ESSAYS ON THE FLOW OF DISTRESS ALONG THE SUPPLY CHAIN

by

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ABSTRACT

This dissertation is composed of three essays which examine the effects of a firm's bankruptcy on its suppliers and customers. Suppliers and customers are considered to be stakeholders of the firm with which they trade and face potential costs if the firm files for Chapter 11. In the first essay, I examine the puzzle that while there is plenty of anecdotal evidence to show that upstream and downstream trading partners face costs when their trading partner is distressed, the existing literature seems to find that contagion effects are relatively small in magnitude. I propose and test a method which potentially reduces noise in the inputs used to determine wealth effects. I show that both suppliers and customers of filing firms experience significantly greater negative wealth effects due to the trading partner's distress than what has been documented in the existing literature.

In the second essay, I examine the following question: how do supplier and customer stock price effects vary in the cross section when the trading partner becomes distressed and files for bankruptcy? I find evidence consistent with the hypothesis that the impact of the filing firm's distress on upstream and downstream firms depends on whether the bankrupt firm is economically distressed or financially distressed. The results show that both customers and suppliers of distressed firms face switching costs which vary significantly with the probability of successful reorganization of the filing firm, and

these costs are higher when the degree of reliance and product specialization are greater. The third and final essay examines the trade credit policy of suppliers when their trading partner is distressed and files for Chapter 11. Trade credit is an economically important source of short-term funds for firms. I study empirically whether the data demonstrate that suppliers support customers in times of distress by continuing to extend credit or whether distressed customers are denied trade credit by suppliers who want to protect their own cash position. Evidence indicates that suppliers may continue to support their distressed customer by extending short-term credit depending on the probability of reorganization.

To my father, Mohit Kumar Kolay

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CHAPTER 1

EFFECT OF DISTRESS ON FILING FIRM'S SUPPLIERS AND CUSTOMERS

1.1 Introduction

In this chapter, I examine the effects of Chapter 11 filing on the filing firm's suppliers and customers. Existing literature shows that firms may adjust both their financing and investment policies in order to preserve their product market relationships. Titman (1984) models a situation where the possibility of liquidation due to financial distress can impose costs on a firm's customers and suppliers. These costs are higher for firms that require greater levels of relationship-specific investments from their suppliers or customers. Such firms may choose relatively low levels of debt in their capital structure in order to present a less risky image to their suppliers and customers. On the other side, suppliers and customers may also affect a firm's investment policy. Williamson (1971) shows that firms may choose to integrate vertically with a supplier or customer for increased efficiency in the presence of transaction costs. Given the importance of a firm's upstream and downstream trading partners, it is therefore likely to suffer from contagion if a customer or supplier files for bankruptcy.

Literature describing the effects of bankruptcy on a firm's upstream suppliers and downstream customers is relatively scarce. Existing research has focused on the effects of

bankruptcy on industry rivals. Lang and Stulz (1992) examine a sample of bankruptcies filed between 1970 and 1989 and find that the market value of the equity of the bankrupt firms' competitors decreases significantly at the time of the bankruptcy announcement.[1] Ferris et al. (1997) also examine the stock price effects and find that for every one dollar of equity value lost by a bankrupt firm on the filing announcement date, the competitors of the filing firm lose $3.32. Hertzel, Li, Rodgers, and Officer (2008) provide the first large sample evidence on the wealth effects of distress and bankruptcy filing for suppliers and customers of filing firms. They find that there exists significant contagion to suppliers of the filing firm and such effects are more severe when the filing firm's industry also suffers contagion. Specifically, using a sample of 250 Chapter 11 filings between 1981 and 2004, they find that the average abnormal return for supplier portfolios is -1.94% (significant at the 5% level) over the 5 days around filing.

The financial distress of an economically important customer may give rise to multiple sources of losses for the suppliers and customers such as lost sales, increased production costs, switching costs, loss on outstanding receivables, or loss of a short-term credit supplier. If the filing firm liquidates, permanent loss of cash flows to the trading partner may occur. For example, if a supplier files, it would take time for the customer to line up a new supplier, negotiate prices and credit terms, and make other adjustments necessary to fit the replacement supplier into the customer's production schedule (Titman and Shapiro, 1985). Given the potential economic importance of a filing firm to its suppliers and customers, it is puzzling that the degree of empirical effects on the

[1] They also present evidence indicating that the competitive effect is simultaneous. Competitive effect is the opposite effect of contagion. In this, some firms gain if the rival filing firm is removed from the market as a result of the bankruptcy.

suppliers and customers documented in the literature is so small.[2] The importance of contagion in the supply chain is anecdotally quite well known. For instance, an article appearing in Time.com on November 28, 2008 states that "68% of participants in a survey of executives for industry suppliers said their companies would have to downsize if General Motors declared bankruptcy, while 12% said their businesses would likely close or would definitely do so."[3] The survey went on to state that an estimated 275,000 jobs would be lost in the Midwest alone as a result of a General Motors (GM) bankruptcy. This shows that the potential magnitude of supply chain contagion in GM's case was anticipated to be very high and to have far-reaching consequences. Indeed, the potential effects of GM's bankruptcy on its suppliers were considered sufficiently serious for the federal government to authorize five billion dollars out of the TARP funds to keep auto parts suppliers afloat.[4] While not all filing firms are as large or important as GM, the results in Hertzel et al. (2008) are nonetheless puzzling, especially since suppliers in their sample generate at least 10% of their total revenue from the bankrupt firm.

Jorion and Zhang (2009) directly examine wealth effects of large unsecured creditors (including suppliers offering trade credit to the bankrupt firm) reported as part of the Chapter 11 filing process. They find that these firms experience negative abnormal returns. However, this sample may result in the exclusion of those suppliers which modified their terms of trade in the prefiling period. Modified terms such as cash on delivery may result in the supplier not being on the list of large outstanding creditors at

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[2] A further puzzling finding in Hertzel et al. (2008) is that they are unable to find any cross-sectional characteristics which explain the level of contagion in suppliers and customers of filing firms. See Chapter 2 for an examination of this topic.

[3] "The Ripple Effect of a Potential GM Bankruptcy" by Steven, Gray, Time.com, November 28, 2008. http://www.time.com/time/business/article/0,8599,1862737,00.html

[4] Auto Supplier Support Program (ASSP). The funds came from the Troubled Asset Relief Program (TARP) March 20, 2009.

the time of filing. Nonetheless, the liquidation of the filing firm may mean large losses for such suppliers. Even with such large direct exposures, lender firms in Jorion and Zhang's (2009) sample experience relatively small abnormal equity returns of -2.29% over a period of 10 days surrounding the filing date.

One of the reasons for the relatively small contagion effects is that the Chapter 11 filing is usually a widely anticipated event. Almost every firm takes action before filing which is likely to have an effect on the suppliers and customers. Examples include announcement of debt restructuring programs, capital expenditure cuts, asset sales, etc. Thus for many firms, Chapter 11 is a final step in the renegotiation and restructuring of the capital structure. This has been recognized by previous studies relating to bankruptcy. For instance Gilson, John, and Lang (1990) and Tashjian, Lease, and McConnell (1996) circumvent this problem by identifying the date on which distressed restructurings start. Instead of using the filing date, they look for restructuring announcements within 5 years prior to the Chapter 11 filing date. Ferris et al. (2003) find they are unable to detect any competitive effects among their sample of firms which are rivals to filing firms. They posit that this may be because the impact has already been incorporated into stock prices prior to the filing date. They work around this problem by evaluating stock price effects for the competitors over a period of 100 days prior to the filing date. Using this method, they find significant positive abnormal returns for those competitors of the filing firm which stood to gain from the elimination of a rival through bankruptcy.

Hertzel et al. (2008) also recognize that the filing date is noisy and in order to gauge the contagion effects accurately, they define the "prefiling distress date." By multiplying the bankrupt firm's market adjusted abnormal return for each trading day in

the year prior to filing with the market capitalization of the previous day, they designate the date on which the dollar loss is maximum as the prefiling distress day. Using this method, they find that an equally weighted portfolio of suppliers to filing firms experience abnormal returns of -0.81% (significant at the 10% level) in the 5-day period surrounding the pre-filing distress date. This is puzzling because if the distress date properly identifies a date on which relevant news regarding the distress arrives to the market, supplier contagion should be greater than that experienced over the filing date (-1.94% significant at the 5% level). Further, they find that an equally weighted portfolio of customers to filing firms experience insignificant abnormal returns in the 5-day period surrounding their distress date.

Given these puzzles, I revisit the problem of suppliers' and customers' contagion caused by their trading partner's financial distress. I use a sample of 215 bankruptcies filed between 1981 and 2009 and corresponding samples of their suppliers and customers. As in previous studies, I find that the event of filing is expected beforehand. I then examine the distress date of Hertzel et al. (2008) by collecting the relevant news about the filing firm around that date. I find that the prefiling distress date is noisy since some firms have either no news at all or no news which is indicative of future distress. In a few cases, the dates are inaccurate due to reversals in the market price of the filing firm. I propose a different method to choose the date of prefiling distress date so that wealth effects can be measured more accurately. I define a less noisy distress date by examining individual news articles related to the filing firm over a period of 1 year before filing and then identifying various dates on which news of the filing firm's distress was released to the market.

Reexamining the supplier and customer contagion using these new distress dates, I find that both supplier and customer contagion is significantly higher than what has been documented in the literature. Using the 5-day period surrounding the Hertzel et al. (2008) distress date leads to supplier abnormal returns of -1.74% (significant at 1% level) in my sample while using the distress date defined using actual news articles leads to abnormal returns equaling -7.27% (significant at 1% level) over 5 days. Following Ferris et al. (2003), I also evaluate long run returns to suppliers over the 1 year prior to the filing date and find that suppliers experience significant negative abnormal long run returns over the period. This confirms that news regarding the filing firm's distress arrives in the market in spurts and using news articles to ascertain distress dates reduces the noise level in the abnormal returns. This allows for a more accurate measure of supplier wealth effects. Turning to the customers, I find the effects to be just as significant. While existing literature does not find any significant contagion effects for the customers, I find that in my sample, customers experience significant negative abnormal returns equaling -1.87% (significant at 1% level). Customers may be the reason behind the filing firm's distress, e.g., if shifting customer demand away from the filing firm causes the distress. However, the finding that customers also experience abnormal returns shows that distress not only flows upstream but downstream as well.

The remainder of this chapter is organized as follows: Section 1.2 describes the relevant literature while Section 1.3 describes the sample of bankruptcies and the process of identifying suppliers and customers used throughout this dissertation. Section 1.4 discusses the problems with the existing method of identifying prefiling distress and

presents the new method. Section 1.5 discusses the contagion results using the new distress date, while Section 1.6 concludes.

1.2 Literature review

Contagion within an industry has long been cited as one of the effects of bankruptcy. Such intra-industry contagion can arise from two sources: firstly, suppliers and customers of a bankrupt firm may become wary of doing business with other firms in the same industry and move away from the entire industry, or the event of filing may release negative information about the filing firm since the components of the filing firm's cash flows are likely to be correlated with other firms in the same industry. Supporting this, Aharony and Swary (1983) find that in banks, if bankruptcy is caused by firm-specific events such as fraud, contagion does not occur, whereas if the filing is associated with industry-wide cash flow problems, negative contagion effect occurs.

Lang and Stulz (1992) provide large-scale evidence of such intra-industry contagion. Using data from 1970-1989, they show that positive competition effects associated with bankruptcy filings are present in industries with low level of competition and low leverage. Industries with high competition and high leverage experience contagion effects when a rival firm files for Chapter 11. The reason for this is that with a lower level of competition, nonfiling rivals will find it easier to take advantage of the bankrupt firm's financial difficulties while firms with lower leverage will have increased flexibility to expand their market share to include that of the rival filing firm. Ferris et al. (2003) confirm these findings regarding intra-industry contagion using a more recent sample, though they are unable to detect similar levels of competitive effects.

While early research examined these sources of contagion in the context of industry, the same reasoning can be applied to a filing firm's upstream and downstream trading partners. For instance, a firm filing Chapter 11 may directly convey negative information about cash flows of suppliers (potentially reduced sales) or customers (higher input prices). In addition to information about the correlated components of cash flow of the filing firm and its trading partners, supply chain contagion may also be caused by the suppliers and customers of the filing firm's trading partners (i.e., second tier trading partners of the filing firms) moving away from them in anticipation of distress. Titman (1984) describes a model where suppliers, customers, and employees are wary of the costs of a filing firm's liquidation and are reluctant to do business with such a firm. The flow of distress may be anticipated prior to the actual distress occurring and such expectations may give rise to costs both up and down the supply chain. Titman's (1984) model predicts that if the firm in question supplies or buys unique goods, costs imposed on the trading partners will be higher and in order to induce such reluctant trading partners to remain in business, the firm will have a lower leverage. Titman and Wessels (1988) and Banerjee, Dasgupta, and Kim (2008) find empirical evidence to support this theory.

Jorion and Zhang (2009) examine wealth effects of the large unsecured creditors reported as part of the Chapter 11 filing process and while they do not separate supplier firms from other type of creditors, a portion of their sample of creditors is likely to be composed of suppliers to the filing firm. They find that for their subset of industrial firms, the largest unsecured creditors experience significant negative abnormal returns over a 10-day period surrounding the filing. Firms that have the greatest exposure to the

filing firms, those whose returns are most correlated with the filing firms and those whose recovery rates, are likely to be the least experience the greatest abnormal negative returns. Boone and Ivanov (2011) examine whether parties involved in strategic alliances and joint ventures with the filing firm suffer from spillover effects due to the bankruptcy. They find evidence that on average, such strategic alliance partners experience negative stock price reaction around the filing announcement.

However, while both the above studies examine contagion effects, the study that finds the most direct evidence of supply chain contagion due to bankruptcy is Hertze et al. (2008). This study finds significant average wealth effects of distress and bankruptcy filing on dependent suppliers of filing firms. Within their sample of 250 Chapter 11 filings, they find the average filing-period abnormal return for supplier portfolios to be -1.94% (significant at the 5% level). Hertzel et al. (2008) also examine the interaction between vertical as well as horizontal flow of distress from the filing firm. They find that suppliers experience an average abnormal filing-period return of -4.76% (significant at the 1% level) for the subsample of filings in which horizontal rivals of filing firms have negative filing-period abnormal returns. In comparison, their subsample of suppliers to filing firms with nonnegative rival abnormal returns experiences insignificant abnormal returns. Hertzel et al. (2008) also define a prefiling distress date to measure the prefiling effects on the supply chain. They use the date in the year prior to filing when the bankrupt firm had the largest dollar abnormal loss. Using this date, they find that the average distress period abnormal return to suppliers of filing firms is -0.81% (significant at the 10% level). No significant results for the customers of filing firms are obtained. Hertzel et al. (2008) further attempt to examine the supplier/bankrupt firm characteristics

which are likely to be associated with the cross-sectional variation in the level of contagion experienced, but no significant characteristics emerge from their tests that can explain the patterns of contagion in their sample.

In sum, the existing literature provides several explanations as to why supply chain contagion may exist and provides some preliminary evidence to show that such effects actually exist in the market. However, the effects documented so far in the literature with respect to suppliers of filing firms are very small, especially when compared to the potential magnitude of supply chain contagion suggested by anecdotal evidence. In addition, no contagion effects for customers of filing firms have been detected empirically. Further, the cross-sectional variation in supply chain contagion has not been fully examined in the literature.

1.3 Sample selection and data description

I start with the Lo Pucki Bankruptcy Research Database for the initial sample of 869 Chapter 11 filings between 1980 and 2009. Each of these firms possesses assets of at least $100 million (in 1980 dollars) at the time of filing and at least one publicly traded stock. I match the filing firms to all firms reported as customers or suppliers in the company segment data available on Compustat. Since these data contain only a text abbreviation for customers' names for a reporting supplier, I use a text matching code to match the abbreviated customer name with the set of bankrupt firms to form the supplier—filing customer pairs. I then invert the same code to match the abbreviated customer name to the universe of all firms on Compustat and select those pairs where the

reporting supplier is in the sample of bankruptcies. I visually inspect every customer-supplier pair found by the code to ascertain that the match is accurate.

In order to ensure a reasonable sample size, I follow Hertzel et al. (2008) and look for a match up to 5 years before the filing date. If multiple matches between the same two firms occur, I choose the one closest to the filing year. I manually check the annual reports of a subsample of the firms to ensure that relationships are still maintained even if the match is made a while before the actual filing. I am able to find 292 filing firms which have either a supplier or a customer or both. Out of these, 50 filing firms drop out due to nonavailability of CRSP returns for the trading partner. The final sample consists of 215 filing firms for which I am able to find all data needed.[5]

Figure 1.1 illustrates the dating convention. The distress date, described in the next section, is determined based on a news event within the 12 months prior to the Chapter 11 filing. "FYE" indicates fiscal year ends relative to the filing date. The filing date, F, occurs between time -1 and time 0. The distress date occurs sometime between time "x", which is 12 months before the filing date and the filing date, F, between time -2 and time -1.

Panel A of Table 1.1 presents the distribution of filing firms by year and Panel B presents the distribution of supplier-customer links for each decade. Panel C presents the statistics by industry. Of the 215 filing firms for which there is enough data to calculate the probability of reorganization, 118 have at least one supplier and 131 have at least one customer. The sample of suppliers consists of 328 individual suppliers (an average of around 3 suppliers per filing firm) and the number of customers equals 284 (an average

[5] A further 4 bankrupt firms are lost as Compustat data to calculate the distress type are not available while 23 observations do not have data to determine whether their industry is distressed, leaving a total of 215 filing firms.

of around 2 customers per filing firm). The sample is concentrated over the 1999 to 2003 period (114 firms or 48% of the sample) and correspondingly, there is a large proportion of firms in the business equipment industry in the sample. The relatively large number of suppliers for the bankrupt customers in years 1987 and 2009 arise from the inclusion of Texaco in 1987 and General Motors in 2009. The sample is evenly distributed across most of the industry groups. Following Hertzel et al. (2008), I include the finance and utilities industries in the sample. These are treated differently under the bankruptcy law but since here the focus is on their trading partners, I do not expect their differential treatment under Chapter 11 to affect the results. Nevertheless, I repeat the tests after dropping these firms and find that the results remain virtually unchanged.

The main variable of interest in all of the tests in this chapter is the wealth effect of the filing firm's trading partner. It is measured by cumulative abnormal return for the supplier or the customer over a 5-day period centered around a date on which relevant economic information about the distressed partner is released to the market.[6] I follow the approach of Hertzel et al. (2008) and compute abnormal returns using the market-adjusted returns method (Brown and Warner, 1985), in which the daily abnormal return is the firm-specific return minus the value-weighted market return from CRSP.

1.4. Distress date

1.4.1 Rationale for examining modified prefiling distress date

Very few Chapter 11 filings come as a surprise since most firms try to avoid bankruptcy by restructuring their assets and liabilities and Chapter 11 is often the final step in the resolution of distress (Asquith, Gertner, and Scharfstein, 1994). If the market

[6] Using a 1-day period for the event study leads to qualitatively similar results

is already well informed about the distress at the time at which wealth effects are measured, effects on the supply chain will be measured inaccurately. For this reason, Hertzel et al. (2008) define the prefiling distress date as the day of the previous 12 months on which the firm has the largest abnormal dollar loss. The dollar loss is measured as the filing firm's return less the CRSP value weighted index return multiplied by the market capitalization of the filing firm of the previous day.

Keeping in view that Hertzel et al. (2008) are unable to find any particular cross-sectional characteristics explaining the level of contagion effects in their sample, I reexamine the distress dates for this sample by conducting Lexis Nexis searches for news around those dates. I begin by verifying that the distress dates are indeed caused by filing-firm specific news and are not caused by exogenous news such as that from the industry, suppliers, or customers. I find that this cannot be completely ruled out. For instance, Rhythm Net Connections which filed on August 1, 2001 had a distress date on August 9, 2000 (abnormal return = -20.5%). During the prefiling distress period, Northpoint Communications, one of Rhythm's competitors, came to an agreement with Verizon to merge their DSL. This caused stocks of firms such as Rhythm Net Connections and Covad to fall as these were Northpoint's rivals in the DSL business as well as suppliers to Verizon. This is an exogenous news event not caused by Rhythm and inclusion of the returns on this date for its suppliers will lead to noise in the tests. Secondly, I find that when there exists the type of news mentioned in Hertzel et al. (2008), e.g., debt downgrades, earnings warnings, missed earnings expectations, it is not always necessarily indicative of the onset of that magnitude of distress which would affect the suppliers. As an example, Table 1.2 presents the timeline of news for Xpedior

Inc, an internet firm that filed for bankruptcy on April 21, 2001. The distress date is September 5, 2000 when it announced that the third quarter revenue for 2000 would fall 10% from that in the second quarter. While this 10% drop could indicate the onset of contagion causing distress, it may not be a sure sign of the imminence of such distress. For instance, Servidyne Inc, another firm belonging to the same two-digit SIC code, experienced a 48.8% drop in revenue over the same two quarters but did not need to restructure. Anacomp Inc, another firm in that industry, also had a 15% revenue drop over the same quarter but continued to operate. Approximately 28% of the bankrupt customers examined in this study have distress dates on which earnings announcements took place. While a drop in revenue on the distress date may foretell the likelihood of future distress, not all firms with revenue drops of 10% move into the type of distress that befell Xpedior. If we look further down the timeline, on March 20, 2001, Xpedior announced that it would be impossible or difficult for it to continue without additional capital after June, that it received notice of default for several covenants, it failed to receive an unqualified report from its auditors, and that NASDAQ would delist its stock due to noncompliance with minimum price requirements. It is much more likely that the greatest impact on suppliers or customers of Xpedior would occur around this date when the magnitude of the severity of the distress becomes clear.

Table 1.3 provides further evidence of the noisiness of the distress date measure. It shows the distress dates for some of the bankrupt firms in this sample for which I am unable to find any news on or around the distress date at all. While there are not many (11% of the bankrupt customers) such firms where no news is available, in a small sample of bankruptcies such as this or that of Hertzel et al. (2008), it is likely that such

noisy observations would cause any cross-sectional effects to remain unobserved. Table 1.4 shows some of the filing firms for which it is unclear whether or not the news around the distress date is negative or not. Examples include Microage Inc. and Northpoint Communications. The former filed on April 13, 2001 (distress date December 2, 1999) and a deal to combine its services with those of Qwest Communications International Inc. was announced on December 1, 1999. This deal would allow it to offer an array of broadband internet solutions. Northpoint Communications, which filed on Jan 16, 2001 announced on its distress date (April 3, 2000) that it was partnering with Netopia and NeedBandwidth to launch the NeedBandwidth DSL Center powered by NorthPoint and Netopia. A possible explanation for these large negative dollar returns on days on which seemingly no negative news came out can be found by examining another bankrupt customer—Metricom Inc. which filed on July 2, 2001. It announced on July 24, 2000 (distress date July 25, 2000, abnormal return -17.98%) that it had launched its Ricochet 128 kbps/sec wireless data network in San Diego. This was followed by an announcement on July 25, 2000 that it had reached "a major milestone in its efforts to deploy its Ricochet network in the state of Rhode Island by executing an attachment agreement with Narragansett Electric Company." On July 24, the abnormal return was +44.37% and over a 5-day period centered on the distress date, the CAR equals +10.07%. It is possible that the inflated market capitalization on July 24, 2000 and the reversal on July 25, 2000 caused a misattribution of the distress date to this particular day.

Overall, I find that the distress date is a noisy measure of the actual date on which the first news of distress relevant to the suppliers or customers came out. Tables 1.3 and 1.4 present the abnormal returns for equal weighted supplier portfolios for the particular

bankrupt customer and it is evident from some of the large positive numbers that the wealth effects documented in Hertzel et al. (2008) are understated due to the noise in their distress date measure.

1.4.2 Redefined distress date

I try to find a date on which unambiguous information indicating that the trading partner is in distress is released. Gilson, John, and Lang (1990) and Tashjian, Lease, and McConnell (1996) identify the date on which distressed restructurings start. They define distressed restructurings as transactions in which existing debt is replaced by a new contract. A restructuring begins if there is an announcement within 5 years prior to the Chapter 11 filing date or out of court restructuring date that the firm is renegotiating with creditors, has already renegotiated, or has defaulted. Asquith, Gertner, and Scharfstein (1994) identify different types of restructuring that distressed firms undertake, including bank debt or public debt restructuring, asset sales, and reduction of capital expenditures. However, since a debt restructuring in anticipation of default is a response to financial distress, I modify their method to look for information indicating onset of, rather than response to, distress.

The process I use to do this is as follows. I search for news articles in Lexis Nexis's "All Newspapers and Wires" category over the period of 1 calendar year prior to filing date using the firm name. From these articles, I choose in order of availability 1) any news mentioning suppliers or customers of the filing firm explicitly suggesting a response to the distress in their trading partner, e.g., suppliers refusing to extend credit or customers requiring extra warranties; 2) news regarding any unsuccessful attempt at

restructuring, that the firm is unlikely to recover, or that it is facing distress and will likely fail if restructuring/refinancing is not obtained; 3) news that a firm has hired an advisory or investment firm for potential restructuring, fails to make debt payments, or it has a going concern qualification by its auditor; and lastly, 4) any announcement of an attempt at asset restructuring such as asset sales, mergers, capital expenditure reductions, and layoffs or debt restructuring. If multiple items in any category are available, I take the earliest.

Direct information pertaining to trading partners is the first choice for identifying distress dates since suppliers and customers have a direct motivation to monitor their trading partners. In addition to the loss of future profits, suppliers also stand to lose goods in progress. In addition, suppliers and customers to the filing firm may be locked into sales/purchase agreements with the filing firm. Suppliers also stand to lose any trade credit that is yet to be paid by the filing firm. Trade credit theories posit that sellers may be better informed about the filing customer firm since the suppliers offer financing to the customer in the form of trade credit when other forms of financing are not available (Biais and Gollier, 1997; Brennan et al., 1988; Bukart and Ellingsen, 2004; Petersen and Rajan, 1997; Smith, 1987). Thus, suppliers and customers are in a position to release new information to the market about the filing firm.

However, choosing such dates also gives rise to the concern that wealth effects of suppliers and customers are driven by information about themselves rather than their filing customer. To mitigate this concern, I perform two types of check on the filing firms for which there is at least one supplier. I focus on the filing firms which have suppliers because I find that in the data, customers to filing firms rarely have any news related to

their distressed supplier and all the dates in this category of articles are based on suppliers, rather than customers, to filing firms. Firstly, I find that only 6% of the dates for the filing firms with suppliers belong to the first category. Excluding these observations from subsequent regressions keeps the results remain qualitatively unchanged. I also redo the date choice process by searching exclusively for dates when bankruptcy of the filing firm was first mentioned as a possibility, either by the firm itself or by analysts or other market participants (and not suppliers to the filing firm). I find that the regression estimates remain qualitatively unchanged.

I choose failed restructuring attempts next since these are likely to have the maximum impact on the trading partners. Since many suppliers function as short-term creditors to their customers, they may keep on extending credit even if they know that their trading partner is distressed. Thus, it is expected that such suppliers will be affected the most when they have already stretched themselves in expectation that the trading partner will restructure successfully and it does not happen. In absence of the first two criteria, news which reflects onset of distress such as missed debt payments or hiring an advisory firm for restructuring is chosen. I focus on these since chronologically, they either appear before any restructuring attempts are made or are the very first steps in the restructuring process. As the last choice, I pick those news stories that indicate that an attempt at asset or liability restructuring has been made. These are not unambiguous bad news for the trading partners and hence are the last choice. In the rare case where there is no attempt at a restructuring before filing, the filing or the announcement of filing is taken as the onset of distress. For the sample of bankrupt firms which have at least one or more suppliers, the dates are distributed between the category types as follows: 5.7%

belong to the first group, 33% to the second group, 37% to the third group, 19.5% to the fourth category, and 4% for which we use the filing date.

Comparing these new distress dates (henceforth referred to as the "distress date") to the date of Hertzel et al. (2008) (henceforth referred to as "value loss date"), I find that on average (median), the distress date occurs 99 (96) days after the value loss day. Figure 1.2 shows the market capitalization and the dollar loss for Northpoint Communications over the year before filing. As the market capitalization becomes smaller due to falling stock prices, the dollar loss in value also tends to fall. This leads to value loss dates which are on average earlier than the distress dates. 145 of the bankrupt firms have distress dates after the value loss date (mean 153 days).[7] Thus, the lack of cross-sectional results for Hertzel et al. (2008) could result from the market not being able to understand the level of distress of the bankrupt trading partners at an early stage.

Tables 1.3 and 1.4 compare the equal weighted abnormal returns for the supplier portfolios of various bankrupt customers. It can be seen that the distress-period abnormal returns are consistently negative and larger in absolute values than those calculated for the value loss dates. Table 1.5 shows the median dollar losses to all the suppliers of bankrupt customers for whom abnormal returns on all three dates are available. Thirty-three (corresponding to 12 different bankrupt customers) suppliers are available for whom dollar values are available on all three dates and both the distress and the value loss dates are the same. The median loss to suppliers on the distress date is $ -3.16 million while it is $ -2.41 million on the value loss date and $-0.48 million on the filing date. Therefore, while the value loss dates are an improvement upon the filing dates in

[7] Twenty-four have their distress dates on average 149 days ahead of the value loss dates and 19 occur on the same day. Twenty-seven have missing value loss date. The median (mean) number of days between the filing date and the value loss date is 266 (233) days.

capturing the information effects of distress on suppliers, the distress dates identified in this study are a further improvement. As the measure becomes less noisy, the impact on the suppliers becomes more evident.

1.5 Empirical results for suppliers and customers to bankrupt firms

I begin by looking at the abnormal returns for the sample of suppliers and customers for the three dates, namely the filing date, distress date, and the value loss date. Table 1.6 presents the results. For each bankruptcy, I form equal-weighted supplier or customer portfolios and find the equal-weighted averages of these portfolio returns. For the suppliers, the returns in Table 1.6 show that the magnitudes of the abnormal returns around the distress date are much higher than those on the filing- or the value loss dates. While for the overall sample of suppliers I find an insignificant abnormal return of 0.18%, on the filing date, it increases to -1.65% on the value loss date which is significant at the 1% level. However, the abnormal return on the value loss date is much smaller than the -6.93% (significant at the 1% level) that is found on the distress date. This shows that the economic impact of supplier contagion is much higher than what has been documented in the existing literature.

In order to examine the effects of bankruptcy on the filing firm's rivals, Ferris et al. (2003) evaluate stock price effects for the competitors over a period of a hundred days prior to the date of filing. They do this in order to avoid the problem of underassessment of effects if the impact of filing has already been incorporated into stock prices prior to the filing date. Using the long run method, they find significant positive stock price abnormal returns for their sample of rivals of the filing firms which stood to gain from

the elimination of a rival through bankruptcy. I also check the robustness of the supplier results presented in Table 1.6 by using a longer period event study.

News regarding the filing firm's distress generally comes out in stages and I pick the date that is likely to contain the greatest level of news regarding the magnitude of customer distress. We should obtain similar, though more noisy, results if longer term event studies are used. I use a buy and hold abnormal returns (BHAR)-based methodology (Barber and Lyon, 1997) for implementing a longer period event study. To find a matching firm for each supplier, the firm that has the following characteristics is chosen: the match firm has the closest (but larger than) market capitalization to the supplier in the year before filing, belongs to the same exchange, and has the same 2-digit SIC code. If the best matching firm does not have data for the event period, I replace it with the next best market-capitalization-based match. If the supplier happens to be the largest in its group, I use the second largest firm as the match. Implementing this method to calculate the abnormal returns for suppliers, I find that over the 3 months prior to filing, suppliers to filing firms experience a statistically and economically significant -25% buy and hold abnormal return.

Table 1.6 also shows the event study results using equally weighted customer portfolios around the 5-day period surrounding the distress date, value loss date, and the filing date. The overall customer sample has significant negative returns (-1.87% significant at the 1% level) around the distress date. While the effect is weaker relative to the supplier group, it is economically significant. Customers may cause the financial distress of their filing supplier firms by moving their demand away from these suppliers. If this is the case, then they are unlikely to be affected by the distress type of their

supplier. As can be seen from the results in Table 1.6, the magnitude of customer abnormal returns is much smaller than that for the suppliers. Further, for any customer-supplier pair, the supplier must be in the Compustat segment database. This implies that while the supplier is reliant on the customer, the opposite may not be true. Therefore, the results for the customers are expected to be weaker relative to that for the suppliers to filing firms. It is interesting to note that customers to filing firms in this sample show significant negative wealth effects around the value loss date as well. This is in contrast to the results found in Hertzel et al. (2008). Since a similar methodology to theirs is implemented in this table, the differences could be due to sample differences.

1.6 Conclusion

I analyze the upstream and downstream flow of contagion when a firm is in distress and files for reorganization under Chapter 11. The effects documented in the literature to date are small compared to what can be expected given the economic importance of the filing firm to the trading partners, especially to the supplier firms. In addition, no contagion effects for the customers have been documented empirically to date. I hypothesize that this arises since event dates used in the prior literature are either too noisy or, if the filing date is used, are fraught with problems of information leakage. In order to overcome this problem, I define filing-firm distress date as that day of the year prior to filing on which the market receives relevant news regarding the onset of distress in the filing firm. Using hand-collected dates, I examine the stock price effects on the filing firm's suppliers and customers and find that the existing literature significantly underestimates the level of contagion, both for suppliers and customers of filing firms.

Table 1.1

Sample of Chapter 11 firms and links between suppliers and customers

Panel A: Yearly distribution of Chapter 11 filings included in sample

This table shows the yearly distribution of Chapter 11 bankruptcy filings included in the sample. Filing firms are those that filed for Chapter 11 between 1981 and 2009, which have assets worth at least $100 million in 1980 dollars, possess at least one publicly traded security, have at least one identified publicly traded supplier or customer, and enough data to calculate the probability of reorganization.

1981-1989		1990-1999		2000-2009	
Filing Year	Number of filings	Filing Year	Number of filings	Filing Year	Number of filings
		1990	10	2000	18
1981	1	1991	7	2001	29
1982	5	1992	3	2002	24
1983	2	1993	7	2003	17
1984	3	1994	1	2004	8
1985	2	1995	3	2005	10
1986	3	1996	4	2006	3
1987	3	1997	3	2007	2
1988	1	1998	6	2008	7
1989	4	1999	12	2009	17

Panel B: Distribution of supplier-customer links by decade

This table shows the distribution of the links between suppliers and/or customers and the filing firms by decade. Filing firms are those that filed for Chapter 11 between 1981 and 2009, which have assets worth at least $100 million in 1980 dollars, possess at least one publicly traded security, have at least one identified publicly traded supplier or customer, and enough data to calculate the probability of reorganization. Suppliers and customers of filing firms are identified from firms reporting major customers in Compustat segment data. Any firm listing a filing firm as a customer in the five years prior to filing is labeled a supplier and vice versa. Column two shows the distribution by decade for the overall sample while the third column shows the number of filing firms that have at least one customer. The fourth column shows the average number of customers in each filing firm's portfolio. The fifth and sixth columns show the corresponding figures for the filing firms and their suppliers.

Filing decade	Number of filing firms with at least one supplier or one customer	Number of filing firms with one or more customers	Average number of customers for each filing firm	Number of filing firms with one or more suppliers	Average number of suppliers for each filing firm
1981-1989	24	12	1.79	16	3.60
1990-1999	56	36	2.35	28	2.03
2000-2009	135	83	2.44	74	2.68
Overall sample	215	131	2.19	118	2.77

Table 1.1 continued

Panel C: Distribution of sample of Chapter 11 filings by industry

The first and second columns show the distribution of Chapter 11 filings included in our sample classified by the Fama French twelve industry groups. Filing firms are those that filed for Chapter 11 between 1981 and 2009, which have assets worth at least $100 million in 1980 dollars, possess at least one publicly traded security, have at least one identified publicly traded supplier or customer, and enough data to calculate the probability of reorganization. Suppliers and customers of filing firms are identified from firms reporting major customers in Compustat segment data. Any firm listing a filing firm as a customer in the 5 years prior to filing is labeled a supplier and vice versa. Column three shows the number of filing firms that have at least one customer and columns four and five show the mean and median number of customers in each filing firm's portfolio. The sixth, seventh, and eighth columns show the corresponding figures for the filing firms and their suppliers.

Industry	Number of filing firms	Number of filing firms with one or more customers	Average number of customers in filing firm's portfolio	Median number of customers in filing firm's portfolio	Number of filing firms with one or more suppliers	Average number of suppliers in filing firm's portfolio	Median number of suppliers in filing firm's portfolio
Business equipment	21	16	2.25	2.0	12	2.75	1.5
Chemicals	5	3	3.00	1.0	3	1.33	1.0
Durables	15	13	3.23	3.0	6	10.50	3.5
Energy	15	13	2.00	2.0	5	7.00	1.0
Health	4	2	1.50	1.5	3	1.00	1.0
Manufacturing	36	29	2.14	1.0	14	1.86	1.0
Finance	8	3	1.00	1.0	6	1.17	1.0
Nondurables	24	22	1.77	1.0	7	1.71	1.0
Other	31	13	1.92	1.0	21	1.76	1.0
Shops	30	6	1.67	2.0	24	2.96	2.0
Telecom	23	10	2.20	2.0	14	2.07	1.0
Utilities	3	1	7.00	7.0	3	2.67	2.0

Table 1.2

Chronology of announcements leading to Xpedior Inc's Chapter 11 filing

This table contains all announcements that were made either by or about Xpedior Inc. during the year prior to its Chapter 11 filing. Value Loss Date is that day of the year prior to filing on which the filing firm experiences the largest abnormal loss of shareholder wealth as measured by the abnormal percent return on the corresponding day multiplied by the market-capitalization from CRSP for the prior day. Distress date is as defined in Section 3. Abnormal returns are computed using the market-adjusted returns method (Brown and Warner, 1985), in which the daily abnormal return is the return of the firm less the CRSP value-weighted market return. Distress Date is defined as in Section 3. Standard errors are computed as described in Patell (1976). ***, **, or * indicates that the average is significantly different from zero (using a two-sided t-test) at the 1%, 5%, or 10% level (respectively).

April 25 2000: Revenues for Q1 00 rose 84% from Q1 99—a historic high for the firm. Reduced EBITDA loss. (AR = - 3.49%)

September 5 2000: Announced that it expects Q3 revenue to fall 10% from Q2. (Value Loss Date) (AR = - 22.82%***)

September 26 2000: Enacted action plan to resume revenue growth by enforcing a 16% reduction in workforce, key management changes and consolidation of geographic segments. (AR = - 2.11%)

November 2 2000: Announced that it lost $ 38.5 m in Q3 and $5 m in Q2, that the CEO, board chairman, president of U.S. operations and the president of international operations all left and had obtained $30 million extra credit from its banker and from PSINet, the stakeholder of 80% of Xpedior. (AR = - 31.77%***)

December 5 2000: Cut 32% cut of its work force and planned to close four offices. (AR = - 34.97%***)

February 1 2001: Sold Xpedior UK operations to Arthur Andersen for generating funds (AR = - 17.41%**)

March 20 2001: (Distress Date) (Delisted from this time onwards)

1. Announced that it anticipated it would have funds only until June 30, 2001 and after that would need additional capital which would be "difficult (or impossible)" to obtain. So it would continue to explore "strategic alternatives for the sale of all or part of its remaining operations. Further announced that even if it is successful in its efforts, it is likely that the common stock will have no value and if necessary for orderly disposal of its assets, Chapter 11 was possible".
2. Announced it would receive a going concern qualification in its audit opinion from its auditors and receive a notice of default under certain covenants of its senior secured credit facility with Comerica Bank.

Table 1.2 continued

3. Announced it had received a notice from NASDAQ that its common stock has failed to maintain the required minimum bid price of $1.00 over a period of 30 consecutive trading days and the firm did not anticipate that it would be able to regain compliance with this NASDAQ listing requirement. 4. Announced the layoff of 42% of its workforce and closure of four more offices.
March 21 2001: NASDAQ said that it had halted trading in Xpedior Inc
March 26 2001: Announced that it filed a Form 15 with the SEC to suspend its obligation to file periodic reports for 90 days and a request with NASDAQ to delist its shares. April 20 2001: (Filing Date) Announced that the Company and its U.S. subsidiaries filed a voluntary Chapter 11 petition

Table 1.3

Examples of bankrupt customers with no news available on value loss date

The following table contains the different dates for some of the bankrupt customers and their suppliers' abnormal returns over these dates. Value Loss Date is that day of the year prior to filing on which the filing firm experiences the largest abnormal loss of shareholder wealth as measured by the abnormal percent return on the corresponding day multiplied by the market-capitalization from CRSP for prior day. Distress Date is as described in text. Abnormal returns are computed using the market-adjusted returns method (Brown and Warner, 1985), in which the daily abnormal return is the return of the firm less the CRSP value-weighted market return. The abnormal returns are cumulated for days -2 to +2 relative to the filing-, relevant- and distress- day, and daily abnormal returns are calculated using Market Adjusted Returns (MAR) with the CRSP value-weighted index as the market index. Equal-weighted customer and supplier portfolios are formed from the individual customers and suppliers for each filing.

Company Name	Filing Date	Value Loss Date	Distress Date	Value loss Date Equal Weighted CAR of Suppliers	Distress Date Equal Weighted CAR of Suppliers	News on Relevant Date
Revere Brass and Copper Inc	10/27/1982	10/27/1981	6/5/1982	-1.45%	-2.23%	Suspends operations at its Alabama aluminum plant due to depressed markets . 600 jobs lost.
Best Products Inc	9/24/1996	10/5/1995	9/18/1996	0.73%	-12.11%	A supplier (Sharp) sues for 2.5 million worth of unpaid supplies. News that Best has stopped paying suppliers and is not accepting shipments of merchandise. News comes after withdrawn offer to buy Best by Ocean Reef Management.
Aventine Renewable Energy Holdings Inc	4/7/2009	9/17/2008	10/31/2008	-29.62%	-39.57%	Announced that it is operating at break-even margins, will preserve liquidity by delaying construction of its ethanol plant in Indiana, reducing inventory, and increasing borrowing.
Carter Hawley Hale Stores Inc	2/11/1991	1/28/1991	10/13/1990	5.67%	2.01%	News report stating that "Carter Hawley Hale Stores Inc....is feeling pressure from some credit agencies, who say the company is late paying bills." Reports that the firm is 90 days late in paying bills.
Paging Network Inc	7/24/2000	3/9/2000	1/27/2000	5.59%	-5.55%	Defaults on two interest payments and rumors circulate that it may have to file Chapter 11 to complete merger with Archnet.

Table 1.3 continued

Company Name	Filing Date	Value Loss Date	Distress Date	Value loss Date Equal Weighted CAR of Suppliers	Distress Date Equal Weighted CAR of Suppliers	News on Relevant Date
Alterra Healthcare Corp	1/22/2003	12/4/2002	4/4/2001	5.28%	-0.62%	Announces that it missed 35 mortgage payments and reports circulate saying that the firm is "flirting with bankruptcy."
Nucorp Energy Inc	7/27/1982	1/7/1982	3/23/1982	-3.52%	-0.20%	Announces that it is facing "a severe liquidity problem" and considering the sale of its oil and gas properties to raise cash for creditors." Also announces that is in default on loans.
Levitz Furniture Inc	9/5/1997	11/14/1996	7/15/1997	6.70%	-6.22%	Statements made in annual report include warnings such as "may seriously jeopardize (Levitz's) ability to continue as a going concern," Auditor Arthur Anderson says Levitz "has suffered recurring losses and has a net capital deficiency."
Builders Transport Inc	5/21/1998	1/21/1998	2/20/1998	4.41%	-0.24%	An informal committee of bondholders informs the firm's board that they would not support the company's proposed exchange offer terms announced by the company on Feb. 4 and their belief that bondholder interests would be best served by the exercise of default remedies.
Geneva Steel Company	2/1/1999	7/14/1998	1/6/1999	-2.33%	-7.17%	Announces that it planned to miss a $ 9 million interest payment due on Jan. 15 on some of its bonds in order to preserve the company's liquidity to pay their vendors and fund ongoing operations.

Table 1.4

Differences between news types on distress- versus value loss date

The following table contains the different dates for some of the bankrupt customers and their suppliers' abnormal returns over these dates. Value Loss Date is that day of the year prior to filing on which the filing firm experiences the largest abnormal loss of shareholder wealth as measured by the abnormal percent return on the corresponding day multiplied by the market-capitalization from CRSP for the prior day. Distress Date is as described in text. Abnormal returns are computed using the market-adjusted returns method (Brown and War 1985), in which the daily abnormal return is the return of the firm less the CRSP value-weighted market return. The abnormal returns cumulated for days -2 to +2 relative to the filing-, relevant- and distress- day, and daily abnormal returns are calculated using Market Adjusted Returns (MAR) with the CRSP value-weighted index as the market index. Equal-weighted customer and supplier portfolios are formed from the individual customers and suppliers for each filing.

Firm	Filing date	Value loss date	Distress date	Filing day equal weighted supplier CAR	Value loss day equal weighted supplier CAR	Distress Day equal weighted supplier CAR	News on value loss date	News on distress date
Microage Inc	4/13/2000	12/2/1999	6/14/1999	-25.02%	25.21%	-17.31%	On 1 Dec announced a deal to combine services with Qwest Communications International Inc.	Announced that it hired Salomon Smith Barney for restructuring financially.
Eagle Geophysical Inc	9/29/1999	10/1/1998	6/14/1999	-20.73%	6.21%	-5.72%	On 29 Sept announced it would buy Natural Resources Geophysical Corp. valued at about $ 5 million and this would cause assumption of $ 2 million in debt.	Announced that it had retained the investment banking firm of CIBC World Markets to serve as its financial advisor in connection with a potential restructuring.
Forum Group Inc	2/15/1991	5/4/1990	9/17/1990	38.26%	1.58%	2.37%	Announced that it opened an additional luxury retirement community in Florida.	Announced that it won't make interest payment payable on 15 Aug citing "liquidity demands."

Table 1.4 continued

Firm	Filing date	Value loss date	Distress date	Filing day equal weighted supplier CAR	Value loss day equal weighted supplier CAR	Distress Day equal weighted supplier CAR	News on value loss date	News on distress date
LTV Corp	12/29/2000	5/9/2000	8/15/2000	-4.53%	0.80%	-4.11%	Announced use of new machinery that would improve steel quality, productivity and yield higher casting speeds	Announced that it will engage in asset sales to generate funds for debt reduction
Braniff Inc	9/28/1989	1/5/1989	9/27/1989	-0.85%	1.42%	-0.81%	Announced that it would buy 50 airbuses for 3.5 billion and an option to buy 50 more	Released a statement announcing indefinite flight cancellation. Articles report that "bankruptcy rumors are flying".
Rhythms Net Connections Inc	8/1/2001	8/9/2000	4/2/2001	-6.31%	9.31%	-20.54%	On 8 Aug, Verizon and Northpoint came to an agreement to merge their DSL causing stocks of rivals such as Rhythms and Covad to fall as these were also suppliers to Verizon.	Announced it hired Lazard Freres & Co. to evaluate a range of restructuring and its auditor had concluded that it would not have enough cash to continue operating through the following year.

Table 1.4 continued

Firm	Filing date	Value loss date	Distress date	Filing day equal weighted supplier CAR	Value loss day equal weighted supplier CAR	Distress Day equal weighted supplier CAR	News on value loss date	News on distress date
Genuity Inc	11/27/2002	5/15/2002	7/25/2002	26.15%	37.34%	-6.57%	On 16 May announced a proposal for a reverse 20-to-1 split of the company's common stock.	Announced that Verizon which had an option to acquire a controlling interest in Genuity informed that it had decided to relinquish the option. This caused a default.
Southmark Corp	7/14/1989	9/7/1988	12/21/1988	-7.50%	-2.75%	-8.85%	A jury found Southmark guilty of fraud in its purchase of Exchange Network ($130.9 million in damages)	Southmark acknowledged that it may not have enough cash to meet operating and debt requirements for next year.
Northpoint Communications Group Inc	1/16/2001	4/3/2000	11/22/2000	37.51%	-0.41%	-21.83%	NorthPoint Communications, Netopia, and NeedBandwidth announced that they were partnering to launch the NeedBandwidth DSL Cente powered by NorthPoint and Netopia.	Announced that it had revised its previously announced Q3 2000 financial results and at the same time speculation arose among analysts that Verizon might renegotiate its $800 million deal to buy 55% of NorthPoint, following the restatement.

Table 1.5

Dollar value loss to suppliers of bankrupt customers over various dates

The table below shows the median dollar loss over the distress-, filing-, and relevant-period to the suppliers of bankrupt firms. The dollar loss is computed as the abnormal percent return of the 5-day trading period centered on the date multiplied by the market-capitalization from CRSP for third prior day. Abnormal returns are cumulated for the indicated windows relative to the filing- and distress-day, and are calculated using Market Adjusted Returns (MAR) with the CRSP value-weighted index as the market index.

	N	Median Loss over distress period ($ mil)	Median Loss over value loss period ($ mil)	Median Loss over filing period ($ mil)
All suppliers for which all three dates exist	133	-3.156	-2.410	-0.478
All suppliers for which all three dates exist and distress date is not same as value loss date	100	-1.934	-1.332	-0.583

Table 1.6

Event Study results for suppliers and customers to bankrupt firms

The following tables contain average cumulative filing-, distress-, relevant-period abnormal supplier and customer portfolio returns for the sample of filing firms. Customers of each filing firm in the prior 5 years are directly identified from FAS14 disclosures and any firm listing the filing firm as a customer in the 5 years prior to filing is labeled a supplier. FAS 14 disclosures are obtained from Compustat. Equal-weighted customer and supplier portfolios are formed from the individual customers and suppliers for each filing. Distress day is identified by searching the CRSP database over the year prior to the Chapter 11 filing date and finding the day on which the filing firm has the most negative dollar abnormal return. The abnormal returns are cumulated for days -2 to +2 relative to the filing- and distress- day, and daily abnormal returns are calculated using Market Adjusted Returns (MAR) with the CRSP value-weighted index as the market index. Standard errors are computed as described in Patell (1976). ***, **, or * indicates that the average is significantly different from zero (using a two-sided t-test) at the 1%, 5%, or 10% level (respectively).

	Supplier Abnormal Returns	Customer Abnormal Returns
	Full sample	
	Distress period	
CAR (-2, +2)	-6.93%***	-1.87%***
# of suppliers	231	222
# of equally weighted portfolios	94	112
	Chapter 11 filing period	
CAR (-2, +2)	0.18%	0.66%*
# of suppliers	226	229
# of equally weighted portfolios	95	119
	Value loss period	
CAR (-2, +2)	-1.65%***	-1.51%***
# of suppliers	232	(236)
# of equally weighted portfolios	(94)	121

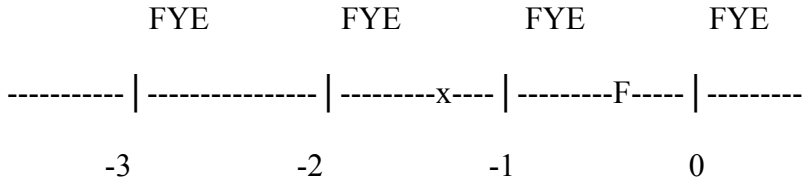

Figure 1.1

Number line demonstrating dating convention used in study

The number line below illustrates the dating convention. The distress date is determined based on a news event within the 12 months prior to the Chapter 11 filing. "FYE" indicates fiscal year ends relative to the filing date. The filing date, F, occurs between time -1 and time 0. The distress date occurs sometime between time" x" which is 12 months before the filing date, and the filing date, F, between time -2 and time -1.

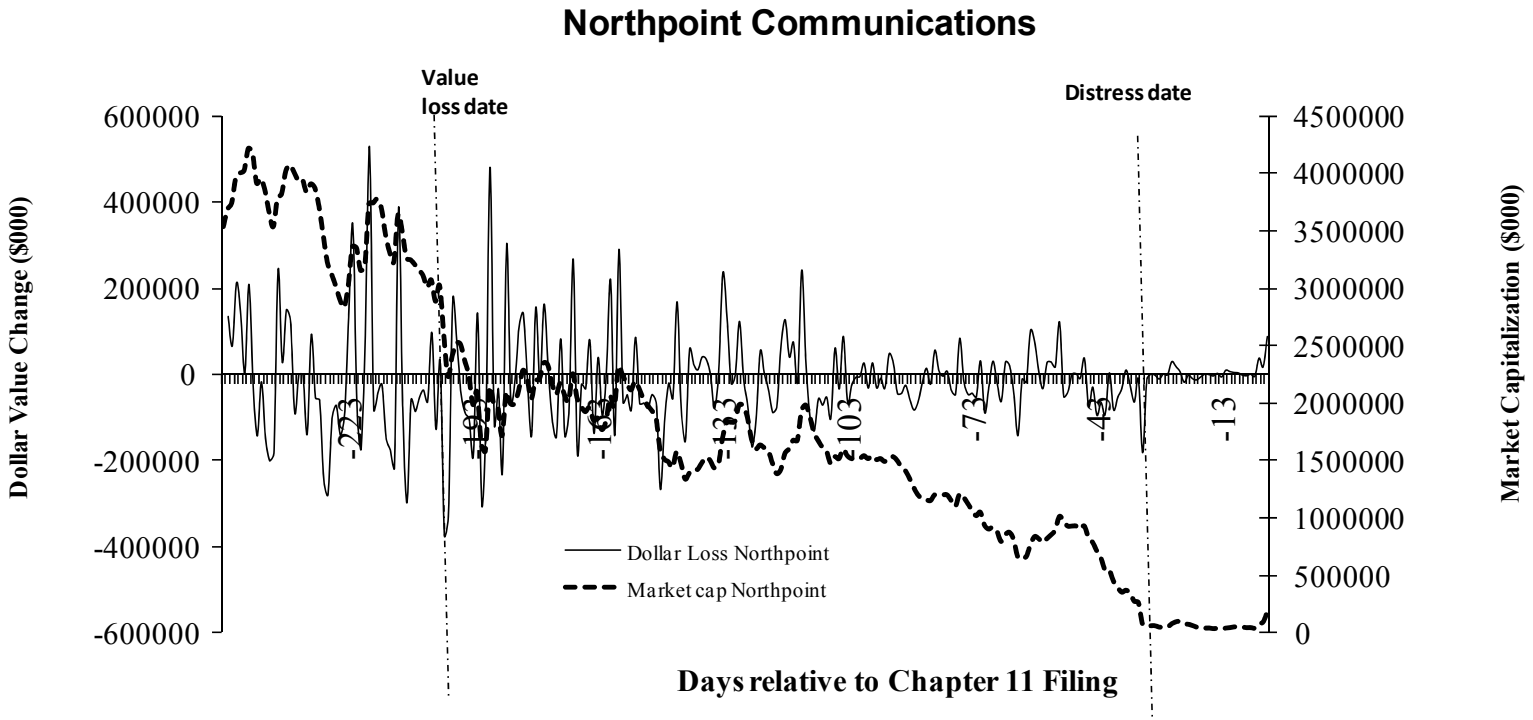

Figure 1.2

Stock price movements leading to Northpoint Communications' Chapter 11 filing

This shows the losses incurred by the filing firm (Northpoint Communications) in dollar value and the timing of the distress and value loss date. Dollar losses shown on the left y-axis are measured as the daily market adjusted abnormal return multiplied by the market capitalization of the previous day. CRSP value-weighted index is used for the market adjustment. The right y-axis measures the daily market capitalization of the filing firm. The first dashed line represents the dollar loss date, i.e., the date when the value of the dollar abnormal loss over the year prior to bankruptcy is maximum, whereas the second vertical dashed line represents the distress date found using hand-collected news articles. See Section 3 for details of distress date.

CHAPTER 2

THE CROSS-SECTIONAL VARIATION IN SUPPLY CHAIN CONTAGION

2.1 Introduction

This chapter examines the cross-sectional variation in the spillover effects of a firm's distress on its upstream and downstream trading partners. Contagion in the supply chain is anecdotally well known. For instance, as discussed in the previous chapter, the potential effects of General Motor's (GM) bankruptcy on its suppliers were considered sufficiently serious for the federal government to authorize $5 billion out of the TARP funds to keep auto parts suppliers afloat. However, every supplier or customer of the distressed firm is not affected in the same way. Among the 49 suppliers to GM identified in this study, the cumulative abnormal return (CAR) over a 5-day period around the date of filing ranges from -17% to +24%. To date, literature has found evidence of supply chain contagion on average but there exists scant empirical evidence regarding the variation in the degree of contagion. In this study, I go beyond existing literature that documents average contagion effects by examining why some firms are affected more or less than others. By examining the cross-sectional variation in the wealth effects to upstream and downstream trading partners of distressed firms, I identify characteristics of both the filing firm and its trading partner which are important in explaining supply chain

contagion. Specifically, I address the following questions in this paper: How does the nature of distress (economic vs. financial) of the filing firm, the degree of product specialization, and the structure of the industry affect upstream and downstream contagion? Are the suppliers of a filing firm affected by their trade credit policy towards their distressed customer? How does the supplier operating performance change once its customer is in distress?

I utilize the same sample of 215 firms and the corresponding sample of their suppliers and customers used in Chapter 1. These firms went bankrupt between 1981 and 2009. In the first set of tests, I regress the 5-day CAR around the distress date on the potential drivers behind the flow of distress in the supply chain.[1] The main hypothesis is that the implication for suppliers and customers will differ based on whether the filing firm is economically distressed or financially distressed. If a filing firm is in economic distress, it has a low operating profit and its value as a going concern is in doubt. This implies that economic distress of the filing firm is caused by an inability to repay debt due to a fundamentally flawed business model. As shown in Lemmon, Ma, and Tashjian (2009), an economically distressed filing firm has a lower probability of emerging from Chapter 11 as an independent firm when compared to a financially distressed filing firm, which is only overleveraged but does not have low operating profits. I classify each filing firm using the degree of economic versus financial distress and use this classification, along with other firm characteristics and a measure of industry distress, to estimate the filing firm's probability of reorganization. In addition, I also test the hypothesis that

[1] I hand-collect news articles to determine the distress date, which I define as the date on which relevant news about the distressed firm first arrived in the market. This reduces the noise level in CARs considerably, allowing me to find much more large-scale contagion effects than those documented in the literature to date. See Chapter 1 for details.

product characteristics such as the level of specialization and the industry competition structure affects the level of contagion.

The first key finding is that, on average, suppliers of economically distressed firms experience much larger contagion effects compared to those firms which supply to purely financially distressed filing firms. Specifically, using distress dates defined in Chapter 1, I find that the suppliers to economically distressed filing firms experience negative abnormal returns equaling -8.3% (significant at the 5% level) over the 5-day distress period, whereas suppliers of financially distressed filing firms display insignificant effects (-0.7%) over the same period. [2] Extending the analysis to a multivariate setting, I find that when filing firms have a lower probability of successful reorganization, i.e., are relatively small in size, operate in distressed industries, and have a combination of low operating profits and low leverage, suppliers tend to experience negative returns on the distress date. In addition, suppliers which depend on their filing customer to generate a larger portion of their sales and which have higher product specialization have a higher level of contagion.

Evaluating the wealth effects at zero probability of reorganization of the filing firm, I find that suppliers would experience abnormal returns equal to -19% over the 5-day period. In contrast, suppliers to filing firms which are sure to reorganize successfully would have no negative stock price effects at all. This is an economically consequential finding. Overall, a 10% lower probability of reorganization would result in an average 2% lower 5-day supplier CAR. This translates to each supplier losing an extra $2.5 million on a median basis from its market capitalization over a 5-day period if its filing

[2] These results are for equally weighted portfolios of suppliers for each bankrupt firm. Elsewhere, I also use sales-to-bankrupt-firm weighted portfolios. Results from the latter are stronger.

customer has a 10% lower chance of reorganizing successfully.[3] Further, in the multivariate setting, customers of filing firms also experience significant contagion. The probability of reorganization is a significant predictor of customer wealth effects, though the magnitude of the coefficient is smaller compared to that for suppliers.[4] The customer's product specialization is the most important factor in explaining its abnormal returns when the supplier files.

Since the empirical results show that the suppliers have more negative wealth effects than customers, I extend the analysis to study the operating performance of suppliers to filing firms. Operating profitability of suppliers deteriorates in the year of filing and the source of the drop can be traced to increased selling, general, and administration (SG&A) costs. This is consistent with suppliers facing fixed costs of switching to new customers. Suppliers may have to incur costs to tailor their products to particular customer such as costs of product adaptations, or time spent in training employees to operate new systems (Shapiro and Titman, 1985). I also find that the overall financial health of suppliers declines, as evidenced by a significant fall in the Altman z-score in the 2 successive years after the customer files.

This study contributes to the literature that studies indirect costs of bankruptcy. The cost of losing one's suppliers or customers is often cited as one of the most important indirect costs of bankruptcy. Trading partners can take steps to safeguard their own financial position; for instance, Shapiro and Titman (1985) cite the example of Wheeling-Pittsburgh Steel Corp., which filed for bankruptcy in April 1985. Its customers reduced

[3] I arrive at this value by multiplying the coefficient of the likelihood that a sample firm is likely to reorganize by the median (mean) market capitalization of the supplier firm sample.
[4] In contrast to suppliers, customers of filing firms experience 0.4% decline in their 5-day CAR when the probability of reorganization drops by 10%. However, sample customers are much larger than the suppliers.

their orders, demanded discount prices on products, and changed their credit terms to cash-on-delivery. Instead of measuring the costs imposed on the filing firm, I focus on how the costs of distress spread upstream and downstream. I show that firms can expect to be affected differently based on their product or industry characteristics as well as the probability of reorganization of their filing trading partner. This can have important implications for corporate policies at every level of the supply chain. Recent evidence in Garfinkel and Hankins (2011) indicates that firms may choose to vertically integrate along the supply chain when they face potential uncertainty in availability of inputs. Instead of operational risk management via vertical mergers, firms could also potentially design their hedging policies using derivatives to safeguard against potential supply chain disruptions.

This analysis also adds to the ongoing debate on whether distress costs that flow along the supply chain are important enough to justify bailouts of very large customers such as GM. In the wake of the auto industry's distress, there was widespread concern that taxpayer's dollars would be used to rescue firms that were distressed due to their own mismanagement or shifting customer demands. But at the same time, another major concern was that the effects should not spillover to its suppliers and cause a chain of bankruptcies (Rauh & Zingales, 2009). The debate is consequential given the magnitude of potential expenses involved on both sides. For instance, on December 11, 2008, Fitch Ratings declared that "In the event of a General Motors bankruptcy, Fitch believes that the resulting contraction in auto production, the supply chain, trade credit and capital-access would cause widespread shutdowns and bankruptcies throughout the supply

chain".[5] On the other hand, estimates of the costs of the auto bailout are as high as $14 billion.[6] By identifying factors which can potentially quantify the costs of flow of distress to the filing firm's suppliers, a quantitative assessment of whether funds should be allocated to supporting distressed firms is possible.

The chapter is organized as follows. Section 2.2 provides a brief overview of the relevant literature and identifies relevant factors affecting supply chain contagion. Section 2.3 describes the set of explanatory variables. Section 2.4 presents the results of the analysis of suppliers, including their wealth effects and effects on trade receivables and operating performance. Section 2.5 describes the results of the analysis of the filing firm's customers' wealth effects. Section 2.6 concludes.

2.2 Factors affecting supply chain contagion

2.2.1 Probability of reorganization

The probability that a filing firm emerges successfully from the Chapter 11 process and remains a customer or supplier in the long run is likely to play a major role in determining supply chain wealth effects. Lemmon et al. (2009) show that one of the main determinants of the outcome of the Chapter 11 process is the type of distress faced by the filing firm. Financially distressed firms are overburdened with debt, but their underlying business model is sound. In contrast, economically distressed firms have very poor operating performance and, despite relatively low leverage, have difficulty repaying debts. The combination of poor performance and the inability to repay debt implies that such firms may not be viable at the current scale in the long run even if their leverage is

[5] http://dealbook.nytimes.com/2008/12/12/markets-consider-domino-effects-if-gm-fails/
[6] http://online.wsj.com/article/SB10001424052702303745304576361663907855834.html

reduced. Lemmon et al. (2009) show that a financially distressed filing firm has a higher probability of emerging as a standalone entity from the Chapter 11 process compared to an economically distressed firm. Even if an economically distressed does survive, they show that recidivism in the first 3 years after emergence among economically distressed firms is three times as high as that among financially distressed firms.

Overall, economically distressed firms have questionable going concern value and thus, questionable chances of remaining a trading partner to the supplier or customer. From a supplier or customer's point of view, the present value of the cash flows forfeited is likely to be larger when the filing firm is economically distressed and hence, the contagion effect should be greater. I classify the sample of filing firms into economically distressed, mixed distressed (a combination of the two extreme types of distress), and financially distressed along the lines of Lemmon et al. (2009) to examine whether the wealth effects vary along these classifications.

Apart from the distress type, firms which are larger in size also have a higher probability of emerging successfully from Chapter 11. Larger firms may be more difficult to acquire due to possible financing constraints of buyers and more difficult to sell or liquidate due to the larger asset fire sale costs (Aghion et al., 1992). Hertzel et al. (2008) find that the wealth effects on suppliers or customers are much stronger when the filing firm's industry is also in distress. Suppliers and customers have greater difficulty in finding alternate trading partners if the entire industry is shrinking and the effects could be further magnified if the suppliers and customers have many trading partners in the filing firm's industry. I use the method of Lemmon et al. (2009) to combine all the factors discussed above to estimate an overall probability of reorganization for each bankrupt

firm in the sample. I hypothesize that the probability of successful reorganization of the filing trading partner is an important determinant of the supply chain contagion.

2.2.2 Other factors affecting suppliers and customers

Potential losses to suppliers and customers rise with the degree of dependence on the filing firm. In addition to direct losses from lost sales or increased input prices, if the filing firm is economically important for its supplier or customer, it may exert bargaining power on its nonfiling trading partners before and during bankruptcy. Wilner (2000) presents a model in which dependent suppliers are forced to offer more concessions during Chapter 11 negotiations to the distressed customer if it wants to maintain an enduring product market relationship. A priori, I expect the degree of reliance to be economically significant in explaining the level of contagion.

Firms selling (buying) specialized or unique goods to (from) the filing firm are likely to suffer negative wealth effects since such suppliers and customers are likely to have made more relationship-specific investments in the filing firm. Thus, sellers or buyers of nonspecific goods or services incur lower switching costs relative to those who buy or sell unique goods from the filing firm. Titman (1984) models such a situation where customers and suppliers of firms which produce unique goods anticipate greater spillover costs from distressed trading partners. He shows that such potentially higher switching costs lead to firms producing specialized goods to maintain lower leverage. Lower leverage implies lower costs of bankruptcy and less risk for the suppliers and customers and acts as an inducement for them to expend resources in relationship-specific investments. Supporting this, Titman and Wessels (1988) find that their proxy for

uniqueness of goods produced (ratio of research and development expenditure to sales) is negatively related to a firm's debt ratio. I hypothesize that if suppliers and customers sell or buy unique goods to the filing firm, supply chain contagion is higher for them. Following Titman and Wessels (1988), I use R&D expenditure as the measure of product specialization.

I also expect that a supplier's or a customer's contagion in response to its partner's distress will be affected by its own leverage. Banerjee, Dasgupta, and Kim (2008) show that both suppliers to, and customers of, firms operating in the durable goods industry maintain lower leverage as both have an incentive to present a low-risk image to their trading partners. Leverage magnifies the value of the equity relative to the total value of the firm and also increases the probability of distress in the supplier or customer, leading to higher bankruptcy costs. Opler and Titman (1994) find that highly leveraged firms lose greater market share to their more conservatively financed competitors during industry downturns. Lang and Stulz (1992) investigate the valuation effects of a bankruptcy announcement on the filing firm's industry and find that rivals of the filing firm with higher leverage suffer greater contagion effects. Thus, the valuation effects of contagion due to the filing firm on its suppliers and customers are likely to be amplified in the presence of higher level of debt in the supplier or customer's own capital structure.

I investigate the effects of both the filing firm's industry concentration and the supplier or customer's own industry concentration. If a filing firm operating in a concentrated industry liquidates, its suppliers have fewer switching alternatives for rerouting their supply. In addition, the filing firm's competitors have greater bargaining

power due to increased market share and may reduce input prices. If the filing firm survives, it may have greater bargaining power over the supplier during the negotiation process and can probably extract greater concessions since it is more difficult for the supplier to find a substitute customer.

The effects of the filing firm's concentration on its customers are more difficult to ascertain. As Hertzel et al. (2008) point out, shifting away of customer demand may drive the filing firm's distress in the first place. In that case, as customers are the reason for the distress, they are unlikely to be affected by the filing firm's industry concentration. But if customers face switching costs of finding other suppliers, surviving firms in the filing firm's industry may collude to reduce output, leading to increased prices for the customer. This is more likely to happen when the filing firm's industry concentration is higher and customers have fewer choices to reroute their purchases. Lang and Stulz (1992) also provide evidence that changes in market share due to Chapter 11 may lead to stock price effects, depending on the relative market shares of the firms in question. Examining the stock price effects on rivals to filing firms, they find that competing firms in industries which are more concentrated receive greater benefit from the removal of a competitor. They can earn higher rents by increasing prices when there is an increase in demand due to a competitor's filing. The effects of contagion may increase with the market share of the supplier or customer of the filing firm if the supplier or customer was initially able to extract greater rents from its filing trading partner.

2.3 Data and variables

I use the same sample of bankruptcies described in Chapter 1 and follow Lemmon, Ma, and Tashjian (2009) to classify each of the bankruptcies into financial-, economic- or mixed-type of distress. I sort bankrupt firms into deciles (within sample) and number them from zero to nine (zero being smallest and nine being largest) based on industry-adjusted EBITDA-to-assets averaged over the 2 years immediately preceding the filing year (year -3 and year -2) and repeat the same process using average leverage.[7] Industry adjustments to the EBITDA are made by subtracting the industry median EBITDA-to-total assets from the sample firms' EBITDA-to-total assets. Industry medians are calculated based on 4-digit SIC codes provided that five or more firms reside in the industry, excluding the sample firm. If the 4-digit SIC code contains fewer than five firms, the industry median is defined using the 3-digit SIC code and I continue to the 2-digit level until five firms are found. Leverage is calculated as the ratio of total liabilities to total assets averaged over year -3 and year -2. The rankings are then summed, resulting in a combined rank from 0 to 18, with firms in categories 0-5 being economically distressed and firms in categories 14-18 financially distressed. Those in the middle are classified as having mixed distress.

Table 2.1 shows distribution of distress type among filing firms by each decade. Across all three decades, 72% of all filing firms which have suppliers suffer from mixed distress, while the rest are equally divided into the financially and economically distressed groups. Correspondingly, 62% of all filing firms which have customers are in

[7] Since the sample is relatively small, if I do not find data for the past 2 years, I take the last available year before bankruptcy. I average over years -3 and -2 relative to filing because I look for distress dates in the year immediately prior to filing. In order to ensure that the accounting data used to calculate the probability of reorganization were already known to the market on the distress date, I do not use data from the year immediately prior to filing.

the mixed distress category, with 26% of the remaining firms economically distressed and the remainder financially. It can be seen that the percentage of economically distressed filing firms increases in the 2000- 2009 period. I use the predicted probability of reorganization from a logistic model which uses the combined rank of the filing firm as the measure of the distress type and log of its assets as a proxy for firm size. In addition, the ratio of R&D expenses to assets of the filing firm is used as a measure of the manager's information advantage in Chapter 11.

I also use an industry distress indicator variable which is similar to that used in Acharya, Bharath, and Srinivasan (2007) and Lemmon et al. (2009) in the logistic regression. The industry median (based on 4-digit SIC code) stock return is calculated for the 12 months immediately prior to the Chapter 11 filing. If there are less than five firms in that 4-digit SIC code, I use the 3-digit (or, if required 2-digit) SIC code to calculate the industry median. Industries that have median return lower than -30% are identified as distressed with an "industry distress" indicator variable equal to one. The last input to the prediction model acts as a control for the effects of economic downturns. An indicator variable is set to one if the sample firm filed for bankruptcy in a year in which the percent change in GDP was in the bottom quartile of GDP changes over our sample period.

For the nonfiling supplier and the nonfiling customer samples, I calculate their dependence on the filing firm by the dollar sales generated from the major customer of the reporting firm in the Compustat segment files (CSALE). When using CSALE to measure the degree of reliance of the suppliers on the filing firm, I normalize it by the supplier's sales. To capture the percent of purchases made from the bankrupt firm by a customer, I divide CSALE by the nonfiling customer's cost of goods sold. I measure this

variable for the year in which the match between the supplier-customer was made from the Compustat data.[8] Publicly traded firms are required to report the identity of any customer that comprises more than 10% of a firm's consolidated revenues along with the percentage of revenues generated, and if losing that customer would have a material adverse effect on the firm.[9] Table 2.2 shows the characteristics of the filing firms, their suppliers, and their customers. Comparing Panels A and B, it is evident that customers are a lot larger than suppliers and less dependent on their filing trading partner since only suppliers are required to report their significant customers and not the other way around. Banerjee, Dasgupta, and Kim (2008) also document that customers reported in this data are larger compared to the supplier which implies these customers may be less constrained if their suppliers are distressed rather than vice versa. This implies that effects on the customers may be limited.[10]

Supplier and customer industry concentrations are measured using the Herfindahl index of all the firms having the same 4-digit SIC code as the customer or supplier in question. Following Fee and Thomas's (2004) approach, I use binary variables to indicate that the supplier operates in a concentrated industry provided the Herfindahl Index is

[8]A potential concern is that the firms may not be related during the filing year. I cross check with a random sample of 10Ks and found that in each case, the relationship existed in the year of filing even if the Compustat match was made 5 years prior to the filing year. I do find that there is some variation in the percentage of sales generated by the major customer and some customers account for less than 10% of the sales in the filing year. In such cases, the measure of reliance will be larger than actual.

[9]As per the SEC website, http://www.sec.gov/rules/proposed/33-7549.htm, "since the adoption of SFAS No. 14, GAAP has required disclosure of revenues from major customers. SFAS No. 131 now (since 1997) requires issuers to disclose the amount of revenues from each external customer that amounts to 10 percent or more of its revenue as well as the identity of the segment(s) reporting the revenues. The accounting standards, however, have never required issuers to identify major customers. On the other hand, Regulation S-K Item 101 historically requires naming a major customer if sales to that customer equal 10 percent or more of the issuer's consolidated revenues and if the loss of the customer would have a material adverse effect on the issuer and its subsidiaries. Since we continue to believe that the identity of major customers is material information to investors, we propose to retain this Regulation S-K requirement."

[10] One potential concern about the filing firms and their suppliers/customers could be that both sides belong to the same industry. I redo all tests after excluding any such observations from the regressions and find that results remain qualitatively unchanged.

greater than 2000. I use a similarly defined indicator if the customer operates in a concentrated industry. To measure operating profitability, EBITDA is divided by total assets and trade credit is measured by total trade receivables divided by total sales. For the trade payables, I scale payables by COGS instead of sales. To calculate an approximate measure of a supplier's trade receivables generated from a particular filing customer, I multiply the percentage of sales generated by the filing customer by the trade receivables to sales ratio of the supplier. In order to measure the leverage of the supplier and the customer firms, I use the firm's ratio of total liabilities to total asset. The supplier or customer's R&D expenditure-to-asset ratio is used as a measure of product specialization. [11] All variables except reliance are calculated at the fiscal year end of the prefiling year (year -2) and at the fiscal year end of the year before that (year -1) and averaged.

The dependent variable in most of the regressions is the wealth effect of the filing firm's distress on its trading partner measured by event study cumulative abnormal return for the supplier or the customer over a 5-day period centered around a date on which relevant economic information about the distressed partner is released to the market. [12] I follow the approach of Hertzel et al. (2008) and compute abnormal returns using the

[11] R&D expenses to assets are being used as two different proxies: R&D to sales of the filing firm is used as a measure of the manager's information advantage for the filing firms. I also use it later as a measure of the product specialization of the supplier or customer of the filing firm. While the results presented are from using R&D as a variable in our logit regression, I drop this variable as it is insignificant and redo all tests. Results remain virtually unchanged. Further, these two are not contradictory since product specialization implies uniqueness of goods produced in which situation managers would have more firm-specific information than others.

[12] I present results for both individual suppliers or customers and also for portfolios formed for each bankrupt trading partner as individual firms contracting with the same filing firms may not be independent. I form portfolios of both the event study returns as well all our independent variables and the weights are equal to either CSALE/SALE for suppliers or CSALE/COGS for customers. The portfolios are formed such that customer weights in any customer portfolio would always add to one. Our results are qualitatively unchanged if we do not sum to one.

market-adjusted returns method (Brown and Warner, 1985), in which the daily abnormal return is the firm-specific return minus the value-weighted market return from CRSP.

2.4 Empirical results for suppliers to bankrupt firms

2.4.1 Abnormal returns to suppliers

Table 2.3 presents the subsample results according to the distress type of the filing customers. For each filing, equal-weighted customer and supplier portfolios are formed.[13] As the distress type changes from financial to economic, the abnormal returns decrease in magnitude. The CAR for the 5-day distress period is a significant -8.30% for economically distressed firms whereas it is an insignificant -0.68% for financially distressed firms. The corresponding CARs for the value loss period are -2.72% and 5.73% (both insignificant). The mixed type of distressed firms are in the middle with a significant -7.70% CAR (-4.50% during the value loss period, significant at 1% level). This provides preliminary evidence that suppliers to bankrupt firms which have a lower likelihood of emergence due to having low going concern values suffer a higher degree of contagion effects.

2.4.2 Supplier multivariate results

Table 2.4 presents the results from the logistic regression used to estimate the probability of reorganization of the filing firm.[14] In both models, the dependent variable equals one if the Chapter 11 outcome is reorganization and zero if the outcome is liquidation or acquisition. Model 1 includes the combined rank measure of profitability

[13] The average supplier and customer returns are the equal-weighted averages of these portfolio returns.
[14]Three utilities drop out from the logistic regression (corresponding to eight suppliers) leaving a sample of filing firms corresponding to 320 suppliers instead of 328

and leverage to proxy for the degree of financial or economic distress, while Model 2 breaks the combined rank measure into its two components. Consistent with the results in Lemmon, Ma, and Tashjian (2009), the combined rank variable is significant at the 1% level and larger firms are more likely to be reorganized rather than be liquidated or acquired. In contrast to Lemmon, Ma, and Tashjian (2009), firms in distressed industries are significantly less likely to reorganize. One reason for this could be that this sample starts from 1981 and includes filings in 2009, whereas theirs covers the period from 1991 to 2004. In our subsequent tests, the predicted probability of reorganization is the main explanatory variable.

Panel A of Table 2.5 shows the results of the OLS regression that explains individual supplier abnormal returns over customer distress and filing periods. All columns except (6) and (7) use abnormal returns measured over the distress period as the dependent variable. Column (6) uses abnormal returns for the filing period CAR as the dependent variable. Column (7) uses portfolio returns instead of returns to individual suppliers. Since the suppliers to a particular filing customer are not independent, the t-statistics presented are based on standard errors which control for industry and month of the year clustering.[15]

The independent variable in column (1) is the predicted probability from Model 1 in Table 2.4. The estimated coefficient on the probability of reorganization is positive and both economically and statistically significant. A 10% lower probability of reorganization is associated with a 2% drop in the CAR over the 5-day period. Multiplying the coefficient by the median market capitalization of the supplier firm sample translates to

[15] Industry is defined as 2-digit SIC code. Month of the year is used so that all suppliers for a particular bankruptcy are clustered because the filing date is same for all.

an approximate loss of $2.5 million ($18 million mean) over 5-days for each firm. In fact, the model suggests that if the customer has a sufficiently high probability of reorganizing successfully, the supplier may not have any negative wealth effects. In column (2), I investigate the hypothesis that a higher level of supplier dependence on a bankrupt customer is associated with a greater loss in firm value. The estimated coefficient for the percentage of sales generated by the filing customer is strongly negative and significant. Together, the measures of reliance and probability of reorganization explain over 13% of the variation in abnormal returns.

Column (3) adds the other independent variables which may have an impact on the abnormal returns.[16] As discussed in Section 2.2.2, more leveraged suppliers are expected to have more negative abnormal returns. However, while the coefficient is negative, it is not significant. The coefficient of R&D expenses over assets is significant and negative. This is consistent with the evidence in Titman and Wessels (1984) and Banerjee, Dasgupta, and Kim (2008): a higher level of product specialization and the consequent higher level of relationship-specific investments in the trading relationship leads to greater costs of switching to a new partner. I do not find any evidence that the supplier industry concentration affects its abnormal returns. However, I find that if the filing customer operates in a more concentrated industry, suppliers have higher returns. The positive coefficient is inconsistent with the hypothesis that it is more difficult for a

[16] If the suppliers are themselves operating in distressed industries, the negative wealth effects may be affected. In addition to the results tabulated and discussed here, I also add the indicator for the filing firm's distress to the base specification (in addition to the probability of reorganization) and an analogously defined distress indicator for the nonfiling supplier's industry. I find that, in addition to the probability of reorganization, the filing firm distress is significant (coefficient: -0.04) but does not reduce the coefficient on the prob. of reorg. significantly and does not lead to any significant increase in the adjusted R squared of the regression. The indicator for the supplier's industry distress is insignificant and does not change the adjusted R squared of the regression. In addition, I also add the supplier's (operating profit/assets X percent of sales from customers other than the filing firm) to explore whether the supplier's financial position can explain the wealth effects and find the variable insignificant

supplier to find a substitute customer in a more concentrated industry or that the filing firm's competitors exert greater bargaining power due to increased market share and reduce input prices.

Next, I examine whether the wealth effects on the supplier during its customer's distress period can be explained by the supplier's own outstanding trade receivables. The loss to the supplier is equal to the losses due to past loans made to the filing customer (in the form of trade credit) plus the present value of future lost sales (switching costs). In performing the tests, I calculate a proxy for the percentage of trade receivables outstanding from the filing customer by multiplying the percentage of supplier's sales generated from the filing customer by the supplier's trade receivables to sales.

This measure assumes that all sales made to the filing customer by the supplier are on credit. The results from adding this variable to the base model from column (3) in Table 2.5 is shown in columns (4) and (5) in Table 2.5. In column (5), the original percentage of supplier's sales to the filing customer is also included. This accounts for the portion of the loss that the supplier expects due to the probability of lower future cash flows due to lost sales. As shown in column (5), the total receivables variable is negative and marginally significant, suggesting that higher amounts of receivables due from the filing customer are interpreted by the market as a negative sign. The coefficient of the total sales percent to the filing customer variable is now slightly smaller in magnitude compared to column (3) but is still significant.

Column (6) uses the independent variables in the baseline model from column (3) to explain the abnormal returns over the filing period instead of the distress period. The results found are consistent with those described in Hertzel et al. (2008). In unreported

results, I also run a similar regression using the CARs from the value loss date and I find no significance for any of the variables except for the overall percentage of sales to the filing customer which is significantly negative. The adjusted R-squared from these regressions are much smaller than those found using the distress period abnormal returns, indicating that accurate measurement of the abnormal returns identifies contagion effects more effectively than in prior studies.

Because the results for the suppliers of a particular customer are not independent, column (7) of Table 2.5 presents results for the base regression specification but uses a portfolio of suppliers to each filing firm as a single observation. The weighting for forming the portfolios of the returns as well as the independent variables is based on the quantity of sales a supplier makes to the customer relative to its total sales, reflecting the degree of reliance of the supplier on the filing customer. Similar to column (3), firms with a higher chance of reorganization suffer from much smaller contagion effects. I add the other variables in our base model to column (7) but find that although firms with higher R&D expenditures to assets and lower customer concentration have lower abnormal returns over the distress period, the coefficients are insignificant.

In all the regressions discussed above, the supplier size, measured by its log of total assets, is included in case any of the other variables are acting as a proxy for the size. As can be seen in the results, supplier's size is uniformly unimportant in all the columns.

Panel B of Table 2.5 presents the results of a similar regression as in Panel A using subsamples of suppliers. In column (1), each filing firm which has five or more suppliers is included while column (2) presents the results obtained using only GM's

suppliers in the regression. The rationale behind these regressions is that similar cross-sectional characteristics should be important in this setup as in Panel A while controlling for the bankrupt firm itself. In column (1), I include dummies for each specific filing firm (15 in total) and the bankrupt-firm specific explanatory variables (probability of reorganization and customer industry concentration) are not included as independent variables. As can be seen from the results, the results mimic those obtained in Panel A using the full sample. Even with the reduced number of observations, the coefficients for the percentage of sales and R&D intensity of the supplier are negative and strongly significant. Column (2) reduces the sample much more drastically by including only suppliers to GM in the regression. Thirty-five supplier firms have the required data to be included in the regression and even in such a small sample, the results show the importance of percentage of sales as an explanatory variable for supplier contagion.

To summarize, I find that the probability of reorganization by itself can explain about 7% of the variation in the supplier abnormal returns over the relevant period. If I add the degree of reliance of the supplier on the customer, an extra 6% explanatory power is added. Together with the level of product specialization and the degree of concentration of the filing customer's industry, these are strong predictors of the degree of supplier contagion.

2.4.3 Long run event study results

In Table 2.6, I check the robustness of the results by implementing a buy and hold abnormal returns (BHAR)-based methodology (Barber and Lyon, 1997) to calculate the abnormal returns for suppliers. To find a matching firm for each supplier, the firm that

has the following characteristics is chosen: the match firm has the closest (but larger) market capitalization to the supplier in the year before filing, belongs to the same exchange, and has the same 2-digit SIC code. If the best matching firm does not have data for the event period, I replace it with the next best market-capitalization-based match. If the supplier happens to be the largest in its group, I use the second largest firm as the match. BHAR is calculated over 6-month and 3-month period prior to the filing date and the results are shown in Table 2.6.[17] As can be seen, only the 3-month individual supplier regression in column (1) has a significant F statistic and the regressions get noisier if we extend the time over which we base our event study or if we form portfolios. The probability of reorganization is strongly significant in these individual supplier-based regressions. The degree of reliance of the supplier has the expected negative coefficient but is not significant.

2.4.4 Operating performance of suppliers

In this section, I examine how the supplier operating performance is affected by the filing firm's distress. To calculate performance changes, I use a matched firm adjustment approach as in Barber and Lyon (1996) and Fee and Thomas (2004). Each supplier to a filing firm is matched with a control firm chosen on the basis of industry, asset size, and operating performance in the prefiling year. Starting with the entire universe of Compustat firms, all bankrupt firms and their suppliers and customers are eliminated. From the remaining firms, those in the same 2-digit SIC code and with asset size at the end of the year prior to bankruptcy between 25% to 200% of the supplier and

[17] The mean number of days between the distress date and filing date is 170 for all bankrupt firms which have at least one or more suppliers.

operating profit percentage between 90% to 110% of the supplier are identified. From the set of these possible matches, the one closest in operating performance to the supplier is chosen. If matches are not found at this stage, the industry screen is relaxed to a 1-digit SIC match requirement. At the next stage, the industry matching requirement is removed and matches are made only on the basis of asset size and performance. If I am still left with no match, I use the operating performance matching only at the last stage. If the match firm drops out, it is replaced with the next best available match. There is attrition in the sample each year as not all suppliers have more than one match using the most relaxed matching criteria and not all suppliers have data for all years on Compustat.[18] I am able to find 194 supplier-match firm pairs by this process in the year prior to customer bankruptcy.[19] I follow the performance of the entire sample of suppliers relative to that of their matching firm from the year prior to filing to 3 years after filing. The aim is to investigate whether supplier contagion can be attributed to loss of sales, increased costs, or overall declining margins.

Panel A of Table 2.7 presents the results in the form of differences between two successive years. The change in supplier sales and COGS that occurs from the year end before filing (time -1) to the fiscal year end after filing (year 0) year is insignificant. This could be so because many filing firms continue to operate as usual while under bankruptcy protection.[20] I find that SG&A costs of suppliers increase significantly in the

[18] As a check for survivorship bias in the results for this section, I fix all firms that have data in year +3 after the filing (varies from 76 to 61 depending on the particular variable) and redo the tests. While significance is diminished in these tests, the trends remain same.

[19] Out of the 194 matches, 157 are formed using two digit industry, size, and profit matching. Twenty-seven are formed using one digit industry matching, size, and profit matching while 10 are formed on the basis of size and performance only.

[20] To ascertain whether the results are driven by the denominator of the operating ratios instead of the numerators, I test whether the gross sales and total assets change significantly between year -1 and year 0. I find that total asset does not change significantly. Gross sales remain unchanged on a mean basis but on a

filing year and correspondingly, a significant 2% median (6% mean) decline in operating profitability is observed. Kalwani and Narayandas (1995) find that those suppliers who are in long-term relationships with their customer spend less on SG&A due to lower service costs, higher repeat sales, and higher overall effectiveness of selling expenditures. Taken together with these results, the evidence suggests that the distress of the filing firm may lead to an erosion (or at least a temporary disruption) of the supplier's combined efficiencies in reducing selling expenses. In addition, if the filing firm liquidates, suppliers have to search for and switch to new customers. There is also evidence of an overall worsening of the financial health of the suppliers from the Altman z-score measure which declines significantly (on a median basis) in the year of filing and continues to decline significantly in the year after filing as well. Along with the z-scores, the significant change in gross margins in the following year is also consistent with the suppliers being forced to change to new customers.[21] [22]

I examine the changes in operating profits across various subsamples (results not tabulated) and find that when divided according to the degree of reliance, suppliers which generate over 10% of their sales from the filing customer experience a significant drop in filing year operating profit while the drop is insignificant for the nonreliant sample. I also

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median basis, there is a drop in sales of $0.06 million which is significant at 5% level. Since the gross profit margin is the only ratio in which I use gross sales as the denominator, I redo this ratio using total assets as the denominator instead of the gross sales and find that the results remain qualitatively unchanged.

[21] Another possible reason for suppliers' rising SG&A in the year of filing could be provisions for doubtful debts, which is the current period expense associated with losses from credit sales and which may be included as part of SG&A expenses. This in turn could imply that uncollected accounts receivables may be responsible for the immediate changes in operating performance rather than lost sales or changed production processes.

[22] I also calculate the results from using the change in operating profit of the supplier as the dependent variable while using the same set of independent variables as in Table 2.5. I verify that the losses are proportional to the probability of reorganization of the firm and find that the coefficient of the prob. of reorganization is significant and similar in magnitude to that in our base model in Table 2.5.

examine whether suppliers operating in durable goods industry suffer more than those operating in nondurable goods industry. Banerjee et al. (2008) show that firms operating in durable goods industry make (and need their trading partners to make) more relationship-specific investments due to the nature of the goods in which they transact. Consistent with their results, I find that suppliers operating in durable goods industry experience larger and more significant drops in operating profit in the year of their customer's filing.

2.5 Empirical results for customers to bankrupt firms

In this section, I examine the wealth effects of the filing firm's distress on its customers. Panel B of Table 2.3 shows event study results using equally weighted customer portfolios around the 5-day period surrounding the distress date and the filing date. The overall customer sample has significant negative returns (-1.87% significant at the 1% level) around the distress date. While the effect is weaker relative to the supplier group (shown in Panel A), it is economically significant.

Customers may in fact cause the financial distress of their filing supplier firms by moving their demand away from these suppliers. If this is the case, then they are unlikely to be affected by the distress type of their supplier. As can be seen from the results in Panel B of Table 2.3, there is no clear ordering with respect to the distress type of the filing firm. The significant results in the mixed distress group could arise due to the relatively large sample size when compared to that of economically and financially distressed firms. Further, as detailed in Chapter 1, for any customer-supplier relationship, the supplier must be in the Compustat segment database. This implies that while the

supplier is reliant on the customer, the customers need not be reliant on the suppliers. [23] As shown in Table 2.2, suppliers account for only 2% (mean) and 0.2% (median) of the purchases made by the customers. Ellis, Fee, and Thomas (2010) find that suppliers who disclose their non-major customers in this data have a higher propensity to release the identity of those customers which are superior performers in their industry.[24] These factors imply that wealth effects in customers at the time of the filing firm's distress may be harder to detect in the data.

Table 2.8 reports the results from the OLS regressions using the abnormal returns from the distress period and the filing period. columns (1) and (2) present results for individual customers while column (3) presents the results for purchases/COGS weighted portfolios of customers, where each portfolio is based on all identified customers of a given bankrupt supplier firm. Column (4) presents results for individual customers using the abnormal return over the filing period. The probability of the filing firm's reorganization has a relatively smaller role in explaining the abnormal returns of customers when compared to the suppliers, although it is still significant. The level of product specialization measured by R&D expenditure and the degree of reliance are more important for downstream contagion.

When compared to the effects on suppliers to filing firms, the importance of reliance is diminished but the importance of R&D expenses is magnified. Switching costs due to product specialization turns out to be one of the main drivers of the wealth effects on the customer. Customers who are not reliant on the filing suppliers in terms of their

[23] This implies that suppliers to filing firms are, by construction, dependent on the filing firm. But customers to filing firms are not necessarily dependent on them. As the sample statistics for the sample of customers in Table 2.1 shows, the median purchases from filing supplier firms is about 0.2% of purchases made by the customer.

[24] Performance measured by ROA.

percentage of purchases may still be technologically dependent on their suppliers. This result is especially interesting in light of the findings of Ellis et al. (2010) that customers with lower R&D expenses are reported in this sample to reduce loss of proprietary information —this implies that product specialization may be even more important than what these results suggest.

2.6 Conclusion

I analyze the upstream and downstream flow of contagion when a firm is in distress and files for reorganization under Chapter 11. Specifically, I examine the cross-sectional factors that are important in such flow of distress. Examining whether the distress type of the filing firm is associated with the level of contagion, I find that suppliers to economically distressed firms have significantly more negative stock price effects than those to financially distressed firms do. This is consistent with the idea that a financially distressed firm can be viable if it reduces leverage whereas an economically distressed firm may not be viable as a going concern even with leverage reduction. In the multivariate tests, I find that the probability of emergence from Chapter 11, the degree of reliance, and level of product specialization are important for ascertaining the wealth effects of suppliers and customers. I further analyze suppliers' operating performance during and after the Chapter 11 filing of its major customer. I find that SG&A increases, operating profits decline, and Altman z-score decreases. This is consistent with deterioration in the overall financial health of the supplier because it incurs switching costs.

Table 2.1

Sample statistics of Chapter 11 filing firms

Panel A: Distribution of distress type of Chapter 11 filings by decade

Filing firms are grouped into distress types using the combined rank measure. Combined rank is constructed in a similar fashion as in Lemmon et al. (2009) by 1) averaging the filing firm's year -3 and year -2 industry-adjusted EBITDA-to-assets and ranking this into deciles among all filing firms in the sample, 2) averaging each filing firm's year -3 and year -2 leverage and ranking this into deciles among all filing firms in the sample, and 3) summing the two decile rankings. Industry-adjusted EBITDA-to-assets is the average of the filing firm's year -3 and -2 EBITDA-to-total assets minus the industry median EBITDA-to-total assets. The industry is defined at the 4-digit SIC level provided that it contains a minimum of five firms. Otherwise, the industry is defined at the 3-digit or 2-digit SIC level. Leverage is measured as average of total liabilities to total assets at year -3 and -2. Firms with combined rank of 0 to 5 are classified as economically distressed and those with combined rank between 14-18 are financially distressed. The remainders (6-13) are classified as mixed distressed firms.

Filing decade	Filing firms with at least one customer in the sample			Filing firms with at least one supplier in the sample		
	Average Percent economically distressed	Average Percent mixed distressed	Average Percent financially distressed	Average Percent economically distressed	Average Percent mixed distressed	Average Percent financially distressed
1981-1989	35	54	10	10	77	13
1990-1999	22	59	18	14	76	11
2000-2009	21	71	8	20	63	17

Table 2.1 continued

Panel B: Descriptive statistics of filing firms and their suppliers and customers

Combined rank is constructed similarly to Lemmon et al. (2009) by 1) averaging the firm's year -3 and year -2 industry-adjusted EBITDA-to-assets and ranking this into deciles among all Chapter 11 sample firms, 2) averaging the firm's year -3 and year -2 leverage and ranking this into deciles among all Chapter 11 sample firms, and 3) summing these two decile rankings. Industry-adjusted EBITDA-to-assets is the average of the sample firm's year -3 and -2 EBITDA-to-total assets minus the industry median EBITDA-to-total assets where both years are available. The industry is defined at the 4-digit SIC level provided that it contains a minimum of five firms. Otherwise, the industry is defined at the 3-digit or 2-digit SIC level. Leverage is measured as average of total liabilities-total assets at year -3 and -2. R&D-to-assets is the average of the ratio of research and development expense to total assets. Firm Size is the value of total assets averaged across year -3 and -2. Industry Concentration is the average Herfindahl index calculated using all the firms in the same 4 digit SIC code over year -3 and year -2. Trade Receivables are scaled by sales and averaged across years -3 and -2 while Trade Payables are scaled by cost of goods sold and averaged across years -3 and -2.

Variable	N	Mean	Median
Combined rank	215	8.72	8.00
R&D intensity	215	0.011	0.00
Leverage (Total liabilities/ Total assets)	215	0.79	0.76
Industry concentration	215	0.22	0.18
Industry adjusted EBITDA/ Total Assets	215	-0.02	-0.01
Filing firm size ($ millions)	215	1002	781
Trade receivables/ Sales	209	0.22	0.15
Trade payables/COGS	208	0.31	0.14

Table 2.2

Descriptive statistics of suppliers and customers

Panel A: Sample Statistics of Suppliers

Results are presented using the number of firms for which the data are available for that variable. Percentage of sales is the sales made from the bankrupt customer in the year in which the relationship is identified between the firms scaled by the total sales of the supplier in that year. Supplier size is the total assets of the firm averaged across year -2 and -1 relative to filing. Leverage is measured as average of total liabilities-total assets at year -2 and -1 relative to filing. Operating earnings to total assets is supplier EBITDA scaled by total assets and averaged over year -2 and year -1 relative to filing. Supplier trade receivables and payables are scaled by sales and cost of goods sold, respectively, and averaged across years -2 and -1 relative to filing. R&D intensity is supplier R&D expense/Total Assets averaged over year -2 and -1 relative to filing. Industry concentration is the Herfindahl index calculated using all the firms in the same 4 digit SIC code as the supplier.

Variable	N	Mean	Median
Percentage of sales generated from bankrupt trading partner	313	14.5	11.0
Supplier size ($ millions)	289	89	117
Supplier leverage (Total liabilities/ Total assets)	288	0.76	0.52
Supplier operating earnings-to-assets	279	-0.03	0.08
Supplier total receivables-to-total sales	277	0.22	0.16
Supplier total payables-to-total COGS	286	0.32	0.14
Supplier R&D intensity	320	0.05	0.00
Supplier industry concentration	290	0.21	0.15

Table 2.2 continued

Panel B: Sample Statistics of Customers

Results are presented using the number of firms for which the data are available for that variable. Percentage of purchases is the purchases made from the bankrupt supplier in the year in which the relationship is identified between the firms scaled by the total cost of goods sold of the customer in that year. Customer size is the total assets of the firm averaged across year -2 and -1 relative to filing. Leverage is measured as average of total liabilities-total assets at year -2 and -1 relative to filing. Operating earnings to total assets is customer EBITDA scaled by total assets and averaged over year -2 and year -1 relative to filing. Customer trade receivables and payables are scaled by sales and cost of goods sold respectively and averaged across years -2 and -1 relative to filing. R&D intensity is customer R&D expense/Total Assets averaged over year -2 and -1 relative to filing. Industry concentration is the Herfindahl index calculated using all the firms in the same 4 digit SIC code as the customer.

Variable	N	Mean	Median
Percentage of purchases made from bankrupt trading partner	248	2.4%	0.2%
Customer size ($ millions)	251	21569	28085
Customer leverage (Total liabilities/ Total assets)	251	0.68	0.66
Customer operating earnings-to-assets	248	0.11	0.11
Customer total receivables-to-total sales	240	0.27	0.14
Customer total payables-to-total COGS	248	0.53	0.14
Customer R&D to total assets	277	0.03	0.003
Customer industry concentration	255	0.22	0.18

Table 2.3

Supplier and customer abnormal returns over different distress types

The following tables contain average cumulative filing- and distress-period supplier and customer abnormal portfolio returns. Supplier and their customers are identified from firms reporting major customers in Compustat segment data. Any firm listing a filing firm as a customer in the 5 years prior to filing is labeled a supplier and vice versa. Equal-weighted customer and supplier portfolios are formed from the individual customers and suppliers for each filing. Distress day is identified as described in Section 3. Suppliers and customers are grouped into distress type using the Combined Rank measure. Combined rank is constructed similarly to Lemmon et al. (2009) by 1) averaging the firm's year -3 and year -2 industry-adjusted EBITDA-to-assets and ranking this into deciles among all Chapter 11 sample firms, 2) averaging the firm's year -3 and year -2 leverage and ranking this into deciles among all Chapter 11 sample firms, and 3) summing these two decile rankings. Industry-adjusted EBITDA-to-assets is the average of the sample firm's year -3 and -2 EBITDA-to-total assets minus the industry median EBITDA-to-total assets. Industry is defined at the 4-digit SIC level provided that it contains a minimum of five firms. Otherwise, the industry is defined at the 3-digit or 2-digit SIC level. Leverage is measured as average of total liabilities-total assets at year -3 and -2. Firms with combined rank of 0 upto 5 are classified as economically distressed and those with the measure between 14-18 are financially distressed. The remainders (6-13) are classified as mixed distressed firms. The abnormal returns are cumulated for days -2 to +2 relative to the filing- and distress- day, and daily abnormal returns are calculated using Market Adjusted Returns (MAR) with the CRSP value-weighted index as the market index. Standard errors are computed as described in Patell (1976). ***, **, or * indicates that the average is significantly different from zero (using a two-sided t-test) at the 1%, 5%, or 10% level (respectively).

Panel A: Abnormal Returns for Suppliers

Supplier Abnormal Returns				
	Full sample	Suppliers to economically distressed firms	Suppliers to mixed distressed firms	Suppliers to financially distressed firms
	Distress period			
CAR (-2, +2)	-6.93%***	-8.26%**	-7.74%***	-0.68%
# of suppliers	231	30	151	50
# of equally weighted portfolios	94	16	66	12
	Chapter 11 filing period			
CAR (-2, +2)	0.18%	2.59%	-0.02%	-2.26%
# of suppliers	226	30	150	46
# of equally weighted portfolios	95	16	67	12

Table 2.3 continued

Panel B: Abnormal Returns for Customers

Customer Abnormal Returns				
	Full sample	Customers of economically distressed firms	Customers of mixed distressed firms	Customers of financially distressed firms
	Distress period			
CAR (-2, +2)	-1.87%***	-1.47%	-2.18%***	-0.98%
# of customers	(222)	(40)	(155)	(27)
# of equally weighted portfolios	(112)	(25)	(73)	(14)
	Chapter 11 filing period			
CAR (-2, +2)	0.66%*	2.50%**	-0.09%	1.63%
# of customers	(229)	(40)	(161)	(28)
# of equally weighted portfolios	(119)	(25)	(80)	(14)

Table 2.4

Logistic regressions for probability of reorganization in Chapter 11

Columns 1 and 2 present the results from binomial logistic regressions where the dependent variable equals zero if the outcome of Chapter 11 is either liquidation or acquisition and equals one if the outcome is reorganization. Combined rank is constructed similarly to Lemmon et al. (2009) by 1) averaging the firm's year -3 and year -2 industry-adjusted EBITDA-to-assets and ranking this into deciles among all Chapter 11 sample firms, 2) averaging the firm's year -3 and year -2 leverage and ranking this into deciles among all Chapter 11 sample firms, and 3) summing these two decile rankings. Industry-adjusted EBITDA-to-assets is the average of the sample firm's year -3 and -2 EBITDA-to-total assets minus the industry median EBITDA-to-total assets. Industry is defined at the 4-digit SIC level provided that it contains a minimum of five firms. Otherwise, the industry is defined at the 3-digit or 2-digit SIC level. Leverage is measured as average of total liabilities-total assets at year -3 and -2. Industry distress is an indicator variable that equals one if stock return of the median firm in the industry is less than -30% in the 12 months immediately prior to Chapter 11 filing. Low GDP quartile equals one if the firm filed for Chapter 11 in any of the years that comprise the lowest quartile of GDP growth over our sample period. R&D-to-assets is the ratio of research and development expense to total assets and is averaged over year -3 and -2 prior to filing. Industry dummy variables are based on Fama and French's specification of 12 industries. The z-statistics for individual coefficients are reported in parentheses. "*", "**", and "***" indicate significance at the 10%, 5%, and 1% levels, respectively.

Variable	Liquid/M&A =0 Reorganize =1 (1)	Liquid/M&A =0 Reorganize =1 (2)
Intercept	-2.7326	-3.1775
	(-2.70)***	(-2.87)***
Pre filing industry adjusted EBITDA to TA		1.2252
		(0.68)
Pre filing Leverage		1.6400
		(2.14)**
Combined rank	0.1104	
	(2.62)***	
Log of total assets	0.3814	0.3956
	(2.80)***	(2.89)***
Industry distress	-0.8978	-0.8121
	(-2.52)***	(-2.28)**
Low GDP quartile	0.2373	0.2034
	(0.47)	(0.41)
R&D to assets	-0.9425	-0.7174
	(-0.23)	(-0.16)
Industry dummy variables	yes	yes
Observations	212	212
Prob > Chi Squared	0.0020	0.0046

Table 2.5

Supplier multivariate regressions

Panel A: OLS regressions for the CAR during various periods for suppliers

The dependent variable in Models 1 through 6 is the suppliers' abnormal cumulated return for days -2 to +2 relative to the distress- or filing-date of the bankrupt (customer) firm and is calculated using Market Adjusted Returns (MAR) with the CRSP value-weighted index as the market index. In column 7, for each bankrupt customer, all the suppliers are formed into portfolios with the weight equal to the sales to bankrupt customer/ total sales of supplier. Leverage is calculated as average of the supplier's total liabilities-to-total assets at year -1 and -2 relative to filing. R&D intensity is R&D expenses/ Total Assets for each supplier calculated as average of R&D expenses-to-total assets at year -1 and -2 relative to filing. Industry concentration is the Herfindahl indexes calculated for each filing firm or supplier firm using all the firms in the same 4 digit SIC code. Probability of reorganization is taken from the predicted values of the logistic regression presented in Table 4 and uses combined rank from Model 1. The percentage of sales is supplier sales generated from the filing firm in the year in which the relationship is identified between the firms scaled by the total sales of the supplier in that year. Supplier receivables from the bankrupt customer are estimated by multiplying the percentage of supplier's sales generated by the filing customer by the average trade receivables in year -2 and year -1 relative to filing. The t-statistics reported in parentheses control for supplier industry and month of the year clustering effects. "*","**", and "***" indicate significance at the 10%, 5%, and 1% levels, respectively.

Dependent Variable	CAR over (-2, +2) for individual suppliers over:						CAR over (-2, +2) for portfolios of suppliers over:
	Distress Date (1)	Distress Date (2)	Distress Date (3)	Distress Date (4)	Distress Date (5)	Chapter 11 Filing Date (6)	Distress Date (7)
Intercept	-0.1928	-0.1647	-0.1390	-0.1424	-0.1815	0.0429	-0.2831
	(-4.09)***	(-3.64)***	(-3.13)***	(-3.06)***	(-3.66)***	(0.93)	(-8.26)***
Supplier Leverage			-0.0089	-0.0147	-0.0219	-0.0275	0.0316
			(-0.26)	(-0.42)	(-0.59)	(-0.62)	(1.67)*
Supplier R&D Intensity			-0.1332	-0.1377	-0.1620	0.1810	-0.0114
			(-2.14)**	(-2.24)**	(-2.12)**	(1.62)	(-0.11)
Supplier Industry Herfindahl Index> 2000			-0.0094	-0.0065	0.0006	0.0080	0.0287
			(-0.60)	(-0.38)	(0.04)	(0.61)	(1.02)
Customer Industry Herfindahl Index> 2000			0.0329	0.0324	0.0410	-0.0184	0.0513
			(2.13)**	(1.98)**	(2.29)**	(-0.73)	(1.82)*

Table 2.5 continued

Dependent Variable	CAR over (-2, +2) for individual suppliers over:						CAR over (-2, +2) for portfolios of suppliers over:
	Distress Date (1)	Distress Date (2)	Distress Date (3)	Distress Date (4)	Distress Date (5)	Chapter 11 Filing Date (6)	Distress Date (7)
Customer Probability of Reorganization	0.1944	0.2095	0.2259	0.2256	0.2128	-0.0215	0.2709
	(3.30)***	(3.71)***	(4.38)***	(4.24)***	(3.96)***	(-0.41)	(3.48)***
Supplier Size			-0.0068	-0.0064	-0.0031	-0.0215	-0.0009
			(-1.67)*	(-1.48)	(-0.74)	(-0.42)	(-0.15)
Percent of Sales from Bankrupt customer		-0.2647	-0.2597	-0.2213		-0.0837	
		(-7.11)***	(-5.94)***	(-3.40)***		(-1.10)	
Supplier receivables from bankrupt customer				-0.0499	-0.0918		
				(-1.85)*	(-6.28)***		
# of observations	227	222	222	212	212	217	87
P value of F statistic	<.0001	<.0001	<.0001	<.0001	<.0001	0.1848	0.0012
Adjusted R squared	0.0729	0.1325	0.1466	0.1452	0.1132	0.0146	0.1791

Table 2.5 continued

Panel B: OLS regressions for the CAR for suppliers subsamples

The dependent variable in Models 1 through 6 is the suppliers' abnormal cumulated return for days -2 to +2 relative to the distress- or filing-date of the bankrupt (customer) firm and is calculated using Market Adjusted Returns (MAR) with the CRSP value-weighted index as the market index. In column 7, for each bankrupt customer, all the suppliers are formed into portfolios with the weight equal to the sales to bankrupt customer/ total sales of supplier. Leverage is calculated as average of the supplier's total liabilities-to-total assets at year -1 and -2 relative to filing. R&D intensity is R&D expenses/ Total Assets for each supplier calculated as average of R&D expenses-to-total assets at year -1 and -2 relative to filing. Industry concentration is the Herfindahl indexes calculated for each filing firm or supplier firm using all the firms in the same 4 digit SIC code. Probability of reorganization is taken from the predicted values of the logistic regression presented in Table 4 and uses combined rank from Model 1. The percentage of sales is supplier sales generated from the filing firm in the year in which the relationship is identified between the firms scaled by the total sales of the supplier in that year. Supplier receivables from the bankrupt customer are estimated by multiplying the percentage of supplier's sales generated by the filing customer by the average trade receivables in year -2 and year -1 relative to filing. The t-statistics reported in parentheses control for supplier industry and month of the year clustering effects. "*","**", and "***" indicate significance at the 10%, 5%, and 1% levels, respectively.

Dependent Variable	CAR over (-2, +2) for individual suppliers over distress date	
	All firms with 5 or more suppliers (1)	General Motors (Clustered Std Error only by industry of supplier) (2)
Intercept	0.0629	0.1870
	(3.34)***	(1.17)
Supplier Leverage	0.0069	0.1613
	(0.11)	(1.99)**
Supplier R&D Intensity	-0.3099	-0.3819
	(-5.36)***	(-0.51)
Supplier Industry Herfindahl Index> 2000	-0.0289	-0.0863
	(-1.13)	(-1.74)
Percent of Sales from Bankrupt customer	-0.2628	-0.4643
	(-2.23)***	(-3.47)***
Supplier Log (Total Assets)	-0.0068	-0.0281
	(-1.14)	(-2.06)**
# of observations	116	35
P value of F statistic	0.0761	0.2313
Adjusted R squared	0.0482	0.0641

Table 2.6

OLS regressions for the BHAR during various periods for suppliers

The dependent variable in models 1 through 4 is the buy and hold abnormal cumulated return for the months specified and are calculated following the Barber & Lyon (1997) method using a matched firm with the closest market capitalization and with the same exchange and 2 digit SIC code. Leverage is calculated as average of the supplier's total liabilities-to-total assets at year -1 and -2 relative to filing. R&D intensity is R&D expenses/ Total Assets for each supplier calculated as average of R&D expenses-to-total assets at year -1 and -2 relative to filing. Industry concentration is the Herfindahl indexes calculated for each filing firm or supplier firm using all the firms in the same 4 digit SIC code. Probability of reorganization is taken from the predicted values of the logistic regression presented in Table 4 and uses combined rank from Model 1. The percentage of sales is supplier sales generated from the filing firm in the year in which the relationship is identified between the firms scaled by the total sales of the supplier in that year. The t-statistics reported in parentheses control for supplier industry and month of the year clustering effects if individual suppliers are used and only for month of the year clustering effects if supplier portfolios are used. "*","**", and "***" indicate significance at the 10%, 5%, and 1% levels, respectively.

Dependent Variable	BHAR over three months prior to customer filing		BHAR over six months prior to customer filing	
	Individual supplier (1)	Sales to customer weighted portfolios (2)	Individual supplier (3)	Sales to customer weighted portfolios (4)
Intercept	-0.6797	-0.3272	-1.1403	-1.0825
	(-3.15)***	(-2.97)***	(-2.31)**	(-3.34)***
Supplier leverage	0.0973	-0.2395	0.1577	-0.1233
	(0.32)	(-1.50)	(0.82)	(-0.29)
Supplier R&D intensity	0.2588	-0.0041	0.0547	0.7326
	(0.87)	(-0.02)	(0.05)	(1.57)
Supplier industry Herfindahl Index> 2000	-0.0577	-0.1943	-0.0034	0.2073
	(-0.59)	(-1.51)	(-0.04)	(0.30)
Filing firm probability of reorganization	0.8169	0.4344	0.8888	0.8625
	(3.41)***	(1.77)*	(2.08)**	(2.09)**
Percent of sales from filing customer	-0.2114		-0.1509	
	(-0.68)		(-0.44)	
Filing customer industry Herfindahl Index> 2000	-0.0010	0.0241	0.2146	0.2618
	(-0.01)	(0.30)	(1.20)	(1.85)*
# of observations	217	88	214	86
P value of F statistic	0.0211	0.2535	0.1127	0.3054
Adjusted R squared	0.0412	0.0195	0.0205	0.0129

Table 2.7

Operating performance of suppliers

This table presents the matched firm-adjusted measures of operating performance for suppliers to filing firms. Each value is a difference found by subtracting the variable value of the corresponding matching firms. Matching firms are calculated using the Barber and Lyon (1996) method by choosing those matched firms which are closest to each sample supplier firm by industry (2 digit SIC code), size (50%-150% of sales) and past performance (measured as ROA in the year -1 prior to bankruptcy announcement). (Year n – Year n-1) difference of each measure is the difference between the values in the corresponding years. Year 0 is the year of bankruptcy announcement (see definition of timing convention in Section 3). Operating Profit is defined as the EBITDA while Altman Z score is equal to (3.3*Operating Earnings + 1.0*Sales + 1.4*Retained Earnings +1.2*Working Capital)/Total Assets. 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.

	Sales/Assets			COGS/Assets		Gross profit/Sales		
	# obs	Mean	Median	# obs	Mean	Median	# obs	Mean	Median
Value in year -1	194	-0.0914	0.0744	194	-0.0776	0.0464	194	-0.0139	0.0024
Change from year -1 to year 0	173	0.0896	-0.0097	173	0.1155	0.0025	173	-0.0260	-0.0070
p value (t test for means and Wilcoxon rank sum test for medians)		(0.53)	(0.20)		(0.40)	(0.38)		(0.19)	(0.16)
Change from year 0 to year 1	122	-0.5714	-0.0189	122	-0.5169	0.0050	122	-0.0545	-0.0187
p value (t test for mean and Wilcoxon rank sum test for medians)		(0.25)	(0.86)		(0.28)	(0.47)		(0.03)**	(0.13)
Change from year 1 to year 2	104	0.8869	0.0061	107	0.8252	0.0036	107	0.0379	0.0142
p value (t test for mean and Wilcoxon rank sum test for medians)		(0.28)	(0.16)		(0.29)	(0.46)		(0.32)	(0.07)*
Change from year 2 to year 3	76	0.0651	0.0124	76	0.0631	0.0136	76	0.0020	0.0095
p value (t test for mean and Wilcoxon rank sum test for medians)		(0.28)	(0.40)		(0.22)	(0.22)		(0.96)	(0.51)

Table 2.7 continued

	SGA/Assets			Operating profit/Assets			Altman z-Score		
	# obs	Mean	Median	# obs	Mean	Median	# obs	Mean	Median
Value in year -1	159	-0.0170	0.0053	194	-0.0002	0.0000	167	-0.3440	0.0994
Change from year -1 to year 0	143	0.0425	0.0030	172	-0.0593	-0.0203	144	-0.0431	-0.1153
p value (t test for means and Wilcoxon rank sum test for medians)		(0.01)***	(0.03)**		(0.01)***	(0.00)***		(0.86)	(0.04)**
Change from year 0 to year 1	95	-0.0228	0.0090	121	-0.0142	-0.0116	108	-0.9555	-0.1182
p value (t test for mean and Wilcoxon rank sum test for medians)		(0.61)	(0.19)		(0.63)	(0.21)		(0.05)**	(0.03)**
Change from year 1 to year 2	83	0.0076	-0.0022	105	-0.0262	0.0088	97	0.5431	0.0562
p value (t test for mean and Wilcoxon rank sum test for medians)		(0.61)	(0.72)		(0.56)	(0.14)		(0.51)	(0.60)
Change from year 2 to year 3	61	0.0312	0.0028	72	-0.0252	0.0135	66	-0.6268	-0.0310
p value (t test for mean and Wilcoxon rank sum test for medians)		(0.16)	(0.35)		(0.43)	(0.20)		(0.09)*	(0.66)

Table 2.8

Customer multivariate regressions

The dependent variable in models 1,2 and 4 is the customer's abnormal cumulated return for days -2 to +2 relative to the distress-, and filing-date of the bankrupt (supplier) firm and is calculated using Market Adjusted Returns (MAR) with the CRSP value-weighted index as the market index. In column 3, for each bankrupt supplier, all the customers are formed into portfolios with the weight equal to the purchases from bankrupt supplier/ total COGS of customer. Leverage is calculated as average of the customer's total liabilities-to-total assets at year -1 and -2 relative to filing. R&D intensity is R&D expenses/ Total Assets for each customer calculated as average of R&D expenses-to-total assets at year -1 and -2 relative to filing. Industry concentration is the Herfindahl's indexes calculated for each filing firm or customer firm using all the firms in the same 4 digit SIC code. Probability of reorganization is taken from the predicted values of the logistic regression presented in Table 4 and uses combined rank from Model 1. The percentage of purchases is the purchase made from the filing firm in the year in which the relationship is identified between the firms scaled by the total COGS of the customer in that year. The t-statistics reported in parentheses control for supplier industry and month of the year clustering effects. "*","**", and "***" indicate significance at the 10%, 5%, and 1% levels, respectively.

Dependent Variable	CAR over (-2, +2) for individual Customers over period defined below:			
	Distress Date (1)	Distress Date (2)	Distress Date Portfolio (3)	Chapter 11 Filing Date (4)
Intercept	-0.0536	-0.0447	-0.0792	0.0256
	(-3.05)***	(-1.23)	(-1.41)	(0.59)
Customer Leverage		0.0004	-0.0127	0.0373
		(0.01)	(-0.47)	(1.52)
Customer R&D Intensity		-0.4456	-0.3873	0.0710
		(-5.75)***	(-3.14)***	(0.57)
Customer Industry Herfindahl Index> 2000		-0.0005	-0.0063	0.0040
		(-0.04)	(-0.44)	(0.36)
Supplier Industry Herfindahl Index> 2000		0.0009	0.0084	0.0035
		(0.06)	(0.61)	(0.34)
Supplier Probability of Reorganization	0.0544	0.0390	0.0722	-0.0208
	(2.40)**	(1.64)*	(2.05)**	(-0.75)
Customer Size		0.0015	0.0030	-0.0034
		(0.59)	(0.87)	(-0.99)
Percent of Sales from Bankrupt supplier		-0.0559		-0.0350
		(-2.01)**		(-2.81)***
# of observations	207	201	99	213
P value of F statistic	0.0131	<.0001	0.0024	0.3028
Adjusted R squared	0.0249	0.1559	0.1334	0.0066

CHAPTER 3

EFFECT OF CUSTOMER DISTRESS ON TRADE CREDIT POLICY OF SUPPLIERS

3.1 Introduction

Trade credit is an important source of short-term credit for firms in the U.S. Rajan and Zingales (1995) document that 18% of the total assets of U.S. firms in 1991 consisted of accounts receivables. More recently, Shenoy and Williams (2011) document that during 1980 to 2009, the median value of accounts receivables to assets was 16% for nonfinancial firms. The corresponding value for accounts payable to assets was 13%. Globally, Demirguc-Kunt and Maksomovic (2001) found that in countries such as Germany, France, and Italy, trade credit exceeded a quarter of total corporate assets. Given that it is such an important source of short-term financing, continued availability of trade credit may be a key determinant of whether a financially distressed firm survives when its ability to raise funds by other means is severely curtailed.

Extant research finds that trade credit can act as a substitute for financial credit. Meltzer (1960) provides evidence that trade credit increases under tight monetary conditions. Petersen and Rajan (1997) posit that since the supplier's value is determined by future cash flows from sales to customers, they prefer that their customer not be

liquidated and have an incentive to maintain credit sales to their distressed customers. They show empirically that credit-constrained customers avail more trade credit from their suppliers. Wilner (2000) shows theoretically that when suppliers are relatively more dependent on their customers, they grant more credit to financially distressed customers than banks do. Frank and Maksimovic (2005) also show theoretically that, in equilibrium suppliers may respond to distressed customers by increasing the level of trade credit.

At the same time, a supplier also has the incentive to secure its own cash position and cut off trade credit or at least tighten its terms to minimize potential losses in bankruptcy. Indeed, extant literature provides evidence that such trade credit relationships can be vehicles for transmission of credit contagion. Jorion and Zhang (2009) find that when a firm files for Chapter 11, its largest outstanding trade creditors experience significant negative stock price effects and that such counterparty risk is a significant determinant of default clustering among industrial firms in the U.S. As described in Ng, Smith, and Smith (1999), a trade credit contract, in its simplest form, specifies that full payment is due within a specified time after delivery. Invoicing occurs either around the date of delivery or at the end of a billing cycle and more complex contracts could also include early payment discount terms. Suppliers who operate on an invoice to invoice basis are under no obligation to continue selling to the customer in financial distress. Among other means, they can request payment in advance, ask for a letter of credit, or switch to cash-on-delivery terms if they feel that the customer's financial position is not strong enough to ensure payment for continued supply.

Therefore, the question arises as to why in some situations suppliers do not stop supporting the financially distressed customers while in others trade credit is reduced or

even cut off? Anecdotal evidence is available on both sides: for instance, in September 2010, CFO.com reported in an article that "…small companies selling to large companies often bend over backward to keep the business, to the point of loosening credit terms to customers on the brink of insolvency."[1] In contrast, in early December 1985, Atlantic Richfield Co., a firm buying and selling crude oil and refined products to Texaco, sent an internal letter urging all its staff to use "prudence" in doing business with Texaco due to its ongoing litigation with Penzoil (Cornell and Shapiro, 1987). Cornell and Shapiro (1987) further cite William C. Rusnack, Arco's senior vice president of marketing and employee relations that the "The basic message was that we'll continue doing business with Texaco, but if we can make the same transaction with someone of less risk, then we should choose someone else." Texaco filed for Chapter 11 in April 1987 but suppliers were dubious about its prospects 2 years prior to that.

One of the problems with existing studies is that the quantity of trade credit actually extended by the supplier cannot be observed; instead, most studies draw inferences from the observed accounts receivables of supplier firms or from accounts payables of the distressed customer. For instance, Molina and Preve (2011) find that firms in financial distress use a significantly larger amount of trade credit to substitute alternative sources of financing. Shenoy and Williams (2011) also find that suppliers whose main customers lack access to bank lines of credit and have a higher probability of bankruptcy as measured by the z-score have higher amounts of outstanding trade credit. However, since the actual trade credit policy of the supplier towards its distressed customer is unobservable, it is unclear whether suppliers actually intend to support their distressed customers or whether customers simply delay repaying their suppliers. Both of

[1] http://www.cfo.com/article.cfm/14526997/?f=rsspage

these would lead to increased accounts payables of distressed customers as well as increased receivables for their suppliers.

In this study, I add to the literature by studying whether the observed trade receivables of supplier to distressed customer vary according to the distress type of the customer. I hypothesize that when suppliers are trading with purely financially distressed customers, they will continue to extend greater support rather than when they are supplying to purely economically distressed firms since the chances of survival in the long run for the former group of firms are relatively higher. As discussed in the preceding chapter, financially distressed firms are overburdened with debt but their underlying business model is sound. In contrast, economically distressed firms have very poor operating performance and despite relatively low leverage, have difficulty repaying debts. The combination of poor performance and the inability to repay debt implies that such firms may not be viable at the current scale in the long run even if their leverage is reduced. Overall, economically distressed firms have questionable going concern value and thus, questionable chances of remaining a trading partner to the supplier or customer.

From a supplier's point of view, the present value of the cash flows forfeited is larger when the filing firm is economically distressed since the probability that the customer survives as a trading partner is relatively low. In this case, intuitively, the incentive for the supplier to "cut its losses" is greater than if it assesses that the distressed customer is likely to reemerge and continue as a trading partner. This approach does not completely avoid the problems associated with the other studies since it also relies on observed trade receivables of suppliers. However, I find that suppliers are indeed significantly increasing their trade credit levels when supplying to financially distressed

customers but not when they are supplying to economically distressed customer. The probability that a supplier is simply passively recording an increase in trade receivables due to nonpayment is lower. It is more likely that the supplier is actively deciding whether or not to extend credit to these distressed customers.

Using distressed firms which filed for bankruptcy adds an extra layer of complexity to the test. Under U.S. bankruptcy laws, once a customer files Chapter 11, outstanding trade credit is usually treated as an unsecured claim, the class of claims which have the lowest priority for payment under Chapter 11. However, in practice bankruptcy courts may prioritize payment to suppliers so that they continue to supply to the bankrupt firm during the reorganization process.

This implies that when the Chapter 11 process is involved, the incentives of the suppliers may vary from case to case; for example in August 2011, three of Saab's suppliers sought to push it into involuntary bankruptcy so that they could claim 12 million Euros of unpaid claims.[2] If the value of claims is high enough, the supplier may prefer to jeopardize future business with the customer in favor of being paid currently. In other cases, such as when a customer is facing tort liabilities such as asbestos claims, suppliers may prefer that the firm file Chapter 11, not to receive the value of their claims, but to make sure that the going concern value of the firm is preserved in the long run. The level of trade credit extended could thus be jointly determined by the incentives of both the supplier and the filing customer characteristics. In this study, I abstract from such problems and instead interpret my results with caution. An increased level of trade

[2] http://www.thetruthaboutcars.com/2011/08/three-suppliers-request-saab-bankruptcy-august-16-is-judgement-day/ SAAB has not yet filed as of Nov 6th 2011 and is trying to make alternate arrangements for financing. In the event of a bankruptcy, the filing would be in Europe.

receivables for suppliers to financially distressed customers is observed in the data and no significant increase is observed for the suppliers to economically distressed customers. While this does not rule out other potential explanations completely, it is consistent with the explanation that suppliers assess the chances of long-run survival of their trading partner while deciding to extend trade credit.

The remainder of this chapter is organized as follows: Section 3.2 discusses the current U.S. bankruptcy laws relating to trade credit while Section 3.3 provides an overview of the literature relating to trade credit, especially in the context of distressed firms. Section 3.4 presents the data and methodology while Section 3.5 presents the main results. Section 3.6 concludes.

3.2 Treatment of trade credit under U.S. bankruptcy laws

Once a customer files Chapter 11, outstanding trade credit is usually treated as an unsecured claim, the class of claims which have the lowest priority for payment under Chapter 11. The Bankruptcy Code Section 503(b)(9) states that the court shall allow as an administrative claim the value of any goods received by the debtor within 20 days before the commencement of a case. The seller also has a right to reclaim any goods sold (up to 45 days before the filing date) in the ordinary course of business provided the supplier asks in writing within 20 days after the filing. But the supplier's claim to reclamation is behind in priority to those of the secured creditors who have security interests in the goods.

After filing for Chapter 11, a firm may also decide that some of its vendors are critical for it to remain in business. A critical vendor motion filed by the debtor provides

that the vendor will receive payment on the prepetition claim. In general, other creditors of the same priority do not get paid on their prepetition claims in Chapter 11, except through a plan of reorganization. However, the equality of payment rule can be violated to allow insolvent debtors to pay vendors whose cooperation is deemed essential to a debtor's continued operations and reorganization. Once the order is approved, the vendor that agrees to the critical status has to continue selling to the filing firm on terms which are either equal to or better than the ones in place before the filing.

However, these rules apply only to the suppliers without any type of executory contract such as a long-term supply agreement. In this situation, the automatic stay after the filing stops the vendor from terminating the contract postpetition or from seeking payment during the bankruptcy. Section 365 of the Code grants the bankruptcy trustee (the filing firm as debtor-in-possession) the option to assume or reject any executory contract or unexpired lease. If the trustee or the debtor firm chooses to assume the executory contract, the vendor has to be paid in full but if the contract is rejected, this rejection constitutes a material breach allowing the supplier to sue for damages. However, the damage claim resulting from rejection is treated as a prebankruptcy claim against the debtor and will only be paid in the bankruptcy distribution as whatever fractional rate is due to general unsecured claims (Andrade, Henry, and Nanda, 2011).

3.3 Literature review

There are many theories to explain the prevalence of trade credit usage such as price discrimination (Brennan, Macksimovic, and Zechner, 1988) or the existence of transaction costs (Ferris, 1981). However, one of the most important ones is that suppliers

may have an advantage over other types of creditors in obtaining information about their customers, i.e., sellers may be better informed about the customer firm's ability to repay due to their ordinary course of business with the trading partner (Biais and Gollier, 1997; Brennan et al., 1988; Frank and Maksimovic 1998; Mian and Smith, 1992; Petersen and Rajan, 1997; Smith, 1987). Apart from an improved ability to gather information, suppliers may also be better able to control buyer behavior since they can cut off supplies, especially if there are few alternatives available to the buyer. Further, the supplier can also seize goods already if the customer defaults. If the supplier operates in the same or in a related industry as the defaulting customer, it will be able to extract a higher price for such collateral compared to other credit institutions. Cunat (2007) shows that due to this ability, suppliers may have a lending advantage relative to banks.

Many of these studies discuss what happens when the customer is in distress and potentially unable to repay debt on time. Wilner (2000) presents a model in which dependent suppliers are forced to grant greater credit to financially distressed customers as well as offer more concessions during Chapter 11 negotiations if it wants to maintain an enduring product market relationship with the filing customer. Frank and Maksimovic (2005) also model a situation where extension of trade credit for a distressed customer is the equilibrium outcome for suppliers.

Petersen and Rajan (1997), who examine small business data reported in the NSSBF survey and analyze trade receivables, posit that since a customer's liquidation is expensive for the supplier, the latter has an implied equity stake in their customer and may therefore extend trade credit to the financially distressed customer. They show empirically that credit-constrained firms such as those with weak banking relationships

take more trade credit from their suppliers. Meltzer (1960) was among the first to discuss the effects of economic cycles and trade credit substitution. He found that in times of monetary contractions, trade credit increases. Nilsen (2002) shows that during monetary contractions, smaller firms are more likely to rely on supplier credit. Molina and Preve (2011) find that firms in financial distress use a significantly larger amount of trade credit and that even though trade credit is relatively expensive as a source of financing, substitution occurs for other forms of credit when a firm is in distress. Shenoy and Williams (2011) find that suppliers whose main customers lack other sources of credit and have a higher probability of bankruptcy and are relatively more financially constrained have higher amounts of outstanding trade credit. All these theoretical and empirical studies suggest that suppliers may support their distressed customer by providing them with much needed financing when other forms of credit have dried out. On the other hand, literature also points out that distressed firms may have difficulties in obtaining trade credit as their suppliers have an incentive to cut them off to protect their own cash cycles (Altman, 1984; Andrade and Kaplan, 1998; Baxter, 1967).

Since both sides of the story have supporting evidence, it leads to the conjecture that perhaps supplier firms neither cut off their distressed customers totally nor do they keep extending trade credit indiscriminately. As discussed earlier, suppliers are potentially able to gather more accurate information about their buyers compared to other lenders and casual observation suggests that many suppliers take action against their customer even prior to default. For instance, Sharp which was a supplier to Best Products Incorporated sued for $2.5 million worth unpaid supplies a few days before the latter filed for Chapter 11 on October 5, 1996. Other steps including changing delivery terms to

cash on delivery or tightening credit terms or even refusing to supply altogether to the insolvent customer are also likely. In such a situation, it is likely that a supplier will assess the likelihood of the distressed customer surviving through the distress period and remaining a trading partner. If the present value of future cash flows is deemed high enough, then the supplier will continue to support the customer. For instance, Best Products Incorporated did not emerge from the Chapter 11 process as a standalone entity. This leads to the following hypothesis: Suppliers will have higher amounts of outstanding trade credit when distressed customers are financially distressed (and therefore, have a higher chance of emerging from the Chapter 11 process as a standalone entity) rather than when customers are economically distressed (and have a lower chance of emerging from the Chapter 11 process as a standalone entity).

3.4 Data and methodology

I start with the sample of bankrupt firms used in Chapters 1 and 2 which consists of 215 bankruptcies filed between the period of 1981 to 2009 as well as the corresponding suppliers to these bankrupt firms. In this chapter, I only investigate the trade credit extension policy of suppliers to distressed customers. Thus, the sample of firms which are customers to distressed suppliers is not considered here. To measure trade credit extended by suppliers, I scale the accounts (trade) receivables of suppliers in each period by the sales made in the same period. Ideally, credit sales would be used but since only total sale is observable, it is used as the proxy. I calculate the change in the supplier's trade credit in the prefiling year as well as in 4 successive postfiling years. In order to avoid any mean reversion, all values of trade credit are measured on a matched

firm basis as in Barber and Lyon (1996) and Fee and Thomas (2004). Each supplier is matched with a control firm chosen on the basis of industry, asset size, and operating performance in the prefiling year. Starting with the entire universe of Compustat firms, all bankrupt firms and their suppliers and customers are eliminated. From the remaining firms, those in the same two digit SIC code and with asset size at the end of the year prior to bankruptcy between 25% to 200% of the supplier and operating profit percentage between 90% to 110% of the supplier are identified. From the set of these possible matches, the one closest in operating performance to the supplier is chosen. If matches are not found at this stage, the industry screen is relaxed to a 1-digit SIC match requirement. At the next stage, the industry matching requirement is removed and matches are made only on the basis of asset size and performance. If there is still no match, I use the operating performance matching only at the last stage. If the match firm drops out, it is replaced with the next best available match. There is attrition in the sample each year as not all suppliers have more than one match using the most relaxed matching criteria and not all suppliers have data for all years on Compustat.

Table 3.1 presents the trade credit statistics of the customers which are the bankrupt firms as well as their suppliers. These figures are averaged over the two fiscal years preceding the one in which the bankrupt firm filed Chapter 11. The mean payables (accounts payables scales by cost of goods sold) of the bankrupt firms is 31% (14% median). Fisman and Love (2003) create stock and flow measures of industry-wide importance of trade credit usage and find that in their sample, trade credit is more important as a source of financing than short-term debt.[3] They found that motor vehicle

[3] Stock Measure= Accounts Payables/Total Assets Flow Measure=Change in Account Payables/Total Assets

industry and petroleum industry were the largest users of trade credit in the 1980s. Accounts payables made up nearly 12% of their assets. At the lower end of the spectrum, drug, leather, pottery, pulp, and paper manufacturers used the least trade credit. Payables amounted to around 6% of their assets. Demirgüç-Kunt and Maksimovic (2001) show that Canada, US, Ireland, and the United Kingdom are heavy users of trade credit relative to short-term debt and in their sample, US firms have slightly more than 14% of their sales tied up in the form of receivables.[4] From Table 3.1, a supplier has, on average, 22% of its sales as outstanding receivables. Such large levels of trade credit implies that in addition to the loss of future sales, it is likely that trade creditors have extended credit prior to the Chapter 11 filing that may not be repaid in full. Given the quantities of potential losses, the decision to keep extending trade credit, with or without any modification of terms, is unlikely to be a passive decision for the supplier.

3.5 Results

3.5.1 Univariate results

Panel A of Table 3.2 presents annual univariate measures of match firm adjusted accounts receivables for suppliers from the prefiling year to 3 years after the customer files for Chapter 11. I find that the only year in which the mean (significant at the 5% level) and median (insignificant) accounts receivables of suppliers increases is from the year before filing to the year of filing. This is consistent with suppliers extending trade credit to customers which are in distress. However, since actual credit sales amount is unobserved, this is also consistent with distressed customer firms taking more time to pay their creditors back and trade receivables remaining longer on the books of the supplier.

[4] Sample goes from 1989-1996

As discussed in prior sections, existing empirical evidence such as that in Petersen and Rajan (1997) shows that suppliers extend trade credit to financially constrained customers. Similarly, Molina and Preve (2011) and Shenoy and Williams (2011) also find that financially distressed customers receive support from its suppliers in the form of trade credit. However, it should be noted that suppliers, especially those which operate on an order-to-order basis always have the opportunity to change their terms of sale and not extend trade credit. Figure 3.1 plots the match-firm adjusted trade receivables of all supplier firms for which data for seven consecutive quarters around the filing period were available.[5] As can be seen, supporting the results in Table 3.2, the graph shows that the quantity of trade receivables for the suppliers increases for three quarters prior to filing.

Panel B of Table 3.2 shows the results of splitting the sample by the type of distress of the filing customer. As discussed in Chapter 2, I use Lemmon, Ma, and Tashjian's (2009) method to classify each bankruptcy into financial-, economic- or mixed-type of distress. I sort the bankrupt firms into deciles (within sample) and number them from 0 to 9 (0 being smallest and 9 being largest) based on industry adjusted EBITDA-to-assets averaged over the 2 years immediately preceding the filing year and repeat the same process using average leverage.[6] Industry adjustments to the EBITDA are made by subtracting the industry median EBITDA-to-total assets from the sample firms' EBITDA-to-total assets. Industry medians are calculated based on 4-digit SIC codes provided that five or more firms reside in the industry, excluding the sample firm. If the

[5] All 32 suppliers for which data are available are used in the graph. None of these have long-term contracts with their bankrupt customer. The number of firms is restricted to forty-two because many Compustat firms do not report the value of RECTRQ. Ten more firms drop out because these have do not have data for all 7 quarters.

[6] Since our sample is relatively small, if we do not find data for the past 2 years, we take the last available year before bankruptcy if it happens to be in the year just before filing.

4-digit SIC code contains fewer than five firms, we define the industry median using the 3-digit SIC code and continue to the 2-digit level until five firms are found. Leverage is calculated as the ratio of total liabilities to total assets. The rankings are then summed, resulting in a combined rank from 0 to 18, with firms in categories 0-5 being economically distressed and firms in categories 14-18 financially distressed. Those in the middle are classified as having mixed distress.

As can be seen, only the group of suppliers to financially distressed firms has consistent and significant increases in both the mean and the median trade receivables. This is consistent with the notion that it would be more beneficial for a supplier to extend trade credit to customers who are more likely to remain solvent. Since a matched sample method is used, the results show that when compared to the supplier of a healthy firm, the supplier to a financially distressed firm actually has a higher level of trade credit outstanding. Similarly, on the economically distressed side, the match firm's customer has a higher relative likelihood of being distressed (since economic distress is due to low leverage and low profits and due to customer demand shifting away). Hence, the insignificant change in the receivables is expected since both the sample supplier and its match are supplying to a distressed customer. Unreported results from splitting the sample along reliant and nonreliant suppliers show that the former group has a significant (on a mean basis) increase in their trade credit whereas nonreliant customers have insignificant changes.

Since the number of firms in the economically distressed and the financially distressed category are small, Table 3.3 presents the results from changing the classification scheme of the distress type. Instead of firms in categories 0-5 being

economically distressed, Panel A presents results where 0-7 are classified as economically distressed and firms in categories 11-18 financially distressed (instead of 14-18). The remaining firms are classified as mixed distress. Panel B presents results from using a classification scheme where the mixed category is cut out: firms having combined rank measure between 0-9 are economically distressed firms while those with combined rank between 10 and 18 are financially distressed. While we see that in Panel A of this table, the results from the financially distressed group actually becomes stronger by increasing the number of firms in the group, in Panel B, the categorization is coarse and even though the number of firms rises, the results are only marginally significant though still positive for the financially distressed group. This shows that only those which are actually near the top end of the combined rank spectrum record a significant increase in their trade credit receivables. This is consistent with suppliers actively deciding to support these firms instead of abandoning them.

3.5.2 Multivariate results

Table 3.4 presents results from the following multivariate regressions where prob. of reorg. is used as an abbreviation for the probability of reorganization calculated from the logit model as shown in Table 2.4.

$$\text{Supplier receivables}_{\text{pre-filing-year}} = \alpha + \beta_1 \text{prob. of reorg} . + \beta_2 \text{controls} + \varepsilon \quad (1)$$

$$\text{Supplier receivables}_{\text{filing year}} = \alpha + \beta_1 \text{ prob. of reorg.} + \beta_2 \text{controls} + \varepsilon \quad (2)$$

$$\Delta \text{(supplier receivables)}_{\text{pre-filing to filing year}} = \alpha + \beta_1 \text{ prob. of reorg.} + \beta_2 \text{ controls} + \varepsilon \quad (3)$$

Column (1) uses the match-firm-adjusted trade receivables of the supplier in the prefiling year as the dependent variable (equation 1 above), column (2) uses the match-firm-adjusted trade receivables from the filing year (equation 2 above) while column (3) uses the change in match-firm-adjusted receivable from the prefiling year to the year of filing (equation 3 above). The rationale for the regressions is that the relative importance of the probability of reorganization as the customer's distress progresses towards filing Chapter 11 is investigated. The third regression measures the change in receivables relative to the base period.

The value of the probability of successful reorganization is taken from Table 2.4 in Chapter 2. The probability of reorganization is estimated from a logit model which uses the filing firm size, its industry distress, as well as the classification into economic versus financial distress to predict the chance of successfully emerging from the bankruptcy process as a standalone entity. Banerjee, Dasgupta, and Kim (2008) provide evidence that firms may attempt to match the maturities of their short-term assets with their short-term liabilities, i.e., a positive relationship exists between receivables/sales and payables/COGS. I include the amount of trade credit used by a firm as a control variable. I calculate the use of trade credit by a firm as the ratio of accounts payable to cost of goods sold. Also included are control variables such as firm operating profit margin (EBITDA/total assets), firm size (log of total assets), Tobin's Q (market value of assets/book value of assets), sales intensity (sales/total assets), and book leverage (book value of debt/book value of assets). As modeled in Wilner (2000), customers with high

market share may be able to exercise higher bargaining power over their dependent suppliers. Therefore, I include the market share of the firm and its bankrupt customer (Herfindahl indices of both) as controls in the regression. Finally, I use the supplier's Altman z-score measure (Altman 1968), which is used to predict bankruptcy to measure the financial health of the supplier. All the independent variables are measured as the difference between the value of the supplier less its matching firm in either the year just prior to the filing or the year of filing.

From the results presented in column (3) of Table 3.4, it can be seen that suppliers experience a significant increase in trade receivables if the probability of a successful reorganization for the customer is high. Results from columns (1) and (2) demonstrate the growing importance of the probability of reorganization. While the coefficient is insignificant, though positive, in the prefiling year, it increases both in magnitude and significance over the next year. It is worthwhile to note here the data used for calculating the probability of reorganization is taken as the average of the two years prior to the pre-filing year. This implies that the information is already known at the time of the changes in the trade receivables.

Overall, the results show that suppliers may extend trade credit to a distressed customer if the chance of survival is assessed to be high. With a low probability of survival, suppliers may value their own cash cycle more and refuse to extend credit.

3.6 Conclusion

In this chapter, I study the effects of customer's financial distress on trade receivables of their suppliers. I find that suppliers increase their level of trade receivables

significantly in the year of filing. However, this observation is driven solely by the suppliers to financially distressed firms. This result is robust to different definitions of the various types of distress. This result provides support to previous studies that have found that supplier firms do not cut off their distressed customers but instead continue to support them, e.g., as in Rajan and Peterson (1997). However, it adds to the previous literature by showing that not all distressed firms are "supported" in this manner. Suppliers may actually be actively deciding which distressed customer to support and to what extent. The decision may depend on an assessment of whether the distressed firm is likely to survive and emerge through the distress and bankruptcy as a standalone customer. If the customer does emerge, then the present values of potential cash flows are high enough to justify supporting the customer prior to the Chapter 11 filing. Consistent with this idea, I find that the distress type as well as the probability of reorganization is associated with whether the supplier records an increase in the level of the trade receivables in the year prior and of filing.

Table 3.1

Sample statistics of trade receivables and payables

Trade Receivables are scaled by sales and averaged across years -3 and -2 while Trade Payables are scaled by cost of goods sold and averaged across years -3 and -2.

Variable	N	Mean	Median
Bankrupt firm's Trade Receivables/ Sales	209	0.22	0.15
Bankrupt firm's Trade Payables/COGS	208	0.31	0.14
Supplier Total Receivables-to-total sales	277	0.219	0.157
Supplier Total Payables-to-total COGS	286	0.322	0.135

Table 3.2

Change in supplier's trade receivables in the years around customer's filing

The table presents the changes in matching firm-adjusted trade receivables for suppliers to filing firms. Each value is based on a difference found by subtracting the variable value of the corresponding matching firms. (Year n – Year n-1) difference of each measure is the difference between the values in the corresponding years. Year 0 is the year of bankruptcy announcement while Year -1 is the prefiling year. 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.

	All Suppliers		
Trade Receivables/Total Asset	Num Obs	Mean	Median
Value in Year -1	178	-0.0948	-0.0147
Change from Year -1 to Year 0	158	0.0710	0.0012
		(0.03)**	(0.27)
Change from Year 0 to Year 1	114	0.0658	-0.0062
		(0.44)	(0.64)
Change from Year 1 to Year 2	103	-0.0710	-0.0021
		(0.29)	(0.89)
Change from Year 2 to Year 3	72	0.1200	-0.0011
		(0.42)	(0.94)

Table 3.3

Change in supplier receivables around filing by customer distress type

Panel A: Standard definition of Distress Type

The table presents the changes in matching firm-adjusted trade receivables for suppliers to filing firms grouped into subsamples according to the distress type based on the Combined Rank measure. Each value of trade credit is based on a difference found by subtracting the variable value of the corresponding matching firms. Matching firms are found as in Table-10 above. (Year n – Year n-1) difference of each measure is the difference between the values in the corresponding years. Year 0 is the year of bankruptcy announcement while Year -1 is the pre-filing year. Combined Rank measure. Combined rank is constructed similarly to Lemmon et al. (2009) by 1) averaging the firm's year -3 and year -2 industry-adjusted EBITDA-to-assets and ranking this into deciles among all Chapter 11 sample firms, 2) averaging the firm's year -3 and year -2 leverage and ranking this into deciles among all Chapter 11 sample firms, and 3) summing these two decile rankings. Industry-adjusted EBITDA-to-assets is the average of the sample firm's year -3 and -2 EBITDA-to-total assets minus the industry median EBITDA-to-total assets where both years are available. When any one is unavailable, the other is taken. The industry is defined at the 4-digit SIC level provided that it contains a minimum of five firms. Otherwise, the industry is defined at the 3-digit or 2-digit SIC level. Leverage is measured as average of total liabilities-total assets at year -3 and -2. Firms with combined rank of 0 upto 5 are classified as economically distressed and those with the measure between 14-18 are financially distressed. The remainders (6-13) are classified as mixed distressed firms. 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.

Suppliers to Economically Distressed Filing Firms			Suppliers to Mixed Distressed Filing Firms			Suppliers to Financially Distressed Filing Firms		
Num Obs	Mean	Median	Num Obs	Mean	Median	Num Obs	Mean	Median
16	0.0890	0.0151	104	-0.0161	-0.0111	38	0.0127	-0.0092
16	0.1530	0.0031	104	0.0693	-0.0045	38	0.0412	0.0358
	(0.31)	(0.60)		(0.13)	(0.62)		(0.02)**	(0.00)***

Table 3.3 continued

Panel B: Modified definition of Distress Type—1

The table presents the changes in matching firm-adjusted trade receivables for suppliers to filing firms grouped into subsamples according to the distress type based on the Combined Rank measure. Each value of trade credit is based on a difference found by subtracting the variable value of the corresponding matching firms. Matching firms are found as in Table-10 above. (Year n – Year n-1) difference of each measure is the difference between the values in the corresponding years. Year 0 is the year of bankruptcy announcement while Year -1 is the pre-filing year. Combined Rank measure. Combined rank is constructed similarly to Lemmon et al. (2009) by 1) averaging the firm's year -3 and year -2 industry-adjusted EBITDA-to-assets and ranking this into deciles among all Chapter 11 sample firms, 2) averaging the firm's year -3 and year -2 leverage and ranking this into deciles among all Chapter 11 sample firms, and 3) summing these two decile rankings. Industry-adjusted EBITDA-to-assets is the average of the sample firm's year -3 and -2 EBITDA-to-total assets minus the industry median EBITDA-to-total assets where both years are available. When any one is unavailable, the other is taken. The industry is defined at the 4-digit SIC level provided that it contains a minimum of five firms. Otherwise, the industry is defined at the 3-digit or 2-digit SIC level. Leverage is measured as average of total liabilities-total assets at year -3 and -2. Firms with combined rank of 0 upto 7 are classified as economically distressed and those with the measure between 8-10 are financially distressed. The remainders (11-18) are classified as mixed distressed firms. 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.

	Suppliers to Economically Distressed Filing Firms (0-7)			Suppliers to Mixed Distressed Filing Firms (8-10)			Suppliers to Financially Distressed Filing Firms (11-18)		
	Num Obs	Mean	Median	Num Obs	Mean	Median	Num Obs	Mean	Median
Year before filing	35	0.0093	0.0090	66	-0.1145	-0.0111	57	-0.1135	-0.0175
Year after filing	35	0.1210	0.0000	66	-0.0640	-0.0230	57	-0.0408	0.0004
		(0.17)	(0.78)		(0.38)	(0.53)		(0.13)	(0.00)***

Panel C: Modified definition of Distress Type—2

	Suppliers to Economically Distressed Filing Firms (0-9)			Suppliers to Financially Distressed Filing Firms (10-18)		
	Num Obs	Mean	Median	Num Obs	Mean	Median
Year before filing	80	-0.0104	0.0000	78	-0.1658	-0.0189
Year after filing	80	0.07906	-0.0148	78	0.0514	0.0086
		(0.11)	(0.99)		(0.20)	(0.08)*

Table 3.4

Multivariate regressions of supplier trade receivables

The table presents the regression of trade receivables of the suppliers to filing firms. All variables except industry concentrations, probability of reorganization and reliant-supplier are calculated on a matched firm adjusted basis. Industry concentrations are binary variables for both the customer and the supplier if their respective Herfindahl Indices are greater than 0.2. The dependent variable in columns 1 and 2 are the match firm adjusted trade receivables of the suppliers in the prefiling and the filing year, respectively, whereas in column 3, the dependent variable is the change in trade receivables from the prefiling to the filing year. The t-statistics control for supplier industry and month of the year clustering effects and are reported in parentheses. "*","**", and "***" indicate significance at the 10%, 5%, and 1% levels, respectively.

Dependent Variable	AR/Sales in pre-filing year (1)	AR/Sales in filing year (2)	Change in AR/Sales over the year before filing to the year of filing (3)
Intercept	-0.0984	-0.1874	-0.0644
	(-1.10)	(-2.09)**	(-1.29)
Altman Z Score of Supplier	0.0049	0.0096	-0.0115
	(0.92)	(1.21)	(-2.33)**
Log (Assets) of Supplier	-0.0061	0.0272	0.0015
	(-0.18)	(1.49)	(0.11)
Sales Intensity	-0.0077	-0.0194	0.0180
	(-0.61)	(-1.81)*	(1.73)*
Accounts Payable of Supplier	0.1036	0.0230	-0.0269
	(2.40)**	(1.27)	(-1.19)
Operating Profit Margin of Supplier	1.8676	-0.0497	-0.5207
	(0.61)	(-0.53)	(-0.33)
Supplier Leverage	0.0124	-0.0182	-0.0197
	(0.90)	(-0.41)	(-1.28)
Supplier Industry Concentration	0.0375	0.0234	-0.0263
	(1.93)*	(0.95)	(-2.32)**
Customer Probability of Reorganization	0.0701	0.1875	0.1103
	(0.74)	(1.94)*	(1.93)*
Customer Industry Concentration	0.0221	0.0083	0.0065
	(0.74)	(0.27)	(0.31)
Tobin's Q of Supplier	0.0006	-0.0026	-0.0063
	(0.09)	(0.16)	(1.36)
# of observations	117	122	117
P value of F statistic	0.0289	0.0279	0.0372
Adjusted R squared	0.0881	0.0852	0.0815

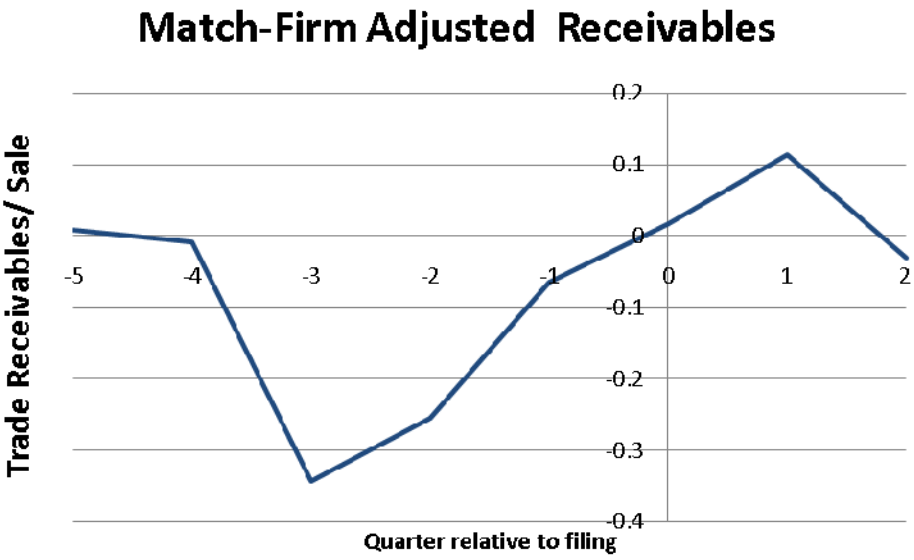

Figure 3.1

Quarterly receivables around the filing period

Plots the matched-firm-adjusted Trade Receivables /Total Sales for suppliers of filing firms for which we are able to find quarterly data for seven quarters around the filing date. The total number of supplier firms for each quarter is 32 and the average across all suppliers is used for each quarter. Each value is adjusted by subtracting the value of a matched firm chosen on the basis of Barber and Lyon (1996). Matching firms are the closest firms to each sample firm by industry, size (50%-150% of sales) and past performance (measured as ROA in the year prior to bankruptcy announcement). Quarter 0 is the quarter period over which the Chapter 11 was filed and quarter 1 is the quarter end after the Chapter 11 filing date.

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