

Spillover Effects of IPOs along Supply Chains: Evidence on Debt Financing

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Abstract

This paper examines the effects of a firm's IPO on the debt financing of its key customer firms. We find that the average loan spreads of customer firms increase by roughly 20% or 23.7 basis points following suppliers' IPO announcements. This negative spillover effect along supply chains is more pronounced when suppliers make significant relationship-specific investment, when the suppliers face less concentrated customer bases, and/or when the customers face more concentrated supplier bases. Our results show that a customer receives less favorable trading terms and is forced to purchase more inputs at higher prices after its supplier goes public, all of which affect the customer's operational cost and risk and hence contribute to the increase in loan costs. Furthermore, we document that the loan contracts of customers become significantly more restrictive in the aftermath of supplier IPOs. Finally, we find that the observed negative spillover effect is also present in customers' access to the public bond market.

JEL classification: G24; G34

Keywords: Supplier IPO; loan spreads; supplier–customer relationships; syndicated bank loans

“Insurance executives believe that their companies need to get bigger to have greater bargaining power to negotiate good deals with health care providers, such as hospital systems, which also have gotten bigger to counter the heft of the insurers.”

—*Insider Louisville*¹

“... apparel-company executives say they are bracing for store closures, cutbacks and thinner profit margins. The potential fallout reflects the huge negotiating power that a combined Federated-May would wield and the diminishing clout of suppliers. It could also accelerate consolidation among apparel suppliers, as they strive to get bigger to better face off against their giant customers.”

—*Wall Street Journal*²

1. Introduction

Supply chains—networks to exchange and mobilize products and services among trading partners—not only generate significant economic value but also create interdependence for the parties involved. This relationship-specific investment and the resulting switching costs make suppliers and customers important stakeholders in each other’s operations (e.g., Banerjee et al. 2008; Fee et al. 2006). In addition, the dynamic nature of a supply chain relationship makes it an important “spillover” channel through which one firm’s financial soundness (e.g., Hertz et al. 2008), investment decisions (e.g., Fee and Thomas 2004; Bhattacharyya and Nain 2011), and financing decisions (e.g., Johnson et al. 2018) influence its trading partners. In this paper, we extend this emerging line of literature by investigating how a firm’s new equity issuance decisions affect its customers’ debt financing costs, with a special focus on the cost of bank loans.

Recent studies examine the spillover effect of a firm’s equity financing on its supply chain partners and find mixed results. For example, Johnson et al. (2018) find that seasonal equity offerings (SEOs) generate adverse market reactions for both issuers and their large customers, supporting the negative spillover effect of equity issuance. In contrast, using Japanese data, Kutsuna et al. (2016) show that an IPO benefits the supply chain partners through increased growth rates in revenue, cash, and PP&E. Although both studies explore the equity value implications of supply chain relationship change, less is known about

¹ “WSJ: Humana, private equity firms in talks to buy Kindred,” *Insider Louisville*, July 23, 2018.

² “Combined Federated-May could stress apparel makers,” *Wall Street Journal*, March 1, 2005.

the specifics of whether and how debtholders value the equity issuance shock in the supply chain relationship.

Banks are considered information specialists because of their ability to extract private information through the lending process and their efficient *ex post* monitoring role in mitigating information asymmetries (Diamond 1984 and 1991; Rajan 1992). Academic research has achieved a consensus view that banks have been paying close attention to the complex and dynamic supply chain relationships (Cen et al. 2015; Campello and Gao 2017; Hasan et al. 2017; Kolay et al. 2016; Houston et al. 2016). If a supplier's equity issuance indeed has a spillover effect, then it is critical for debt providers to assess such major corporate events of suppliers and incorporate related information into their price schemes when lending to the suppliers' customers. Exploring this issue would create a better understanding of the financial implications for supply chain interdependence and changes.

On one hand, a supplier's IPO may have a positive effect on its customers. Moving from the private domain to the public arena increases the supplying companies' access to various financial resources that are essential for sustainable competitive advantages (Chemmanur and He 2011; Chod and Lyandres 2011). Kutsuna et al. (2016) use a sample of Japanese firms and find that, after going public, firms transmit liquidity to their private trading partners. If the suppliers are willing to pass their gains from going public to their trading partners, we would expect the customers to have enhanced liquidity positions and lower operational risk following a supplier's IPO. Therefore, if banks view trading partners' IPOs as a mechanism of liquidity transformation and risk mitigation, a supplier IPO would result in a subsequent reduction in loan spreads when the supplier's customers borrow.

On the other hand, an IPO event may allow a supplier to gain market power and then have a negative implication for the consumer firms, leading to higher loan costs. The business press often discusses that suppliers strive to grow in order to better face off against their giant customers, as evidenced by the quotes at the beginning of this paper. Academic studies empirically show that firms with increased market power tend to put pressure on their supply chain partners and hence deteriorate the value of their trading partners

(Fee and Thomas 2004; Shahrur 2005; Bhattacharyya and Nain 2011). Assuming an IPO event allows a supplier to gain market power (e.g. Maksimovic and Pichler 2001), the supplier could realize selling efficiencies by restricting trade credit, raising selling prices, or forcing more input usages. Therefore, if banks view a supplier IPO as a possible channel of enhancing selling power, we would expect that such an event contributes to an increase in operational costs and default risk, raising costs of debt for the supplier's customers.

Given the unclear theoretical prediction for the spillover effects of supplier IPO events on their customers' cost of bank loans, empirical analyses become necessary and critical to advance our understanding of supply chain interdependence. In this paper, we identify a set of IPO firms and construct a sample of loan facilities borrowed by their customer companies from 1986 to 2013. To mitigate endogeneity concerns, we cautiously design our baseline model by imposing a lead-lag structure for the variables used in regression and including firm fixed effects to control for the unobservable heterogeneity bias. Our empirical results suggest that banks view suppliers' access to equity market financing as a negative shock for those suppliers' major customers (i.e., a negative spillover effect) and charge higher loan spreads accordingly when the customers borrow. The increase in loan spreads is statistically and economically significant. Specifically, the customers' cost of bank loans increases by roughly 23.7 basis points on average in the aftermath of a supplier declaring IPO, which translates into a \$6 million increase in interest expense for the customers.

Our findings are robust with various tests, including when we use deal-level observations to control for potential correlation within deals, median regression to address the possible effects of outliers, and subsamples to mitigate confounding effects of the recent subprime crisis and the nature of lending relationship. To address another concern that the changes in customers' borrowing costs may be driven by secular shifts in customer quality that are independent of their suppliers' IPO events, we conduct the "placebo test" and the "dynamic test." In the placebo test, we find that the coefficient of the hypothetical event year is not statistically significant. In the dynamic test, we document an insignificant change in loan

spreads in years prior to supplier IPO, suggesting that the change in customer companies' loan costs is unrelated to any preexisting conditions.

More importantly, we further adopt a difference-in-differences approach to alleviate the endogeneity concern that some common factors may drive both suppliers' IPO decisions and their customers' loan cost changes because of the close supplier–customer relationship. To implement this approach, we identify a control firm (i.e., a firm that does not experience a supplier IPO) for each treatment firm (i.e., a firm that experiences a supplier IPO). Using propensity score matching, we ensure that the matching and treatment firms are from the same industry and have similar financial characteristics. The result suggests that loan costs for customer firms affected by supplier IPOs increase significantly in the post supplier-IPO period by almost one-third more than firms in the control group.

Next, we examine the factors that might accentuate or attenuate the effects of a supplier's equity issuance on its customers' cost of borrowing. Intuitively, one might expect a supplier to gain more selling power after an IPO, when its customers are relatively more reliant on the newly public supplier for input purchases. Specifically, the adverse spillover effect of supplier IPO on its customers' cost of debt will be even stronger if the customers face more substantial switching costs. Indeed, we find that the documented positive relationship between supplier IPO and customers' loan costs is more pronounced when the suppliers make significant relationship-specific investment (RSI), when the suppliers face less concentrated customer bases (i.e., more customers to sell to), or when the customers face more concentrated supplier bases (i.e., fewer suppliers to purchase from).

To drill down farther, we also explore the underlying mechanisms that explain the observed negative spillover effects. As we argue, post-IPO suppliers can exercise their increased selling power through restricting trade credit, raising selling prices, or forcing more input usage. Our results show that customers indeed receive less favorable trading terms and are forced to purchase more inputs with higher prices after a supplier's IPO, all of which affect customers' operational costs and risk and hence contribute

to the increase in loan costs. We also provide direct evidence showing that customers' riskiness (both accounting measure and market measure of risk) increases after their suppliers go public.

In addition to changes in price terms of loans, we also examine whether and to what extent supplier IPO events affect the non-price terms in loan contracts of customers. We find that customer companies generally face more-restrictive provisions after suppliers' IPOs. The finding suggests that banks view supplier IPO as a source of risk for the borrowing customers. Hence, a wider range of covenants are placed in the loan contract to reflect the increased needs of monitoring the loan origination *ex post*.

We then take our study a step further by examining the public debt market. We find that the cost of bond issuance also increases for customer companies that experience supplier IPOs, although the magnitude of economic significance is smaller than that for private loan contracts. Putting everything together, our study shows that a supplier IPO is critical information for both private and public debtholders when it comes to assessing the borrowing customers' risk profiles and designing the debt contracts accordingly.

Our results have important implications for several strings of literature. First, our paper is the first to explore the effects of a supplier going public on the borrowing costs of its key customers. Extant literature that studies the spillover effect of suppliers' equity issuance yield mixed results (Johnson et al. 2018; Kutsuna et al. 2016). We provide evidence that suppliers gain market power after going public and exercise their enhanced selling power at their customers' expense. Such events contribute to the increased operational costs, risk, and thus increased costs of debt for customers, supporting the negative spillover effect of equity issuance along the supply chain. Second, our paper adds to the growing literature that examines the effect of change in supply chain relationship in shaping corporate policies and outcomes (Hertzel et al. 2008; Fee and Thomas 2004; Shahrur 2005; Bhattacharyya and Nain 2011; Houston et al. 2016). In particular, our paper complements Houston et al. (2016) by documenting the credit market response to another type of supply chain shock: supplier IPO. Through investigating the pricing and non-pricing terms of loan contracts, this paper enables us to measure the spillover risks of equity issuance along

the supply chain relationship. Finally, our paper contributes to the bank loan literature (e.g., Graham et al. 2008) and provides direct evidence showing that banks consider the behavior of the supply chain partner of the borrowing firm and pay particular attention to any change in the supply chain relationship when designing debt contracts.

The remainder of our paper is organized as follows. Section 2 reviews related literature. Section 3 details our data, sample, and measures. Section 4 presents our identification strategies and empirical results. Section 5 summarizes and concludes.

2. Literature Review and Hypothesis Development

In this section, we discuss the related literature, highlight its contribution, and formulate our hypothesis on the relation between supplier IPO and customers' cost of borrowing.

2.1. Contribution in relation to contemporary studies

The supplier–customer relationship is complex and dynamic in the sense that one firm's investment decisions, financing decisions, or financial status may “spill over” to affect its trading partner. A set of studies has examined how corporate mergers and acquisitions, bankruptcy filings, or equity offerings at one firm influence its supply chain partners. For instance, Hertz et al. (2008) document significant bankruptcy filing contagion effects along the supply chain. Fee and Thomas (2004), Shahrur (2005), and Bhattacharyya and Nain (2011) investigate the effects of horizontal mergers on stock market reaction and post-merger operating performance of customers and suppliers.

Most relevant to our study, two papers investigate the spillover effect of equity issuance along the supply chain (Johnson et al. 2018; Kutsuna et al. 2016). For example, Johnson et al. (2018) find that seasoned equity offerings (SEOs) generate an adverse market reaction toward both issuers and their large customers. They also find that customers' operating performance and credit ratings both decline after the supplier SEO. In contrary, using Japanese data, Kutsuna et al. (2016) document a positive IPO spillover

effect, showing that private suppliers and customers experience significantly higher growth rates in revenue, cash, and PP&E when the trading partner goes public. The two contemporary studies on equity issuance find a contradictory spillover effect on the supply chain partner. In addition, they focus on the market revaluation and operating performance. Nevertheless, it remains an open question how banks view such equity issuance shock in the supply chain relationship. More specifically, it remains unclear whether the spillover effect of supplier IPOs on customers' bank loan cost is positive or negative. Banks, as delegated monitors (Diamond 1984), play a central role in overcoming informational problems (Strahan 1999). *Ex ante*, banks must invest in costly information production and due diligence to assess potential borrowers' creditworthiness. *Ex post*, banks must devote resources to monitoring borrowers in order to mitigate moral hazard problems, even for borrowers with acceptable credit risk. Therefore, compared with equity holders, banks are more apt to be sensitive to the risks or benefits associated with equity issuance by borrowers' trading partners.

Extant studies have shown that banks have been paying close attention to the complex and dynamic supply chain relationships. Cen et al. (2015) find that banks regard the customer–supplier relationship as a certifying mechanism, and consequently they charge smaller loan spreads and impose looser loan covenants when lending to suppliers that have a continuing long-term relationship with a principal customer. Campello and Gao (2017) suggest that the suppliers' bank loan interest rates and covenant restrictiveness increase with customer concentration. Hasan et al. (2017) show that analyzing a supply chain relationship allows banks to collect information on the current borrower's trading customers, and the reduced cost of information production allows banks to grant loans at lower rates. Two other studies, Kolay et al. (2016) and Houston et al. (2016), highlight the negative spillover effect of financial distress on the supply chain partners. In our study, we extend this emerging line of research by examining how banks evaluate the information embedded in the one-sided shock (i.e., supplier IPO) in the supply chain relationship.

2.2. Hypothesis

Moving from private domain to public domain enhances the issuing firms' name recognition and competitive position in the marketplace (Chemmanur and He 2011; Chod and Lyandres 2011). It also enables the issuers to access to various financial resources that are essential for their liquidity. Using a Japanese sample, Kutsuna et al. (2016) find that firms that go public transmit liquidity to their private trading partners, which reduces the private firms' concern of a funding gap. If suppliers are willing to pass their gains from going public to their trading partners, as suggested by Kutsuna et al. (2016), then customers are expected to have an enhanced liquidity position and reduced perceived credit risk after their suppliers go public. Moreover, going public will increase publicity for suppliers and subject them to intense market discipline, which in turn limits their opportunistic behaviors in dealing with their trading partners. We could expect lower operational risk for customers whose supplier goes public. Therefore, if banks view trading partners' IPO as a mechanism of liquidity transformation and risk mitigation, a supplier IPO may affect the customer's position positively, resulting in a subsequent reduction in loan spreads when the customer borrows from banks.

Nonetheless, whether or not suppliers that have gone public will pass on their gains of accessing public equity market to their trading partners is, in fact, an empirical question. In other words, supplier IPOs might have negative spillover effects on their major customers. Theoretical work of Maksimovic and Pichler (2001) and Spiegel and Tookes (2008) suggests that public firms' market shares increase in the years subsequent to IPOs. Chemmanur and He (2011) and Chod and Lyandres (2011) document consistent empirical evidence that firms experience market share increases after IPOs, whereas their industry incumbents experience the opposite. Other studies show that firms with increased market share and market power tend to put pressure on their supply chain partners, which deteriorates their trading partners' value (Fee and Thomas 2004; Shahrur 2005; Bhattacharyya and Nain 2011). Johnson et al. (2018) provide empirical evidence to support that a supplier's equity financing decision leads to an adverse spillover effect to its customers' operational and financial performance. Because an IPO event allows suppliers to gain market power, the supplier might exercise its enhanced selling power against customers by restricting trade

credit, raising selling prices, or forcing more input usage. Therefore, if banks view supplier IPO as potentially increasing selling power, we would expect that such an event may adversely affect the customers' positions, resulting in a subsequent increase in operation costs, risk, and thus increased cost of debt for the customers.

3. Data, Sample, and Measures

3.1. Data and sample selection

FASB No. 14 requires supplying companies to disclose the identities and sales levels of major customers that represent 10% or more of their total sales. Such information is contained in Compustat Segment Customer data file, which allows us to extract the supplier–customer pairs. We rely on the Thomson Financial SDC Platinum New Database (SDC) to retrieve information on IPOs. Following convention in the IPO literature (Loughran and Ritter 2004; Purnanandam and Swaminathan 2004), we exclude IPOs of American Depositary Receipts (ADRs), non-ordinary shares, real estate investment trusts (REITs), closed-end fund shares, unit offerings, partnerships, and firms not covered by CRSP within six months of the offering. We also eliminate IPOs by issuers that conduct seasonal equity offerings (SEOs) within the subsequent five-year window to reduce concerns that the announcements of SEOs may confound our results.

To identify the supplying companies that experienced IPOs, we then match the suppliers in Compustat Segment Customer with the IPO firms in SDC. We record the customer companies of those matched suppliers and the dates when their suppliers went public. When a particular customer company has multiple suppliers going public, we focus on the largest supplier according to that customer's sales.

We collect bank loan data for customers from the Loan Pricing Corporation (LPC) DealScan database. To ensure that we can properly assess the spillover effect of suppliers' IPOs on customers' loan contracts, we require that loans borrowed by a particular customer company occur within a time window

surrounding its supplier's IPO (i.e., up to four years before and after the event). In addition, we ensure that the corresponding supplier–customer relationship was not terminated before the loan origination year. Following other bank loan studies such as Graham et al. (2008), we exclude loans borrowed by customers in the financial (SIC code 6000–6999) and utility (SIC code 4900–4999) industries. We supplement the loan sample with information from Compustat and CRSP for both the suppliers and the customers. After removing observations with incomplete information, our final loan sample consists of 1,646 loans issued to 388 unique customers from 1986 through 2013.

3.2. *Measurement of variables*

3.2.1. *Dependent variable*

The cost of a particular loan is measured using all-in-spread-drawn (AISD), loan spread in basis points over London Interbank Offered Rate (LIBOR) on the drawn amount. We take the natural logarithm of AISD to normalize the distribution and capture the percentage change of loan price determined by various explanatory variables.

3.2.2. *Main explanatory variable*

To capture the spillover effects of the suppliers' IPOs on their customers' cost of debt financing, we define a binary variable, *Post supplier IPO*, which takes the value of one if a particular loan facility for a customer company is originated up to four years after the supplier IPO announcement year, and zero otherwise.

3.3.3. *Other control variables*

In the regression analysis, we control for two sets of variables. The first captures various firm characteristics that have been documented as important determinants of loan contracts. Specifically, we control for *Firm size* as the natural logarithm of firm book assets. We measure *Profitability* as the ratio of earnings before interest, taxes, depreciation, and amortization (EBITDA) to the book value of assets. We control for *Market to book*, the ratio of the market value of assets to the book value of assets, to measure a

firm's growth opportunities. We control for firm *Book leverage*, measured as the ratio of book value of total debt to the book value of assets. We calculate *Assets tangibility* as the ratio of property, plant, and equipment (PPE) to total assets. We add the modified Altman's (1968) *Z-score* representing a firm's likelihood of bankruptcy ($[1.2 \text{ Working capital} + 1.4 \text{ Retained earnings} + 3.3 \text{ EBIT} + 0.999 \text{ Sales}]/\text{Total assets}$). We include the standard deviation of previous three-year ROA (*Earnings volatility*) and S&P debt rating (*Credit rating*) as two additional controls.

The second set of control variables captures various loan characteristics. We measure *Loan size* as the natural logarithm of the facility's dollar value in millions. We measure *Loan maturity* as the natural logarithm of the number of months from the time a loan facility is activated until its maturity date. We include a variable, *Syndicate size*, to measure the number of lenders for a particular loan facility. We use an indicator, *Relationship loan*, to distinguish relationship loans from first-time loans. We define a loan as a relationship loan if a particular borrower has obtained a loan during the five-year window preceding the focal loan (Bharath et al. 2011). In addition, following existing literature (Strahan 1999; Graham et al. 2008; Bharath et al. 2011), we include a series of indicators to capture loan purposes (loan purpose fixed effects) and loan types (loan type fixed effects).

Table 1 reports the summary statistics of *Post supplier IPO*, firm characteristics, and loan characteristics.³ In our loan sample, 43% of loans are issued after supplier IPOs. The average AISD is 117 basis points (median 75 basis points). The average loan size is \$723.5 million with a mean maturity of 42 months. The average syndicate size is around 12 lenders. In general, the sample statistics of variables used in this study are similar to the numbers reported in prior studies (Strahan 1999; Graham et al. 2008; Bharath et al. 2011).

[Insert Table 1 about here]

³ To mitigate the effect of extreme values, all variables are winsorized at the 1% and 99% levels.

4. Results

4.1. Identification strategy

We investigate whether the suppliers' IPO decisions have any spillover effects along the supply chain in the context of syndicated loans granted to their customer companies. We use the following model in our empirical identification:

$$\text{Log}(AISD_{it}) = \alpha + \beta_i + \beta_t + \beta_1 \text{Post supplier IPO} + \gamma \text{Firm characteristics}_{t-1} + \delta \text{Loan characteristics}_t + \varepsilon_{it} \dots\dots\dots(1)$$

where the dependent variable is the natural logarithm of the loan costs that customer companies pay. *Post supplier IPO* is the main independent variable that equals 0 in the pre-IPO period and 1 in the post-IPO period. Following existing studies (Strahan 1999; Graham et al. 2008; Bharath et al. 2011), we control for a set of variables capturing various firm characteristics and loan characteristics, explained in the previous section.

For all model specifications, we include firm fixed effects (β_i) to control for any time-invariant unobservable firm characteristics, and we add year fixed (β_t) effects to control for economy-wide shocks. In addition, we cluster standard errors at the firm level to control for the dependence of error terms for the same borrower.

4.2. Baseline regression results

In Table 2, we present the results. Column (1) represents the result for the sample of loans granted to a customer within the time window covering four years before and after its supplier's IPO. We use this sample as our main one for further tests because the mean loan maturity is around four years. For a robustness check, in columns (2)–(5), we also use one-, two-, three- and five-year windows pre- and post-supplier IPO events.

The results indicate that the customer companies' average loan cost significantly increases following a supplier's IPO. The corresponding coefficients on the *Post supplier IPO* dummy are all

statistically significant, ranging from 0.171 in column (5) to 0.231 in column (4). Using column (1) as example, the finding suggests that the average loan spread increases by 20.2% in the aftermath of a supplier’s IPO. Given that the sample firms’ average loan spread is 117.45 basis points, suppliers’ going public increases customers’ loan spreads by about 23.7 basis points ($= 20.2\% \times 117.45$). Given that the mean sample loan size is \$723.54 million and the average loan’s time to maturity is around 3.5 years, a supplier IPO results in an average \$6 million increase ($= \$723.54 \text{ million} \times 0.00237 \times 3.5$) in interest expense for the customer.

Our estimate is comparable to prior study that also examines the creditor’s reaction to the supply chain shock. For instance, Houston et al. (2016) find that a firm’s bank financing cost increases by roughly 20% (23 basis points) following a client’s bankruptcy. Thus, equity issuance has an economically significant spillover effect on the trading party’s debt financing. Regarding other control variables, we generally find results that are in line with existing literature (Graham et al. 2008; Bharath et al. 2011).

In column 6 of Table 2, we adopt an alternative model as in Equation (2) to control for the possibility that time trends could differ across firms. By doing so, we allow firms to have intercepts ($\beta_i + t \times \beta_i$) varying over time. The inclusion of a time trend for each firm ensures that any differential pre-trends in the cost of debt in the treatment and control groups are controlled for (Angrist and Pischke, 2008). With the alternative model specification, we report a significantly positive coefficient for *Post supplier IPO* ($\beta_1 = 0.154; p < 0.01$), which suggests that that our findings are not plagued by any omitted pre-trend variable bias.

$$\text{Log}(AISD_{it}) = \alpha + \beta_i + \beta_t + t \times \beta_i + \beta_1 \textit{Post supplier IPO} + \gamma \textit{Firm characteristics}_{t-1} + \delta \textit{Loan characteristics}_t + \varepsilon_{it} \dots\dots\dots(2)$$

[Insert Table 2 about here]

4.3. Robustness check

We conduct a set of additional tests (see Appendix A) to ensure the robustness of our findings

reported in Table 2. First, we re-run our main model specification at deal-level regression instead of at the facility level to control for potential correlation within a particular deal (column 1). Second, we use median regressions to address the possible effects of outliers (column 2). Third, we use a subsample that excludes observations after 2007 to mitigate confounding effects of the recent subprime lending crisis (column 3). Fourth, we partition our sample according to the nature of lending relationship. We rerun our model specification use two subsamples of first-time loans (column 4) and relationship loans (column 5), and our main result holds regardless of the different model specifications and samples.

In Appendix B, we address another concern that the changes in customers' borrowing costs may be driven by secular shifts in customer quality that are independent of the observed IPO events experienced by their supplying companies. We construct a set of placebo tests wherein we replicate the results in column 1 of Table 2, but we now run tests for the period T-9 to T-1, where T-5 is assumed to be the hypothetical event year (note that T = 0 is the year that the actual IPO takes place). In line with our expectation, the coefficient related to the *Post supplier IPO* is not statistically significant (column 1 of Appendix C). In column 2 of Appendix B, we examine the dynamic effect of the suppliers' IPOs on customers' loan cost. Following Bertrand and Mullainathan (2003), we regroup our sample loans according to the time of supplier IPO events. Specifically, *Bank loan* (-3, -2) is a dummy variable that takes the value of one in the three years before the IPO events and zero otherwise; *Bank loan* (-2, -1) is a dummy variable that takes the value of one in the two years before the IPO events and zero otherwise; *Bank loan* (-1, 0) is a dummy variable that takes the value of one in the one year before the IPO events and zero otherwise; *Bank loan* (0, 0) is a dummy variable that takes the value of one in the year of the IPO and zero otherwise; and *Post supplier IPO* is an indicator that takes a value of one for up to four years after the year of supplier IPO events and zero otherwise. The insignificant coefficients for *Bank loan* (-3, -2), *Bank loan* (-2, -1), *Bank loan* (-1, 0), and *Bank loan* (0, 0) indicate that the change in loan cost of customer companies is unrelated to any preexisting conditions. Moreover, we consistently document a positive effect of supplier IPO events on loan spread of customer companies in the years after suppliers' IPOs.

In Appendix C, we turn to examine other fees that are important components in loan contracts and represent a significant portion of loan cost (Berg, Saunders, and Steffen 2015). Specifically, we investigate all-in-spread-undrawn (column 1), facility fee (column 2), upfront fee (column 3) and letter of credit fee (column 4). In general, customer companies also experience higher fees in their loan contracts after their supplier IPO events.

4.4. *Difference-in-differences (DID) analysis*

In establishing our main result, we cautiously design our empirical tests to address the endogeneity concern. Although it is unlikely that changes in customer companies' loan cost drive their suppliers' IPO decisions, we impose a lead–lag structure for the variables used in regression analysis. We also include firm fixed effects to control for the unobservable heterogeneity bias. In addition, we conduct the test to rule out the possibility that changes in customer companies' loan cost are related to any preexisting conditions prior to their suppliers' IPO events. Nonetheless, endogeneity concerns remain in the sense that there might exist common factors driving both suppliers' IPO decisions and customers' changes in loan cost because of the close supplier–customer relationship. Therefore, we further adopt a difference-in-differences approach to alleviate this concern.

To conduct a difference-in-differences (DID) analysis, we construct a matching sample of firms in the customers' industries with similar firm size, performance, book leverage, and *z*-score. For these matching firms, however, their suppliers did not experience IPOs. In particular, we use a propensity score matching (PSM) method (Irani and Oesch 2013; Hasan et al. 2014) to form the sample of matching firms. We first run logistic regressions for firms in the customers' industries with a binary dependent variable, *Affected firm*, which takes the value of one if a firm experiences an IPO event by its supplier and zero otherwise, and a set of independent variables including *firm size*, *profitability*, *market to book*, *book*

leverage, and *z-score*.⁴ For each customer in the treatment group, we are able to identify a matching firm without replacement on a yearly basis according to the propensity score estimated from the logistic regression. To ensure close matches, following Hasan et al. (2014), we use the caliper matching method, in which “caliper” refers to the differences in the propensity scores for firms in the treatment group and control group. Further, we require that both firms in a matched pair have at least one loan facility within the window of four years before and after the matching year. Our matching procedure yields a sample of 1,588 loan facilities for 133 matching pairs of treated and untreated firms.

We then use the following model specification (see Equation 3) to conduct a DID analysis as detailed earlier. We report our results in Table 3.

$$Loan\ spread_t = \beta_0 + \beta_1 \times Affected\ firm + \beta_2 \times Post\ supplier\ IPO + \beta_3 \times Affected\ firm \times Post\ supplier\ IPO + \sum \beta \times Firm\ characteristics_{t-1} + \sum \gamma \times Loan\ characteristics_t + \varepsilon_t \dots \dots \dots (3)$$

In this model, the variable of interest is the interaction term *Affected firm × Post supplier IPO*. The coefficient of this interaction term (β_3) captures the difference-in-differences estimate in bank loan spreads between treated and untreated firms across the pre- and post-IPO sample periods. We find that the coefficient is positive and significant ($\beta_3 = 0.274$; $p < 0.01$), which suggests that loan costs for firms affected by supplier IPO (i.e., treated firms) increase significantly by more than one-fourth in the post-supplier-IPO period compared with that of untreated matching firms.

Taken as a whole, the results reported in Table 2, Table 3, and the robustness check section consistently suggest that customers experience a statistically and economically significant increase in bank loan cost when a key supplier goes public. The findings suggest that banks view suppliers’ access to equity

⁴ Because matching firms directly based on all observable firm characteristics is complicated because of the “curse of dimensionality” (Zhao 2004), the PSM method has become increasingly popular in recent studies (Irani and Oesch 2013; Hasan et al. 2014). We thereby follow existing studies to choose relevant variables in the matching process. In addition, similar to Irani and Oesch (2013), we also try the match using all controls in the baseline model, which does not materially change our results.

market financing as negative shock for that supplier's major customers and charge higher loan spreads accordingly when those customers borrow. This result highlights the adverse spillover effect from the newly public supplier to its related major customers.

[Insert Table 3 about here]

4.5. *Factors influencing the link between supplier IPO events and customer loan cost*

Our empirical analyses thus far have established a robust link between supplier IPO and its spillover effects on customers' cost of bank loans. In this section, we examine the factors affecting this relationship. One might expect that the adverse spillover effect caused by supplier IPO will be even stronger if the switching cost for customers is higher. Our goal is to investigate the factors through which switching costs might be exacerbated or attenuated.

4.5.1. *Suppliers' relationship-specific investment (RSI)*

Partner firms along supply chains typically make sizable investments that are relationship-specific (Williamson 1991). We focus on the relationship-specific investments (RSI) made by suppliers. By allocating a significant amount of resources to RSI, suppliers can deeply lock in their customers and hence increase their switching cost. Therefore, we expect to observe that the documented positive relationship between supplier IPO events and customer loan cost will be more pronounced when suppliers make significant RSI.

Our first measure of suppliers' RSI is *Supplier R&D_H*, defined as a dummy variable that equals one when a supplier's research and development (R&D) expenditures scaled by total assets is higher than the sample median (Kale and Shahrur 2007), and zero otherwise. Second, we use the supplying firm's advertising expenditure to proxy for RSI, because more spending on advertising implicitly suggests that the suppliers' products require RSI. Specifically, *Supplier Ad_H* is a dummy variable that equals one when the advertising expenditures-to-assets ratio is greater than the sample median (Kale and Shahrur 2007), and zero otherwise. Third, we sort firms into differentiated and undifferentiated industries based on the approach

proposed by Rauch (1999). *Differentiated Industry* is a dummy variable that equals one if the supplier industry produces differentiated output, and zero otherwise. We interact our proxies for supplier RSI with *Post supplier IPO* and report our results in Table 4. Across different model specifications, we document that customer companies experience a larger increase in borrowing cost if the IPO supplier makes significant RSI. The corresponding coefficients on the interaction terms between *Post supplier IPO* and high RSI indicators are all statistically significant, ranging from 0.12 in column (1) to 0.21 in column (2). The finding suggests that customers' average borrowing cost increases by 12% to 21% more when IPO suppliers invest highly in RSI than when they do not.

[Insert Table 4 about here]

4.5.2. *Concentrated customer base*

According to Snyder (1996), the buyer power hypothesis suggests that the presence of a concentrated customer base limits a seller's ability to exercise bargaining power and extract economic rent. The implication is that a supplier should have even more enhanced selling power after an IPO when its customer base is not concentrated. Therefore, we predict that the spillover effects of a supplier IPO on its customer companies' loan cost will be more pronounced when the supplier has a less concentrated customer base. Accordingly, following existing literature (Banerjee et al. 2008; Patatoukas 2012), we construct three measures—*Customersales_L*, *Customermax_L*, and *Customerhhi_L*—to indicate a lower concentration level of customer base. *Customersales_L* is defined as a dummy variable that equals one if, for a particular supplying firm, the sum of the percentage of sales from its major customers (i.e., those with at least 10% of total sales) is smaller than the sample median. *Customermax_L* is a dummy variable that equals one if, for a particular supplying firm, the percentage of sales for the largest customer is smaller than the sample median. *Customerhhi_L* is a dummy variable that equals one if, for a particular supplying firm, the Herfindahl index based on sales to each major customer is smaller than the sample median. We include the interaction terms of *Post supplier IPO* and proxies to test our hypothesis, and we report the results in Table 5. In line with our expectation, we find that across different model specifications, the coefficients of the

interaction terms are positive and significant, suggesting that supplier IPO has a particularly larger effect on the customer's cost of borrowing when the supplier has a less concentrated customer base. Specifically, we find that the customers' borrowing cost increases by an additional 12.7% to 16.6% after the supplier IPO, when the level of customer base moves from higher to lower than sample median.

[Insert Table 5 about here]

4.5.3. *Concentrated supplier base*

We now look at the feature of a customer company's supplier base. A client is likely to have higher switching costs if it has limited alternatives for suppliers. Within our context, this fact implies that a supplier can gain more enhanced selling power after an IPO if it is one of only a few suppliers for the customer. Consequently, the adverse spillover effect of supplier IPO on the customer's cost of borrowing tend to be more prominent for customers with a concentrated supplier base. We thereby construct three proxies—*Supplierpurchases_H*, *Suppliermax_H*, and *Supplierhhi_H*—to indicate a higher concentration level of supplier base. *Supplierpurchases_H* is a dummy variable that equals one if, for a particular customer company, the sum of the percentage purchases from its major suppliers is greater than the sample median. *Suppliermax_H* is a dummy variable that equals one if, for a particular customer company, the percentage purchase from the largest supplier is greater than the sample median. *Supplierhhi_H* is a dummy variable that equals one if, for a particular customer company, the Herfindahl index of purchases from its major suppliers is greater than the sample median. We include the interaction terms of *Post supplier IPO* and three proxies for supplier-base concentration, and we report the results in Table 6. The results, across all model specifications, suggest that supplier IPO has a more pronounced effect on the borrowing cost of customers whose supplier base is relatively more concentrated.

[Insert Table 6 about here]

4.6. *Channel tests*

In this section, we perform additional tests to further explore several underlying mechanisms that

can explain the observed spillover effects of supplier IPOs on their customers' loan cost. As we argue, if the supplier companies indeed gain market power from publicity, their exercise of selling power may affect various aspects of their customer companies' operations. For example, suppliers with increased market power may provide less trade credit, force more sales, and demand high purchase prices from their customers.

We adopt two measures to gauge trade credit received by customers: *Accounts payable_sale* (accounts payable to sale ratio) and *Accounts payable_COGS* (accounts payable to cost of goods sold). Furthermore, we calculate the inventory to sales ratio (*Inventory_sale*) and cost-of-goods-sold to sales ratio (*COGS_sale*) to investigate whether the supplier IPO events have any effects on the quantity and price of inputs purchased by the customers. We then use those measures as our dependent variables and run firm-fixed effect models in Table 8. Results reported in columns 1 and 2 of Table 7 indicate that customers receive less favorable trading terms in the post-IPO period. Results reported in columns 3 and 4 of Table 7 support that the going-public suppliers indeed exercise their increased market power by forcing their existing customers to purchase more inputs at higher prices.

[Insert Table 7 about here]

In short, all the foregoing identified factors could translate the supplier IPO events into higher operating risk for customers and hence lead lending banks to demand a higher risk premium. Next, we directly test whether the supplier IPO events indeed affect the overall riskiness of their customers in the post-event period. We use both accounting and market data to construct the risk measures of customer companies. For example, *Volatility of ROE* is calculated as the standard deviation of return on equity (ROE) on a yearly basis using quarterly data. Following existing research (Coles et al. 2006), we calculate *Volatility of stock return* as the annualized standard deviation of firm daily stock returns over 252 trading days for a particular customer company in a given year. Following Houston et al. (2010), we calculate *idiosyncratic risk* as the standard deviation of the regression residuals from a single-factor market model using monthly data. In columns 1–3 of Table 8, we report our results using *Volatility of ROE*, *Volatility of*

stock return, and *Idiosyncratic risk* as dependent measures, respectively. Strikingly, all three risk measures are positively and significantly related to *Post supplier IPO*, indicating that customer companies' riskiness increase after their suppliers going public.

[Insert Table 8 about here]

4.7. *Effects of supplier IPO on non-price terms*

In this section, we examine whether and to what extent supplier IPO events affect the restrictive provisions (i.e., covenants) in loan contracts. Lending banks put in place a wide range of covenants to control for additional risk and protect debtholders' claims so that banks can take actions in the events of covenant violation (Bharath et al. 2011). As a result, the intensity of the covenants increases with the monitoring needs (Rajan and Winton 1995). Following Graham et al. (2008), we create three covenant indexes: *General covenant intensity*, *Financial covenant intensity*, and *Total covenant intensity*. These indexes capture the stringency of loan contracts in restricting corporate management (Bradley and Roberts 2015). Specifically, *General covenant intensity* is the total number of general covenants in the loan contract (e.g., prepayment covenants, dividend covenants, and voting-rights covenants); *Financial covenant intensity* is the total number of financial covenants (e.g., maintaining a minimum level of interest coverage ratio, current ratio, leverage, and net worth covenants); and *Total covenant intensity* is the sum of *General covenant intensity* and *Financial covenant intensity*.

In Table 9, we use logged measures of three covenant indexes as dependent variables and estimate the spillover effects of supplier IPO events on non-price terms. We document significant and positive coefficients for *Post supplier IPO* for all three model specifications. Our assessment of the economic significance of the results reveals that, all else being equal, supplier IPO events increase *General covenants intensity*, *Financial covenants intensity*, and *Total covenant intensity* by 14.8%, 15.1%, and 20.6%, respectively.

[Insert Table 9 about here]

4.8. *Effect of supplier IPO events on the cost of public debt*

In this section, we take our empirical analyses one step further by investigating the spillover effects of supplier IPO events on the cost of public debt (i.e., corporate bonds) for customer companies. To do this, we retrieve information on bonds issued by our sample customer companies from the SDC New Issue Database from 1988 to 2013. Following the convention, we eliminate all convertible and private placement bonds. We are able to identify 2,691 bond issuances by our sample customer companies. In regression analysis, the dependent variable is $\text{Log}(\text{At-issue yield spread})$, defined as the natural logarithm of the spread difference between the yield to maturity on a coupon-paying corporate bond and the yield to maturity on a coupon-paying government bond with the same maturity date. We control for a set of bond characteristics including the natural logarithm of issue proceeds (*bond issuing size*), the natural logarithm of a bond's time to maturity in months (*bond maturity*), bond seniority (*Senior*), bond callable feature (*callable*), and the numeric measure of bond rating (*bond rating*). In Table 10, we report a positive and significant coefficient for *Post supplier IPO*. The result reveals that the spillover effects of supplier IPOs also exist for the cost of public debts of customer companies. Compared with result in column 1 of Table 2, however, the magnitude of the economic significance for this coefficient is slightly smaller. Combined together, our results show that both private and public debtholders incorporate information of supplier IPO into their assessment of customer companies' risk profiles and pricing it accordingly in debt contracts.

[Insert Table 10 about here]

5. **Summary and Conclusion**

In this study, we empirically examine the spillover effect of supplier IPOs on their customer companies' cost of debt financing. To our knowledge, our paper is the first to present empirical evidence on this issue. Our main finding is that the cost of bank loans for customer companies increases significantly after their suppliers go public. The results suggest a negative spillover effect of supplier IPOs on customer companies. Second, we investigate whether the adverse spillover effect caused by supplier IPO is contingent on customers' switching cost. Specifically, we offer empirical evidence showing that the extent

of RSI by supplier firms intensifies the negative spillover effect. Our results also reveal that a customer receives more-unfavorable price terms when it is one of many customers of the going-public supplier, or when it faces limited alternative suppliers. Third, given our empirical findings that supplier IPOs are significantly related to higher costs of debt capital for customers, we examine two potential underlying mechanisms that could contribute to this association. In particular, we investigate whether supplier IPOs lead to increased operating costs and financial risk for the customer firms, and our results support both channels. Last, we extend our analysis to the public debt market and find a negative spillover effect of supplier IPOs on the cost of bonds for customers. In summary, focusing on supplier IPO events, our study sheds further light on the supply chain interdependence in the context of debt financing.

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Table 1 Summary statistics

Variable	N	Mean	Median	St Dev	P5	P95
Post supplier IPO	1,646	0.43	0	0.5	0	1
AISD	1,646	117.45	75	111.2	18.75	325
Facility amount (\$mil)	1,646	723.54	325	1409.68	17.5	2500
Maturity	1,646	42.11	36	28.04	12	84
Syndicate size	1,646	12.28	9	11.69	1	35
Relationship loan	1,646	0.53	1	0.5	0	1
Firm size	1,646	8.11	8.27	1.87	4.68	10.79
Profitability	1,646	0.15	0.14	0.09	0.04	0.29
Market to book	1,646	2.02	1.55	1.33	0.95	4.55
Book leverage	1,646	0.26	0.25	0.15	0.01	0.52
Assets tangibility	1,646	0.34	0.28	0.22	0.05	0.76
Z-Score	1,646	2.17	2.08	1.77	0.56	4.51
Earnings volatility	1,646	0.02	0.01	0.04	0	0.05
Credit rating	1,646	12.15	10	6.82	4	23

Table 2 Baseline regressions relating supplier IPO events to loan costs of customer companies

Independent variables	Dependent variable: Log(AISD)					
	(1) Window [-4,4]	(2) Window [-1,1]	(3) Window [-2,2]	(4) Window [-3,3]	(5) Window [-5,5]	(6) Window [-4,4]
Post supplier IPO	0.202*** [3.890]	0.174*** [2.761]	0.225*** [4.129]	0.231*** [4.574]	0.171** [2.489]	0.154*** [5.740]
Firm size	-0.070*** [-2.766]	-0.047 [-1.021]	-0.080*** [-3.060]	-0.060** [-1.986]	-0.073*** [-2.963]	-0.139*** [-5.065]
Profitability	-0.240 [-0.460]	-0.415 [-0.896]	-0.471 [-1.076]	-0.497 [-1.289]	-0.363 [-0.773]	-1.062*** [-7.613]
Market to book	-0.108*** [-3.040]	-0.197*** [-3.814]	-0.120*** [-3.037]	-0.132*** [-4.943]	-0.091** [-2.504]	-0.179*** [-16.173]
Book leverage	1.048*** [6.790]	1.031*** [5.009]	1.026*** [5.765]	0.896*** [6.470]	1.022*** [7.657]	1.083*** [14.703]
Assets tangibility	-0.368*** [-4.553]	-0.370*** [-3.785]	-0.527*** [-4.691]	-0.449*** [-5.453]	-0.537*** [-6.829]	-0.409*** [-17.895]
Z-Score	-0.050 [-1.579]	-0.082*** [-3.495]	-0.113*** [-5.172]	-0.070*** [-3.749]	-0.064*** [-2.782]	-0.082*** [-18.540]
Earnings volatility	3.354 [1.449]	5.110*** [3.448]	4.978*** [3.126]	3.336 [1.440]	1.172 [0.697]	2.190*** [10.923]
Credit rating	0.029*** [4.995]	0.040*** [3.344]	0.030*** [5.103]	0.032*** [5.484]	0.034*** [5.944]	0.023*** [9.515]
Loan size	-0.144*** [-6.582]	-0.140*** [-6.158]	-0.110*** [-5.791]	-0.132*** [-5.187]	-0.127*** [-6.893]	-0.146*** [-5.431]
Loan maturity	0.016 [0.428]	0.073 [1.046]	0.046 [1.332]	0.023 [0.580]	0.032 [0.927]	0.061 [1.273]
Syndicate size	-0.001 [-0.256]	-0.005 [-1.298]	-0.006 [-1.631]	-0.004 [-1.270]	-0.002 [-1.284]	-0.002 [-0.353]
Relationship loan	-0.066* [-1.703]	-0.091 [-1.366]	-0.128** [-2.466]	-0.095* [-1.842]	-0.049 [-1.514]	-0.099 [-1.252]
Constant	5.580*** [20.062]	5.310*** [9.040]	5.631*** [19.117]	5.595*** [18.756]	5.555*** [21.441]	6.325*** [34.893]
Loan type	Y	Y	Y	Y	Y	Y
Loan purpose	Y	Y	Y	Y	Y	Y
Year fixed effects	Y	Y	Y	Y	Y	Y
Firm fixed effects	Y	Y	Y	Y	Y	Y
Firm-specific time trends						Y
Clustered standard errors	Firm	Firm	Firm	Firm	Firm	Firm
Observations	1,646	724	1,069	1,360	1,881	1,646
Adjusted R-squared	0.691	0.771	0.736	0.703	0.668	0.75

Note: Robust *t*-statistics that adjust for heteroskedasticity and within-firm clustering are reported in brackets. Significance at the 10%, 5%, and 1% levels is indicated by *, **, and ***, respectively.

Table 3 Difference-in-difference estimations

Independent variables	Dependent variable: Log(AISD)
Post supplier IPO	0.082 [1.512]
Affected firm	-0.277*** [-6.230]
Affected firm × Post supplier IPO	0.274*** [4.664]
Firm size	-0.025 [-1.545]
Profitability	-1.665*** [-5.984]
Market to book	-0.031 [-1.572]
Book leverage	1.225*** [12.271]
Assets tangibility	-0.107 [-1.239]
Z-Score	0.014 [0.657]
Earnings volatility	4.882*** [6.639]
Credit rating	0.025*** [8.428]
Loan size	-0.234*** [-13.857]
Loan maturity	-0.031 [-0.926]
Syndicate size	0.007*** [4.046]
Relationship loan	-0.179*** [-5.657]
Constant	4.652*** [6.406]
Loan type fixed effects	Y
Loan purpose fixed effects	Y
Year fixed effects	Y
Firm fixed effects	Y
Clustered standard errors	Firm
Observations	1,588
Adjusted R-squared	0.786

Note: Robust *t*-statistics that adjust for heteroskedasticity and within-firm clustering are reported in brackets. Significance at the 10%, 5%, and 1% levels is indicated by *, **, and ***, respectively.

Table 4 Supplier's relationship-specific investment

Independent variables	Dependent variable: Log(AISD)		
	(1)	(2)	(3)
Post supplier IPO	0.182*** [3.747]	0.129*** [3.170]	0.133*** [3.050]
Supplier R&D_H	0.032 [0.473]		
Post supplier IPO × Supplier R&D_H	0.120* [1.893]		
Supplier Ad_H		-0.082 [-1.087]	
Post supplier IPO × Supplier Ad_H		0.210*** [2.914]	
Differential Industry			-0.199*** [-3.153]
Post supplier IPO × Differentiated industry			0.149** [2.248]
Firm size	-0.073*** [-3.114]	-0.110*** [-4.541]	-0.098*** [-4.145]
Profitability	-0.094 [-0.261]	0.037 [0.100]	0.116 [0.322]
Market to book	-0.112*** [-5.098]	-0.156*** [-6.758]	-0.152*** [-6.745]
Book leverage	1.041*** [6.650]	1.014*** [6.142]	0.928*** [5.770]
Assets tangibility	-0.312** [-2.215]	-0.298** [-2.161]	-0.352** [-2.578]
Z-Score	-0.057** [-2.110]	-0.062** [-2.168]	-0.072*** [-2.622]
Earnings volatility	3.301*** [4.122]	3.231*** [3.947]	3.356*** [4.127]
Credit rating	0.027*** [5.545]	0.029*** [5.820]	0.030*** [6.131]
Loan size	-0.126*** [-7.743]	-0.146*** [-8.980]	-0.145*** [-9.056]
Loan maturity	-0.010 [-0.485]	0.065*** [3.264]	0.065*** [3.323]
Syndicate size	-0.001 [-0.428]	-0.001 [-0.667]	-0.001 [-0.743]
Relationship loan	-0.058* [-1.816]	-0.085*** [-2.584]	-0.070** [-2.190]
Constant	5.456*** [19.521]	5.990*** [20.488]	5.887*** [20.585]
Loan type fixed effects	Y	Y	Y
Loan purpose fixed effects	Y	Y	Y
Year fixed effects	Y	Y	Y
Firm fixed effects	Y	Y	Y
Clustered standard errors	Firm	Firm	Firm
Observations	1,646	1,646	1,646
Adjusted R-squared	0.703	0.694	0.702

Note: Robust *t*-statistics that adjust for heteroskedasticity and within-firm clustering are reported in brackets. Significance at the 10%, 5%, and 1% levels is indicated by *, **, and ***, respectively.

Table 5 Concentrated customer base

Independent variables	Dependent variable: Log(AISD)		
	(1)	(2)	(3)
Post supplier IPO	0.127*** [2.794]	0.142*** [3.125]	0.143*** [3.130]
Customersales_L	-0.186*** [-2.949]		
Post supplier IPO × Customersales_L	0.166** [2.572]		
Customermax_L		-0.096 [-1.535]	
Post supplier IPO × Customermax_L		0.127** [1.982]	
Customerhhi_L			-0.147** [-2.328]
Post supplier IPO × Customerhhi_L			0.131** [2.050]
Firm size	-0.065*** [-2.730]	-0.068*** [-2.900]	-0.072*** [-3.054]
Profitability	-0.218 [-0.599]	-0.249 [-0.684]	-0.170 [-0.468]
Market to book	-0.108*** [-4.814]	-0.108*** [-4.761]	-0.113*** [-4.998]
Book leverage	1.088*** [6.756]	1.041*** [6.510]	1.060*** [6.631]
Assets tangibility	-0.374*** [-2.747]	-0.370*** [-2.679]	-0.347** [-2.527]
Z-Score	-0.044 [-1.578]	-0.050* [-1.823]	-0.048* [-1.758]
Earnings volatility	3.261*** [4.084]	3.489*** [4.339]	3.596*** [4.466]
Credit rating	0.028*** [5.750]	0.029*** [5.835]	0.029*** [5.832]
Loan size	-0.142*** [-8.423]	-0.142*** [-8.465]	-0.142*** [-8.440]
Loan maturity	0.014 [0.479]	0.015 [0.508]	0.020 [0.671]
Syndicate size	-0.001 [-0.457]	-0.000 [-0.226]	-0.001 [-0.390]
Relationship loan	-0.075** [-2.307]	-0.066** [-2.039]	-0.071** [-2.159]
Constant	5.591*** [19.797]	5.600*** [19.758]	5.618*** [19.854]
Loan type fixed effects	Y	Y	Y
Loan purpose fixed effects	Y	Y	Y
Year fixed effects	Y	Y	Y
Firm fixed effects	Y	Y	Y
Clustered standard errors	Firm	Firm	Firm
Observations	1,646	1,646	1,646
Adjusted R-squared	0.693	0.692	0.692

Note: Robust *t*-statistics that adjust for heteroskedasticity and within-firm clustering are reported in brackets. Significance at the 10%, 5%, and 1% levels is indicated by *, **, and ***, respectively.

Table 6 Concentrated supplier base

Independent variables	Dependent variable: Log(AISD)		
	(1)	(2)	(3)
Post supplier IPO	0.114** [2.346]	0.101** [2.134]	0.130** [2.490]
Suppliersales_H	-0.209*** [-3.255]		
Post supplier IPO × Suppliersales_H	0.125** [1.962]		
Suppliermax_H		-0.287*** [-4.490]	
Post supplier IPO × Suppliermax_H		0.148** [2.347]	
Supplierhhi_H			-0.265*** [-4.110]
Post supplier IPO × Supplierhhi_H			0.128** [1.979]
Firm size	-0.073*** [-3.161]	-0.074*** [-3.220]	-0.061*** [-2.652]
Profitability	-0.430 [-1.195]	-0.436 [-1.225]	-0.160 [-0.448]
Market to book	-0.107*** [-4.906]	-0.103*** [-4.779]	-0.112*** [-5.074]
Book leverage	1.023*** [6.511]	0.974*** [6.242]	0.965*** [6.170]
Assets tangibility	-0.464*** [-3.347]	-0.501*** [-3.624]	-0.566*** [-4.093]
Z-Score	-0.062** [-2.271]	-0.072*** [-2.628]	-0.079*** [-2.927]
Earnings volatility	2.884*** [3.613]	2.767*** [3.494]	2.752*** [3.473]
Credit rating	0.025*** [5.102]	0.023*** [4.759]	0.027*** [5.494]
Loan size	-0.161*** [-10.121]	-0.158*** [-9.994]	-0.152*** [-9.549]
Loan maturity	0.009 [0.421]	-0.001 [-0.056]	0.014 [0.690]
Syndicate size	0.001 [0.376]	0.000 [0.161]	0.000 [0.239]
Relationship loan	-0.094*** [-2.924]	-0.088*** [-2.784]	-0.077** [-2.426]
Constant	5.823*** [21.220]	6.012*** [21.864]	5.756*** [21.290]
Loan type fixed effects	Y	Y	Y
Loan purpose fixed effects	Y	Y	Y
Year fixed effects	Y	Y	Y
Industry fixed effects	Y	Y	Y
Clustered standard errors	Firm	Firm	Firm
Observations	1,646	1,646	1,646
Adjusted R-squared	0.700	0.703	0.704

Note: Robust *t*-statistics that adjust for heteroskedasticity and within-firm clustering are reported in brackets. Significance at the 10%, 5%, and 1% levels is indicated by *, **, and ***, respectively.

Table 7 Testing underlying mechanisms

Independent variables	Accounts payable_sale	Accounts payable_COGS	COGS_sale	Inventory_sale
	(1)	(2)	(3)	(4)
Post supplier IPO	-0.028*** [-2.779]	-0.253** [-1.974]	0.162*** [4.643]	0.009*** [3.065]
Firm size	-0.043*** [-7.339]	-0.513*** [-6.501]	0.033 [1.589]	-0.006*** [-3.551]
Profitability	-0.158 [-1.564]	-1.954 [-1.416]	0.143 [0.400]	-0.100*** [-3.281]
Market to book	-0.003 [-0.772]	-0.053 [-0.911]	-0.010 [-0.697]	-0.004*** [-2.914]
Book leverage	-0.277*** [-6.004]	-3.102*** [-4.921]	0.836*** [5.134]	0.036*** [2.618]
Assets tangibility	-0.066* [-1.707]	-1.184** [-2.232]	0.679*** [4.957]	-0.127*** [-10.965]
Z-Score	-0.051*** [-6.185]	-0.636*** [-5.622]	0.112*** [3.833]	0.014*** [5.493]
Earnings volatility	0.172 [0.750]	-0.481 [-0.154]	2.128*** [2.630]	-0.120* [-1.762]
Credit rating	-0.001 [-0.361]	-0.004 [-0.233]	0.003 [0.604]	-0.000 [-0.155]
Constant	0.823*** [11.357]	8.552*** [8.650]	0.332 [1.299]	0.191*** [8.799]
Observations	1,646	1,646	1,646	1,646
Adjusted R-squared	0.705	0.676	0.830	0.654
Year effects	Y	Y	Y	Y
Firm effects	Y	Y	Y	Y
Clustered standard errors	Firm	Firm	Firm	Firm

Note: Robust *t*-statistics that adjust for heteroskedasticity and within-firm clustering are reported in brackets. Significance at the 10%, 5%, and 1% levels is indicated by *, **, and ***, respectively.

Table 8 Do spillover effects of supplier IPO events increase customers' risk exposure?

Independent variable	Dependent variables		
	Volatility of ROE	Volatility of stock return	Idiosyncratic risk
	(1)	(2)	(3)
Post supplier IPO	0.077* [1.762]	0.031*** [3.643]	0.022*** [2.827]
Firm size	-0.087*** [-3.556]	-0.020*** [-3.928]	-0.029*** [-6.271]
Profitability	0.429 [0.983]	-0.415*** [-4.534]	-0.314*** [-3.816]
Market to book	0.061*** [3.356]	0.029*** [8.060]	0.023*** [7.335]
Book leverage	0.482** [2.417]	0.100** [2.403]	0.116*** [3.091]
Assets tangibility	-0.966*** [-5.713]	-0.196*** [-5.206]	-0.192*** [-5.675]
Z-Score	-0.051 [-1.440]	-0.005 [-0.591]	-0.006 [-0.876]
Credit rating	-0.006 [-1.055]	0.007*** [5.750]	0.006*** [5.437]
Constant	1.000*** [3.310]	0.551*** [8.597]	0.592*** [10.270]
Year fixed effects	Y	Y	Y
Firm fixed effects	Y	Y	Y
Clustered standard errors	Firm	Firm	Firm
Observations	1,646	1,646	1,646
Adjusted R-squared	0.344	0.631	0.652

Note: Robust *t*-statistics that adjust for heteroskedasticity and within-firm clustering are reported in brackets. Significance at the 10%, 5%, and 1% levels is indicated by *, **, and ***, respectively.

Table 9 Supplier IPO events and non-price terms in customers' loan contracts

Independent variables	Dependent variables		
	General covenants intensity (1)	Financial covenants intensity (2)	Total covenants intensity (3)
Post supplier IPO	0.148** [2.187]	0.151*** [3.084]	0.206*** [2.609]
Firm size	-0.032 [-0.389]	-0.036 [-0.578]	-0.035 [-0.353]
Profitability	0.199 [0.294]	0.434 [0.863]	0.506 [0.736]
Market to book	-0.012 [-0.556]	-0.013 [-1.057]	-0.014 [-0.582]
Book leverage	0.090 [0.237]	-0.072 [-0.269]	0.039 [0.088]
Assets tangibility	-0.266 [-0.450]	0.318 [0.937]	-0.181 [-0.288]
Z-Score	-0.054 [-0.978]	-0.034 [-0.867]	-0.061 [-0.960]
Earnings volatility	-0.630 [-0.492]	-0.287 [-0.273]	-0.535 [-0.343]
Credit rating	0.002 [0.193]	0.000 [0.051]	0.006 [0.471]
Loan maturity	0.003 [0.138]	0.007 [0.394]	-0.001 [-0.037]
Loan size	0.031 [1.148]	-0.008 [-0.472]	0.023 [0.738]
Syndicate size	0.022*** [6.915]	0.013*** [5.552]	0.027*** [7.178]
Relationship loan	-0.062 [-1.351]	-0.004 [-0.105]	-0.046 [-0.864]
Constant	0.772 [0.884]	0.592 [0.960]	0.902 [0.869]
Loan type fixed effects	Y	Y	Y
Loan purpose fixed effects	Y	Y	Y
Year fixed effects	Y	Y	Y
Firm fixed effects	Y	Y	Y
Clustered standard errors	Firm	Firm	Firm
Observations	1,646	1,646	1,646
Adjusted R-squared	0.573	0.572	0.587

Note: Robust *t*-statistics that adjust for heteroskedasticity and within-firm clustering are reported in brackets. Significance at the 10%, 5%, and 1% levels is indicated by *, **, and ***, respectively.

Table 10 Effects of supplier IPO on public bond yields

Independent variables	Dependent variable: Log(At-issue yield spread) (1)
Post supplier IPO	0.183*** [4.524]
Firm size	-0.043 [-0.736]
Profitability	-2.584*** [-4.056]
Market to book	-0.030 [-0.686]
Book leverage	1.509*** [6.665]
Assets tangibility	0.449 [1.190]
Z-Score	0.364*** [5.836]
Earnings volatility	-0.352 [-0.391]
Bond size (logged)	0.040*** [4.952]
Bond maturity (logged)	0.276*** [19.806]
Callable	0.055 [1.330]
Senior	-0.208*** [-3.463]
Constant	3.907*** [5.228]
Bond rating	Y
Firm fixed effects	Y
Year fixed effects	Y
Clustered standard errors	Firm
Observations	2,691
Adjusted/Pseudo R-squared	0.581

Note: Robust *t*-statistics that adjust for heteroskedasticity and within-firm clustering are reported in brackets. Significance at the 10%, 5%, and 1% levels is indicated by *, **, and ***, respectively.

Appendix A Robustness tests

The dependent variable is the natural logarithm of the amount the borrower pays, in basis points, over LIBOR for each dollar drawn down, or all-in spread drawn (AISD). *Post supplier IPO* is a binary variable, taking the value one for up to four years after the year of supplier IPO and zero otherwise. In column 1, we re-run our main model specifications by using deal-level regression to control for potential correlation within deals. In column 2, we use median regressions to address the effects of outliers. In column 3, we use a reduced sample in which we exclude data from 2007 through 2009 to mitigate the effect of the recent subprime crisis. To mitigate the concern that our findings are driven by either first-time borrowers or repeat borrowers, in columns 4 and 5 we create two reduced samples in which we include only loans that a firm borrows from a specific lead bank for the first time or we include only loans that a firm borrows from a specific lead bank multiple times, respectively, to ensure that repeated borrowing–lending relationships do not confound our results. Estimates are based on the firm fixed effect model. Appendix A provides detailed definitions and measurements for all variables. We report robust *t*-statistics that adjust for heteroskedasticity and within-firm clustering in parentheses. Significance at the 10%, 5%, and 1% levels is indicated by *, **, and ***, respectively.

Independent variables	Dependent variable: Log(AISD)				
	Deal-level regression	Median regression	Before 2007	First-time loan	Relationship loan
	(1)	(2)	(3)	(4)	(5)
Post supplier IPO	0.171*** [3.493]	0.236*** [4.707]	0.152*** [3.399]	0.204*** [3.234]	0.200*** [2.991]
Firm size	-0.044 [-1.256]	-0.035 [-0.587]	-0.069*** [-2.730]	-0.081** [-2.568]	-0.017 [-0.298]
Profitability	-0.587 [-0.905]	0.212 [0.422]	-0.553 [-1.446]	0.175 [0.354]	-1.216 [-1.401]
Market to book	-0.074** [-2.392]	-0.039 [-1.374]	-0.096** [-2.566]	-0.164*** [-4.128]	-0.091*** [-3.167]
Book leverage	1.079*** [8.073]	0.513** [2.121]	1.001*** [6.145]	0.891*** [3.894]	1.237*** [5.910]
Assets tangibility	-0.425*** [-4.725]	0.221 [0.604]	-0.324*** [-4.271]	-0.733*** [-7.381]	0.005 [0.043]
Z-Score	-0.038 [-1.349]	-0.045 [-0.892]	-0.035** [-1.993]	-0.102*** [-3.309]	0.004 [0.101]
Earnings volatility	2.576 [1.399]	1.691 [1.489]	2.867 [1.121]	4.847** [2.271]	6.775*** [4.835]
Credit rating	0.023*** [4.642]	0.024*** [3.365]	0.027*** [4.791]	0.019** [2.109]	0.040*** [3.779]
Loan size	-0.084** [-2.341]	-0.046** [-2.372]	-0.152*** [-6.965]	-0.155*** [-6.257]	-0.135*** [-3.282]
Loan maturity	-0.050 [-1.285]	-0.008 [-0.352]	0.031 [0.859]	0.022 [0.379]	0.015 [0.278]
Syndicate size	-0.001 [-0.537]	-0.002 [-1.103]	-0.000 [-0.018]	-0.003 [-0.763]	-0.001 [-0.460]
Relationship loan	-0.101** [-2.305]	-0.003 [-0.095]	-0.061* [-1.682]		
Constant	5.306*** [18.600]	2.580 [1.084]	5.563*** [21.217]	6.131*** [10.883]	4.602*** [8.852]
Loan type fixed effects	Y	Y	Y	Y	Y

Loan purpose fixed effects	Y	Y	Y	Y	Y
Year fixed effects	Y	Y	Y	Y	Y
Firm fixed effects	Y	Y	Y	Y	Y
Clustered standard errors	Firm	Firm	Firm	Firm	Firm
Observations	1,646	1,646	1,556	778	868
Adjusted/Pseudo R-squared	0.704	0.729	0.711	0.662	0.741

Appendix B Placebo test and dynamic test

Independent variables	Dependent variable: Log(AISD)	
	Placebo Test (1)	Dynamic Test (2)
Bank loan (-3, -2)		-0.056 [-0.882]
Bank loan (-2, -1)		0.007 [0.060]
Bank loan (-1, 0)		0.087 [1.521]
Bank loan (0, 0)		-0.076 [-1.463]
Post supplier IPO	0.059 [0.641]	0.199*** [2.668]
Firm size	-0.137*** [-5.527]	-0.071*** [-2.650]
Profitability	-1.081 [-1.375]	-0.187 [-0.352]
Market to book	-0.098** [-2.500]	-0.108*** [-3.084]
Book leverage	0.789*** [5.204]	1.048*** [6.722]
Assets tangibility	-0.017 [-0.113]	-0.373*** [-4.605]
Z-Score	-0.023 [-0.544]	-0.050* [-1.705]
Earnings volatility	1.067 [0.790]	3.345 [1.411]
Credit rating	0.025*** [6.295]	0.028*** [4.797]
Loan size	-0.107*** [-5.242]	-0.144*** [-6.549]
Loan maturity	0.041 [0.654]	0.018 [0.441]
Syndicate size	0.004** [2.136]	-0.000 [-0.145]
Relationship loan	-0.001 [-0.007]	-0.065 [-1.648]
Constant	5.769*** [19.686]	5.602*** [19.586]
Loan type fixed effects	Y	Y
Loan purpose fixed effects	Y	Y
Year fixed effects	Y	Y
Firm fixed effects	Y	Y
Clustered standard errors	Firm	Firm
Observations	1,646	1,646
Adjusted R-squared	0.661	0.693

Note: Robust *t*-statistics that adjust for heteroskedasticity and within-firm clustering are reported in brackets. Significance at the 10%, 5%, and 1% levels is indicated by *, **, and ***, respectively.

Appendix C Effects of supplier IPO events on other fees in customers' loan contracts

Independent variables	Dependent variables			
	All in spread undrawn (1)	Facility fee (2)	Upfront fee (3)	Letter of credit fee (4)
Post supplier IPO	0.143** [2.553]	0.204** [3.156]	0.872** [2.133]	0.274* [1.731]
Firm size	-0.208** [-2.530]	-0.226 [-1.133]	-0.580 [-1.087]	-0.118 [-0.536]
Profitability	-0.110 [-0.139]	0.541 [0.710]	-0.044 [-0.008]	1.184 [0.707]
Market to book	-0.070* [-1.675]	-0.108** [-2.815]	-0.255 [-0.787]	-0.145 [-1.604]
Book leverage	0.852** [2.555]	0.637 [0.680]	0.970 [0.448]	0.359 [0.510]
Assets tangibility	0.250 [0.575]	0.076 [0.224]	0.255 [0.054]	-0.528 [-0.379]
Z-Score	-0.014 [-0.148]	-0.080 [-1.140]	0.388 [0.484]	-0.096 [-0.520]
Earnings volatility	-0.958 [-0.630]	0.333 [0.056]	0.349 [0.022]	2.376 [0.973]
Credit rating	0.015 [1.538]	0.016 [0.720]	0.012 [0.142]	0.004 [0.151]
Loan size	-0.010 [-0.440]	-0.041 [-0.923]	-0.024 [-0.255]	0.041 [0.377]
Loan maturity	0.131*** [5.240]	0.122*** [5.316]	-0.045 [-0.284]	-0.161 [-1.086]
Syndicate size	-0.003 [-1.576]	0.004 [0.831]	0.001 [0.046]	-0.002 [-0.213]
Relationship loan	0.034 [0.765]	-0.019 [-0.555]	-0.322 [-1.007]	-0.038 [-0.296]
Constant	3.852*** [4.576]	4.093* [2.243]	7.291 [1.259]	5.799*** [2.863]
Loan type fixed effects	Y	Y	Y	Y
Loan purpose fixed effects	Y	Y	Y	Y
Year fixed effects	Y	Y	Y	Y
Firm fixed effects	Y	Y	Y	Y
Clustered standard errors	Firm	Firm	Firm	Firm
Observations	1,218	785	406	375
Adjusted R-squared	0.76	0.742	0.583	0.724

Note: Robust *t*-statistics that adjust for heteroskedasticity and within-firm clustering are reported in brackets. Significance at the 10%, 5%, and 1% levels is indicated by *, **, and ***, respectively.