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# Effects of Customer Financial Distress on Supplier Capital Structure

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**Abstract**

We study how financial distress of a significant customer impacts capital structure of suppliers. Using a sample of U.S. firms that filed for Chapter 11 between 1980 and 2013, we find that the suppliers of these firms increase their leverage ratio over the two years prior to the filing date. This change is economically significant and consistent with the bargaining power theory, which states that an increase in suppliers' debt decreases the surplus available for negotiations. Therefore, suppliers increase their financing leverage to fortify their bargaining power with significant, distressed customers. We also find evidence that suppliers reduce their leverage after the customer reorganizes its liabilities and capital structure in the Chapter 11 process, indicating a return to a previous status quo.

*Keywords:* Bankruptcy; Financial distress; Capital structure; Supply chain
*JEL classification:* G32; G33

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## 1. Introduction

The imbalance of bargaining power that exists between a supplier and a large client can influence the supplier's corporate policy and even foster abusive buying practices. Demanding retrospective payments, extra discounts, after-sale rebates, late payments, and/or return of unsold goods to suppliers are some of the examples of how large clients can increase uncertainty for and affect suppliers financially. The importance of such influence by large clients on their suppliers has become more significant during and after the financial crisis of 2007–2009, during which many of the United States' biggest companies experienced financial distress and moved toward more aggressive cash management practices. Putting more pressure on their small and powerless suppliers by adding to the amount of time it takes to pay them seems to be one of the most practical solutions they came up with as part of such practices. Referring to Procter & Gamble's supplier relationship management in the aftermath of the financial crisis, for example, the *Wall Street Journal* notes, "companies that hold on to cash longer create deficits at suppliers that have to find financing, raise prices or squeeze other firms along the supply chain. Smaller companies with little bargaining power and less access to credit ultimately could see their costs rise, pinching funds that could otherwise be spent on hiring or investments."[3] In this paper, we study one of the mechanisms suppliers have to balance this bargaining power. We investigate how suppliers increase their bargaining power by strategically altering their capital structure in response to change in the riskiness of a major customer in anticipation of the customer's distress. To that end, we provide new insights as part of the literature that highlights the importance of supplier-customer relationship in determining the capital structure of the supplier.

A traditional approach in investigating the determinants of capital structure policy has been the identification of firm and market characteristics that can explain the observed level of

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[3] Serena Ng, "P&G, Big Companies Pinch Suppliers on Payments," *Wall Street Journal,* April 16, 2013.

corporate debt (Parsons and Titman, 2008). Extending this view, Titman (1984), Bronars and Deere (1991), and Perotti and Spier (1993), among others, investigate the possibilities of additional factors that might impact capital structure decisions. These factors are related to a firm's competitive position and the strategy it employs in its relationships with its nonfinancial stakeholders, such as employees, competitors, customers, and suppliers. Building on this literature, we examine how a supplier adjusts its debt level in response to the impending financial distress of a significant customer (defined as a customer that accounts for at least 10% of a supplier firm's annual sales).

We hypothesize that the supplier reacts to a customer's distress by increasing its debt level in order to fortify its bargaining position. The bargaining theory (Bronars and Deere, 1991) states that the firm increases its debt when the bargaining power of its counterparty increases in order to reduce the amount of surplus available in a negotiation. This theory is supported by evidence on firms that increase their debt levels when facing negotiations with strong nonfinancial stakeholders such as unions (Agrawal and Matsa, 2013; Matsa, 2010). In our setting, the main concern for the supplier is to keep its strategic negotiation position as strong as possible if it believes that the customer has substantial chances of recovery. Suppliers' bargaining power is especially relevant because distressed customers may be pressing their suppliers to give better trade conditions such as reducing prices or extending credit. The implicit assumption is that in this extreme situation, other considerations for the choice of capital structure, such as the relation-specific investment theory from Titman (1984) and Titman and Wessels (1988), are less relevant.[4] Additionally, we hypothesize that this strategic negotiation

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[4] Relation-specific investment theory states that suppliers and customers choose their capital structure in order to minimize costs of distress in a possible future situation. In our setting, the customer is already in distress in the years preceding Chapter 11 filing, and bargaining power considerations during upcoming contract negotiations are more relevant for leverage decisions.

move is temporary, with the supplier returning to a previous relative status quo when the distressed customer reemerges from Chapter 11 after reorganization.

We analyze the changes in capital structure of suppliers during a period of customer financial distress. We construct the sample of such suppliers using comprehensive data on reported supplier-customer relationships from the Compustat Customer Segment database and bankruptcy filings between 1980 and 2013 from the LoPucki Bankruptcy Research Database. We document empirical evidence that suppliers of distressed customers use an increase in debt as a strategic tool to keep or improve their bargaining position vis-à-vis distressed customers in the two years before the customers file for Chapter 11, provided that the customers reorganize and reemerge from Chapter 11. We also find evidence of reduction in their debt levels after the customers reorganize in Chapter 11, indicating that the strategic negotiation move was temporary.

Another possible explanation for the observed increase in supplier leverage is that suppliers act as liquidity providers to their important customers in distress. Under this explanation, suppliers borrow to finance additional trade credit to their distressed customers that cannot obtain financing on their own. If this trade credit is the underlying mechanism we would also observe a temporary increase in the supplier's total debt because of the increase in the supplier's current liabilities. We discriminate between the trade credit and bargaining power hypotheses by examining the behavior of both short-term and long-term debt ratios. Based on the bargaining power explanation, suppliers are interested in arguing during renegotiations that they do not have the flexibility to offer better prices and that their ability to extend credit is limited because they have to meet their own debt obligations. Consequently, these suppliers increase not only their short-term debt but also their long-term debt obligations to generate more credibility during negotiations with a distressed client about their leverage induced constraints. In contrast,

if the trade credit channel is the reason for the increase in suppliers' leverage, it should result in increases in short-term debt ratios rather than long-term debt ratios. Consistent with this reasoning, we first document that while suppliers' short-term debt ratio is positively related to their accounts receivable ratio, their long-term debt ratio is unrelated to the trade credit they provide to their customers. Thus, while increases in trade credit may potentially account for increases in the short-term debt ratio, it is unlikely to explain changes in the long-term debt ratio.

We show that there is a statistically significant increase in both the suppliers' short-term and long-term debt ratios during the customers' distress years. While the increase in long-term debt ratios supports the bargaining power hypothesis, it is unclear whether the increase in short-term debt ratio is driven by the trade credit mechanism or bargaining power considerations or both. We explore this issue in two ways.

First, we examine whether there is an unusual increase in suppliers' accounts receivable ratios when a significant customer is in financial distress. Employing control variables identified in prior empirical studies of trade credit, we find no unusual increase in suppliers' trade credit when the customer is in financial distress. This result raises doubts about the trade credit based explanation of the observed increase in leverage prior to customer bankruptcy.

Second, we conduct a more detailed examination by using a two-stage model to explicitly control for the impact of unusual changes in the accounts receivable ratio on the various leverage measures. In the first-stage, we estimate the abnormal level of the accounts receivable ratio after controlling for determinants other than leverage that have been identified in the prior literature on trade credit; in the second stage, we include the measure of abnormal accounts receivable as an additional control variable in our analysis of financial leverage during customer financial distress. The analysis reveals a significant increase in both short-term and long-term financial leverage during financial distress of a significant customer even after controlling for the impact

of changes in the suppliers' trade credit. There is no diminution of the increase in the short-term debt ratio during customer financial distress when the abnormal accounts receivable ratio is added as an explanatory variable; the statistical significance of the leverage increase is however much stronger for long-term leverage compared to short-term leverage. This result points strongly to the role of bargaining considerations as an important driver of supplier financial leverage during periods of customer financial distress.

We conduct a number of robustness tests to support our conclusions about the bargaining power hypothesis. We use a benchmark sample to test whether other factors can be driving our results, such as changes in leverage attributable to the dynamics in the supplier's industry rather than customer financial distress. Benchmark suppliers in the same industries as treatment suppliers do not change their leverage during the years of interest if they do not have a business relationship with a distressed customer. Next, we examine the impact of supplier industry concentration. If the supplier's industry is concentrated, the supplier should possess higher bargaining power and is less likely to resort to increasing leverage in order to boost its bargaining power with a distressed customer. Consistent with this reasoning, we find that greater concentration in the supplier's industry is associated with lower increases in the supplier's debt.

Furthermore, we argue that suppliers assess the ex-ante probability of continuing the business relationship with the distressed customers while deciding on appropriate capital structure responses. If a customer is likely to be liquidated, the supplier will not bother to increase financial leverage. Consistent with this reasoning, in the case of customers that are liquidated after filing for Chapter 11, we find no evidence of changes in the suppliers' debt level.

In sum, the empirical evidence supports the hypothesis that financial leverage is used as a tool to determine how economic rents are divided between suppliers and customers. The rest of the paper is organized as follows. Section 2 presents the literature review. Section 3 describes the

data, the sample construction method, and the methodology. Section 4 presents the results and analyses. Section 5 concludes the paper.

## 2. Literature review

Our paper builds on a series of related papers on the effects of distress and bankruptcy on external stakeholders. Lang and Stulz (1992) investigate the effect of bankruptcy announcements (Chapter 11 filing) on the equity value of a firm's competitors. They find significant effects, either positive or negative, depending primarily on the degree of concentration or leverage in the industry. They call this effect a "contagion effect" when it is negative and a "competitive effect" when it is positive. They argue that the latter is driven by an increase in market power of the surviving competitors. Ferris, Jayaraman, and Makhija (1997) extend this empirical research by examining the extent to which a firm's bankruptcy impacts the valuation of its competitors, finding contagion effects for large and small firm bankruptcies but not finding competitive effects on the days centered around the Chapter 11 announcements. Slovin, Sushka, and Polonchek (1999) find both contagion and competitive effects in the banking industry. Hertzel, Li, Officer, and Rodgers (2008) investigate the valuation implications of distress and bankruptcy on suppliers and customers of distressed firms, as well as how these effects interact with the wealth effects for industry rivals. They find that there are significant prefiling and filing date contagion effects extending not only to competitors but also to suppliers of the bankrupt firm.[5] Moreover, they find that suppliers' contagion effects are more severe when the intra-industry competitors of the filing firm also suffer contagion.

Kolay, Lemmon, and Tashjian (2015) study the nature of "spillover effects" of financial distress, where distress of a given firm is associated with negative equity returns to rivals,

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[5] However, customers of distressed firms do not experience contagion effects.

suppliers, and customers. They measure the extent to which expected costs of replacing a distressed customer explain spillover costs for suppliers. They find that selling, general, and administrative (SGA) costs of suppliers increase, reducing their profitability during the year of the customer's bankruptcy filing. Based on further analysis, they report that suppliers to financially distressed companies that are highly likely to reorganize in bankruptcy incur little or no spillover costs. However, suppliers to economically (rather than financially) distressed firms experience large losses in market value, which are linked to proxies for the cost of replacing their bankrupt customer. These papers assume a passive role for suppliers' financial policy. Our paper extends this literature by exploring an additional channel in which a major customer's distress affects suppliers, namely the suppliers' capital structure. Specifically, we investigate whether suppliers strategically increase leverage in order to countervail the bargaining power of significant, distressed customers.

This paper is related to the work on the impact of supplier-customer strategic relationships on corporate capital structure. Titman's (1984) seminal paper argues that switching costs are uniquely high when the supplier's products are specific to the relationship and the supplier is liquidated. He shows that these costs affect the supplier's choice of capital structure, and the supplier commits to a liquidation policy (lower leverage levels) that takes into account the effects on its customers. Titman and Wessels (1988) also argue that firms in durable goods industries choose lower leverage to assuage customer concerns; forced liquidation of suppliers imposes costs on their customers that have to switch suppliers.

Providing empirical evidence consistent with the arguments of Titman (1984) and Titman and Wessels (1988), Banerjee, Dasgupta, and Kim (2008) show that firms in bilateral relationships are likely to produce or procure unique products, especially when they are in durable goods industries, and that such firms maintain lower leverage. Kale and Shahrur (2007)

also find empirical evidence that firms use decreased leverage as a commitment mechanism that enables customers and suppliers to undertake relation-specific investments. Therefore, the relation-specific investment theory argues that debt is harmful in enticing investments specific to the supplier-customer relationship. Thus, the supplier will decrease its leverage if a significant customer increases leverage to reduce the risk of relationship-specific investments. Such reactions lead to a negative relation between supplier and customer debt levels.

Espousing a different view, several researchers (Agrawal and Matsa, 2013; Bronars and Deere, 1991; Chu, 2012; Dasgupta and Sengupta, 1993; Hennessy and Livdan, 2009; Matsa, 2010) develop and test the bargaining theory arguments in the context of a firm's financial leverage decision. This theory states that when a firm increases its leverage, it increases its bargaining power with its customers and suppliers. Consequently, the bargaining theory predicts a positive leverage relationship between suppliers and customers in contrast with the relation-specific investment theory of Titman (1984). For instance, if a customer increases its leverage, it increases its bargaining power with its suppliers. The suppliers may respond by increasing their own leverage in order to not lose their bargaining power. Kale and Shahrur (2007) investigate the bargaining role for debt and find a positive relation between firm debt level and the degree of concentration in supplier/customer industries, which proxies for bargaining power. Brown, Fee and Thomas (2009) find that suppliers experience significantly negative abnormal returns at the announcements of customer leveraged buyouts (LBOs). Their argument is that LBO creates an opportunity for a firm to extract concessions from its suppliers because of the improved bargaining power conferred by higher leverage. Towner (2015) uses the health-care industry to test the bargaining power theory and its effectiveness. He shows that reimbursement rates negotiated between a hospital and insurers for a specific procedure are higher when the hospital has more debt. He also shows that this effect is stronger when hospitals have less ex ante

bargaining power relative to insurers and that hospitals take on more debt when they have less bargaining power.

Chu and Wang (2011) test both the bargaining power and relation-specific investment theories and find that the positive leverage relationship is dominant and significant, but also that the positive relationship is weaker if it requires more relation-specific investments, thus confirming the existence of both phenomena. Demirci (2013) investigates the notion that customer risk is an important determinant of suppliers' financing decisions. She uses customers' credit ratings, stock return volatility, and industry-adjusted book leverage as proxies of customers' risks to identify the impact on suppliers' leverage and net debt issuance. She finds that when customer risk is proxied by credit ratings or stock return volatility, it has a negative impact on supplier's debt financing, and that young firms and firms operating in concentrated industries are more sensitive to changes in customer risk. However, in contrast to Chu and Wang (2011), she does not find a statistically significant relationship between customer book leverage and supplier book leverage in her sample. Our paper is different from these studies in that we focus on a time window of acute customer financial distress during which bargaining power in contract renegotiations assumes added importance for suppliers' leverage decisions.

An alternative channel through which a supplier's capital structure is affected by its relationship with a customer is through trade credit provision (Cunat, 2006; Fisman and Love, 2003; Klapper, Laeven and Rajan, 2011; Ng, Smith, and Smith, 1999; Petersen and Rajan, 1997). Petersen and Rajan (1997) distinguish between large suppliers and small suppliers. They argue that large suppliers have financing advantages. That is, they can receive bank loan more easily and at a cheaper price than their customers. Also by routinely monitoring repayments, these suppliers have better information about their customer than lending financial institutions do. Further, Petersen and Rajan (1997) find that suppliers that are more creditworthy and have

access to financing offer more trade credit. Lastly, small suppliers provide less trade credit. Gathering information on credit terms offered by suppliers by using survey data, Ng, Smith and Smith (1999) find that credit terms between suppliers and customers are industry-specific, and that these terms are stable over time. The authors conclude that information asymmetries between suppliers and their customers and customers' reputation are important in the design of trade credit contracts. Ng et al. (1999), however, do not find results consistent with the theories of trade credit that suggest liquidity of the supplier is a primary determinant in the decision to extend credit, nor did they find support for the notion that suppliers who face variable demand prefer to alter credit terms in lieu of price to deal with fluctuations. Comparing trade credit with bank credit, Cunat (2006) finds that the relatively high implicit interest rates of trade credit are the result of insurance and default premiums that are amplified whenever suppliers face a relatively high cost of funds. Implicitly assuming large suppliers dealing with small customers, the author finds that suppliers have a comparative advantage over banks in enforcing their contracts because they are able to stop the supply of intermediate goods.

Klapper, Laeven, and Rajan (2011) provide the most relevant work. Using 30,000 actual trade credit contracts between small suppliers and large buyers in the United States and Europe, they test the validity of existing theories in the trade credit literature. This paper is relevant because like them, our sample includes a few large clients and a larger number of relatively small suppliers. Looking at both sides of the contract in their data set, they argue that because suppliers that extend credit are generally small, lesser-known firms they are unlikely to have access to cheaper financing. Rejecting the financing advantage argument, they provide alternative explanations for why these suppliers should extend credit to larger borrowers. Trade credit is a means for suppliers to provide a warranty assuring customers of product quality. They also conclude that trade credit provides a means for the buyer to exercise market power and to

squeeze smaller suppliers. This evidence indicates that the supplier-customer financial relationship is influenced by bargaining considerations.

## 3. Data

### 3.1. Sample construction

We use the LoPucki Bankruptcy Research Database (hereafter, bankruptcy data set) to identify all Chapter 11 filings between 1980 and 2013 (980 filings).[6] The firms in the bankruptcy data set have assets of at least $100 million in 1980 dollars at the time of filing, and each has at least one publicly traded security. We match these firms to all firms reported as significant customers in the Compustat Customer Segment database (hereafter, customer data set).

The customer data set contains the list of significant customers, defined as a firm that accounts for at least 10% of the total sales revenue of a supplier. This requirement was established by the SEC under FASB 14 (1976). As of January 1998, under FASB 131 (1997), firms are no longer required to report the identity of their principal customers, but they still need to report the sales to each of them; many firms continue to disclose the identity of their principal customers voluntarily.

Significant customers are identified only by their names, which are sometimes abbreviated. Therefore, we run the "reclink" Stata algorithm to match customer names in the customer data set with the firms that filed for Chapter 11 and manually inspect all matches for accuracy.[7] Our matched sample includes 6,516 pair-year observations. We look for matches up to 10 years before and after the Chapter 11 filing date, following Hertzel et al. (2008) and Kolay et al. (2015). We gather financial data for all firms from the Compustat Fundamental Annual

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database from 1980 to 2013. We require that all firms have non-missing data for the variables used in the subsequent analyses (these variables are described in Section 3.3). We identify 795 suppliers to 207 customers that filed for bankruptcy.

We exclude suppliers in the following industry classifications: utilities, financials, and public administration (SIC codes 4900–4999, 6000–6999 and 9000–9999). After this step, we have 751 suppliers with 195 bankrupt customers.[8] Following Li and Tang (2016) and Demirci (2013), we conservatively discard all supplier-customer pairs that have only one or two years of matching to filter out temporary/short-lived relationships. We obtain 386 supplier-customer pairs with long-standing reported relationships of three years or more. This sample contains 358 suppliers and 94 filing customers.[9]

### 3.1.1. Identification of financial distress

Because we want to examine the leverage of suppliers during the period of customers' distress, we must first identify customer distress years. Figure 1 with the number line indicates our dating convention. The numbers correspond to the end of each fiscal year for the supplier. "F" denotes the Chapter 11 filing date of a significant customer, which occurs between end of fiscal years –1 and 0. Thus, the supplier's Year -2 financial leverage is observed anywhere between 12 and 24 months before the customer's bankruptcy filing date. In our sample, we require a supplier-customer relationship reported in at least one of the three years: –2, –1, and 0. This additional condition generates our final treatment sample with 156 suppliers and 62

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[8] We include customers that are in finance and utilities industries in our sample following Hertzel et al. (2008) and Kolay et al. (2015). Because we focus on the effects on their suppliers rather than on the filing customers themselves, we do not expect their different treatment under Chapter 11 to affect our results. Nevertheless, we repeat our tests after dropping these customers and find that results remain qualitatively unchanged.
[9] The imposition of a minimum of three years of reported relationships is the key difference compared to Kolay, et al. (2015); otherwise, we get a similar sample size.

customers. We consider years –2 and –1 as customer distress years, per the discussion below.

Year 0 is considered as a transition year between distress and the start of reorganization.

**Figure 1**
Dating convention of key years examined in the analysis.
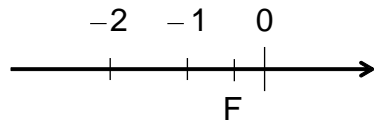


Hertzel et al. (2008) identify the firm distress *day* by the date of the most significant

abnormal drop in the market value of the filing firm in the preceding year leading up to the

bankruptcy filing, which in our convention could be located in year –1 or year 0. Kolay et al.

(2015) focus on the date where information about distress is released prior to Chapter 11, and

they search LexisNexis for the first announcement that the firm is negotiating or has already

negotiated with creditors, or has defaulted. Using this methodology, they find that on average, a

firm's distress announcement date occurs 99 days after the value loss day advocated by Hertzel

et al. (2008). Kolay et al. (2015) measure filing customers' characteristics using Compustat data

in the two years preceding the distress announcement dates. Asquith, Gertner and Scharfstein

(1994) define financial distress based on interest coverage ratios. A firm is classified as

financially distressed if in any two years after issuing junk bonds its EBITDA is less than its

reported interest expense, or if in any one year EBITDA is less than 80% of its interest expense.

They argue that selecting distressed firms using stock market information, as used in Gilson,

John and Lang (1990), may be misleading because stock market performance measures may

include some information about the ability of a firm to cope with financial distress. If the market

perceives that a particular company will be able to costlessly resolve its financial distress, the

market will not be severely negative on the stock valuation, and the sample will be biased to

firms with relatively costly financial distress. Although we fundamentally agree with the

arguments of Asquith et al. (1994), when the approach using interest expenses is tried in our sample, we identify a very small number of firm-years as distress years. Therefore, to obtain a larger sample, we select a less conservative approach considering the two years before filing for Chapter 11, years –2 and –1, as a good approximation of the distress years when the relevant negotiations and bargaining happen. We also calculate Ohlson (1980) O-scores and Altman (1968) Z-scores to verify that the two years before filing may be characterized as distress years. Our final sample consists of 163 supplier-customer pairs and 1,664 pair-year observations in the time window of interest, with 10.2 yearly observations per pair on average

### 3.1.2. Summary statistics

The time window of interest of a pair primarily includes all the years in which there is a reported relationship inside the limit of minus 10 and plus 10 years relative to the Chapter 11 filing date. Because we are interested in investigating suppliers' leverage changes before and after customers' bankruptcy filing, we include supplier data up to five years after Chapter 11 filing in the sample, even if the reported relationship ends before year +5. Suppliers with sales less than $10 million in 1990 dollars were dropped and observations with book leverage ratio greater than 1 were right-censored at 1.[10] All ratio variables are winsorized at the 1% and 99% levels to lessen the effects of outliers. In the sample there are 156 unique suppliers distributed in 86 industries as defined by their four-digit SIC codes.

Table 1 reports the summary statistics for the suppliers and customer firms. We define *Book Leverage* as the book value of total debt (debt in current liabilities [dlc] + long-term debt [dltt]) divided by the book value of total assets (at). *Market Leverage* is defined as the book value of total debt divided by the market value of assets (market value of equity [cshpri*prcc_f]

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[10] Alternatively, trimming observations in which supplier book leverage is greater than 1, instead of right-censoring, does not qualitatively change the results.

+ total debt + preferred stocks liquidation value [pstkl] – deferred taxes and investment credit [txditc]). *Short-Term Leverage* is short-term debt (dlc) divided by book value of assets (at). *Long-Term Leverage* is long-term debt (dltt) divided by book value of assets (at). *Size* is computed as ln(sales). *Market-to-Book* ratio is defined as the ratio of market value of assets to the book value of total assets. *Profitability* is the operating income before depreciation (oibdp) divided by total assets. *Tangibility* is net property, plant and equipment (ppent) divided by total assets. *R&D Intensity* is total R&D expenditures (xrd) divided by total assets. This variable is replaced with zero when R&D expenditures are not reported. *Industry Median Leverage* is the median book leverage of the other firms in the same four-digit SIC industry classification. *Accounts Receivable Ratio* is accounts receivable (rect) divided by sales.

Panel A of Table 1 reports the summary statistics for the suppliers, and Panel B reports the statistics for the customers.[11] Customer firms are much larger than supplier firms; the larger size of customers potentially increases suppliers' vulnerability to pressure during contract renegotiations. As expected, mean and median market leverage ratios of customers are significantly higher, more than twice the magnitude of the suppliers' market leverage. This is due to customer stock prices being severely affected during the distress years. Considering the spillover effects to suppliers' stock prices (Hertzel et al. (2008)), we conservatively rely on measures of supplier book leverage instead of supplier market leverage for our analyses. Market leverage is calculated using stock prices, and a decrease in supplier stock prices will increase the value of its market leverage, even if there is no actual change caused by issuance or retirement of debt or equity. Panel C reports characteristics of the total sample and the sub-samples with only the firms that reemerged (129 supplier-customer pairs) and only the firms that were liquidated (34 supplier-customer pairs).

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[11] There are 3 suppliers whose Profitability is lower than -0.5. Reported results are robust to excluding these three observations.

We verify that the customers can be considered to be in financial distress in the two years before filing for Chapter 11 by calculating the Ohlson (1980) scores (O-scores) and Altman (1968) Z-scores. The average O-score for customers in the sample is –0.58 over all firm-years. However, the average customer O-score increases from –0.81 in year –3 before filing, to –0.19 in year –2, to 2.04 in year –1, indicating an increase in financial distress. The average O-score drops to 0.31 in the filing year potentially reflecting the impact of some firms reorganizing quickly in Chapter 11; a positive average O-score is nonetheless indicative of financial distress. Similar qualitative results are obtained with Z-scores.

*3.2. Benchmark sample*

We also develop a sample of benchmark supplier-customer pairs for comparison to control for changes in unobserved market and industry factors that might have affected firms' capital structure. We follow a similar matching procedure as used above for filing firms; however, in this instance, we match the customer data set with all Compustat companies and then eliminate all treatment supplier and customer firms, as well as suppliers that are financial, public, and utilities. Further, we restrict the benchmark sample to satisfy the following requirements: pairs in the same industries as treatment pairs; customers and suppliers did not file for Chapter 11; pairs reporting supplier-customer relationships in the same distress years as the treatment pairs; and pairs with Compustat data available in the same years as the treatment pairs. Following the multiple criteria above, and using four-, three-, and two-digit SIC industries in this order of priority, we manually identify a unique benchmark supplier-customer pair for 72% of the treatment supplier-customer pairs.

Our benchmark sample consists of 93 supplier-customer pairs that matched pairs with reemerged customers in the treatment sample and 786 firm-year observations. It is not possible

to find benchmark pairs for 36 of the treatment pairs with reemerged customers, primarily due to the non-coincidence of the relationship reporting years. Again, all ratio variables are winsorized at the 1% and 99% levels to lessen the effects of outliers. In this benchmark sample there are 86 unique suppliers distributed in 45 industries defined by their four-digit SIC codes. Panel A of Table 2 reports the summary statistics for the benchmark suppliers, Panel B reports summary statistics for the benchmark customers, and Panel C reports characteristics of the benchmark sample. As expected, in this sample, mean and median market leverage customers' ratios are not substantially higher than suppliers' ratios because customers did not file for bankruptcy protection and, on average, are not in distress.

## 4. Results and discussion

### 4.1. Supplier leverage around customer Chapter 11 filing

We examine the financial leverage of suppliers whose customers reorganized and reemerged after Chapter 11.[12] If a supplier believes that its customer will liquidate, there is no point in adjusting capital structure in order to change its bargaining power. Implicitly, we propose that a supplier is informed about its customer and can form a reasonable opinion about a customer's viability and the likelihood that the customer can reorganize and survive the bankruptcy.[13] This is because when a supplier's livelihood depends on a major customer, the supplier constantly assesses the customer's assets and capabilities in order to reduce the costs of under-diversification. There is a constant flow of information between suppliers and customers through formal (order processing) and informal (meetings, phone and online conversations, and site visits) channels through which suppliers and customers can gain insider-like information

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[12] In subsequent analysis, we separately investigate the financial leverage of suppliers whose customers were liquidated after filing for Chapter 11.
[13] We relax this assumption later by using an empirical model to predict customer reorganization or liquidation.

about each other. Consequently, a supplier can develop an informed evaluation of the possibility of recovery of the customer.

Table 3 reports the univariate analysis for supplier book leverage. Panel A presents the mean and median industry-adjusted supplier book leverages from year –4 to year +4 for suppliers with reemerged customers.[14] The timing of suppliers adopting higher leverage for bargaining purposes depends upon when they anticipate facing bargaining pressure from customers while negotiating long-term supplier contracts. It can be argued that the customer may exert more bargaining power when they first encounter financial difficulties. Closer to the bankruptcy filing, they may be in a much weaker bargaining position and may need the help of suppliers for survival.

There is a substantial increase in supplier book leverage in year –2. The mean industry-adjusted book leverage is significantly greater than zero at the 1% level in year –2 and marginally significant in year –1, but insignificant for all other years. Panel B presents the mean and median industry-adjusted supplier book leverages from year –4 to year +4 for suppliers with liquidated customers. In this panel, both the mean and median book leverages exhibit a trend with a small decrease until year –1; however, the deviations from the median industry leverage are not statistically significant in any year. Although the results in Panel A are not compelling, the univariate test results do seem to suggest that suppliers increase their leverage in the years before the customer files for Chapter 11 if they assess that the customer will be able to reemerge after Chapter 11 and, therefore, will have a continuing business relationship.

Next, we conduct a multivariate analysis of the changes in supplier capital structure employing standard control variables. Equation (1) presents the model for the multivariable regressions with supplier's book leverage as the dependent variable.

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[14] Industry-adjusted book leverage is calculated by subtracting the industry median book leverage from the firm book leverage.

$$Leverage_{i,t} = \alpha + \beta_1 BeforeFiling_{i,t} + \beta_2 Transition_{i,t} + \beta_3 AfterFiling_{i,t} + \sum_{j=4}^{8} \beta_j X_{i,t-1}$$

$$+ u_i + \mu_t + \varepsilon_{i,t} \qquad (1)$$

To ensure that our results are not driven by our choice in designating the period of customer distress, we explore two specifications. In our first specification (Model 1), *BeforeFiling* is a dummy variable that is set to 1 in the two years before the customer's Chapter 11 filing, years –2 and –1, and zero otherwise. The *Transition* dummy variable is set to 1 in the year of and the two years after the Chapter 11 filing, and zero otherwise. In our second specification (Model 2), we split the *BeforeFiling* dummy in two separate dummies, one for year –2 and the other for year –1. *BeforeFiling[–2]* receives the value of one in the year –2, and zero otherwise. *BeforeFiling[–1]* receives the value of one in the year before the filing for Chapter 11, year –1, and zero otherwise; *Transition* is set to one in the year of and the two years after the Chapter 11 filing, and zero otherwise. In both models, the *AfterFiling* dummy variable is set to 1 in year +3 and all the subsequent years, and zero otherwise. $X_{i,t-1}$ are the controls for supplier's book leverage, $u_i$ controls for firm fixed effects, $\mu_t$ controls for year fixed effects, and $\varepsilon_{i,t}$ is a random error term.

Table 4 reports the results of the pooled OLS regressions using the model of Eq. (1) for all dummy variables' specifications.[15] The coefficients of the *BeforeFiling* dummies are positive and statistically significant. The positive relationships are also economically significant. In column 1, our first specification for the dummies, the coefficient implies that suppliers increase their leverage by 5.5% on average in the two years before the distressed customer files for Chapter 11. The coefficient of the *Transition* dummy is positive and statistically significant at

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[15] Because the number of suppliers (125) is almost the same as the number of pairs (129) in our treatment sample, use of pair-year fixed effects present similar results as supplier-year fixed effects. Additionally, when errors are clustered by customers, a natural grouping with this sample because several customers are reported by multiple suppliers, the results are similar.

the 5% level, indicating that suppliers keep a higher leverage in these years. When dummy variables are used to analyze supplier leverage in years –2 and –1 separately as shown in Model 2, the coefficients are both positive and statistically significant, indicating that suppliers maintain a higher leverage in year –1, after increasing it in year –2.

The coefficients of the *AfterFiling* dummy are also positive but not statistically different from zero. Thus, the leverage levels before and after the distress and transition years are not significantly different. This evidence indicates that although supplier leverage increases prior to a significant customer's bankruptcy filing, it eventually returns to previous levels.[16] Given the protection during the Chapter 11 process and the expected financial restructuring of liabilities during reorganization, customers are no longer vulnerable to financial distress. Thus, the need for leverage-induced enhancement of supplier bargaining power is diminished, if not eliminated. Consequently, suppliers return to leverage levels deemed to be optimal under normal conditions.

The effect and signs of the control variables in Table 4 are consistent with the literature (e.g., Leary and Roberts 2014), and most of these coefficients are statistically significant. The high $R^2$s found in the specifications are consistent with short data panels where firm dummies capture a large portion of the cross-sectional variation (Flannery and Hankins 2013). In addition to controlling for unobservable firm and year effects, there may be common local unobservable economic shocks that may affect customer and supplier simultaneously. To address this concern, we add state fixed effects to these models in Table 4 and we find that the results are qualitatively unchanged and quantitatively very similar.[17]

In this analysis, we have considered all suppliers whose customers reorganized successfully. However, suppliers may initiate leverage adjustments only if they expect the

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[16] Note that the coefficients for the *BeforeFiling, Transition* and *AfterFiling* dummy variables measure deviations from supplier leverage maintained during the years prior to customer financial distress.

[17] We thank an anonymous referee for suggesting this additional test. We do not tabulate these additional results in the interest of brevity.

reorganized customer to continue to be a significant customer. Based on the reported supplier-customer relationship after the distress years, we eliminated observations where the distressed customer is no longer reported as a significant customer after the customer's bankruptcy filing. When we estimate the models of Table 4 for this smaller sample, we obtain similar results. For instance, the coefficient for the *BeforeFiling* dummy is 0.039 compared to 0.055 reported in Model 1 of Table 4, and it is statistically significant at the 1% level. The coefficient for the *AfterFiling* dummy remains statistically insignificant. In the interest of brevity, these results are not tabulated.

In sum, the results indicate that the suppliers of distressed customers modify their relative negotiating position by increasing leverage during the years before customers file for bankruptcy, supporting the bargaining theory hypothesis put forward by Bronars and Deere (1991). The evidence also indicates that these suppliers return to their previous leverage levels a few years after the customers file for Chapter 11.


*4.2. Analysis of the alternative hypothesis based on trade credit extension*

Another possible explanation for the increase in supplier leverage before a customer files for Chapter 11 is that suppliers may be inclined to offer trade credit and act as liquidity providers to their important costumers in distress. For example, Bougheas, Mateut and Mizen (2009) develop a model and investigate the trade-off between inventories and trade credit. Their argument is that the supplier may extend trade credit to financially constrained customers in order to obtain credit-financed sales, instead of accumulating costly inventories of finished goods that may or may not be sold in the future. Although these authors do not specifically look at

customers that are in distress, their arguments for a trade credit extension hypothesis are relevant in our setting and deserve to be investigated.[18]

If suppliers increase their debt in order to extend trade credit to distressed customers who face constraints in accessing capital, we expect that suppliers preferentially contract short-term debt to match the maturity of the short-term credit they extend to their distressed customers. We examine the validity of this maturity matching argument in Table 5, by assessing the relationship of accounts receivable to short-term and long-term leverage. We rely on Dass, Kale and Nanda (2015), and Molina and Preve (2009) to select our control variables. The accounts receivable-to-sales ratio is the dependent variable in all three models in Table 5 but they differ in the debt ratio used as an explanatory variable. Evidence reported in Table 5 confirms that trade credit is positively related to the total debt ratio lending credence to the argument that the increase in total debt ratio prior to customer distress observed in Table 4 may be driven by additional trade credit extended by suppliers to distressed customers. Examining Models 2 and 3, we find that, consistent with the maturity matching hypothesis, trade credit is positively related to the short-term debt ratio but it is unrelated to the long-term debt ratio in our sample. Results in Table 5 suggest that while the trade credit mechanism may lead to increases in short-term debt ratios, it is unlikely to explain changes in the long-term debt ratios.

Following the bargaining power theory mechanism, suppliers are interested in arguing during negotiations that they do not have flexibility to offer better prices and trade conditions to their distressed customers because they need to meet their own debt obligations. In this framework, we expect that suppliers prefer to contract long-term debt instead of short-term debt in order to provide more credibility to their argument. Based on these observations, we examine the behavior of short-term and long-term debt ratios prior to customer distress. Table 6 presents

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[18] We thank an anonymous referee for suggesting this alternative mechanism.

the result of the analysis of supplier book leverages using short-term (Model 1) and long-term (Model 2) book debt, normalized by total book assets, as dependent variables. The *BeforeFiling* dummy is set to 1 in years –2 and –1, following Model 1 of Table 4. The coefficients are positive and statistically significant for both definitions of the dependent variable; however, the results show that most of the increase in the leverage ratio is due to the increase in long-term debt (4.9% vs 1.8%), supporting primarily the bargaining power hypothesis. Nevertheless, it is possible that both mechanisms — trade credit and bargaining power — may be at work in our setting, especially in the case of short-term debt. Thus, we analyze the dynamic characteristics of the trade credit in the time window of interest, that is, the years just before the customer applies for Chapter 11.

Model 1 of Table 7 presents the results of the analysis of supplier trade credit in the two years before the customer files for Chapter 11.[19] We use the same time dummies *BeforeFiling*, *Transition,* and *AfterFiling* as defined in Model 1 of Table 4 to study the behavior of trade credit when a significant customer experiences financial distress. We do not include any leverage measure as an explanatory variable, since their inclusion may mask the increase in accounts receivable, if debt is used to finance such increases. The results show that the coefficient for the *BeforeFiling* time dummy variable is positive but not significantly different from zero at the usual significance levels. Therefore, in our sample, suppliers of important distressed customers do not extend more trade credit, on average, during periods of customer distress. This evidence does not support the trade credit mechanism explanation for the increase in supplier book leverage during periods of financial distress of significant customers.

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[19] In addition, we develop a univariate analysis tabulating the changes in suppliers' Accounts Receivable/Sales and Accounts Payable/Costs of Good Sold, adjusted by either benchmark firm ratios or industry median ratios, from years –4 to +2. The results present no evidence of increase in these supplier ratios before the customer files for Chapter 11.

Next, we use a two-stage model to conduct a more detailed examination of whether trade credit can explain the increases in supplier financial leverage during periods of customer financial distress. In the first stage, we estimate the level of abnormal accounts receivable, and in the second stage we add this measure of abnormal accounts receivable as an explanatory variable in our leverage analysis to check whether it can account for the increase in supplier leverage during periods of customer financial distress. Model 2 of Table 7 is used to estimate the normal level of accounts receivable given the determinants of trade credit; the residuals from this model are used as the measure of abnormal accounts receivable.

In the second stage analysis, we use the abnormal accounts receivable as an additional control in our primary model of Leverage (Eq. (1)). These estimates are presented in Table 8. Model 1 of Table 8 uses the total debt ratio as the dependent variable, previously defined as total book debt to total book assets. Models 2 and 3 are the decomposition in which the dependent variables are the short-term and long-term debt ratios. We observe that total leverage is positively related to the abnormal accounts receivable (Model 1). Thus, it appears that firms increase leverage to provide additional trade credit. However, the coefficient for the *BeforeFiling* dummy continues to be statistically significant even after controlling for the impact of trade credit on leverage. Thus, the previously documented significant increase in leverage during customer distress cannot be attributed to changes in trade credit.

Next, we examine the results separately for short-term and long-term debt ratios of suppliers in Models 2 and 3 of Table 8. Not surprisingly, only the short-term debt ratio has a significant, positive relation to the use of trade credit. This positive relation is consistent with trade credit partially explaining the changes in short-term debt. Nonetheless, the coefficient for the *BeforeFiling* dummy is still positive and statistically significant even after controlling for the potential impact of changes in trade credit; comparing it with the corresponding coefficient value

reported in Table 6, there is no diminution in the increase in the short-term debt ratio during the period before a significant customer's bankruptcy filing. Model 3 shows that the long-term debt ratio is unaffected by the level of abnormal accounts receivable and it has a positive coefficient for the *BeforeFiling* dummy, which is highly statistically significant. Thus, the trade credit-based explanation cannot fully account for the observed changes in supplier leverage during periods of customer distress. Overall, the evidence is consistent with the bargaining power hypothesis explanation of supplier leverage changes.

## 4.3. Benchmark sample tests

Next, we present evidence on whether changes in supplier leverage are driven by the dynamics in the supplier industry rather than customer financial distress. Table 9 presents the result of the analysis of supplier book leverage in the sample of benchmark suppliers in the same industry as suppliers in our treatment sample but whose customers do not file for bankruptcy. The *BeforeFiling* dummy variable is defined relative to the Chapter 11 filing date of the treatment customers in order to verify if the increase of leverage is specific to the treatment suppliers or if it is systematic to their industries. The coefficients of *BeforeFiling* dummies are positive, but not statistically significant at the usual levels. We also test several different definitions for the years of the dummy variables during the time window of interest, before and after the Chapter 11 filing (e.g., using three or four years before filing), during the reorganization time window, and after reemerging—with similar nonsignificant results. In sum, the benchmark sample is used as a control group in the same years we see the effects in the treatment sample, and we are not able to identify any effect on the benchmark suppliers' leverage.[20] Therefore, the

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[20] Another commonly used technique for benchmark comparisons is Propensity Score Matching. The difficulty in our framework is to find one or more relevant conditioning variables, based on finance theory and empirical evidence, that affect both the propensity of customers in that participate in the event (customer files for Chapter 11) and the performance of suppliers (supplier increases leverage).

observed changes in supplier leverage in our sample cannot be attributed to industry-wide effects. Rather, it is unique to suppliers whose customers experience financial distress.

*4.4. Additional implications of the bargaining power hypothesis*

We examine two settings where suppliers have less motivation to adjust capital structure for bargaining power considerations. First, we investigate if supplier industry concentration, which may also proxy for bargaining power, has any effect on the results. Second, we investigate suppliers that do not have a continuing reported relationship with their distressed customers. The absence of a reported relationship after the distress years may be either due to the liquidation of the customers or due to the fact that sales to them are greatly diminished and they are no longer significant customers. In such cases, we do not expect suppliers to adjust their capital structure, because maintaining bargaining power with respect to such customers has no value.

*4.4.1. Analysis of effects of supplier industry concentration*

We are interested in gauging the effect of customer distress and bankruptcy on suppliers' leverage in concentrated industries. Suppliers in highly concentrated industries do not need to fortify their bargaining power, or at least not as much as suppliers in less concentrated industries, because they already have enough power for negotiations with customers. Thus, we expect that suppliers in high concentration industries do not increase their leverage as much as suppliers in low concentration industries. We measure industry concentration by the Herfindahl-Hirschman index, which is calculated as the sum of the squared market shares of the firms that operate in a business segment of the industry, defined by its four-digit SIC.

We report in Table 10 the results of the analysis of the impact of supplier concentration. We create a new dummy, called *HighSuppHefIndex,* that receives the value of 1 if the supplier

industry Herfindahl-Hirschman index is in the top 25% of Herfindahl-Hirschman indices for our sample in the two years before customer filing, and zero otherwise. We include three new factors in the regressions, the interactions between our previous dummies and the new dummy *HighSuppHefIndex*, in order to segregate the effect for the suppliers in high-concentration industries. All the coefficients of these new independent variables are negative and, specifically for the interaction with the *BeforeFiling* dummy, it is statistically significant at the 10% level. A combined coefficient for *BeforeFiling* and for high industry-concentration suppliers indicates an increase in leverage of only 2.1%, instead of 5.5% for the total treatment sample. This result shows that a higher supplier industry concentration is associated with a substantially smaller increase in suppliers' leverage in the distress years, consistent with the bargaining power hypothesis.

*4.4.2. Analysis of leverage changes for suppliers with distressed customers that are liquidated or become unimportant*

Suppliers have no incentives to adjust leverage for bargaining power reasons if they do not expect that they will continue to have a significant relationship with a distressed customer in the future. Therefore, we investigate suppliers that do not present a continuing reported relationship with their distressed customers. The absence of a reported relationship after the distress years may be either due to the liquidation of the customers or due to the fact that sales to them are greatly diminished and they are no longer significant customers. In both cases, we do not expect suppliers to adjust their capital structure, because maintaining bargaining power with respect to such customers has no value.

First, we analyze leverage changes of suppliers whose distressed customers are liquidated during the Chapter 11 process. Table 11 reports these results in Column 1. The empirical

evidence indicates that suppliers do not increase their leverage before the customer files for Chapter 11 if the customer liquidates after the distress years. The coefficient of the *BeforeFiling* dummy is negative and not statistically significant. This result supports our assumption that suppliers increase their leverage only if they expect that the distressed customer will reemerge from Chapter 11.

Second, from the sample of suppliers with customers that reorganized and reemerged from bankruptcy, we create a subsample of suppliers that end the relationship after the customer files for Chapter 11. The last report of a significant relationship with the distressed customer occurs before the bankruptcy filing. Thus, in these cases, suppliers in our sample either completely terminated their business relationship with the distressed customer or the relationship is no longer important, with sales representing less than 10% of total sales. We verify that these suppliers continue to report a relationship with at least one other customer after the distressed customer files for bankruptcy. Therefore, the lack of a reported relationship with the distressed customer is not due to the supplier changing its policy on naming significant customers.

If the bargaining power theory describes supplier's behavior in this setting, we predict that suppliers do not change capital structure in such situations, because they anticipate that their relationship with the distressed customer will not be important anymore. We supplement the sample considered in Column 1 of Table 11 with the sample of suppliers with reemerged customers that are no longer important and estimate Eq. (1) for this combined sample of suppliers. The results are reported in Column 2 of Table 11. As expected, the results for this sample confirm that suppliers do not increase leverage before the customer's bankruptcy filing, when the relationship with the customer is either terminated or no longer significant.[21]

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[21] One potential explanation for results in Table 4 is that there is a mechanical increase in supplier book leverage because the distress of a significant customer depresses the book value of supplier equity, perhaps due to lower profit margins. Results in Table 11 refute this possibility because we do not observe an increase in supplier book leverage prior to customer bankruptcy filing in these samples.

*4.5. Ex-ante assessment of customers that are likely to reorganize versus liquidate*

We argue that a supplier will use leverage as a bargaining tool in negotiations only if it believes that its customer has substantial chances of recovery from distress. In Section 4.1, we investigate the sample of suppliers whose customers reemerged after Chapter 11 and we find that suppliers increase their leverage before the filing. Such an analysis assumes that suppliers can identify the customers that will successfully reemerge from Chapter 11.

To relax this assumption of perfect foresight regarding the customer reorganization or liquidation decision, we rely on the forecast of the probability of customer reorganization using the coefficients from a binomial logistic regression (Model 2) presented in Kolay et al. (2015).[22] Table 12 reports the results. Panel A presents the summary statistics for calculated probabilities of reorganization for customers that reemerged and for customers that liquidated. The mean probability of reorganization for the group of reemerged customers is 0.607 and the corresponding mean for the liquidated customers is 0.445. The difference between the means of probabilities of reorganization between the two groups is significant at the 1% level. In Panel B (confusion matrix), we verify that this model can successfully predict reorganization for 79% of the customers that actually reorganized; similarly, it predicts liquidation for 65% of the customers that actually liquidated.[23]

Using the predictions of this model, we conduct the analysis on a sample of suppliers whose customers are predicted to reemerge after reorganization. Table 13 presents the results, which are qualitatively similar to the original treatment sample comprising suppliers to customers that did in fact reorganize. Suppliers increase leverage by 4.4% in the years before

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[22] This model is similar to Model 3 in Lemmon, Ma and Tashjian (2009).
[23] We classify customer firms as predicted to be reorganized (liquidated), if the probability of reorganization is greater (less) than 0.5.

customers file for Chapter 11 and return to previous levels after the bankruptcy filing.[24] We also

analyze leverage changes of suppliers whose customers are predicted by the model to liquidate,

and the unreported results for this subsample indicate that suppliers do not increase their leverage

before the customer files for Chapter 11.

The model from Kolay et al. (2015) relies on public accounting information, which

implies that its prediction is a more conservative estimate of the predictive capability of

suppliers. Nevertheless, the results still support our conclusion that suppliers increase their

leverage when a significant customer enters financial distress if they believe that the customer

will likely reemerge from Chapter 11.


## 5. Conclusion

A distressed, large customer might put pressure on its under-diversified suppliers — for

instance, to provide a larger discount or to accept late payments — especially if the customer

believes that the suppliers have resource slack. Predicting this behavior, a supplier might take

measures to increase its bargaining power as the customer prepares to formally file for

bankruptcy. This paper investigates how economic or financial distress of a major customer can

impact the strategic choices of capital structure of a supplier.

Looking at customer firms that reemerged from bankruptcy after reorganizing, we find

that their suppliers increase their leverage in the years before the filing date. This change is

economically significant and consistent with the bargaining theory hypothesis proposed by

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[24] We also estimate the probability of customer reorganization using a modified model from the original in Kolay et al. (2015). Their model employs variables such as industry-adjusted operating performance (EBITDA-to-assets) and R&D-to-assets ratio using the average of values in years –3 and –2, as well as industry distress and low GDP year dummies assessed in years 0 or –1. In our modified model, we omit variables that are assessed in years 0 and –1. Our intention is to test a prediction model which can be used to evaluate the probability of reorganization two years before the customer files for Chapter 11. Not surprisingly, this modified model is less accurate as it increases our number of predicted reorganized customers by six, but only two of these customers actually reorganized. Nevertheless, regression results are qualitatively similar for both models.

Bronars and Deere (1991), which states that an increase in debt decreases the surplus available for negotiations with nonfinancial stakeholders, thus increasing the firm's bargaining power. In our setting, the supplier firm increases its debt when the bargaining power of its counterparty increases. The main concern for the supplier is to keep its strategic negotiation position as strong as possible if it believes that its customer has substantial chances of recovery. Suppliers' bargaining power is especially relevant because distressed customers may be pressing their suppliers to give better trade conditions, such as reducing prices or extending credit. We also find that suppliers do not increase leverage in the years before customers' Chapter 11 filing when customers are liquidated or if suppliers cease to report the distressed firm as a significant customer. If the supplier believes the customer will liquidate or become insignificant in terms of relative sales, there is no need for the supplier to fortify its bargaining power. Furthermore, we show that the use of debt to enhance bargaining power is lower for suppliers that are in high-concentrated industries, compared to suppliers in less concentrated industries.

We also investigate another possible explanation for the increase in supplier leverage: the trade credit mechanism. Suppliers may be inclined to offer trade credit and act as liquidity providers to their important customers in distress. We find no evidence that suppliers increase their accounts receivable before their distressed customer files for Chapter 11. Moreover, most of the increase in supplier leverage is due to an increase in long-term debt rather than short-term debt, which also does not support a trade credit mechanism argument.

Additionally, we hypothesize and investigate if this strategic negotiation move is temporary, with the supplier returning to a previous relative status quo, probably inside a target range for leverage, after the distressed customer reorganizes and reemerges from Chapter 11. We find evidence that suppliers do indeed reduce their leverage after the customer reemerges from Chapter 11, indicating a return to a previous status quo of bargaining power.

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**Table 1**

Summary statistics—treatment sample.

This table reports summary statistics for our sample during the period 1980–2013. The sample consists of suppliers whose significant customers filed for bankruptcy under Chapter 11. Panel A reports summary statistics for suppliers, Panel B reports summary statistics for customers that filed for bankruptcy, and Panel C reports the sample and sub-sample characteristics. Book Leverage is total debt divided by total book value of assets. Short-Term Leverage is short-term debt divided by total book value of assets. Long-Term Leverage is long-term debt divided by total book value of assets. Market Leverage is total debt divided by total market value of assets. Firm Size is the log of sales. Tangibility is net property, plant, and equipment divided by total assets. Profitability is EBITDA divided by total assets. Market-to-Book is the market value of total assets to total book assets. R&D Intensity is R&D expense divided by total assets. Accounts Receivable Ratio is accounts receivable divided by sales. All ratios were winsorized at 1% and 99%.

*Panel A. Supplier summary statistics*

|  | N | Mean | Median | Std. Dev. | Min. | Max. |
|---|---|---|---|---|---|---|
| Book Leverage | 1,664 | 0.25 | 0.21 | 0.23 | 0 | 1.00 |
| Short-Term Leverage | 1,664 | 0.06 | 0.02 | 0.10 | 0 | 0.56 |
| Long-Term Leverage | 1,664 | 0.19 | 0.13 | 0.22 | 0 | 1.00 |
| Market Leverage | 1,664 | 0.31 | 0.23 | 0.29 | 0 | 1.07 |
| Size | 1,664 | 5.58 | 5.39 | 1.89 | 2.30 | 10.46 |
| Tangibility | 1,664 | 0.27 | 0.22 | 0.21 | 0 | 0.93 |
| Profitability | 1,664 | 0.09 | 0.11 | 0.15 | -1.20 | 0.64 |
| Market-to-Book | 1,664 | 1.26 | 0.90 | 1.38 | 0.03 | 23.45 |
| R&D Intensity | 1,664 | 0.03 | 0 | 0.07 | 0 | 0.82 |
| Accounts Receivable Ratio | 1,664 | 0.18 | 0.15 | 0.15 | 0.02 | 0.35 |

*Panel B. Customer summary statistics*

|  | N | Mean | Median | Std. Dev. | Min. | Max. |
|---|---|---|---|---|---|---|
| Book Leverage | 1,664 | 0.43 | 0.31 | 0.37 | 0 | 1.82 |
| Market Leverage | 1,664 | 0.62 | 0.68 | 0.34 | 0 | 3.06 |
| Size | 1,664 | 10.31 | 10.50 | 1.86 | 2.35 | 12.24 |
| Tangibility | 1,664 | 0.37 | 0.33 | 0.20 | 0 | 0.82 |
| Profitability | 1,664 | 0.10 | 0.10 | 0.09 | -1.06 | 0.36 |
| Market-to-Book | 1,664 | 0.93 | 0.65 | 0.80 | 0.0001 | 6.56 |
| R&D Intensity | 1,664 | 0.04 | 0 | 0.06 | 0 | 0.38 |

**Table 1** *(continued)*

*Panel C. Sample characteristics*

| | Total Sample | Sample with Reemerged Customers Only | Sample with Liquidated Customers Only |
|---|---|---|---|
| No. of Observations (Firm-years) | 1,664 | 1,402 | 262 |
| No. of Supplier-Customer Pairs | 163 | 129 | 34 |
| No. of Suppliers | 156 | 125 | 33 |
| No. of Customers | 62 | 36 | 26 |

**Table 2**

Summary statistics — benchmark sample.

This table reports summary statistics for our benchmark sample during the period 1980-2013. The sample has all supplier-customer pairs in the same industries as the treatment firms, where the supplier-customer relationship was reported in the same time window as the treatment pairs, but the customers did not file for bankruptcy. Panel A reports summary statistics for the suppliers and Panel B for the customers. Panel C reports the sample characteristics. Book Leverage is total debt divided by total book value of assets. Short-Term Leverage is short-term debt divided by total book value of assets. Long-Term Leverage is long-term debt divided by total book value of assets. Market Leverage is total debt divided by total market value of assets. Firm Size is the log of sales. Tangibility is net property, plant, and equipment divided by total assets. Profitability is EBITDA divided by total assets. Market-to-Book is the market value of total assets to total book assets. R&D Intensity is R&D expense divided by total assets. All ratios were winsorized at 1% and 99%.

*Panel A. Supplier summary statistics*

|                      | N   | Mean | Median | Std. Dev. | Min.  | Max.  |
|----------------------|-----|------|--------|-----------|-------|-------|
| Book Leverage        | 786 | 0.22 | 0.19   | 0.21      | 0     | 1.00  |
| Short-Term Leverage  | 786 | 0.06 | 0.01   | 0.11      | 0     | 0.58  |
| Long-Term Leverage   | 786 | 0.16 | 0.09   | 0.19      | 0     | 0.81  |
| Market Leverage      | 786 | 0.25 | 0.17   | 0.26      | 0     | 1.01  |
| Size                 | 786 | 5.32 | 5.03   | 1.67      | 2.32  | 9.88  |
| Tangibility          | 786 | 0.27 | 0.21   | 0.21      | 0.001 | 0.93  |
| Profitability        | 786 | 0.10 | 0.12   | 0.16      | -1.57 | 0.42  |
| Market-to-Book       | 786 | 1.34 | 1.02   | 1.29      | 0.18  | 14.15 |
| R&D Intensity        | 786 | 0.04 | 0.002  | 0.07      | 0     | 0.59  |

*Panel B. Customer summary statistics*

|                 | N   | Mean | Median | Std. Dev. | Min.  | Max.  |
|-----------------|-----|------|--------|-----------|-------|-------|
| Book Leverage   | 786 | 0.41 | 0.39   | 0.23      | 0     | 1.16  |
| Market Leverage | 786 | 0.48 | 0.46   | 0.30      | 0     | 1.10  |
| Size            | 786 | 9.91 | 10.01  | 1.85      | 4.19  | 13.05 |
| Tangibility     | 786 | 0.39 | 0.29   | 0.23      | 0.05  | 0.92  |
| Profitability   | 786 | 0.15 | 0.13   | 0.09      | -0.21 | 0.42  |
| Market-to-Book  | 786 | 2.07 | 1.05   | 2.97      | 0.28  | 20.11 |
| R&D Intensity   | 786 | 0.04 | 0.006  | 0.07      | 0     | 0.37  |

**Table 2** *(continued)*

*Panel C. Sample characteristics*

|  | Benchmark Sample |
|---|---|
| No. of Observations (Firm-years) | 786 |
| No. of Supplier-Customer Pairs | 93 |
| No. of Suppliers | 86 |
| No. of Customers | 60 |

**Table 3**

Univariate analysis of industry-adjusted suppliers book leverage.

This table reports univariate analysis of industry-adjusted book leverage for suppliers whose significant customers filed for bankruptcy under Chapter 11. Panel A reports the leverage for suppliers whose customers reemerged from bankruptcy, and Panel B reports the leverage for suppliers whose customers liquidated. Book Leverage is total debt divided by total book value of assets, adjusted by subtracting the industry median value. The p-values (reported in parentheses) are calculated from t-tests for the means and from Wilcoxon rank sum tests for the medians. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

*Panel A. Industry-adjusted book leverage for suppliers with reemerged customers*

|  | Year | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
|  | -4 | -3 | -2 | -1 | 0 | 1 | 2 | 3 | 4 |
| Mean | 0.03 | 0.04 | 0.08*** | 0.05* | 0.01 | 0.02 | 0.01 | 0.00 | 0.02 |
|  | (0.30) | (0.12) | (0.009) | (0.08) | (0.65) | (0.49) | (0.81) | (0.99) | (0.45) |
| Median | 0.00 | 0.02 | 0.03* | 0.00 | -0.03 | -0.03 | -0.03 | -0.04 | -0.02 |
|  | (0.69) | (0.40) | (0.07) | (0.29) | (0.33) | (0.66) | (0.35) | (0.50) | (0.95) |

*Panel B. Industry-adjusted book leverage for suppliers with liquidated customers*

|  | Year | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
|  | -4 | -3 | -2 | -1 | 0 | 1 | 2 | 3 | 4 |
| Mean | 0.00 | -0.01 | -0.03 | -0.03 | 0.02 | 0.01 | 0.05 | 0.00 | 0.03 |
|  | (0.91) | (0.87) | (0.41) | (0.40) | (0.67) | (0.84) | (0.22) | (0.99) | (0.42) |
| Median | -0.05 | -0.03 | -0.01 | -0.02 | 0.03 | -0.01 | 0.02 | -0.02 | -0.01 |
|  | (0.86) | (0.65) | (0.44) | (0.36) | (0.64) | (0.92) | (0.35) | (0.79) | (0.55) |

**Table 4**

Analysis of leverage changes of suppliers to distressed customers that survived.

This table reports analysis of supplier book leverage before and after customer bankruptcy filing using lagged supplier firm controls for the sample of suppliers whose customers remerged after bankruptcy. In Model (1), BeforeFiling is a dummy variable that is set to 1 in years –2 and –1 relative to the customer's Chapter 11 filing, and zero otherwise. Transition is a dummy variable that is set to 1 in the year of customer's Chapter 11 filing (year 0), in the years 1 and 2, and zero otherwise. In Model (2), BeforeFiling$_{[-2]}$ dummy is set to 1 in year –2 and zero otherwise, and BeforeFiling$_{[-1]}$ dummy is set to 1 in year –1 relative to the customer's Chapter 11 filing, and zero otherwise; the Transition dummy is set to 1 in years 0, 1 and 2, and zero otherwise. In all models, AfterFiling is a dummy variable that is set to 1 in year 3 and all subsequent years, and zero otherwise. Firm Size is the log of sales. Profitability is EBITDA divided by total assets. Tangibility is net property, plant, and equipment divided by total assets. Market-to-Book is the market value of total assets to total book assets. R&D Intensity is R&D expense divided by total assets. Heteroskedastic-robust t-statistics are in parentheses. The symbols ***, ** and * indicate significance levels at the 1%, 5%, and 10% levels based on p-values.

|                                | (1)          | (2)          |
|--------------------------------|--------------|--------------|
| BeforeFiling                   | 0.0547***    |              |
|                                | (3.232)      |              |
| BeforeFiling$_{[-2]}$          |              | 0.0497**     |
|                                |              | (2.484)      |
| BeforeFiling$_{[-1]}$          |              | 0.0604***    |
|                                |              | (2.819)      |
| Transition                     | 0.0364**     | 0.0373**     |
|                                | (2.149)      | (2.197)      |
| AfterFiling                    | 0.0144       | 0.0152       |
|                                | (0.708)      | (0.747)      |
| Size$_{t-1}$                   | 0.0408***    | 0.0409***    |
|                                | (4.442)      | (4.436)      |
| Market-to-Book$_{t-1}$         | -0.0167***   | -0.0168***   |
|                                | (-3.994)     | (-4.083)     |
| Profitability$_{t-1}$          | -0.209***    | -0.210***    |
|                                | (-3.279)     | (-3.283)     |
| Tangibility$_{t-1}$            | 0.0560       | 0.0573       |
|                                | (0.856)      | (0.872)      |
| R&D-to-Assets$_{t-1}$          | -0.189*      | -0.189*      |
|                                | (-1.692)     | (-1.691)     |
| Industry Median Leverage$_{t-1}$ | 0.127**    | 0.126**      |
|                                | (2.130)      | (2.106)      |
|                                |              |              |
| No. of observations            | 1,350        | 1,350        |
| R-squared                      | 0.781        | 0.781        |
| Year FE                        | Yes          | Yes          |
| Supplier FE                    | Yes          | Yes          |

**Table 5**

Analysis of accounts receivable changes of suppliers to distressed customers that survived.

This table reports analysis of supplier accounts receivable before and after customer bankruptcy filing using supplier firm controls for the sample of suppliers whose customers remerged after bankruptcy. In models 1 thru 3, the dependent variable (logarithm of the firm's accounts receivable to sales ratio) and the controls are the same as Table II of Dass, Kale and Nanda (2015), supplemented by three additional control factors used by Molina and Preve (2009): accounts payable ratio, inventory ratio and sales growth. Relationship-specific investment measure (RSI) is R&D expense divided by lagged total assets. Operating profits is EBITDA divided by sales. Firm Size is the log of sales. Leverage measures are total book leverage (Model 1), short-term book leverage (Model 2) or long-term book leverage (Model 3). Cash holdings ratio is cash held by the firm divided by its lagged total book assets. Market-to-Book is the market value of total assets to total book assets. Profitability is income before extraordinary items divided by lagged total assets. Tangibility is net property, plant, and equipment divided by total assets. Kaplan-Zingales Index is constructed as per Dass, Kale and Nanda (2015). It is equal to: 3.139x(Book Leverage) + 0.283x(Tobin's Q) – 1.002x (Cashflow/Lagged Assets) – 39.368x(Dividends) – 1.315x(Cash Holdings). Accounts payable ratio is accounts payable to cost of goods sold. Inventory ratio is inventory to cost of goods sold. Sales growth is the percent difference in sales from the previous year. Heteroskedastic-robust t-statistics are in parentheses. The symbols ***, ** and * indicate significance levels at the 1%, 5%, and 10% levels based on p-values.

| | (1) | (2) | (3) |
|---|---|---|---|
| RSI (R&D-to-Assets$_{t-1}$) | 0.0826 | 0.0583 | 0.119 |
| | (0.110) | (0.078) | (0.158) |
| EBITDA-to-Sales | -0.0187 | -0.0158 | -0.0190 |
| | (-0.110) | (-0.0935) | (-0.112) |
| Size | -0.0645*** | -0.0525** | -0.0549** |
| | (-2.756) | (-2.358) | (-2.379) |
| Total Debt/Total Assets | 0.237** | | |
| | (2.392) | | |
| Short-Term Debt/Total Assets | | 0.325** | |
| | | (2.292) | |
| Long-Term Debt/Total Assets | | | -0.0269 |
| | | | (-0.337) |
| Cash Holdings | -0.452*** | -0.417*** | -0.446*** |
| | (-3.671) | (-3.371) | (-3.622) |
| Market-to-Book | 0.0032 | 0.0005 | -0.0007 |
| | (0.243) | (0.038) | (-0.054) |
| Profitability | 0.256* | 0.244* | 0.224 |
| | (1.743) | (1.682) | (1.552) |
| Tangibility | -0.435*** | -0.423** | -0.436** |
| | (-2.607) | (-2.495) | (-2.570) |
| Kaplan-Zingales Index | -0.0387** | -0.0229 | -0.0151 |
| | (-2.188) | (-1.632) | (-0.937) |
| Accounts Payable Ratio | 0.475*** | 0.478*** | 0.484*** |
| | (4.329) | (4.402) | (4.409) |
| Inventory Ratio | 0.314** | 0.312** | 0.320** |
| | (2.023) | (2.001) | (2.030) |
| Sales Growth | 0.0628* | 0.0644* | 0.0660* |
| | (1.731) | (1.784) | (1.820) |
| | | | |
| No. of observations | 1,250 | 1,250 | 1,250 |
| R-squared | 0.844 | 0.844 | 0.843 |
| Year FE | Yes | Yes | Yes |
| Supplier FE | Yes | Yes | Yes |

**Table 6**

Analysis of short-term and long-term leverage changes of suppliers to distressed customers that survived.

This table reports analysis of supplier book leverage before and after customer bankruptcy filing using lagged supplier firm controls for the sample of suppliers whose customers remerged after bankruptcy. In Model (1), the dependent variable is short-term debt to total book assets. In Model (2), the dependent variable is long-term debt to total book assets. BeforeFiling is a dummy variable that is set to 1 in years –2 and –1 relative to the customer's Chapter 11 filing, and zero otherwise. Transition is a dummy variable that is set to 1 in the year of customer's Chapter 11 filing (year 0), in the years 1 and 2, and zero otherwise. AfterFiling is a dummy variable that is set to 1 in year 3 and all subsequent years, and zero otherwise. Firm Size is the log of sales. Profitability is EBITDA divided by total assets. Tangibility is net property, plant, and equipment divided by total assets. Market-to-Book is the market value of total assets to total book assets. R&D Intensity is R&D expense divided by total assets. Heteroskedastic-robust t-statistics are in parentheses. The symbols ***, ** and * indicate significance levels at the 1%, 5%, and 10% levels based on p-values.

| | (1) STD/TA | (2) LTD/TA |
|---|---|---|
| BeforeFiling | 0.0184* | 0.0492** |
| | (1.678) | (2.359) |
| Transition | 0.0243** | 0.0055 |
| | (2.225) | (0.266) |
| AfterFiling | 0.0105 | -0.0004 |
| | (0.826) | (-0.017) |
| Size$_{t-1}$ | -0.0011 | 0.0378*** |
| | (-0.202) | (2.955) |
| Market-to-Book$_{t-1}$ | -0.0054** | -0.0091* |
| | (-2.436) | (-1.750) |
| Profitability$_{t-1}$ | -0.0868** | -0.166** |
| | (-2.473) | (-2.501) |
| Tangibility$_{t-1}$ | -0.0197 | 0.0944 |
| | (-0.527) | (1.163) |
| R&D-to-Assets$_{t-1}$ | -0.0394 | -0.229* |
| | (-0.629) | (-1.820) |
| Industry Median Leverage$_{t-1}$ | 0.0044 | 0.156** |
| | (0.098) | (2.233) |
| | | |
| No. of observations | 1,350 | 1,350 |
| R-squared | 0.443 | 0.720 |
| Year FE | Yes | Yes |
| Supplier FE | Yes | Yes |

**Table 7**

Analysis of accounts receivable changes of suppliers to distressed customers that survived.

This table reports analysis of supplier accounts receivable before and after customer bankruptcy filing using supplier firm controls for the sample of suppliers whose customers remerged after bankruptcy. In models 1 and 2, the dependent variable (logarithm of the firm's accounts receivable to sales ratio) and the controls are the same as Table II of Dass, Kale and Nanda (2015), supplemented by three additional control factors used by Molina and Preve (2009) in their model: accounts payable ratio, inventory ratio and sales growth. BeforeFiling is a dummy variable that is set to 1 in years –2 and –1 relative to the customer's Chapter 11 filing, and zero otherwise. Transition is a dummy variable that is set to 1 in the year of customer's Chapter 11 filing (year 0), in the years 1 and 2, and zero otherwise. AfterFiling is a dummy variable that is set to 1 in year 3 and all subsequent years, and zero otherwise. Relationship-specific investment measure (RSI) is R&D expense divided by lagged total assets. Operating profits is EBITDA divided by sales. Firm Size is the log of sales. Cash holdings ratio is cash held by the firm divided by its lagged total book assets. Market-to-Book is the market value of total assets to total book assets. Profitability is income before extraordinary items divided by lagged total assets. Tangibility is net property, plant, and equipment divided by total assets. Kaplan-Zingales Index is constructed as per Dass, Kale and Nanda (2015). It is equal to: 3.139x(Book Leverage) + 0.283x(Tobin's Q) – 1.002x (Cashflow/Lagged Assets) – 39.368x(Dividends) – 1.315x(Cash Holdings). Accounts payable ratio is accounts payable to cost of goods sold. Inventory ratio is inventory to cost of goods sold. Sales growth is the percent difference in sales from the previous year. Heteroskedastic-robust t-statistics are in parentheses. The symbols ***, ** and * indicate significance levels at the 1%, 5%, and 10% levels based on p-values.

|                              | (1)        | (2)        |
| ---------------------------- | ---------- | ---------- |
| BeforeFiling                 | 0.0359     |            |
|                              | (0.821)    |            |
| Transition                   | -0.0059    |            |
|                              | (-0.128)   |            |
| AfterFiling                  | -0.0111    |            |
|                              | (-0.198)   |            |
| RSI (R&D-to-Assets$_{t-1}$)  | 0.126      | 0.123      |
|                              | (0.166)    | (0.163)    |
| EBITDA-to-Sales              | -0.0276    | -0.0217    |
|                              | (-0.162)   | (-0.128)   |
| Size                         | -0.0559**  | -0.0559**  |
|                              | (-2.439)   | (-2.492)   |
| Cash Holdings                | -0.458***  | -0.449***  |
|                              | (-3.691)   | (-3.662)   |
| Market-to-Book               | -0.0006    | -0.0005    |
|                              | (-0.048)   | (-0.043)   |
| Profitability                | 0.234      | 0.228      |
|                              | (1.597)    | (1.564)    |
| Tangibility                  | -0.433**   | -0.436**   |
|                              | (-2.517)   | (-2.572)   |
| Kaplan-Zingales Index        | -0.0183    | -0.0172    |
|                              | (-1.297)   | (-1.212)   |
| Accounts Payable Ratio       | 0.483***   | 0.484***   |
|                              | (4.280)    | (4.403)    |
| Inventory Ratio              | 0.316**    | 0.320**    |
|                              | (2.012)    | (2.031)    |
| Sales Growth                 | 0.0665*    | 0.0659*    |
|                              | (1.829)    | (1.815)    |
|                              |            |            |
| No. of observations          | 1,250      | 1,250      |
| R-squared                    | 0.844      | 0.843      |
| Year FE                      | Yes        | Yes        |
| Supplier FE                  | Yes        | Yes        |

**Table 8**

Analysis of leverage changes of suppliers controlling for abnormal changes in trade credit.
This table reports analysis of supplier book leverage before and after customer bankruptcy filing using lagged supplier firm controls for the sample of suppliers whose customers remerged after bankruptcy. In Model (1), the dependent variable is total book leverage. In Model (2), the dependent variable is short-term debt to total book assets. In Model (3), the dependent variable is long-term debt to total book assets. BeforeFiling is a dummy variable that is set to 1 in years –2 and –1 relative to the customer's Chapter 11 filing, and zero otherwise. Transition is a dummy variable that is set to 1 in the year of customer's Chapter 11 filing (year 0), in the years 1 and 2, and zero otherwise. AfterFiling is a dummy variable that is set to 1 in year 3 and all subsequent years, and zero otherwise. Firm Size is the log of sales. Profitability is EBITDA divided by total assets. Tangibility is net property, plant, and equipment divided by total assets. Market-to-Book is the market value of total assets to total book assets. R&D Intensity is R&D expense divided by total assets. Abnormal A/R is the residual from the regression in Model 2 of Table 7. Heteroskedastic-robust t-statistics are in parentheses. The symbols ***, ** and * indicate significance levels at the 1%, 5%, and 10% levels based on p-values.

|  | (1) | (2) | (3) |
|---|---|---|---|
|  | Total Debt/TA | STD/TA | LTD/TA |
| BeforeFiling | 0.0687*** | 0.0199* | 0.0643*** |
|  | (3.813) | (1.706) | (3.073) |
| Transition | 0.0471*** | 0.0293*** | 0.0117 |
|  | (2.604) | (2.635) | (0.559) |
| AfterFiling | 0.0319 | 0.0136 | 0.0143 |
|  | (1.490) | (1.053) | (0.576) |
| $Size_{t-1}$ | 0.0413*** | -0.00562 | 0.0452*** |
|  | (3.552) | (-0.962) | (3.179) |
| $Market\text{-}to\text{-}Book_{t-1}$ | -0.0163*** | -0.0057** | -0.0075 |
|  | (-3.446) | (-2.331) | (-1.298) |
| $Profitability_{t-1}$ | -0.201** | -0.0658 | -0.192** |
|  | (-2.522) | (-1.623) | (-2.380) |
| $Tangibility_{t-1}$ | 0.0579 | 0.0269 | 0.0240 |
|  | (0.780) | (0.756) | (0.287) |
| $R\&D\text{-}to\text{-}Assets_{t-1}$ | -0.137 | -0.012 | -0.212 |
|  | (-1.074) | (-0.169) | (-1.548) |
| $Industry\ Median\ Leverage_{t-1}$ | 0.0797 | -0.0061 | 0.111 |
|  | (1.342) | (-0.128) | (1.626) |
| Abnormal AR | 0.0315* | 0.0234** | -0.0059 |
|  | (1.911) | (2.311) | (-0.318) |
| No. of observations | 1,250 | 1,250 | 1,250 |
| R-squared | 0.780 | 0.473 | 0.723 |
| Year FE | Yes | Yes | Yes |
| Supplier FE | Yes | Yes | Yes |

**Table 9**

Analysis of leverage changes of benchmark suppliers.

This table reports analysis of supplier book leverage using lagged supplier firm controls for benchmark suppliers whose customers did not file for bankruptcy; the benchmark sample has all supplier-customer pairs in the same industries as the treatment firms. In Model (1), the dependent variable is total book leverage. In Model (2), the dependent variable is short-term debt to total book assets. In Model (3), the dependent variable is long-term debt to total book assets. BeforeFiling is a dummy variable that is set to 1 in years –2 and –1 relative to the customer's Chapter 11 filing, and zero otherwise. Transition is a dummy variable that is set to 1 in the year of customer's Chapter 11 filing (year 0), in the years 1 and 2, and zero otherwise. AfterFiling is a dummy variable that is set to 1 in year 3 and all subsequent years, and zero otherwise. Firm Size is the log of sales. Profitability is EBITDA divided by total assets. Tangibility is net property, plant, and equipment divided by total assets. Market-to-Book is the market value of total assets to total book assets. R&D Intensity is R&D expense divided by total assets. Heteroskedastic-robust t-statistics are in parentheses. The symbols ***, ** and * indicate significance levels at the 1%, 5%, and 10% levels based on p-values.

| | (1)<br>Total Debt/TA | (2)<br>STD/TA | (3)<br>LTD/TA |
|---|---|---|---|
| BeforeFiling | 0.0261 | 0.0075 | 0.0111 |
| | (1.302) | (0.530) | (0.543) |
| Transition | 0.0159 | 0.0272* | -0.0120 |
| | (0.673) | (1.769) | (-0.504) |
| AfterFiling | 0.0268 | 0.0405* | -0.0143 |
| | (0.728) | (1.785) | (-0.430) |
| $Size_{t-1}$ | 0.0897*** | 0.0162* | 0.0678*** |
| | (6.177) | (1.676) | (5.479) |
| Market-to-Book$_{t-1}$ | 0.00268 | 0.00286 | -0.0059 |
| | (0.409) | (0.886) | (-1.585) |
| Profitability$_{t-1}$ | -0.360*** | -0.0641 | -0.248*** |
| | (-4.885) | (-1.533) | (-4.589) |
| Tangibility$_{t-1}$ | 0.174** | 0.123*** | 0.0635 |
| | (2.224) | (3.098) | (0.860) |
| R&D-to-Assets$_{t-1}$ | -0.0758 | -0.0202 | -0.0191 |
| | (-0.636) | (-0.286) | (-0.184) |
| Industry Median Leverage$_{t-1}$ | -0.0911 | 0.0574 | -0.152 |
| | (-1.042) | (0.922) | (-1.412) |
| | | | |
| No. of observations | 730 | 730 | 730 |
| R-squared | 0.776 | 0.584 | 0.715 |
| Year FE | Yes | Yes | Yes |
| Supplier FE | Yes | Yes | Yes |

**Table 10**

Impact of industry concentration on supplier leverage responses to customer distress.

This table reports the impact of supplier industry concentration on supplier book leverage for the sample of suppliers whose distressed customers remerged after Chapter 11 filing. BeforeFiling is a dummy variable that is set to 1 in years –2 and –1 relative to the customer's Chapter 11 filing, and zero otherwise. Transition is a dummy variable that is set to 1 in the year of customer's Chapter 11 filing (year 0), in the years 1 and 2, and zero otherwise. AfterFiling is a dummy variable that is set to 1 in year 3 and all subsequent years, and zero otherwise. HighSuppHefIndex is a dummy variable that receives the value of 1 if the supplier industry Herfindahl index in the two years before customer bankruptcy filing is in the top 25% of Herfindahl Indices, and zero otherwise. Firm Size is the log of sales. Profitability is EBITDA divided by total assets. Tangibility is net property, plant, and equipment divided by total assets. Market-to-Book is the market value of total assets to total book assets. R&D Intensity is R&D expense divided by total assets. Heteroskedastic-robust t-statistics are in parentheses. The symbols ***, ** and * indicate significance levels at the 1%, 5%, and 10% levels based on p-values.

| | |
|---|---|
| BeforeFiling | 0.0663*** |
| | (3.612) |
| Transition | 0.0418** |
| | (2.434) |
| AfterFiling | 0.0258 |
| | (1.215) |
| BeforeFiling*HighSuppHefIndex | -0.0454* |
| | (-1.721) |
| Transition*HighSuppHefIndex | -0.0222 |
| | (-1.035) |
| AfterFiling*HighSuppHefIndex | -0.0435* |
| | (-1.752) |
| $Size_{t-1}$ | 0.0398*** |
| | (4.287) |
| $Market\text{-}to\text{-}Book_{t-1}$ | -0.0170*** |
| | (-4.095) |
| $Profitability_{t-1}$ | -0.206*** |
| | (-3.230) |
| $Tangibility_{t-1}$ | 0.0535 |
| | (0.814) |
| $R\&D\text{-}to\text{-}Assets_{t-1}$ | -0.179 |
| | (-1.619) |
| $Industry\ Median\ Leverage_{t-1}$ | 0.119** |
| | (1.989) |
| | |
| No. of observations | 1,350 |
| R-squared | 0.782 |
| Year FE | Yes |
| Supplier FE | Yes |

**Table 11**

Analysis of leverage changes of suppliers with distressed customers that are liquidated or become unimportant.

This table reports regression results of supplier book leverage on a before filing dummy and lagged supplier firm controls. The sample includes suppliers whose customers liquidated after filing for Chapter 11 (column1) or whose customers either liquidated or become unimportant (column 2) after the Chapter 11 filing. BeforeFiling is a dummy variable that is set to 1 in years – 2 and –1 relative to the customer's Chapter 11 filing, and zero otherwise. Transition is a dummy variable that is set to 1 in the year of customer's Chapter 11 filing (year 0), in the years 1 and 2, and zero otherwise. AfterFiling is a dummy variable that is set to 1 in year 3 and all subsequent years, and zero otherwise. Firm Size is the log of sales. Profitability is EBITDA divided by total assets. Tangibility is net property, plant, and equipment divided by total assets. Market-to-Book is the market value of total assets to total book assets. R&D Intensity is R&D expense divided by total assets. Heteroskedastic-robust t-statistics are in parentheses. The symbols ***, ** and * indicate significance levels at the 1%, 5%, and 10% levels based on p-values.

| | (1) | (2) |
|---|---|---|
| BeforeFiling | -0.0209 | -0.0010 |
| | (-0.573) | (-0.033) |
| Transition | 0.0596 | 0.0439 |
| | (1.138) | (1.137) |
| AfterFiling | 0.0496 | 0.0109 |
| | (0.713) | (0.218) |
| Size$_{t-1}$ | -0.0157 | 0.0052 |
| | (-0.724) | (0.261) |
| Market-to-Book$_{t-1}$ | -0.0125** | -0.0221*** |
| | (-2.380) | (-5.829) |
| Profitability$_{t-1}$ | -0.0033 | 0.0143 |
| | (-0.051) | (0.236) |
| Tangibility$_{t-1}$ | 0.0500 | -0.137 |
| | (0.306) | (-1.025) |
| R&D-to-Assets$_{t-1}$ | 0.0424 | -0.0718 |
| | (0.203) | (-0.373) |
| Industry Median Leverage$_{t-1}$ | 0.112 | -0.0982 |
| | (0.635) | (-0.667) |
| | | |
| No. of observations | 248 | 363 |
| R-squared | 0.734 | 0.715 |
| Year FE | Yes | Yes |
| Supplier FE | Yes | Yes |

**Table 12**
Probability of reorganization.
This table presents the results of forecasting the probability of reorganization using the model in Kolay, Lemmon and Tashjian (2015). The table reports summary statistics of the calculated probability of reorganization for all customers that filed for Chapter 11 in our sample during the period 1980-2013. The customers were divided into two groups: firms that reorganized and a second group of firms that were either liquidated or acquired. Panel A reports summary statistics for the customers, where Reorganization = 1 and Liquidation/M&A = 0. Panel B presents the confusion matrix.

*Panel A. Predicted probability of reorganization*
*(Reorganize = 1, Liquidate/M&A = 0)*

|  | Reorganized Customers | Liquidated/M&A Customers | t-test of difference |
|---|---|---|---|
| Mean | 0.607 | 0.445 | 4.239*** |
| Median | 0.600 | 0.434 | |
| Std. Dev. | 0.137 | 0.147 | |
| Min | 0.305 | 0.242 | |
| Max | 0.879 | 0.719 | |
| N | 35 | 22 | |

*Panel B. Confusion matrix*

| | Predicted | |
|---|---|---|
| Actual | Reorganization | Liquidation |
| Reorganized | 27 (79%) | 7 (21%) |
| Liquidated | 8 (35%) | 15 (65%) |

**Table 13**

Analysis of leverage changes of suppliers with distressed customers that are predicted to be reorganized.

This table reports analysis of book leverage of suppliers whose distressed customers are predicted to be reorganized rather than liquidated using the model in Kolay, Lemmon and Tashjian (2015). BeforeFiling is a dummy variable that is set to 1 in years –2 and –1 relative to the customer's Chapter 11 filing, and zero otherwise. Transition is a dummy variable that is set to 1 in the year of customer's Chapter 11 filing (year 0), in the years 1 and 2, and zero otherwise. AfterFiling is a dummy variable that is set to 1 in year 3 and all subsequent years, and zero otherwise. Firm Size is the log of sales. Profitability is EBITDA divided by total assets. Tangibility is net property, plant, and equipment divided by total assets. Market-to-Book is the market value of total assets to total book assets. R&D Intensity is R&D expense divided by total assets. Heteroskedastic-robust t-statistics are in parentheses. The symbols ***, ** and * indicate significance levels at the 1%, 5%, and 10% levels based on p-values.

| | |
|---|---|
| BeforeFiling | 0.0436*** |
| | (2.948) |
| Transition | 0.0466*** |
| | (3.012) |
| AfterFiling | 0.0157 |
| | (0.838) |
| Firm Size$_{t-1}$ | 0.0440*** |
| | (5.412) |
| Market-to-Book$_{t-1}$ | -0.0168*** |
| | (-5.509) |
| Profitability$_{t-1}$ | -0.197*** |
| | (-4.157) |
| Tangibility$_{t-1}$ | 0.0654 |
| | (1.040) |
| R&D-to-Assets$_{t-1}$ | -0.188* |
| | (-1.901) |
| Industry Median Leverage$_{t-1}$ | 0.138** |
| | (2.502) |
| | |
| No. of observations | 1,353 |
| R-squared | 0.781 |
| Year FE | Yes |
| Supplier FE | Yes |