	
Adjusted R-squared	0.5764		0.5751		0.5735	

This table reports cross-sectional variation in the association between loan spread and cost stickiness through the information risk channel. All regressions include the same control variables in Table 4. The t-statistics are based on standard errors clustered at the firm and year level. ***, **, and * represent two-tailed p-value significance levels of 0.01, 0.05, and 0.1 respectively. FE stands for Fixed Effects. All variables are defined in Appendix A.

measure of cost stickiness, *Dstick*. Similar to the results in Column 1, we find that the coefficient on *Dstick* is positive and statistically significant for high-intensity firms and insignificant otherwise. Our inference remains similar when we use the third measure of cost stickiness, *Mstick* (Column 3).

6.2. Endogeneity of cost stickiness

There are endogeneity-related issues that might affect the validity of our results. One can argue that managers may engage in cost management around loan financing.[16] First, we argue that one unique feature of private bank loan is that lenders are able to engage in post-contract monitoring. Borrowers who are strategic during the pre-contracting period may be eventually caught by the post-contract monitoring. Our third hypothesis confirms this.[17] Second, Zhou (2023) finds that cost stickiness experiences a sharp decline following debt covenant violations, when control rights are transferred to creditors. This finding further confirms that creditors may exert influence over managerial decisions to mitigate incentive conflicts (Nini, Smith, & Sufi, 2012; Shleifer & Vishny, 1997).

Nevertheless, to further alleviate concerns about potential endogeneity, we employ three approaches. First, we use the Heckman (1979) procedure to control for endogeneity due to self-selection. In the first-stage regression, we use the employee intensity (*Empintensity*, measured as the the log-ratio of the number of employees to sales) as the exclusionary variable and estimate the predicted probability of "sticky" firm, based on the following probit model:

$$\begin{aligned} Pr(Sticky = 1|X) = \quad & \Phi\,(\alpha_0 + \alpha_1 Size + \alpha_2 Leverage + \alpha_3 MTB \\ & + \alpha_4 Cfvolatility + \alpha_5 Profitability + \alpha_6 Tangibility \\ & + \alpha_7 Opaque + \alpha_8 Rating + \alpha_9 Empintensity \\ & + YearIndustryFixedEffects + \varepsilon) \end{aligned} \tag{3}$$

We then compute the Inverse Mills ratio (*IMR*) from the first stage probit model in Eq. (3) and estimate our AIS model with *IMR* included as an additional control variable. Panel B of Table 8 reports the results of the second-stage regressions involving *IMR*.[18] We find that cost stickiness has a significant impact on loan spread after controlling for *IMR*, which is consistent with our main results. On the other hand, the coefficients on *IMR* are insignificant at the conventional level across all three columns, suggesting that our baseline results in Table 4 are

[16] For example, Banker and Fang (2016) find that firms have lower cost stickiness in the two years prior to obtaining the loan.

[17] Moreover, if managers manipulate cost structure prior to the loan initiation, this will bias against finding our results.

[18] First-stage estimation results are available upon request (untabulated).

Table 6
Cross-Sectional Variation in the Association between Cost Stickiness and Loan Spread – Default Risk.

	(1)		(2)		(3)	
	AIS		*AIS*		*AIS*	
VARIABLES	Coeff.	t-stat	Coeff.	t-stat	Coeff.	t-stat
*Stickiness*Hi_DefRisk*	6.4673**	(2.47)				
*Dstick*Hi_DefRisk*			8.4796	(1.62)		
*Mstick*Hi_DefRisk*					13.8745**	(2.10)
Stickiness	−0.4701	(−0.42)				
Dstick			−0.1944	(−0.07)		
Mstick					−1.5435	(−0.33)
Hi_DefRisk	32.4118***	(9.29)	35.7591***	(8.90)	29.7863***	(7.95)
Loan-Specific Characteristics						
LnMaturity	−5.5398	(−1.27)	−6.6348	(−1.57)	−3.8359	(−0.95)
LnLoansize	−21.9493***	(−10.08)	−22.4774***	(−10.28)	−23.1076***	(−11.38)
Ppricing	−19.2570***	(−6.96)	−22.7655***	(−7.68)	−18.1288***	(−5.88)
LnNlenders	−7.9642***	(−2.81)	−6.8595**	(−2.38)	−9.1468***	(−2.98)
Borrower-Specific Characteristics						
Leverage	88.6000***	(11.44)	54.5676***	(10.84)	95.4177***	(14.14)
Profitability	−183.7158***	(−6.28)	−135.1992**	(−2.58)	−173.1820***	(−4.62)
Size	−3.0969*	(−1.75)	−4.8561***	(−2.79)	−1.0421	(−0.58)
Mtb	−0.5365	(−1.31)	−0.5000	(−0.73)	−0.5156	(−0.93)
ZScore	4.4872***	(2.85)	−0.1698***	(−3.86)	2.3622*	(1.66)
Cfvolatility	2.4315***	(3.74)	−2.0256***	(−10.95)	2.3318***	(3.36)
Tangibility	−13.7719	(−1.48)	−15.1118	(−1.56)	−14.6878	(−1.25)
Opaque	−0.1003	(−0.74)	0.1915	(0.76)	−0.1571	(−0.99)
Macroeconomic Factors						
Cspread	0.3875	(0.06)	0.3909	(0.06)	8.7973	(1.25)
Tspread	2.8395	(0.48)	3.8809	(0.69)	4.8120	(0.90)
Constant	607.3034***	(13.86)	749.0359***	(12.73)	638.1526***	(13.18)
Year FE	Yes		Yes		Yes	
Industry FE	Yes		Yes		Yes	
Loan Type FE	Yes		Yes		Yes	
Loan Purpose FE	Yes		Yes		Yes	
Observations	11,883		11,883		8831	
Adjusted R-squared	0.5483		0.5269		0.5465	

This table reports cross-sectional variation in the association between loan spread and cost stickiness through the default risk channel. All regressions include the same control variables in Table 4. The t-statistics are based on standard errors clustered at the firm and year level. ***, **, and * represent two-tailed p-value significance levels of 0.01, 0.05, and 0.1 respectively. FE stands for Fixed Effects. All variables are defined in Appendix A.

unlikely to be driven by the endogeneity problem associated with self-selection bias.

Second, we construct a matched sample using the propensity score matching (PSM) method. Specifically, we compute the predicted probability (i.e., preonsity score) of "sticky" firm using the probit model in Eq. (3). For each sticky firm, we choose a matched control firm that has the closest propensity score with the treatment firm, but with anti-sticky cost behavior. We perform this one-to-one propensity score matching with a maximum distance of 0.01. After applying the above PSM procedures, we obtain a matched sample of 3950 firms with 5756 loan facilities. We further check and find that our PSM procedure is overall effective in achieving covariate balance between the treatment and control samples. We then reestimate our AIS model using this PSM sample. Panel C of Table 8 reports these estimation results. We find that the coefficients on three stickiness measures are all positive and statistically significant at the 5% level or better.

Third, we use the firm fixed effect model to estimate the effect of cost stickiness on loan contract terms. The fixed effects research design controls for the unobservable differences between the treatment group (firms with sticky costs) and the control group (firms with anti-sticky costs) and eliminates the potential bias caused by endogeneity, as long as the unobservable factors remain constant during the sample period (Lennox, Francis, & Wang, 2012). The results of firm fixed effects regressions are reported in Panel D of Table 8. We find that the estimated coefficients on the cost stickiness are significantly positive across all three measures, which is consistent with our main results. To the extent that firm fixed effects capture the unobservable firm-specific characteristics that may affect loan terms, this additional analysis helps us alleviate the concerns about potential problems associated with correlated unobserved (and thus omitted) variables. Despite the effort, we acknowledge that we cannot completely rule out concerns related to endogeneity, which is one limitation of our study.

6.3. *Alternative measure of contract strictness*

Murfin (2012) suggests that financial covenant intensity captures only one dimension of the covenant portfolio and proposes an aggregate probability of violation measure that captures various dimensions of contract strictness. Demerjian and Owens (2016) later develop a nonparametric version of the Murfin measure. As a robustness check, we employ this alternative measure to test H3. We continue to find a positive association between cost stickiness and the alternative measure of contract strictness (untabulated).

6.4. *The joint determination of loan contractual terms*

We also address the issue of joint determination of price and nonprice terms of loan contracts. We re-estimate the model specifications for the price and nonprice terms of loans jointly using an IV framework. Following Bharath et al. (2011), we use prevailing *Default Spread*, measured as the difference between the yield on Moody's seasoned corporate bonds with a BAA rating and ten-year U.S. government bond,

Table 7
Cost Stickiness and Non-pricing Loan Contract Terms.

Panel A: Probit Regression using Collateral as the Dependent Variable

	(1)		(2)		(3)	
	Collateral		*Collateral*		*Collateral*	
VARIABLES	Coeff.	z-stat	Coeff.	z-stat	Coeff.	z-stat
Stickiness	0.0422***	(2.59)				
Dstick			0.1099***	(3.43)		
Mstick					0.1002*	(1.88)
Loan-Specific Characteristics						
LnMaturity	0.1049**	(2.37)	0.1051**	(2.39)	0.1786***	(3.12)
LnLoansize	−0.1426***	(−5.18)	−0.1432***	(−5.18)	−0.1582***	(−5.67)
Ppricing	0.3520***	(8.93)	0.3512***	(8.89)	0.3509***	(7.46)
LnNlenders	−0.0468	(−1.17)	−0.0449	(−1.13)	−0.0672	(−1.58)
Borrower-Specific Characteristics						
Leverage	0.6930***	(3.99)	0.6937***	(4.02)	0.7432***	(3.60)
Profitability	−1.3159***	(−3.59)	−1.3322***	(−3.66)	−1.7310***	(−4.92)
Size	−0.1418***	(−5.95)	−0.1416***	(−5.97)	−0.1247***	(−4.41)
Mtb	−0.0161*	(−1.77)	−0.0160*	(−1.74)	−0.0089	(−0.84)
ZScore	0.0039	(0.20)	0.0044	(0.23)	−0.0098	(−0.51)
Cfvolatility	0.0280***	(3.28)	0.0280***	(3.26)	0.0295***	(2.99)
Tangibility	−0.0737	(−0.50)	−0.0844	(−0.58)	−0.1653	(−1.09)
Rating	0.1612***	(15.58)	0.1615***	(15.68)	0.1578***	(13.60)
Opaque	−0.0003	(−0.10)	−0.0003	(−0.10)	0.0016	(0.46)
Macroeconomic Factors						
Cspread	0.0182	(0.22)	0.0213	(0.26)	0.0975	(0.89)
Tspread	−0.0255	(−0.27)	−0.0260	(−0.27)	−0.0464	(−0.65)
Constant	1.5658**	(2.37)	1.4996**	(2.25)	0.7818	(0.80)
Year FE	Yes		Yes		Yes	
Industry FE	Yes		Yes		Yes	
Loan Type FE	Yes		Yes		Yes	
Loan Purpose FE	Yes		Yes		Yes	
Observations	11,883		11,883		8831	
Adj./Pseudo R^2	0.3734		0.3659		0.3628	

Panel B: OLS Regression using GenCov as the Dependent Variable

	(1)		(2)		(3)	
	GenCov		*GenCov*		*GenCov*	
VARIABLES	Coeff.	t-stat	Coeff.	t-stat	Coeff.	t-stat
Stickiness	0.0831***	(3.94)				
Dstick			0.1253**	(2.00)		
Mstick					0.1936**	(2.06)
Loan-Specific Characteristics						
LnMaturity	0.1825*	(1.79)	0.1831*	(1.81)	0.1704	(1.55)
LnLoansize	0.0841***	(3.72)	0.0833***	(3.67)	0.0899***	(2.83)
Ppricing	2.2077***	(28.33)	2.2058***	(28.19)	2.2152***	(20.67)
LnNlenders	0.4482***	(10.00)	0.4500***	(10.00)	0.4435***	(7.41)
Borrower-Specific Characteristics						
Leverage	0.4979**	(2.33)	0.4973**	(2.34)	0.8036***	(3.86)
Profitability	0.1761	(0.46)	0.1652	(0.43)	−0.0379	(−0.07)
Size	−0.2325***	(−7.93)	−0.2321***	(−8.00)	−0.2398***	(−6.92)
Mtb	−0.0163	(−1.26)	−0.0163	(−1.26)	−0.0133	(−0.94)
ZScore	0.0147	(0.53)	0.0149	(0.54)	−0.0225	(−0.90)
Cfvolatility	−0.0099	(−0.84)	−0.0102	(−0.86)	0.0039	(0.30)
Tangibility	−0.2767	(−1.13)	−0.2873	(−1.18)	−0.3747	(−1.25)
Rating	0.1816***	(11.83)	0.1820***	(11.74)	0.1749***	(9.64)
Opaque	−0.0027	(−0.73)	−0.0027	(−0.72)	−0.0014	(−0.34)
Macroeconomic Factors						
Cspread	0.1243	(1.19)	0.1310	(1.27)	0.1987	(1.42)
Tspread	−0.0635	(−0.72)	−0.0681	(−0.78)	0.0031	(0.03)
Constant	−4.0280**	(−2.48)	−4.0508**	(−2.53)	−2.6507	(−1.12)
Year FE	Yes		Yes		Yes	
Industry FE	Yes		Yes		Yes	

(*continued on next page*)

Table 7 (*continued*)

Panel B: OLS Regression using GenCov as the Dependent Variable

	(1)		(2)		(3)	
	GenCov		*GenCov*		*GenCov*	
VARIABLES	Coeff.	t-stat	Coeff.	t-stat	Coeff.	t-stat
Loan Type FE	Yes		Yes		Yes	
Loan Purpose FE	Yes		Yes		Yes	
Observations	11,883		11,883		8831	
Adj./Pseudo R^2	0.4041		0.4036		0.4109	

Panel C: OLS Regression using FinCov as the Dependent Variable

	(1)		(2)		(3)	
	FinCov		*FinCov*		*FinCov*	
VARIABLES	Coeff.	z-stat	Coeff.	t-stat	Coeff.	t-stat
Stickiness	0.0241**	(2.20)				
Dstick			−0.0310	(−0.66)		
Mstick					0.0595	(1.58)
Loan-Specific Characteristics						
LnMaturity	−0.0837**	(−2.20)	−0.0841**	(−2.22)	−0.0595	(−1.58)
LnLoansize	−0.0682***	(−2.95)	−0.0683***	(−2.96)	−0.0702***	(−3.01)
Ppricing	1.1293***	(15.95)	1.1294***	(15.97)	1.1418***	(15.44)
LnNlenders	0.1919***	(8.61)	0.1924***	(8.57)	0.1766***	(7.38)
Borrower-Specific Characteristics						
Leverage	0.1723	(1.56)	0.1624	(1.45)	0.2976**	(2.22)
Profitability	0.2371	(1.00)	0.2391	(1.00)	0.3033	(0.91)
Size	−0.1905***	(−11.24)	−0.1912***	(−11.28)	−0.2057***	(−9.34)
Mtb	−0.0112*	(−1.90)	−0.0112*	(−1.89)	−0.0108	(−1.41)
ZScore	−0.0018	(−0.12)	−0.0015	(−0.10)	0.0016	(0.11)
Cfvolatility	−0.0198***	(−2.62)	−0.0201***	(−2.65)	−0.0150**	(−2.08)
Tangibility	−0.0975	(−0.58)	−0.0955	(−0.56)	−0.0689	(−0.35)
Rating	0.0414***	(4.47)	0.0416***	(4.47)	0.0399***	(4.37)
Opaque	−0.0033	(−1.06)	−0.0033	(−1.09)	−0.0029	(−0.96)
Macroeconomic Factors						
Cspread	0.0186	(0.34)	0.0204	(0.37)	0.0335	(0.61)
Tspread	0.0649	(1.07)	0.0630	(1.05)	0.0746	(1.06)
Constant	3.4948***	(3.15)	3.5285***	(3.22)	1.1903	(1.31)
Year FE	Yes		Yes		Yes	
Industry FE	Yes		Yes		Yes	
Loan Type FE	Yes		Yes		Yes	
Loan Purpose FE	Yes		Yes		Yes	
Observations	11,883		11,883		8831	
Adj./Pseudo R^2	0.3882		0.3880		0.3922	

Panel A reports the logit regression results of the effect of borrowers' cost stickiness on requirements for collateral (*Collateral*). The z-statistics, in parenthesis, are based on standard errors clustered at the firm and quarter-year level. ***, **, and * represent two-tailed p-value significance levels of 0.01, 0.05, and 0.1 respectively. FE stands for Fixed Effects. All variables are defined in Appendix A.
Panel B reports the ordinary least squares (OLS) regression results with GenCov as the dependent variable. The t-statistics, in parenthesis, are based on standard errors clustered at the firm and quarter-year level. ***, **, and * represent two-tailed p-value significance levels of 0.01, 0.05, and 0.1 respectively. FE stands for Fixed Effects. All variables are defined in Appendix A.
Panel C reports the ordinary least squares (OLS) regression results with *FinCov* as the dependent variable. The t-statistics, in parenthesis, are based on standard errors clustered at the firm and quarter-year level. ***, **, and * represent two-tailed *p*-value significance levels of 0.01, 0.05, and 0.1 respectively. FE stands for Fixed Effects. All variables are defined in Appendix A.

as an instrument for interest spread. We also use another instrument, average AIS of loans completed over the previous six months (*MAIS)*. For non-price terms, since our results for covenant intensity are weak and lack economic impact, we focus on collateral only. We follow Bharath et al. (2011) and use *Loan Concentration* as the instrument for collateralization. Results (untabulated) are robust to the simultaneous determination of contract terms.

7. Conclusion

An influential study conducted by Anderson et al. (2003) introduces the notion of cost stickiness. Since then, numerous research has examined the implication of a firm's asymmetric cost behavior. To date, existing research has focused primarily on the impact of cost structure from the perspective of equity market participants. In contrast, our study investigates the private debt market consequences of cost stickiness. We hypothesize that cost stickiness increases the variability of future earnings, which increases lenders' uncertainty about the liquidation value of assets. To compensate for this uncertainty, lenders charge a higher interest *ex-ante*. Consistent with our conjecture, we find that greater cost stickiness is associated with a significant increase in loan spreads after controlling for loan-specific, firm-specific, and macroeconomic factors. We also hypothesize that the effect of cost stickiness on bank loan contracting depends on both information risk and default risk. Consistent with this notion, we find

Table 8
Additional Tests.

Panel A: Variation in adjustment cost flexibility

	(1)		(2)		(3)	
	AIS		*AIS*		*AIS*	
VARIABLES	Low Intensity	High Intensity	Low Intensity	High Intensity	Low Intensity	High Intensity
	(L)	(H)	(L)	(H)	(L)	(H)
Stickiness	1.083	5.600**				
	(0.67)	(2.33)				
Dstick			4.086	6.765**		
			(0.80)	(1.90)		
Mstick					4.531	9.688*
					(0.69)	(1.76)
Difference (H-L)	4.517*		2.679*		5.157	
Control Variables	Included	Included	Included	Included	Included	Included
Observations	3929	3926	3929	3926	2919	2920
Adjusted R-squared	0.5604	0.5758	0.5605	0.5701	0.5523	0.5780

Panel B: Heckman two-step procedure (Second-stage)

	(1)		(2)		(3)	
	AIS		*AIS*		*AIS*	
VARIABLES	Coeff.	t-stat	Coeff.	t-stat	Coeff.	t-stat
Stickiness	3.4398**	(2.33)				
Dstick			5.0049***	(2.63)		
Mstick					8.0101***	(2.77)
IMR	45.7585	(0.68)	29.8551	(0.47)	26.1092	(0.32)
Control Variables	Included		Included		Included	
Observations	11,883		11,883		8831	
Adjusted R-squared	0.5594		0.5547		0.5524	

Panel C: Propensity score matching (PSM) approach

	(1)		(2)		(3)	
	AIS		*AIS*		*AIS*	
VARIABLES	Coeff.	t-stat	Coeff.	t-stat	Coeff.	t-stat
Stickiness	3.8277***	(3.01)				
Dstick			5.3569**	(1.98)		
Mstick					16.1743***	(5.09)
Control Variables	Included		Included		Included	
Observations	5756		5756		3307	
Adjusted R-squared	0.5533		0.5326		0.5617	

Panel D: Firm fixed-effects regression

	(1)		(2)		(3)	
	AIS		*AIS*		*AIS*	
VARIABLES	Coeff.	t-stat	Coeff.	t-stat	Coeff.	t-stat
Stickiness	2.4174**	(2.21)				
Dstick			3.9796*	(1.68)		
Mstick					4.246*	(1.83)
Control Variables	Included		Included		Included	
Observations	11,883		11,883		8831	

Panel A presents the OLS regression results of loan spread on cost stickiness in the subsamples ranked by employee intensity, measured as the number of employees in the year prior to loan initiation scaled by the sales revenue. All regressions include the same control variables in Table 4. The t-statistics are based on standard errors clustered at the firm and year level. ***, **, and * represent two-tailed *p*-value significance levels of 0.01, 0.05, and 0.1 respectively. All variables are defined in Appendix A.
Panel B presents the results of the second-stage regressions controlling for the Inverse Mills Ratio (*IMR*) from the first-stage probit regression. The t-statistics are based on standard errors clustered at the firm and year level. ***, **, and * represent two-tailed p-value significance levels of 0.01, 0.05, and 0.1 respectively. All variables are defined in Appendix A.
Panel C presents THE regression results of the effect of borrowers' cost stickiness on loan spread with the PSM sample. The t-statistics are based on standard errors clustered at the firm and year level. ***, **, and * represent two-tailed p-value significance levels of 0.01, 0.05, and 0.1 respectively. All variables are defined in Appendix A.
Panel D presents the firm fixed effects regression results of the effect of borrowers' cost stickiness on loan spread. The t-statistics are based on standard errors clustered at the firm and year level. ***, **, and * represent two-tailed p-value significance levels of 0.01, 0.05, and 0.1 respectively. All variables are defined in Appendix A.

that the positive association between cost stickiness and loan spread is stronger for borrowers with higher information risk and lower credit ratings. We further find evidence suggesting that lenders not only screen borrowers *ex-ante*, but also monitor them *ex-post*; for borrowers with stickier cost behavior, lenders are more likely to have loan being collaterialized and tend to impose more restrictive covenants.

One unique feature of our setting is that bank loan contracting contains multiple terms that can be used for both *ex-ante* screening and *ex-post* monitoring. This makes borrowers' pre-contracting strategic behavior less likely and hence, at least partially mitigates concerns over potential endogeneity. To further alleviate the endogeneity concerns, we show that our results are robust to the use of Heckman two-state trement-effect model, PSM sample, and firm fixed-effect model. Nevertheless, our results should be interpreted cautiously because one cannot completely rule out potential endogeneity. With this limitation and caveat, our results provide useful insights into how banks and other private lenders factor borrowers' cost stickiness into loan contracting.

Data availability

Data will be made available on request.

Appendix A. Variable definitions

Cost Stickiness	
Stickiness	Following Weiss (2010), we measure the difference between the mean cost function slope under upward adjustments made on quarters from *t*-3 through *t* and the mean cost function slope under downward adjustments made on quarters from *t*-3 through *t*. We then multiply the difference by negative one so that a higher value of *Stickiness* indicates more sticky cost behavior.
Dstick	An indicator variable set to one if *Stickiness* > 0 and zero otherwise.
Mstick	Following Weiss (2010), we measure the difference between the mean cost function slope under upward adjustments made on quarters from *t*-7 through *t* and the mean cost function slope under downward adjustments made on quarters from *t*-7 through *t*. We then multiply the difference by negative one so that a higher value of *Stickiness* indicates more sticky cost behavior.

Borrower-specific Characteristics	
Leverage	The ratio of total debt (long-term debt plus debt in current liabilities) to total asset that is estimated in the year prior to loan initiation.
Profitability	EBITDA divided by total assets estimated in the year prior to loan initiation.
Size	Natural logarithm of total assets that is estimated in the year prior to loan initiation.
MTB	Market-to-book ratio, measured as the market value of equity divided by the book value of common shareholders' equity that is estimated in the year prior to loan initiation.
ZScore	Modified Altman (1968) *Z*-score = (1.2*working capital +1.4*retained earnings +3.3*EBIT +0.999*sales)/total assets. As with Graham et al. (2008), we use a modified z-score that excludes the ratio of the market value of equity to book value of total debt because a similar term, market-to-book, enters the regressions as a separate variable. We multiply this value by negative one so that larger values indicate higher credit risk.
CFVolatility	The standard deviation of quarterly cash flows from operations scaled by total assets over the past five years.
Tangibility	Net PPE divided by total assets estimated in the year prior to loan initiation.
Rating	The numerical value of S&P domestic long-term issuer credit rating from Compustat. AAA = 1, AA+ = 2, …, SD = 23, N.M. = 24. For firms not rated by S&P, we follow Beatty et al. (2008) and estimate the ratings. We first regress debt ratings on assets, return on assets, leverage, dividend indicator, subordinated debt indicator, a loss indicator, industry, and year fixed effects. We then use the estimated coefficients from the above regression and the firm's financial data to compute a credit rating for each firm in each year. The computed rating values are winsorized at 1 and 24 to be consistent with the range of ratings reported in Compustat. The value of *Rating* decreases in credit quality.
Opaque	Three-year moving sum of the absolute value of annual discretionary accruals from the model by Dechow, Sloan, and Sweeney (1995).
Hi_InfoRsik	We measure analyst forecast dispersion as the standard deviation of all annual earnings forecasts in the year prior to loan initiation scaled by the beginning of the year stock price. We create a dummy variable, *Hi_InfoRisk*, that is set to one for firm-quarters in which analyst forecast dispersion is above the median of the distribution and zero otherwise.
Hi_DefRisk	An indicator variable that equals one if the credit rating is below BB and zero otherwise.
Empintensity	The log-ratio of the number of employees to sales.

Loan-specific Characteristics	
AIS	Loan spread measured as the All-In-Spread drawn. All-in-spread drawn describes the amount (in basis points over *LIBOR* or *LIBOR* equivalent) that the firm pays for each dollar drawn down.
LnMaturity	Natural logarithm of the maturity of the loan in months.
LnLoansize	Natural logarithm of the amount of the loan in millions of dollars.
Collateral	An indicator variable that equals one if the loan facility is secured with collateral and zero otherwise.
GenCov	General covenant index, measured as the number of general covenants contained in a loan contract.
FinCov	Financial covenant index, measured as the number of financial covenants contained in a loan contract.
PPricing	An indicator variable that equals one if the loan includes performance pricing and zero otherwise.
NLenders	Total number of lenders in a loan.
Loan Purpose	Purpose of the loan. Loan purposes include debt repayment, dividend recapitalization, equipment purchases, and lease financing among others.
Loan Type	Type of loan. Loan types include term loans, revolvers, 364-day facilities, bridge loans, acquisition facilities, etc.

Macroeconomic Factors	
CSpread	The difference between an AAA corporate bond yield and a BAA corporate bond yield that we obtained from the Federal Reserve Board of Governors measured in the month prior to loan initiation.
TSpread	The difference between the ten-year and the two-year Treasury-bill yields that are obtained from the Federal Reserve Board of Governors measured in the month prior to loan initiation.

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