Customer concentration, relationship, and debt contracting

Ziyun Yang

Department of Accounting, University of Houston-Victoria, Katy, Texas, USA

Abstract

Purpose – The purpose of this paper is to examine the effect of a firm's customer base concentration on its loan contract terms and how this effect varies with the strength of its customer relationship.

Design/methodology/approach – This study is an archival research based on a sample of US public firms that have loan contract data between 1990 and 2008. Major customer sales data are used to construct customer concentration and customer relationship measures. A debt contract model is employed to relate loan spread and other contract terms to customer concentration and relationship.

Findings – This study finds that firms with more concentrated customer bases have higher loan spread and shorter loan maturity and are more likely to issue secured loans. These negative effects disappear when the supplier firm maintains strong relationship with its customers.

Research limitations/implications – Additional forward-looking measure of customer relationship could benefit future research.

Practical implications – A firm's customer base characteristics can have significant impacts on the terms of its loan contracts. Findings from this study support the notion that customer relationship is an important intangible asset that is informative to stakeholders of the firm.

Originality/value – This study proposes a new measure of customer relationship based on the past repeated relationships between a firm and its major customers. It shows that customer characteristics may affect firms' contracts with creditors: customer base concentration increases credit risk whereas strong customer relationship improves credit quality.

Keywords Customer relationship, Customer concentration, Debt contracting, Loan contract

Paper type Research paper

1. Introduction

A firm can be viewed as a "nexus of contracts" among various factors of production (Jensen and Meckling, 1976; Fama and Jensen, 1983). Various contracts, explicit or implicit, are interrelated. In this paper, I investigate how the contracts between a firm and its customers impact its contracts with creditors[1]. Specifically, I examine the effect of a firm's customer base concentration on its loan contract terms and how this effect varies with the strength of its customer relationship. This question is particularly important for the accounting literature because a firm's relationship with its customers is an important intangible asset, which could have significant impacts on firm fundamentals and corporate strategies but is not captured by the existing accounting rules (Lev, 2001; Ittner and Larcker, 1998b; Nagar and Rajan, 2005).

I study the relation between customer base concentration and loan contract terms. Prior literature suggests that customer base concentration increases firms' operating risk, because relationship breakdown with or demand fluctuation from major customers can have material adverse impacts on firm performance (e.g. Albuquerque *et al.*, 2011; Becchetti and Sierra, 2003; Dhaliwal *et al.*, 2016). For instance, Becchetti and Sierra (2003) show that customer base concentration is positively associated with the supplier firm's bankruptcy risk. Albuquerque *et al.* (2011) document that customer concentration is positively associated with future stock return volatility. Anecdotally, customer base concentration is often referred to as one major operating risk in firm documents such as bond prospectuses and annual reports (Albuquerque *et al.*, 2011). Following this line of thinking, I predict that firms with more concentrated customer bases obtain less favorable loan contract terms.

The above prediction remains as an empirical issue for several reasons. First, prior studies have shown that customer base concentration could improve firm performance.

For instance, Patatoukas (2012) shows that customer base concentration is positively associated with accounting performance and asset utilization. Better firm performance in turn leads to better loan terms. Second, since major customers have significant investment in the customer-supplier relationship, they become important stakeholders of the supplier firm and have incentives and power to monitor (e.g. Cornell and Shapiro, 1987; Hui *et al.*, 2012; Albuquerque *et al.*, 2011). Other stakeholders of the supplier firm, therefore, can possibly benefit from the strengthened monitoring from major customers. For instance, Albuquerque *et al.* (2011) argue that shareholders can benefit from the monitoring activities of large customers with lower compensation cost, because shareholders can have lower overall monitoring costs in firms with greater customer concentration, thereby making incentive compensation relatively less attractive[2]. Hui *et al.* (2012) show that firms adopt more conservative accounting when facing major customers who have great bargaining power. The conservative accounting reporting will benefit creditors along with other stakeholders (Zhang, 2008).

I further investigate whether customer relationship plays a role in the association between concentrated customer bases and loan contract terms. I predict that strong customer relationship, defined as strong economic bonds between a firm and its customers, helps mitigate the unfavorable effects associated with customer concentration on loan terms. First, prior studies generally support that customer relationship is positively associated with future financial performance of the supplier firm (e.g. Ittner and Larcker, 1998a; Nagar and Rajan, 2005; Gruca and Rego, 2005; Ittner *et al.*, 2009). Second, strong customer relationship insulates a firm from competitors' efforts and external environmental shocks, thereby reducing its operating risk (e.g. Gruca and Rego, 2005; Fornell *et al.*, 2006; Tuli and Bharadwaj, 2009). For instance, Gruca and Rego (2005) find that customer satisfaction creates shareholder values by increasing future cash flow growth and reducing future cash flow volatility. Finally, customers with stronger economic bonds with the supplier firm have greater incentives and bargain power to monitor the supplier firm due to their greater relationship-specific investments and information advantages.

Using the major customer data from the Compustat Segment Files, I measure customer base concentration with a firm's major customer sales, which is the total sales percentage to reported major customers, and a Herfindahl-Hirschman index of the major customer sales based on Patatoukas (2012). The loan terms examined in this study include loan spread and three major non-price terms: loan security, maturity, and covenant intensity. I identify a major customer as a strong relationship customer (SRC, hereafter) if it was also the firm's major customer in each of the previous five years. To serve these research designs, I restrict the sample to firms reporting at least one named major customer. Using a sample of loans issued by firms that report major customers in the period 1990-2008, I find that firms with more concentrated customer bases have higher loan spread and shorter loan maturity and are more likely to issue secured loans. However, I find no evidence that customer base concentration affects covenant intensity. These findings are mostly consistent with the first prediction that firms with more concentrated customer bases obtain less favorable loan terms, suggesting creditors generally view concentrated customer bases as risk factors and demand for more protection and monitoring[3].

To examine whether strong customer relationship exerts different effect on loan contract terms, I decompose overall customer base concentration into sales concentration on SRCs and that on non-SRCs and compare their effects on loan terms. I find that the effects of sales concentration of SRCs on loan spread, security, and maturity are more favorable than the effects of sales concentration of non-SRCs, and the differences are statistically significant. In fact, the effects of sales concentration of SRCs on these loan terms are generally insignificant or even become favorable, whereas the effects of sales concentration on non-SRCs remain unfavorable.

One concern is that customer base concentration and customer relationship may not be randomly assigned and the empirical models do not adequately account for differences between firms with and without customer concentration/relationship[4]. I perform several robustness checks to address this concern. First, I adopt propensity score matched sample analyses. For each firm with major customer sales above the sample median I try to match a control firm from the rest of the sample based on firm characteristics that are possibly associated with loan contract terms. For the matched sample, I continue to find that customer base concentration is positively associated with loan spread and security and negatively associated with loan maturity, and these associations are statistically significant. Second, using a similar matching approach, for each firm with sale concentration on SRCs above the sample median I try to match a control firm from other firms. For this smaller matched sample, I continue to find that strong customer relationship mitigates the adverse effect of customer base concentration on loan spread, security, and maturity.

This study contributes to both the literature on customer base characteristics and the literature on debt contracting. First, this study shows that customer base concentration decreases while strong customer relationship increases firms' credit quality, complementing the literature on the implication of customer base characteristics on firm fundamentals and corporate strategies (e.g. Albuquerque *et al.*, 2011; Gruca and Rego, 2005; Fornell *et al.*, 2006; Dhaliwal *et al.*, 2016). This study extends the recent Dhaliwal *et al.*'s (2016) finding that customer concentration increases the supplier firm's cost of equity. From a debt contracting perspective, I show that customer concentration is associated with higher loan spread, shorter loan maturity, and the issuance of secured loans. Second, findings from this study support the notion that customer relationship is an important intangible asset that is informative about future firm fundamentals (Ittner and Larcker, 1998a; Nagar and Rajan, 2005; Gruca and Rego, 2005). Using customers' purchasing history as a proxy for customer relationship, I show that strong customer relationship mitigates the increased operating risk brought by customer concentration. Finally, I add to the literature on the determinants of loan contract terms by showing that a firm's customer base characteristics can have significant impacts on the terms of its loan contracts.

The remainder of the paper is organized as follows. Section 2 reviews prior studies and develop the main hypotheses. Section 3 presents the empirical analyses. Section 4 concludes.

2. Prior literature and hypothesis development

2.1 Customer base concentration

Prior studies have examined the effect of customer base concentration on a variety of corporate strategies and outcomes. One stream of the empirical literature advocates that customer base concentration increases firms' operating risk (e.g. Becchetti and Sierra, 2003; Dhaliwal *et al.*, 2016). In particular, a loss of one major customer could significantly harm a firm's business and financial condition. Becchetti and Sierra (2003) show that customer concentration is positively associated with firm bankruptcy risk. Albuquerque *et al.* (2011) find that customer concentration is positively associated with future stock return volatility. Accordingly, as Banerjee *et al.* (2008) suggest, firms with major customers will maintain low leverage to protect themselves from the adverse effects of losing major customers. A recent paper by Dhaliwal *et al.* (2016) documents that customer base concentration is positively associated with the implied cost of equity capital.

The link between customer base concentration and firm performance is theoretically and empirically ambiguous. On one hand, firms with large relationship customers can reduce marketing and transaction costs, resulting in better firm performance. On the other hand, major customers have more bargaining power and therefore can expropriate the supplier firm by obtaining favorable terms in transactions. Some early empirical studies use industry-level data to find customer bargaining power is associated with lower gross

margins for suppliers (e.g. Lustgarten, 1975; LaFrance, 1979; Ravenscraft, 1983). Kim (1996) finds that major customers tend to reduce big suppliers' profit margins, whereas this effect is insignificant with medium or small suppliers. Patatoukas (2012), however, finds that customer base concentration is positively associated with accounting performance and asset utilization. The mixed evidence in the literature implies that the relation between customer base concentration and firm performance may be a function of certain customer-supplier characteristics. For instance, Irvine *et al.* (2016) show that the relation between customer-based concentration and profitability is a function of the relationship life cycle: it is significantly negative in the early years of the relationship, but becomes positive as the relationship matures.

Prior studies also examine major customers' incentives to monitor the supplier firm and the related consequences. Major customers, as stakeholders of a firm, have incentives and power to monitor the supplier firm due to their relationship-specific investments (Cornell and Shapiro, 1987). The monitoring effects from major customers will affect the supplier firm's governance and accounting practices. For example, Albuquerque *et al.* (2011) argue that the monitoring activities of major customers can lower the overall monitoring costs for shareholders, making incentive compensation relatively less attractive in contracting managers of the supplier firms. They document that executive equity incentives are negatively related to the magnitude of the firm's sales to major customers. Hui *et al.* (2012) predict that a firm's customers will have a preference for the firm to apply more conservative accounting, which limits the firm's downside risk. They show that when a firm's customers have greater bargaining power, the firm recognizes losses more quickly.

The information need from powerful customers may also induce the supplier firm to manipulate financial reporting (e.g. Bowen *et al.*, 1995; Raman and Shahrur, 2008; Dou *et al.*, 2013). Raman and Shahrur (2008) argue that firms use financial disclosures to their advantage in the customer-supplier relationships. They find that firms are more likely to manipulate earnings in environments where relationship-specific investments are more intensive. Similarly, Bowen *et al.* (1995) document that firms which depend on implicit claims from customers are more likely to manipulate earnings.

2.2 Customer relationship
As an important intangible asset of a firm, customer relationship is likely to contain forward-looking information about the firm's future financial performance and risk profile that is absent in conventional financial measures. Lambert (1998) argues that customer relationship is a function of multiple economic factors, including customer satisfaction, product uniqueness, product market competition, customers' production function and investment opportunity set (if the customer is another firm), and contractual arrangements between the firm and its customers. Also, Nagar and Rajan (2005) argue that "customer relationship is a multidimensional business process, involving activities by both the supplier firm (e.g. the nature of the firm's products and services) and the customers (e.g. customers' satisfaction levels and usage); these activities, through a series of cause-and-effect interrelations, result in profits." Prior studies on the information content of customer relationship primarily focus on the predictive ability and the stock market valuation of customer satisfaction of individual customers, which is only one aspect of customer relationship[5].

Intuitively, customer relationship is positively associated with future revenues, and perhaps future profits. Relationship customers are more likely to return in the future, resulting in a positive relation between customer relationship and future revenues. However, maintaining customer relationship is costly. Suppliers may need to incur extra marketing costs, offer more favorable price and non-price terms to relationship customers, or provide more customized products. Empirical studies generally support that customer relationship

is positively associated with supplier firms' future performance (e.g. Ittner and Larcker, 1998a; Nagar and Rajan, 2005; Gruca and Rego, 2005; Ittner *et al.*, 2009). Ittner and Larcker (1998a) examine the value relevance of customer satisfaction measures using customer, business-unit, and firm-level data, and find that the relations between customer satisfaction measures and future accounting performance are generally positive and statistically significant. Using a unique and proprietary cross-sectional data set of the retail banking industry, Nagar and Rajan (2005) reach the same conclusion that customer relationship improves future profits.

Prior studies also find that customer relationship is value relevant in the stock market and there exists market mispricing of customer relationship information. For instance, Fornell *et al.* (2006) find that a trading rule based on the American Customer Satisfaction Index (ACSI) data can produce substantial long-run returns. Customer relationship also insulates a supplier firm from competitors' efforts and from external environmental shocks, which eventually reduces its operating risk. Gruca and Rego (2005) find that customer satisfaction creates shareholder values by increasing future cash flow growth and reducing future cash flow volatility. Tuli and Bharadwaj (2009) find that investment in customer satisfaction insulates a firm's stock return from market movements and lowers the volatility of its stock returns.

2.3 Debt contracts

I examine the main debt contract terms that are related to the borrowing firm's credit quality and agency problems: interest spread, loan security, covenant intensity, and maturity. Since a debt contract is a package of contract terms and lenders offer the borrower a trade-off between different terms (Melnik and Plaut, 1986), it is important to investigate how customer base concentration and customer relationship are reflected in different contract dimensions.

Agency theory has different predictions on the relation between loan security and borrower quality. On one hand, adverse selection models (e.g. Bester, 1985; Besanko and Thakor, 1987) argue that willingness to provide collateral serve as a credible signal of borrower quality. These models predict that high-quality borrowers would post collateral and obtain lower spreads for the loans. On the other hand, moral hazard models (e.g. Holmstrom and Tirole, 1997; Stulz and Johnson, 1985) argue that low quality borrowers can credibly commit to lower asset substitution by providing collateral. These models predict a negative relation between borrower quality and the use of collaterals. Consistent with the second view, most empirical studies document that collateral is associated with riskier loans (e.g. Harjoto *et al.*, 2006; Asquith *et al.*, 2005; Berger and Udell, 1990).

Agency theory argues that debt covenants mitigate agency problems between debtholders and shareholders and predict that firms with more agency problems are more likely to use covenants (Jensen and Meckling, 1976; Myers, 1977; Smith and Warner, 1979). The incomplete contracting theory emphasizes the efficient allocation of control rights in debt contracting relationships and views debt covenants as a mechanism for control right allocation (e.g. Aghion and Bolton, 1992; Dewatripont and Tirole, 1994). Debtholders are granted control rights in a state contingent manner when borrowers financially underperform. Empirical studies generally support that loan contracts contain more restrictive covenants when the borrowing firm is riskier or has more agency problems (e.g. Bradley and Roberts, 2015; Demiroglu and James, 2010).

Prior studies argue that debt maturity also plays a monitoring role (e.g. Diamond, 1991; Rajan and Winton, 1995). Diamond (1991) shows that shorter debt maturity enables more frequent monitoring by the lender. Leland and Toft (1996) claim that short-term debt can reduce or even eliminate agency costs associated with asset substitution. Because of the monitoring role of short-term debt, Armstrong, Guay and Weber (2010) argue that reduction in maturity can be a substitute for debt covenants in monitoring the borrower. Consistent with the monitoring role of short-term debt, Bharath *et al.* (2008) document that firms with

lower accounting quality issue shorter-term loans. Brockman *et al.* (2010) document a negative (positive) relation between CEO portfolio deltas (vegas) and short-maturity debt. They also find that short-maturity debt mitigates the influence of vega- and delta-related incentives on bond yields.

2.4 Hypothesis development

My first prediction is that firms with more concentrated customer bases obtain less favorable loan contract terms, namely, higher interest spread, higher likelihood of loan security, shorter maturity, and more covenants. The main reason for this prediction is that, as discussed in Section 2.1, customer base concentration increases the supplier firm's operating risk because relationship breakdown with or demand fluctuation from major customers can have material adverse impacts on firm performance (e.g. Albuquerque *et al.*, 2011; Becchetti and Sierra, 2003; Dhaliwal *et al.*, 2016). I note that this prediction is not obvious, because as discussed in Section 2.1, customer base concentration may improve the supplier firm's profitability (Patatoukas, 2012) and creditors may benefit from the fact that the borrowing firm's major customers have incentives and power to monitor the borrowing firm (e.g. Cornell and Shapiro, 1987; Hui *et al.*, 2012; Albuquerque *et al.*, 2011):

> *H1.* Firms with more concentrated customer bases obtain less favorable loan contract terms, namely, higher interest spread, higher likelihood of loan security, shorter maturity, and more covenants.

I further predict that strong customer relationship, defined as strong economic bonds between a firm and its customers, mitigates the adverse effect of customer base concentration on loan contract terms. As discussed in Section 2.2, customer relationship is positively associated with future financial performance of the supplier firm (e.g. Ittner and Larcker, 1998a; Nagar and Rajan, 2005; Gruca and Rego, 2005; Ittner *et al.*, 2009), and reduces the supplier firm's operating risk (e.g. Gruca and Rego, 2005; Fornell *et al.*, 2006; Tuli and Bharadwaj, 2009). In addition, customers with stronger economic bonds with the supplier firm have greater incentives and bargain power to monitor the supplier firm due to their greater relationship-specific investments and information advantages:

> *H2.* Strong customer relationship mitigates the adverse effect of customer base concentration on loan contract terms.

3. Empirical analysis

3.1 Variable measurement and research design

I employ two measures of customer base concentration. The first measure, *MC_Sales*, is the total percentage of sales to the reported major corporate customers reported in the Compustat Segment Files; that is:

$$MC\_Sale_{it} = \sum_{j=1}^{J} \frac{Sales_{ijt}}{Sales_{it}}, \tag{1}$$

where $Sales_{ijt}$ is firm i's sales to major customer j in year t, and $Sales_{it}$ represents firm i's total sales in year t. The second measure, customer concentration score (*CC_Score*), follows Patatoukas (2012):

$$CC\_Score_{it} = \sum_{j=1}^{J} \left(\frac{Sales_{ijt}}{Sales_{it}} \right)^2. \tag{2}$$

CC_Score is an application of the Herfindahl-Hirschman index of the percentage of sales. Its theoretical value ranges between 0 and 1. A higher value of *CC_Score* implies a more concentrated customer base.

I estimate the following two models to investigate the effect of customer base concentration on loan contract terms and how it varies with the strength of customer relationship:

$$Contract\ term = \alpha + \beta_1 MC\_Sales + \beta_2 MC\_Sales\_Relation$$

$$+ \sum_{i=3}^{n} \beta_i\ Control\ variable_i, \tag{3}$$

and:

$$Contract\ term = \alpha + \beta_1 CC\_Score + \beta_2 CC\_Score\_Relation$$

$$+ \sum_{i=3}^{n} \beta_i\ Control\ variable_i, \tag{4}$$

where *Contract term* includes loan spread (*Interest Spread*), security (*Secured*), maturity (*Maturity*), and the number of covenants (*Covenant Intensity*). I estimate an OLS model when the dependent variable is loan spread, maturity or covenant intensity, and a probit model when the dependent variable is loan security.

I measure the strength of customer relationship with a major customer's repeated purchase behaviors. A major customer is classified as a SRC if it was also the firm's major customer in each of the previous five years[6]. After identifying SRCs, I recalculate *MC_Sales* and *CC_Score* using sales to all SRCs and label them as *MC_Sales_Relation* and *CC_Score_Relation*, respectively. When *MC_Sales_Relation* is not included into Equation (3), a positive estimated value of β_1 when the dependent variables are interest spread, loan security, and covenant intensity and a negative estimated value of β_1 when the dependent variable is loan maturity are consistent with *H1*. The interpretation of β_1 in Equation (4) is similar.

When both *MC_Sales* and *MC_Sales_Relation* are included into Equation (3), it is conceptually equivalent to separately estimating the effects of sale concentration of SRCs and non-SRCs. β_1 measures the effect of sale concentration of non-SRCs, while $\beta_1 + \beta_2$ captures the effect of sale concentration on SRCs. Thus, a negative estimated value of β_2 when the dependent variables are interest spread, loan security, and covenant intensity and a positive estimated value of β_2 when the dependent variable is loan maturity are consistent with *H2*. β_2 in Equation (4) can be interpreted in a similar manner. Relative to the customer satisfaction measures (e.g. ACSI) used in prior studies, my customer relationship measures summarize multiple aspects of customer relationship in historical purchasing behaviors of the customer, and allow large sample tests for a firm's relationship with its corporate customers[7].

Control variables are consistent with prior studies (e.g. Costello and Wittenberg-Moerman, 2011; Bharath *et al.*, 2008; Barclay and Smith, 1995; Stohs and Mauer, 1996). All regressions include the following control variables: lending relationship (*Relationship Lender*), institutional loan (*Institutional Investor*), loan size (*Loan Size*), firm credit rating (*Credit Rating*), number of lenders (*Number of Lenders*), performance pricing indicator (*PP Indicator*), firm size (*Firm Size*), profitability (*Profitability*), and leverage ratio (*Leverage*). Lending relationship is negatively associated with the agency costs of debt (Bharath *et al.*, 2011). Relative to bank term loans, institutional loans are more risky, have a longer maturity, and have a back-end-loaded schedule (Costello and Wittenberg-Moerman, 2011). I control for loan size because larger loans are priced at lower interest rates (Booth, 1992; Costello and Wittenberg-Moerman, 2011). Asquith *et al.* (2005)

document that performance pricing provisions become common when agency cost of debt is higher. I control for firm size because smaller firms have greater information asymmetry and higher probability of distress (Bharath *et al.*, 2007).

I also control for loan maturity (*Maturity*) and revolvers (*Revolver*) in the regressions of interest spread, loan security, and covenant intensity. Longer maturity loans typically have a higher default risk and higher ex post incentive conflicts (Flannery, 1986; Demiroglu and James, 2010). Prior research finds that revolvers are priced at lower interest rates than term loans (Harjoto *et al.*, 2006; Zhang, 2008). Agency theory predicts a negative relation between interest spread and covenant intensity (Jensen and Meckling, 1976; Smith and Warner, 1979). Therefore, I control for the number of financial covenants (*Financial Covenants*) in the loan spread regressions and control for interest spread in the covenant intensity regression. Following Costello and Wittenberg-Moerman (2011), I include both the credit rating and the square of credit rating in the maturity regression to allow a non-monotonic relation between a borrower's credit quality and debt maturity (Diamond, 1991). I control for industry and year fixed effects and cluster the standard errors by firm in all regressions.

3.2 Data and descriptive statistics

I obtain loan information for US public firms from Thomson Reuters LPC's Dealscan database for the sample period 1990-2008. Dealscan contains a wide range of loan characteristics, such as interest rate, loan amount, and covenants. The loan data are then matched to the major customer data from the Compustat Segment Files. US public firms are required to disclose the sales to major customers. The Compustat Segment Files collect the type and name of a major customer and the dollar amount of annual sales to each major customer. I drop government customers because the economic incentives of government customers may be different from those of corporate customers. For example, government customers are less likely to have significant relationship investment or declare bankruptcy[8]. To appropriately construct customer concentrations and relationships, I further drop customers whose identities are not disclosed by firms. The sample keeps loan facilities whose borrowers have named major corporate customers in the fiscal year prior to the loan active date and loan facilities with available loan or firm characteristics for the empirical analysis[9]. The final sample includes 4,319 loan facilities for 1,517 firms.

Table I reports the descriptive statistics of variables used in this study, and Table AI lists variable definitions. The average loan spread is 219 basis points above London Interbank Offer Rate. On average, the loans contain 1.4 financial covenants and 2.8 general covenants. The average loan maturity is 43 months. In total, 58 percent of loans are secured. On average, the loan amount accounts for 24 percent of the borrowing firm's assets at the fiscal year end prior to the loan active date. The mean of *MC_Sales* is 0.36, which indicates that on average major customer sales account for 36 percent of a supplier firm's total sales. Only 14 percent of firms have SRCs. Conditional on having SRCs, the average sales percentage to SRCs is 22 percent. The mean value of *CC_Score* is 0.09, comparable to 0.10 in Patatoukas (2012). Conditional on having SRCs, the average *CC_Score* based on sales to SRCs is 0.055.

To provide further descriptive evidence on major customers' repeated relationships with the supplier firm, I calculate the number of times that a customer was also the firm's major customer in the previous five years, labeled as *Customer Relation*. The mean of *Customer Relation* is 1.70 (Table I), suggesting that on average, a major corporate customer was also a major customer of the same supplier firm in 1.7 of the previous five years.

One concern is that *Customer Relation* is based on historical purchase behaviors and may not necessarily have any implication for future customer relationship. To verify the validity of this measure, I provide evidence on how a customer's purchase history with the supplier firm relates to its future purchase from the same supplier firm. I measure future purchase with two variables, *Repeat_1_Year* and *Repeat_2_Year*. *Repeat_1_Year* is an indicator

	Mean	SD	Median	n
Loan characteristics				
Interest Spread	218.956	141.327	200.000	4,319
Financial Covenants	1.415	1.433	1.000	4,319
General Covenants	2.798	3.141	3.000	4,319
Covenant Intensity	4.213	3.906	4.000	4,319
Number of Lenders	4.960	6.060	3.000	4,319
Institutional Investor	0.081	0.273	0.000	4,319
Revolver	0.601	0.489	1.000	4,319
Loan Size	0.235	0.238	0.157	4,319
Maturity	43.053	25.936	37.000	4,319
PP Indicator	0.392	0.488	0.000	4,319
Relationship Lender	0.401	0.490	0.000	4,319
Secured	0.583	0.493	1.000	4,319
Firm characteristics				
Total assets (in millions)	2,001	5,793	349	4,319
Firm Size	5.864	1.935		
Credit Rating	18.051	6.256	23.000	4,319
Profitability	0.003	0.155	0.036	4,319
Leverage	0.490	0.205	0.487	4,319
Tangibility	0.335	0.237	0.274	4,319
MC_Sales	0.360	0.236	0.315	4,319
MC_Sales_Relation	0.031	0.091	0.000	4,319
MC_Sales_Relation > 0 {0, 1}	0.141	0.348	0.000	4,319
MC_Sales_Relation (when *MC_Sales_Relation* > 0)	0.217	0.137	0.184	608
CC_Score	0.086	0.111	0.044	4,319
CC_Score_Relation	0.008	0.029	0.000	4,319
CC_Score_Relation (when *CC_Score_Relation* > 0)	0.055	0.056	0.031	608
SRC	0.119	0.324	0.000	4,319
Customer characteristics				
Customer Relation	1.695	1.675	1.000	8,001
Repeat_1_Year	0.604	0.489	1.000	8,001
Repeat_2_Year	1.011	0.834	1.000	8,001

Notes: This table presents descriptive statistics for the sample of 4,319 loan facilities for the period 1990-2008. The sample for customer characteristics consists of 8,001 loan-customer observations. Variable definitions are in Table AI

variable equal 1 if the major customer status remains in the following year and 0 otherwise. *Repeat_2_Year* is the number of times that a customer is still a major customer of the supplier firm in the next two years. The means of *Repeat_1_Year* and *Repeat_2_Year* are 0.6 and 1.0, respectively (Table I), suggesting that 60 percent of major customers are still major customers of the same supplier firm in the next year and a major customer is still a major customer of the same supplier firm once in the next two years.

Table II reports the frequency distributions of *Repeat_1_Year* and *Repeat_2_Year* for customers with different past relationships with the supplier firm. Panel A reports the frequency distributions of *Repeat_1_Year* and *Repeat_2_Year* for SRCs and non-SRCs. A SRC is 14 percent more likely to continue to be a major customer of the same supplier firm in the next year and is 17 percent more likely to be a major customer again in the next two years than a non-SRC. The χ^2 test suggests that a SRC is significantly more likely to be the supplier firm's major customer again in the next one or two years than a non-SRC.

Table II, Panel B, reports the frequency distributions of *Repeat_1_Year* and *Repeat_2_Year* for major customers with various years of repeated relationships with the

| | Repeat_1_Year | | Repeat_2_Year | | |
	0 (%)	1 (%)	0 (%)	1 (%)	2 (%)
Panel A: frequency distribution of future relationship for SRCs and non-SRCs					
Non-SRCs	41.0	59.0	35.1	31.2	33.7
SRCs	27.4	72.6	26.7	23.7	50.2
Panel B: frequency distribution of future relationship by customer relation					
Customer Relation					
0	48.0	52.0	42.8	29.8	27.4
1	38.4	61.6	33.3	30.6	36.1
2	39.2	60.8	32.4	37.4	30.3
3	40.9	59.1	30.7	33.5	35.7
4	24.2	75.8	20.3	24.1	55.7
5	27.4	72.6	26.1	24.0	50.2

Notes: This table presents evidence on how a major customer's past repeated relationship with the supplier firm relates to its future purchases from the same supplier firm. *Repeat_1_Year* is an indicator variable for whether a major customer is still a major customer of the same supplier firm in the following year. *Repeat_2_Year* is the number of times that the customer is still a major customer of the supplier firm in the next two years. A customer is classified as strong relationship customer (SRC) if it was also a major customer of the supplier firm in each of the previous five years. *Customer Relation* is the number of times that a customer was also the firm's major customer in the previous five years. *p*-Value for χ^2 test is < 0.001

Table II.
Validity of customer
relationship measure

supplier firm during the previous five years. A SRC, which is defined as a firm having five repeated relationships with the same supplier, is 21 percent more likely to be a major customer of the supplier firm again in the next year and is 23 percent more likely to be a major customer again in both of the next two years than a major customer that was never the supplier firm's major customer in the past five years. The χ^2 test suggests that a major customer with more past repeated relationships with the supplier firm is significantly more likely to be the supplier firm's major customer again in the next one or two years. Overall, Table II suggests that my approach of measuring customer relationship is valid.

3.3 Empirical results

3.3.1 The effect of customer base concentration on loan spread. Table III presents univariate evidence on the effects of customer base concentration and relationship on loan contract terms. The average loan spread is 232 basis points when *MC_Sales* is above the sample median and 206 basis points when *MC_Sales* is below the sample median and the difference is statistically significant (Panel A). The evidence based on *CC_Score* is qualitatively similar. The Pearson correlation between *MC_Sales* (*CC_Score*) and loan spread is 10.3 percent (7.7 percent) and is statistically significant (Panel B). This evidence suggests that firms with more concentrated customer bases are charged higher interest rates. However, the loan spread is higher when *MC_Sales_Relation* is below the sample median than otherwise (221 vs 206 basis points) and the difference is statistically significant (Panel A)[10]. Consistently, loan spread is significantly and negatively correlated with *MC_Sales_Relation* (Panel B). This evidence suggests that firms with more sales concentrated on SRCs are charged lower interest rate. Taken together, the univariate evidence in Table III provides preliminary support for my hypotheses.

Table IV reports the OLS regression results for the effect of customer base concentration on loan interest spread. As shown in Column 1, the effect of *MC_Sales* is significantly positive, implying that consistent with *H1*, interest spread is higher when customer base is more concentrated. The effect of customer base concentration is economically non-trivial.

Panel A: loan contract terms by subsamples

	Interest Spread	Covenant Intensity	Secured	Maturity
MC_Sales ≤ 0.315 (median)	205.8	3.97	0.523	44.00
MC_Sales > 0.315 (median)	232.1***	4.45***	0.642***	42.11**
CC_Score ≤ 0.044 (median)	206.9	3.99	0.525	43.18
CC_Score > 0.044 (median)	230.7***	4.43***	0.640***	42.92
MC_Sales_Relation = 0 (median)	221.0	4.30	0.601	42.55
MC_Sales_Relation > 0 (median)	206.2**	3.71**	0.470***	46.09***

Panel B: correlation matrix

	Covenant Intensity	Secured	Maturity	MC_Sales	MC_Sales_Relation	CC_Score	CC_Score_Relation
Interest Spread	0.006	0.221***	−0.011	0.103***	−0.028*	0.077***	−0.024
Covenant Intensity	1	0.358***	0.179***	0.077***	−0.042***	0.014	−0.039**
Secured		1	0.047***	0.155***	−0.069***	0.114***	−0.056***
Maturity			1	−0.026*	0.060***	−0.015	0.061***
MC_Sales				1	0.153***	0.772***	0.193***
MC_Sales_Relation					1	0.184***	0.950***
CC_Score						1	0.248***

Notes: This table presents univariate results for the effect of customer base concentration and customer relationship on loan contract terms. The sample consists of 4,319 loan facilities for the period 1990-2008. Panel A presents mean loan terms by subsamples based on measures of customer base concentration and customer relationship. **,***The mean is significantly different from the mean in the subsample right above at the 5 and 1 percent levels, respectively. Panel B reports correlation matrix for the main loan contract terms and measures of customer base concentration and customer relationship. Variable definitions are in Table AI. *,**,***Significant of correlations at the 10, 5 and 1 percent levels, respectively

Table III.
Univariate results

	Interest spread			
	1	2	3	4
MC_Sales (β_1)	29.430** (0.012)	34.768*** (0.003)		
MC_Sales_Relation (β_2)		−70.633** (0.026)		
CC_Score (β_1)			30.762 (0.189)	44.422* (0.054)
CC_Score_Relation (β_2)				−198.86* (0.051)
Firm Size	−14.539*** (0.000)	−14.212*** (0.000)	−14.764*** (0.000)	−14.500*** (0.000)
Profitability	−108.47*** (0.000)	−106.17*** (0.000)	−109.21*** (0.000)	−107.38*** (0.000)
Leverage	50.122*** (0.001)	50.644*** (0.001)	50.044*** (0.002)	50.377*** (0.001)
Credit Rating	2.380*** (0.001)	2.415*** (0.001)	2.415*** (0.001)	2.448*** (0.001)
Relationship Lender	−5.382 (0.278)	−6.060 (0.223)	−5.505 (0.269)	−6.103 (0.221)
Institutional Investor	44.665*** (0.000)	44.922*** (0.000)	45.055*** (0.000)	45.479*** (0.000)
Revolver	11.089** (0.020)	11.426** (0.016)	11.061** (0.020)	11.398** (0.017)
Financial Covenants	0.582 (0.794)	0.453 (0.839)	0.797 (0.720)	0.693 (0.756)
Loan size	−12.894 (0.222)	−13.428 (0.204)	−11.808 (0.261)	−12.464 (0.234)
Maturity	0.162* (0.081)	0.171* (0.066)	0.157* (0.091)	0.167* (0.075)
Number of Lenders	0.423 (0.281)	0.436 (0.264)	0.437 (0.268)	0.437 (0.266)
PP Indicator	−10.367* (0.097)	−9.906 (0.112)	−10.255* (0.100)	−9.805 (0.115)
Year fixed effects	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes
Observations	4,319	4,319	4,319	4,319
Adj. R^2	13.11%	13.29%	12.95%	13.09%
p-value for $\beta_1+\beta_2=0$		0.261		0.121

Notes: This table presents OLS regression results for the effect of customer base concentration on loan interest spread. The sample consists of 4,319 loan facilities for the period 1990-2008. All regressions include year and industry (Fama-French 12 industries) indicator variables. Standard errors are clustered at the firm level. Intercepts are not reported. This table reports estimated coefficients and p-values (in parentheses) for testing zero coefficients. Variable definitions are in Table AI. *,**,***Significant at the 10, 5 and 1 percent levels, respectively

Table IV.
Effect of customer
base concentration
on loan spread

A one standard deviation increase in *MC_Sales* will increase the loan spread by about 8 basis points. When *MC_Sales_Relation* is added to the regression in Column 2, its estimated coefficient is significantly negative. As explained in Section 3.1, when both *MC_Sales* and *MC_Sales_Relation* are included into the regression, the estimated coefficient on *MC_Sales* measures the effect of sales concentration on non-SRCs while the sum of the coefficients on *MC_Sales* and *MC_Sales_Relation* measures the effect of sales concentration on SRCs. The estimated coefficient on *MC_Sales* (34.8) suggests that increasing sales to non-SRCs by 10 percent will increase the loan spread by 3 basis points, and the effect is statistically significant. The sum of the coefficients on *MC_Sales* and *MC_Sales_Relation* ($−35.8 = 34.8 − 70.6$) implies that a 10 percent increase in sales to SRCs will decrease the loan spread by 4 basis points. This effect, however, is statistically insignificant based on the statistical test reported at the bottom of the table. The results based on the customer concentration score in Columns 4 are qualitatively similar to those in Column 2 and lead to the same conclusions. However, the estimated coefficient on *CC_Score* in Column 3 becomes statistically insignificant due to the opposite effects of sales concentration on SRCs and non-SRCs. Overall, these results indicate that as predicted in *H2*, strong customer relationship mitigates the adverse effect of customer base concentration on loan spread.

3.3.2 The effect of customer base concentration on non-price loan terms. Table III, Panel A, indicates that firms with *MC_Sales* above the sample median are more likely to have secured loans, shorter loan maturity, and more covenants than other firms, and these differences are statistically significant. For instance, 64 percent of loans are secured for firms with *MC_Sales* above the sample median. In contrast, among firms with *MC_Sales*

below the sample median, only 52 percent of loans are secured. The evidence based on *CC_Score* is qualitatively similar, except that the difference for loan maturity between firms with *CC_Score* above and below the sample median becomes statistically insignificant. This evidence suggests that consistent with *H1*, loans of firms with more concentrated customer bases have more unfavorable non-price terms.

However, non-price loan terms are more favorable for firms with *MC_Sales_Relation* above the sample median than other firms and the differences are all statistically significant (Table III, Panel A). For instance, 60 percent of loans are secured for firms with *MC_Sales_Relation* below the sample median. In contrast, among firms with *MC_Sales_Relation* above the sample median, only 47 percent of loans are secured. This evidence suggests that firms with more concentrated sales on SRCs have more favorable non-price loan terms, which is consistent with *H2*. The correlations among the corresponding variables in Table III, Panel B are consistent with the evidence in Panel A. For instance, loan security is positively correlated with *MC_Sales* and *CC_Score* and negatively correlated with *MC_Sales_Relation* and *CC_Score_Relation*, and these correlations are all statistically significant. Overall, the univariate evidence in Table III provides preliminary support for my hypotheses with respect to non-price loan terms.

Table V reports the probit regression results for the effect of customer base concentration on loan security. To facilitate interpretation, I report the average marginal effects and the related *p*-values for testing zero marginal effects. The marginal effects of

	Loan security			
	1	2	3	4
MC_Sales (β_1)	0.145*** (0.006)	0.186*** (0.000)		
MC_Sales_Relation (β_2)		−0.482***(0.000)		
CC_Score (β_1)			0.186* (0.096)	0.288** (0.015)
CC_Score_Relation (β_2)				−1.354*** (0.000)
Firm Size	−0.135*** (0.000)	−0.133*** (0.000)	−0.135*** (0.000)	−0.135*** (0.000)
Profitability	−0.552*** (0.000)	−0.539*** (0.000)	−0.552*** (0.000)	−0.541*** (0.000)
Leverage	0.416*** (0.000)	0.423*** (0.000)	0.416*** (0.000)	0.422*** (0.000)
Asset Tangibility	−0.001 (0.987)	0.003 (0.969)	0.001 (0.989)	0.003 (0.967)
Credit Rating	0.001 (0.693)	0.001 (0.636)	0.001 (0.668)	0.001(0.627)
Relationship Lender	−0.0119 (0.593)	−0.017 (0.436)	−0.012 (0.579)	−0.017 (0.451)
Institutional Investor	0.276*** (0.000)	0.277*** (0.000)	0.277*** (0.000)	0.278*** (0.000)
Revolver	−0.003 (0.858)	−0.001 (0.965)	−0.003 (0.851)	−0.001 (0.964)
Interest Spread	0.0003*** (0.000)	0.0003*** (0.000)	0.0003*** (0.000)	0.0003*** (0.000)
Loan Size	−0.033 (0.503)	−0.036 (0.456)	−0.028 (0.566)	−0.031 (0.525)
Maturity	0.001*** (0.006)	0.001*** (0.004)	0.001*** (0.112)	0.001*** (0.005)
Number of Lenders	0.001 (0.474)	0.001 (0.454)	0.001 (0.438)	0.001 (0.462)
PP Indicator	0.212*** (0.000)	0.215*** (0.000)	0.213*** (0.000)	0.216*** (0.000)
Year fixed effects	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes
Observations	4,319	4,319	4,319	4,319
Pseudo R^2	23.24%	23.65%	23.07%	23.40%
p-value for $\beta_1+\beta_2=0$		0.011		0.002

Notes: This table presents probit regression results for the effect of customer base concentration on loan security. The sample consists of 4,319 loan facilities for the period 1990-2008. All regressions include year and industry (Fama-French 12 industries) indicator variables. Standard errors are clustered at the firm level. Intercepts are not reported. This table reports estimated average marginal effects and *p*-values (in parentheses) for testing zero marginal effects. Variable definitions are in Table AI. *,**,***Significant at the 10, 5 and 1 percent levels, respectively

Table V.
Effect of customer base concentration on loan security

MC_Sales and *CC_Score* are significantly positive in Columns 1 and 3, implying that a loan is more likely to be secured when the borrowing firm's customer base is more concentrated. To put the economic effect in perspective, a one standard deviation increase in *MC_Sales* and *CC_Score* will increase the likelihood of loan security by about 3 and 2 percent, respectively. When *MC_Sales_Relation* and *CC_Score_Relation* are added to the regression in Columns 2 and 4, respectively, their estimated marginal effects are significantly negative, while the marginal effects of *MC_Sales* and *CC_Score* remain significantly positive. These results suggest that strong customer relationship mitigates the adverse effect of customer base concentration on loan security. In fact, the effect of sale concentration on SRCs on loan security, namely, $\beta_1 + \beta_2$, is negative and statistically significant based on the statistical tests reported at the bottom of the table.

Table VI reports the OLS regression results for the effect of customer base concentration on loan maturity. The effect of *MC_Sales* is significantly negative in Column 1, implying that lenders are more likely to increase monitoring through shorter-term debt when the borrowing firms' customer base is more concentrated. When *MC_Sales_Relation* is added to the regression in Column 2, I find a significantly positive coefficient on *MC_Sales_Relation*, while the coefficient on *MC_Sales* remains significantly positive. These results further support the notion that firms with more concentrated customer bases have less favorable loan terms while this effect is mitigated by strong customer relationship. Columns 3 and 4 present the estimation results based on the customer concentration score. The coefficient on *CC_Score_Relation* is also significantly positive in Column 4. The coefficient on *CC_Score*, however, becomes statistically insignificant in both regressions.

	Loan maturity			
	1	2	3	4
MC_Sales (β_1)	−3.492* (0.052)	−4.461** (0.011)		
MC_Sales_Relation (β_2)		12.418** (0.022)		
CC_Score (β_1)			−2.061 (0.587)	−4.767 (0.205)
CC_Score_Relation (β_2)				39.139** (0.022)
Firm Size	2.606*** (0.000)	2.569*** (0.000)	2.641*** (0.000)	2.605*** (0.000)
Profitability	14.481*** (0.000)	14.170*** (0.000)	14.521*** (0.000)	14.243*** (0.000)
Leverage	−0.314 (0.897)	−0.523 (0.829)	−0.167 (0.945)	−0.307 (0.899)
Asset Tangibility	12.566*** (0.000)	12.475*** (0.000)	12.461*** (0.000)	12.407*** (0.000)
Credit Rating	4.899*** (0.000)	4.947*** (0.000)	4.830*** (0.000)	4.830*** (0.000)
Relationship Lender	−4.006*** (0.000)	−3.876*** (0.000)	−4.003*** (0.000)	−3.875*** (0.000)
Institutional Investor	18.030***(0.000)	17.905*** (0.000)	18.043*** (0.000)	17.914*** (0.000)
Interest Spread	0.001 (0.680)	0.001 (0.616)	0.001 (0.727)	0.001 (0.665)
Loan Security	1.333 (0.183)	1.504 (0.133)	1.261 (0.209)	1.420 (0.158)
Loan Size	13.883*** (0.000)	13.941*** (0.000)	13.732*** (0.000)	13.818*** (0.000)
Credit Rating Square	−0.147*** (0.000)	−0.149*** (0.000)	−0.145*** (0.000)	−0.146*** (0.000)
Number of Lenders	−0.081 (0.201)	−0.084 (0.189)	−0.083 (0.193)	−0.083 (0.194)
PP Indicator	4.777*** (0.000)	4.672*** (0.000)	4.759*** (0.000)	4.650*** (0.000)
Year fixed effects	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes
Observations	4,319	4,319	4,319	4,319
Adj. R^2	19.36%	19.52%	19.28%	19.44%
p-value for $\beta_1 + \beta_2 = 0$		0.154		0.040

Notes: This table presents OLS regression results for the effect of customer base concentration on loan maturity. The sample consists of 4,319 loan facilities for the period 1990-2008. All regressions include year and industry (Fama-French 12 industries) indicator variables. Standard errors are clustered at the firm level. Intercepts are not reported. This table reports estimated coefficients and *p*-values (in parentheses) for testing zero coefficients. Variable definitions are in Table AI. *,**,***Significant at the 10, 5 and 1 percent levels, respectively

Table VI.
Effect of customer base concentration on loan maturity

Table VII reports the OLS regression results for the effect of customer base concentration on loan covenant intensity. I find that none of the treatment variables, namely, *MC_Sales*, *MC_Sales_Relation*, *CC_Score*, and *CC_Score_Relation*, has a statistically significant association with covenant intensity. In unreported analyses, I also separately examine the effect of customer base concentration on the number of financial covenants and the number of general covenants. The results are qualitatively very similar to those for all covenants reported in Table VII.

Overall, the evidence in Tables III-VII are consistent with my prediction that firms with more concentrated customer bases have less favorable loan contract terms and this adverse effect is mitigated by strong customer relationship. The effects of control variables in Tables IV-VII are largely consistent with theoretical predictions. For instance, loan spread significantly increases with *Institutional Investor*, *Credit Rating*, and *Leverage*, and significantly decreases with *Loan Size*, *Firm Size*, and *Profitability*.

3.3.3 Propensity score matching (PSM) analysis. One concern with the analysis in Sections 3.3.1 and 3.3.2 is that customer base concentration and customer relationship could both be associated with other firm characteristics that are relevant for debt contracting, e.g., brand names and firm reputation. Although I control for a battery of firm characteristics identified by the prior literature to explain loan terms, the empirical models assume a linear functional form to control for confounding variables and may not adequately account for differences among firms with various degrees of customer concentration or relationship (Armstrong, Jagolinzer and Larker, 2010). Therefore, I supplement the main test by employing a PSM methodology.

| | Covenant intensity | | | |
	1	2	3	4
MC_Sales (β_1)	0.165 (0.514)	0.169 (0.516)		
MC_Sales_Relation (β_2)		−0.059 (0.925)		
CC_Score (β_1)			−0.350 (0.513)	−0.334 (0.557)
CC_Score_Relation (β_2)				−0.231 (0.899)
Firm Size	0.227*** (0.000)	0.228*** (0.000)	0.222*** (0.000)	0.222*** (0.000)
Profitability	2.066*** (0.000)	2.068*** (0.000)	2.062*** (0.000)	2.064*** (0.000)
Leverage	0.126 (0.704)	0.126 (0.703)	0.110 (0.740)	0.110 (0.738)
Credit Rating	0.048*** (0.001)	0.048*** (0.001)	0.048*** (0.001)	0.048*** (0.001)
Relationship Lender	0.170 (0.150)	0.169 (0.152)	0.171 (0.147)	0.170 (0.149)
Institutional Investor	1.819*** (0.000)	1.819*** (0.000)	1.822*** (0.000)	1.822*** (0.000)
Interest Spread	0.0002 (0.646)	0.0002 (0.649)	0.0002 (0.612)	0.0002 (0.615)
Loan Security	2.439*** (0.000)	2.438*** (0.000)	2.447*** (0.000)	2.446*** (0.000)
Loan Size	0.552** (0.016)	0.551** (0.016)	0.569** (0.012)	0.568** (0.013)
Maturity	0.006*** (0.004)	0.006*** (0.004)	0.006*** (0.004)	0.006*** (0.004)
Number of Lenders	0.012 (0.114)	0.012 (0.113)	0.012 (0.113)	0.012 (0.113)
PP Indicator	3.505*** (0.000)	3.506*** (0.000)	3.506*** (0.000)	3.506*** (0.000)
Year fixed effects	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes
Observations	4,319	4,319	4,319	4,319
Adj. R^2	54.70%	54.70%	19.28%	19.44%
p-value for $\beta_1+\beta_2=0$		0.860		0.739

Notes: This table presents OLS regression results for the effect of customer base concentration on loan covenant Intensity. The sample consists of 4,319 loan facilities for the period 1990-2008. All regressions include year and industry (Fama-French 12 industries) indicator variables. Standard errors are clustered at the firm level. Intercepts are not reported. This table reports estimated coefficients and *p*-values (in parentheses) for testing zero coefficients. Variable definitions are in Table AI. **,***Significant at the 5 and 1 percent levels, respectively

Table VII.
Effect of customer
base concentration
on covenant intensity

I begin with matching firms with high and low major customer sales based on firm characteristics shown in Equation (3), namely, firm size, profitability, leverage ratio, asset tangibility, credit rating, banking relationship, and industry and year fixed effects. For each firm with *MC_Sales* above the sample median I try to match a control firm from firms with *MC_Sales* below the sample median using PSM (no replacement, caliper of 0.001). The matching procedure results in 1,478 pairs of observations. Unreported *t*-tests indicate that the differences in variable means between the treatment and control samples are insignificant for all firm characteristics used in the PSM procedure. I repeat the analyses in Tables IV-VI using the matched sample and present the results in Table VIII, Panel A. To conserve table space, I only present the results based on *MC_Sales* and *MC_Sales_Relation*[11]. Despite the smaller sample size of the matched sample, the results in Table VIII, Panel A, are qualitatively similar to those in Tables IV-VI.

To address the endogeneity of sale concentration on SRCs, I also match on firm characteristics for firms with *MC_Sales_Relation* above and below the sample median. As the majority of firms have *MC_Sales_Relation* equal to zero, this procedure is equivalent to matching firms with sales to SRCs to other firms. I use a similar matching procedure as in the case of matching for major customer sales. The matching procedure results in 459 pairs of firm-years observations. Unreported *t*-tests indicate that the differences in variable means between the treatment and control samples are insignificant for all firm characteristics used in the matching. I repeat the analyses related to *MC_Sales_Relation* in Tables IV-VI using the matched sample and present the results in Table VIII, Panel B. To conserve table space, I only present the results based on *MC_Sales* and *MC_Sales_Relation*. Once again, the results are qualitatively similar to the full sample results reported in Tables IV-VI.

3.3.4 Additional analyses. I also perform several sensitivity tests. First, to further address the concerns that firms with very weak customer relationship may have low credit quality, I condition the analysis on firms with at least one major customer whose *Customer Relation* is greater than 1. In other words, I exclude firms whose major customers were never reported as major customers in the previous five years. This restriction reduces sample size from 4,319 to 2,501. For this reduced sample I find qualitatively similar results shown in Tables IV-VII. Second, I employ more control variables for credit risk, including Altman's (1968) *Z*-score and Ohlson's (1980) *O*-score. I continue to find qualitatively similar results for Tables IV-VII. Finally, to mitigate the concern that the numerical values of credit rating may contain measurement errors by assuming equal distance between adjacent rating categories, I replace the variable *Credit Rating* with rating fixed effects. Once again, I find qualitatively similar results for Tables IV-VII.

4. Conclusions

I examine how a firm's customer base concentration impacts its debt contract terms and how the effect varies with its relationship with customers. I predict that firms with more concentrated customer bases obtain less favorable loan contract terms, because customer base concentration increases the supplier firms' operating risk. I further predict that strong customer relationship, defined as strong economic bonds between a firm and its customers, mitigates the adverse effect of customer base concentration on loan contract terms. This is because strong customer relationship improves future financial performance of the supplier firm, reduces its operating risk, and increases customers' monitoring of the supplier firm.

Empirical evidence is consistent with these predictions. I find that firms with more concentrated customer bases have higher loan spread and shorter loan maturity and are more likely to issue secured loans. I further find that the effects of sale concentration of

Panel A: matching for MC_Sales

	Loan spread		Loan security		Loan maturity	
	1	2	3	4	5	6
MC_Sales (β₁)	44.143*** (0.001)	50.110*** (0.000)	0.192*** (0.001)	0.222*** (0.000)	−4.888** (0.024)	−6.328** (0.003)
MC_Sales_Relation (β₂)		−69.878* (0.059)		−0.329** (0.011)		16.40** (0.011)
Model	OLS	OLS	Probit	Probit	OLS	OLS
Control variables	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2,956	2,956	2,956	2,956	2,956	2,956
Adj./Pseudo R²	14.6%	14.8%	23.0%	23.2%	18.0%	18.3%
p-Value for β₁+β₂ = 0		0.581		0.400		0.124

Panel B: matching for MC_Sales_Relation

	Loan spread	Loan security	Loan maturity
	1	2	3
MC_Sales (β₁)	55.219*** (0.013)	0.293** (0.011)	−2.366 (0.563)
MC_Sales_Relation (β₂)	−66.564* (0.081)	−0.592*** (0.000)	15.686** (0.018)
Model	OLS	Probit	OLS
Control variables	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes
Observations	918	918	918
Adj./Pseudo R²	13.1%	33.5%	21.0%
p-Value for β₁+β₂ = 0	0.751	0.051	0.059

Notes: This table presents the results of propensity score matched sample analysis for the effect of customer base concentration on loan terms. Panel A presents the results of matching for *MC_Sales*. For each firm that has *MC_Sales* above the sample median, I try to match a control firm from firms with *MC_Sales* below the sample median using propensity score matching (no replacement, caliper of 0.001). The matching variables are all firm characteristics in Equation (3), including industry and year fixed effects. I then repeat the analyses in Tables IV to VI using the matched sample. Panel B presents the results of matching for *MC_Sales_Relation*. For each firm that has *MC_Sales_Relation* above the sample median, I try to match a control firm from firms with *MC_Sales_Relation* below the sample median, using propensity score matching (no replacement, caliper of 0.001). The reported numbers are estimated coefficients for an OLS model, and estimated average marginal effects for a probit model. Numbers in parentheses are *p*-values for testing zero coefficients or marginal effects. Standard errors are clustered at the firm level. Variable definitions are in Table AI. *, **, ***Significant at the 10, 5 and 1 percent levels, respectively

Table VIII.
Propensity score
matched sample
analysis

SRCs on loan spread, security, and maturity are more favorable than the effects of sale concentration of other customers. The effects of sale concentration of SRCs on these loan terms are generally insignificant or even favorable.

This study contributes to both the literature on customer base characteristics and the literature on debt contracting. Customers are important economic agents in the firm, which is often regarded as a "nexus of contracts." I show that firms' contracts with customers, either explicit or implicit ones, affect their explicit contracts with creditors: customer base concentration increases credit risk whereas strong customer relationship improves credit quality. I also propose a new measure of customer relationship based on the past repeated relationships. This measure arguably captures the multiple-dimensional nature of customer relationship. That said, I acknowledge that this relationship measure is backward-looking, and may not fully capture the forward-looking aspect of customer relationship. Future studies can attempt to improve on this measurement problem. For instance, the explicit supply contracts between a firm and its customers could be a good forward-looking measure of customer relationship.

Notes

1. Contracts between a firm and its customers can be either explicit or implicit. Implicit contracts are self-enforcing agreement backed by the supplier-customer relationship.

2. Consistent with this argument, they document that equity incentives are negatively related to the magnitude of sales to major customers.

3. Loan spread and security are generally negatively associated with the borrowing firm's credit quality (Holmstrom and Tirole, 1997; Stulz and Johnson, 1985; Asquith *et al.*, 2005; Berger and Udell, 1990). Shorter debt maturity enables more frequent monitoring by the lender (Diamond, 1991; Rajan and Winton, 1995). Armstrong, Jagolinzer and Larker (2010) argue that reduction in maturity can be a substitute for accounting based covenants in monitoring the borrower.

4. Prior studies are more concerned about whether a firm reports a major customer or not, because they believe these two types of firms might be different (Dhaliwal *et al.*, 2016). I do not have this concern in this study because my sample is conditional on firms with major customers; the selection process has mitigated the correlated omitted variable concern to some extent.

5. Nagar and Rajan (2005) is an exception. They use empirical measures that attempt to capture multiple dimensions of customer relationship.

6. Customer-supplier pairs with less than five years of data are classified as non-strong relationship customers (SRCs) despite their relationships might be actually strong. The construction of the SRC related measures will bias against my findings.

7. For a customer to be a SRC, the supplier should be able to isolate the customer from competing suppliers (through unique products, more favorable price and non-price terms, better customer service, market power, and so on), and the customer should have stable business and demand.

8. Dhaliwal *et al.* (2016) find that, compared to corporate customers, government customers have the opposite effects on firm operating risk.

9. I drop loan facilities without named corporate customers to fit the research design of customer concentration and relationship, which requires named customer to construct customer relationship. I understand that excluding these borrowers may reduce the cross-sectional variation along the customer concentration dimension.

10. As the majority of firms have no sales to SRCs, the median of *MC_Sales_Relation* and *CC_Scores_Relation* are both zero. Thus, sample partition based on the median of *CC_Score_Relation* is the same as that based on *MC_Sales_Relation*.

11. The results based on *CC_Score* and *CC_Score_Relation* are qualitatively similar.

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Further reading

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(The Appendix follows overleaf.)

Appendix

Variable	Definition
CC_Score	The concentration of sales from the reported major corporate customers with non-missing names in the Compustat Segment Files, calculated as the sum of the squares of firm i's sales percentage to each major customer in year t
CC_Score_Relation	CC_Score calculated using sales from strong relationship customers. A customer is identified as a strong relationship customer if it was also the firm's major customer in each of the previous five years
Covenant Intensity	The number of financial covenants and general covenants in a loan contract. Data source: Dealscan
Credit Rating	The numerical value for S&P crediting rating, with AAA equal to 1, AA+ equal to 2, …, D equal to 22. Moody's rating is converted to S&P rating through the conventional conversion table. Rating information is from Compustat and Dealscan. Following Costello and Wittenberg-Moerman (2011), I assign the lowest rating (23) to firms without S&P or Moody's rating
Customer relation	The number of years of a major customer is reported as a major customer in the previous five years
Firm size	The natural logarithm of the borrowing firm's total assets calculated at the fiscal year end prior to the loan agreement date. Data source: Compustat
Financial covenants	The number of financial covenants in a loan contract. Data source: Dealscan
General covenants	The number of general covenants in a loan contract. Data source: Dealscan
Interest spread	Loan interest spread measured with basis points over London Interbank Offer Rate (LIBOR). Data source: Dealscan
Institutional investor	An indicator variable equal to one if a loan's type is term loan B, C or D, zero otherwise. Data source: Dealscan
Leverage	The ratio of long-term debt to total assets, calculated at the fiscal year end prior to the loan agreement date. Data source: Compustat
Loan size	The loan facility amount scaled by the borrower's total assets. Data source: Dealscan
Market_to_Book	The market value of equity plus the book value of debt divided by total assets, calculated at the fiscal year end prior to the loan agreement date. Data source: Compustat
Maturity	The number of months between a loan facility's issue date and the date when the loan matures. Data source: Dealscan
MC_Sales	The total percentage of sales to reported major corporate customers with non-missing names in the Compustat Segment Files
MC_Sales_Relation	MC_Sales calculated for strong relationship customers. A customer is identified as a strong relationship customer if it was also the firm's major customer in each of the previous five years
Number of Lenders	Number of participants in the loan syndicate of a loan contract. Data source: Dealscan
PP Indicator	An indicator variable equal to one if the loan contract has a performance pricing provision, zero otherwise. Data source: Dealscan
Profitability	Income before extraordinary items scaled by total assets for the fiscal year prior to the loan agreement date. Data source: Compustat
SRC	An indicator variable equal one if a firm's largest major customer is a strong relationship customer. A customer is identified as a strong relationship customer if it was also the firm's major customer in each of the previous five years
Relationship Lender	An indicator variable equal to one if at least one of the loan's lead arrangers had previously served as a lead arranger of the borrower's loans over the 5 year period preceding the loan's issue date, zero otherwise. Data source: Dealscan

Table AI.
Variable definitions

Variable	Definition
Repeat_1_Year	An indicator variable equal to one if a major customer is still a major customer of the supplier firm in the following year, zero otherwise
Repeat_2_Year	The number of times a major customer that remains as a major customer of the supplier firm in the next two years
Revolver	An indicator variable equal to one if the loan's type is revolver, zero otherwise. Data source: Dealscan
Sale_Pct	A firm's sales percentage to its largest major customer
Secured	An indicator variable equal to one if a loan is secured, zero otherwise. Data source: Dealscan
Tangibility	The ratio of net PPE to total assets at the fiscal year end prior to the loan agreement date. Data source: Compustat

Table AI.

Corresponding author
Ziyun Yang can be contacted at: YangZ1@uhv.edu