

# **Inter-firm Linkages and the Wealth Effects of Financial Distress along the Supply Chain: Rivals, Customers, and Suppliers**

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# **Inter-firm Linkages and the Wealth Effects of Financial Distress along the Supply Chain: Rivals, Customers, and Suppliers**

## **Abstract**

Previous research examines the extent to which bankruptcy is contagious within industries. This study broadens the investigation by examining the wealth effects of distress on customers and suppliers prior to bankruptcy. On average, important contagion effects occur *prior* to bankruptcy and extend beyond industry competitors along the supply chain. Specifically, distress in advance of bankruptcy is associated with negative and significant stock price effects for rivals, customers and suppliers. Consistent with expectations, customer and supplier effects are more negative when industry contagion is more severe. Industry structure and specialized product nature also have significant implications for suppliers and customers when a material member of the supply chain becomes distressed.

## **Inter-firm Linkages and the Wealth Effects of Financial Distress along the Supply Chain: Rivals, Customers, and Suppliers**

### **1. Introduction.**

The question of whether financial distress has contagious effects that spread to other firms is of interest to academics, practitioners, and policymakers. Previous research in finance has examined the extent to which bankruptcy is contagious within industries (see, for example, Warner (1977) and Lang and Stulz (1992))<sup>1</sup>. In this study we broaden the investigation by examining the wealth effects of distress *prior to bankruptcy* on customers and suppliers, and by considering how these effects interact with the wealth effects for rivals. We find evidence that important contagion effects extend beyond industry competitors along the supply chain. Specifically, distress leading to bankruptcy is associated, on average, with negative and significant stock price effects for rivals, customers, and suppliers.

There is, however, considerable cross-sectional variation in rival, customer, and supplier reaction among the distressed firms. Implications for firms along the supply chain depend on whether the bankrupt firm's industry experiences contagion or competitive effects, the structure of the bankrupt firm's industry, and the specialized nature of the products supplied and sold. Most importantly, both customer and supplier wealth effects are more negative when distressed firm industry contagion is more severe. However, suppliers are also adversely affected when distressed firm industry contagion does *not* exist but industry characteristics allow rivals to exercise greater market or buying power with respect to suppliers. Similarly, customers are *less* adversely affected when the distressed firm is dominant in its industry and *more* adversely affected when collusion is likely among distressed firm's rivals. Combined, these results suggest that customers and suppliers are more likely to suffer if the remaining rivals gain market power with the elimination of a competitor. Overall, these findings provide insight into the nature and extent of

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<sup>1</sup> Other papers that consider contagion effects associated with bankruptcy and financial distress include Ferris, Jayaraman, Makhija (1997), Hertz and Smith (1993), Kang and Stulz (2000) and Slovin, Sushka, and Polonchek (1999).

contagion and a more complete picture of the overall social costs associated with (financial and economic) distress and bankruptcy.

The contagion associated with distress is naturally considered in the context of the classic trade-off theory of capital structure.<sup>2</sup> In discussions of the trade-off theory, the actions of suppliers and customers of firms in distress are often cited as a source of indirect costs that can arise with impending bankruptcy. Suppliers are thought to impose costs by failing to supply trade credit, backing away from entering into long-term contracts and delaying shipments. Customers wary of product quality, reduced value of warranties, continuity of supply and serviceability impose costs by reducing purchases.<sup>3</sup> Although it seems clear that they may be important, the magnitude of these indirect costs of distress is difficult to estimate practically and evidence of their existence is thus far mostly anecdotal.<sup>4</sup> We believe this to be the first paper to provide direct evidence on how distress (leading to bankruptcy) affects the distressed firms' customers and suppliers.

More broadly, the effect of distress on customers and suppliers provides evidence on the extent of "financial linkage" in the economy and provides us with a better understanding of how impairment (both economic and financial) at one firm can ripple through other layers of the supply chain. This, in turn, provides perspective on how expectations of distress at one level in the supply chain may influence corporate policy (e.g. capital structure, product-market behavior) at another.

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<sup>2</sup> In the tradeoff theory, capital structure is determined by trading off the tax benefit of leverage with the increased probability of incurring explicit (lawyers, accountants, managerial time) and implicit costs of financial distress and, ultimately, bankruptcy as a consequence of higher leverage. The implicit costs of financial distress have, for most of the modern literature on capital structure, been considered to be particularly important. For example, Ruback (1983) contains the following statement: "... at least some of the costs of financial distress are likely to be incurred prior to the actual default. There (sic) costs will be borne by virtually every agent that deals with the firm – bondholders, stockholders, suppliers, customers, and labor."

<sup>3</sup> Titman (1984) argues that the price a firm can charge for a product that may need future serving or spare parts will fall as the likelihood of bankruptcy and liquidation increases. Maksimovic and Titman (1991) present a model where customers may be reluctant to do business with a firm in financial distress even if they suffer no costs if the firm is liquidated. In this model, reluctance is due to concerns about the incentive to reduce product quality and not honor implicit contracts.

<sup>4</sup> See Cutler and Summers (1988) for anecdotal evidence from the Texaco bankruptcy.

The paper is organized as follows. Section 2 describes the sample of distressed firms, and section 3 contains abnormal returns for those firms' rivals, customers, and suppliers. Section 4 examines the cross-sectional determinants of these wealth effects, and discussion of our findings, direction of future research, and conclusions are presented in Section 5.

## **2. Sample of distressed firms**

We obtain a preliminary sample of 1735 bankruptcy filings between 1980 and April 2002 from Bankruptcy DataSource Index; these BDS data are now available from Lexis. Of these, 1240 can be found on CRSP prior to bankruptcy. However, as in Lang and Stulz (1992), there is considerable clustering of bankruptcy filings by time and industry in our sample, and this clustering has the potential to dilute the information released by Chapter 11 filings and related distress announcements. Consequently, we remove all but the first bankruptcy filing in any industry and month from the sample, leaving 805 Chapter 11 filings.<sup>5</sup>

In this study, we investigate the effects of a pre-bankruptcy distress date rather than the filing of a bankruptcy petition for the following reasons. First, we believe that distress may be widely known well in advance of the actual bankruptcy petition. More importantly, we believe the pre-bankruptcy distress catalysts are themselves of likely consequence to rivals, suppliers, and customers. For example, U.S. Airways reported a 23% reduction in operations eleven months prior to filing a bankruptcy petition in August 2002. The airline announced reductions in the number of flights along some routes and the cancellation of other routes entirely before petitioning for bankruptcy court protection from creditors. Such contraction was clearly consequential to the carrier's suppliers and customers. Similarly, in the case of Bethlehem Steel, there was discussion in the popular press of struggles ten months in advance of the formal Chapter 11 filing, including greater than expected losses, endangered joint ventures, a potential debt covenant breach, the hiring of a well-known industry consultant to help the firm cut costs,

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<sup>5</sup> We add back all filings for some analyses in sections 3 and 4. We discuss in section 3.2.

renegotiating labor union agreements, and a reduction in salaried work force. Perhaps of greatest interest to our present study, nine months prior to filing their bankruptcy petition, Bethlehem Steel added a significant energy surcharge to their customer's bills to help alleviate the effects of their rising cost of production.

To identify pre-bankruptcy distress, we search the CRSP tapes over the calendar year prior to (and including) the Chapter 11 filing date and find the day on which the distressed firm has the most negative *dollar* abnormal return (Malatesta, 1983). This day represents the day on which the eventually-bankrupt firm experiences the largest loss of shareholder wealth, and is referred to as the *distress date*. Throughout the paper we measure abnormal returns over the *distress period*, which we define as the three-trading-day period centered on the distress date.<sup>6</sup>

Table 1 reports our sample of distressed firms by calendar year of distress and their associated market values computed the day preceding the distress date. As expected, the number of distress dates per year increases during the recessionary periods in our sample: 1989 – 1991 and 1999 – 2001. While the average distressed firm is relatively small, with an average (nominal) market-capitalization of \$262 million, the periods of high distress activity noted above also correspond to periods where larger firms are failing. For example, the average market-capitalization of firms with distress dates in 2001 (i.e. firms that declare bankruptcy in 2001 or 2002) is \$1,261 million, considerably higher than the overall sample average.

The next two columns in Table 1 show the average distress date abnormal percent and abnormal dollar return to the eventually-bankrupt firms. Abnormal percent returns are computed using the market-adjusted method (Brown and Warner, 1985), where the daily abnormal return is

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<sup>6</sup> One caveat with our approach is that the distress date abnormal return may be generated by an exogenous industry, customer or supplier event. The concern here is with the direction of causality. To address this, we conduct Factiva searches for a subsample of distress dates and find that the majority of our distress date value reductions reflect firm-specific events, e.g., debt downgrades, earnings warnings, missed earnings expectation, firm-specific lawsuit, etc. We plan to search for the entire sample and report results by type of distress.

the firm-specific return minus the value-weighted market return from CRSP.<sup>7</sup> Abnormal daily dollar returns are computed as the abnormal percent return on the corresponding day multiplied by the market-capitalization from CRSP for the prior day.

By construction, these abnormal returns are large, as the distress date is chosen as the day on which the largest loss of shareholder wealth is recorded in the year prior to the bankruptcy filing. The average distress date abnormal return is -28%, and the average distress date (nominal) dollar abnormal return is -\$49m. The last column in Table 1 contains the average lag for each sample year, where the lag is the number of trading days between the distress date and the Chapter 11 filing date. The sample average is 140 trading days, which corresponds to distress dates a little over 6 months prior to the filing date, on average.

### **3. Distress period returns to rivals, suppliers and customers.**

#### *3.1. Rivals.*

Table 2 contains the distress period abnormal returns to equal- and value-weighted portfolios of rivals of the distressed firms. Following Lang and Stulz, we define rivals as firms in the same 4-digit SIC as the eventually-bankrupt firm. To ensure that rival portfolios are comprised of an adequate number of firms to give meaningful averages, we use all firms in the same three three-digit SIC code if there are fewer than five firms available at the four-digit SIC level. In 68 cases we were unable to identify a sufficient number of rivals to form rival portfolios.<sup>8</sup>

Rival portfolios in Lang and Stulz (1992) are comprised of all firms on CRSP regardless of the number of business segments the rival firms have. We note, however, that rival firms that

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<sup>7</sup> In general, the results from most studies of abnormal returns are not sensitive to the use of this definition of abnormal returns in place of the market-model approach. See, for example, Moeller, Schlingemann, and Stulz (2004), as the most recent of many papers making this observation.

<sup>8</sup> These are bankruptcies in the following 4-digit CRSP SIC codes: 0181, 0251, 0762, 1241, 1321, 1330, 1499, 1540, 1541, 1731, 2211, 2221, 2258, 2282, 2360, 2363, 2392, 2396, 2542, 2796, 2950, 3296, 3362, 3483, 3750, 3930, 4131, 4420, 4423, 4441, 4581, 4742, 4822, 5150, 5231, 5250, 5261, 5390, 5631, 5632, 5661, 5680, 5699, 5720, 5921, 5984, 6011, 6700, 7030, 7033, 7261, 7920, 8011, 8021, 8110, 8399, 8911, 8980, 9511, 9611.

are diversified will have a primary SIC listed on CRSP, but may have substantial business operations outside the industry of the distressed firm, lessening the importance of industry distress to a diversified firm.<sup>9</sup> Thus, we also examine a subset of rival portfolios where rivals are selected only from single-division firms.<sup>10</sup>

Panel A of Table 2 reports median equal- and value-weighted rival portfolio returns around the pre-bankruptcy distress date for both the single-segment subsample and the full sample of rival portfolios. The median distress period abnormal return for the value-weighted portfolio of single-segment rivals is -0.22% and statistically significantly different from zero at the 5% level. Abnormal returns for the other breakdowns are of similar sign and magnitude, but significant at the 1% level for the full sample of rivals. These results suggest that pre-bankruptcy distress has valuation effects for industry rivals and that contagion effects appear to dominate competitive effects. These findings are consistent with the evidence on contagion that Lang and Stulz document around the bankruptcy filing date and extend their results by showing that the market begins to account for contagion in advance of bankruptcy.<sup>11</sup> In this regard, the valuation effects we document might be viewed as additive to the contagion effects documented at the time of the bankruptcy filing. That is, overall contagion effects appear to be larger than those documented in Lang and Stulz.

To provide additional evidence on the comparative nature of pre-bankruptcy and filing date contagion, we investigate the determinants of distress period returns to rivals in a manner similar to Lang and Stulz (1992). The results of this cross-sectional analysis are presented in Panel B of Table 2. The dependent variable in all four specifications is the rival portfolio distress period abnormal return; the first two specifications use the equal-weighted rival portfolios, the second two use the value-weighted portfolios. The analysis is based on the notion that financial

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<sup>9</sup> An entirely different issue that also affects this study (at a later point) is that CRSP and COMPUSTAT SICs can be very different for the same firm (Kahle and Walkling, 1996). When matching data by SIC we always match CRSP to CRSP or COMPUSTAT to COMPUSTAT.

<sup>10</sup> The number of divisions a firm reports is taken from the COMPUSTAT segment tapes.

<sup>11</sup> Our distress dates coincide with bankruptcy filing dates in only 17 of 805 cases.

distress and bankruptcy can result in *contagion* and *competitive* effects for industry rivals. Competitive effects can arise when firm-specific distress allows rivals to capture market share or act in an oligopolistic fashion; contagion effects arise where the distress in one firm has adverse implications for the performance of industry rivals or is indicative of an industry-wide distress event. Lang and Stulz suggest that, in the absence of a specifically characterized distress factor, competitive effects are more likely to be found in industries with low leverage and high concentration (as measured by the Herfindahl index).

To calculate the Herfindahl index, we first determine market share for each firm in the industry (including the distressed firm) by taking firm sales divided by the sum of sales for all firms in the industry. The distressed-industry Herfindahl index is then the sum of squared market shares for all firms in the industry. Distressed-industry leverage is measured as the average book-value of leverage ((long-term debt + debt in current liabilities)/book value of assets) for the industry containing the distressed firm. All accounting data is from COMPUSTAT in the fiscal year prior to the distress date, and industries are defined at the 4-digit SIC level from COMPUSTAT. The first regression in the Panel B is similar to the cross-sectional specification considered in Lang and Stulz. The first three explanatory variables in this specification are dummy variables measuring whether industry concentration and leverage are “high” or “low.” If the Herfindahl index for a distressed firm industry is greater (less) than the sample median Herfindahl index then the industry is defined as “high” (“low”) concentration, and similarly for industry leverage.

We find results for our pre-bankruptcy distress dates that are similar to those reported in Lang and Stulz for bankruptcy filings.<sup>12</sup> The distress period rival portfolio (equal-weighted) abnormal return is significantly more positive for low leverage/high concentration industries (the second dummy variable). For the value-weighted rival portfolio, coefficients are of the sign predicted by Lang and Stulz, but lack statistical significance.

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<sup>12</sup> Lang and Stulz analyze value-weighted portfolios to gauge returns to bankruptcy announcements.

The second and fourth regressions in Panel B use continuous independent variables to explain rival abnormal returns and generate results that are qualitatively similar to the previous two specifications. The first two continuous variables are again the Lang and Stulz factors – industry Herfindahl index and average leverage. For the equal-weighted portfolios, we find that distress period abnormal returns to rivals are significantly increasing in the Herfindahl index and decreasing in average leverage. This again suggests that rivals are most likely to benefit from the distress of a competitor if the industry is concentrated and the firms in the industry have more financial slack to take advantage of product-market opportunities. However, these factors do not significantly explain rival returns when the value-weighted portfolios are used (as they are in Lang and Stulz).

The last two explanatory variables in Panel B are the market share of the distressed firm and the number of rivals in the distressed firm industry. (The number of rivals in the distressed firm industry is the number of firms in the industry portfolio.) Both factors are significantly related to rival abnormal returns in both the equal- and value-weighted regressions. Rival returns are significantly negatively related to the distressed firm's market share, suggesting that industry-wide distress factors are more prevalent when high market-share firms become distressed (i.e. the market interprets the distress of a high market-share firm as more likely to be a systematic distress factor for the industry). Rivals returns are also significantly negatively related to the number of firms in the industry, holding industry concentration and the market-share of the distressed firm constant. This again suggests that industries with large numbers of firms are more subject to contagion rather than competitive effects, where the number of firms potentially proxies for an aspect of low industry concentration that is not captured by the Herfindahl index.

### *3.2. Customers and suppliers.*

We identify two separate groups of customers and suppliers. The first group includes the customer and supplier *industries* which respectively buy from and sell to the distressed firm

industry. (Because the phrase “distressed industry” may imply contagion where none exists, we refer to the industry containing the distressed (and eventually-bankrupt) firm as the “distressed firm industry.”) The second group consists of specific customers and suppliers that are *material* (10% or greater) to the individual distressed firms.

The customer and supplier industries are identified via an IO matrix, which is compiled using data collected by the Census Bureau. Specifically, we employ the “Use” table of the 1997 benchmark input-output accounts for the U.S. economy (generated by the Bureau of Economic Analysis of the U.S. Department of Commerce) to infer supplier and customer relations between industry sectors.<sup>13</sup> This “Use” table reports estimates of the dollar value of each supplier industry’s output that is used as input in each customer industry’s production.

As in Matsusaka (1993), we define customer industries to be those industries that use more than 5% of the total output of the distressed firm industry. Correspondingly, we define supplier industries to be those industries from which the distressed firm industry sources at least 5% of its inputs. All single-segment firms in the identified customer and supplier industries are included in the customer and supplier portfolios, and the distress period abnormal returns to the individual firms in these portfolios are then either equal- or value-weighted to produce portfolio returns.<sup>14</sup> We restrict these customer and supplier portfolios to single-segment firms because diversified firms may have business segments in unrelated industries or, worse, in the distressed firm industry itself. Our tests should be more powerful with multi-division firms removed from the pool.

These data and this general approach have been used recently to identify customer and supplier relations in Fan and Lang (2000), Matsusaka (1993), and Shahrur (2004). We note that while some of the distressed firms’ actual customers and suppliers will be in the customer and

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<sup>13</sup> These accounts are compiled once every five years, and the 1997 accounts were the most recent available when we started this project.

<sup>14</sup> The input-output accounts roughly define industries at the three-digit SIC level, implying that industry portfolios are relatively large.

supplier IO matrix portfolios, these portfolios contain firms that supply to (or buy from) the distressed firm *industry* and may have only the *potential* to transact with the distressed firm itself. In their study of customer and supplier stock price behavior and operating performance around mergers, Fee and Thomas (2004) refer to these broad groups as “potential” customers and suppliers to their sample firms. These firms however, are *actual* customers and suppliers to the distressed firm industry (at least to the rivals if not to the distressed firms themselves). To the extent that there are important contagion effects at the industry level, these effects may well reach the suppliers and customers of rivals.

While the supplier and customer industries are interesting in their own right, we expect firms with a direct supply-chain link to our eventually-bankrupt firms to be most heavily affected. Our second approach focuses on identifying actual customers and suppliers of the distressed firms. Financial Accounting Statement #14 requires public firms to disclose all material customers accounting for at least 10% of total sales.<sup>15</sup> These disclosures are available from COMPUSTAT segment tapes, however these files only list a text abbreviation for customers’ names. Many listed customers are governments or regions (e.g. Pacific, or Mexican Government), which we discard. For those remaining, we use a text-matching program<sup>16</sup> to identify all COMPUSTAT firms listed by our distressed firms as important customers. We then reverse the process and identify all COMPUSTAT firms that list our distressed firms as material customers, which provides our sample of specific (material) suppliers to our distressed firms. This technique is used by Fee and Thomas (2004), and a detailed description can be found there.

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<sup>15</sup> We indicated in section 2 that we consider only the first bankruptcy in any industry in any month because we believed less information is revealed about the state of the industry in subsequent filings. This is accurate for all analyses of distressed firms, portfolios of rivals, and portfolios of customer and supplier industries. However, for the analyses of all particular customers and suppliers material to distressed firms, we include all observations.

<sup>16</sup> The text -matching code was kindly provided by Vance Anthony. Following the execution of the text matching by computer we visually inspected every match to ensure accuracy. This visual inspection clearly involves some discretion, but is conducted in a conservative manner that reduces the sample size but ensures all matches are certain.

Table 3 contains median distress period abnormal returns for the customer and supplier industries and for the individual customers and suppliers that are material to the distressed firm. We report median supplier and customer portfolio returns for the full sample and for two subsamples formed according to whether the average distress period return to industry rivals is greater than or less than zero. We separate the sample by rival portfolio return for two reasons. First, many of the individual suppliers to (and customers of) our eventually-bankrupt firms may also have contracts with competitors of the distressed firm. To the extent that contagion (rival portfolio return less than zero) suggests that distress is industry-wide, our material customers and suppliers will also suffer on their dealings with others in the distressed firm industry. Furthermore, when industry contagion exists, a greater number of firms in the customer and supplier *industries* are likely to be affected by the systematic distress factor affecting the distressed firm's rivals. For the material customers and suppliers who do not have existing business with competitors, we expect the costs of switching vendors or redirecting product to new buyers ("switching costs") to be higher when these alternative firms are also facing distress. These factors all imply that, if contagion spreads along the supply chain to customers and suppliers, we expect it will be most pronounced when rivals experience contagion.

Secondly, competitive effects are thought to accrue to surviving rivals of bankrupt firms in the form of increased market share and/or increased market power. When the wealth gains to remaining rivals merely reflects the assumption of the bankrupt firm's market share (with constant industry-wide supply and demand), the effect on customers and suppliers may only involve the cost of switching to other firms in the industry (with whom they may have existing business). The magnitude of these costs is likely a function of product specificity and perhaps the flexibility afforded by their respective capital structures.<sup>17</sup> However, if the wealth gains among surviving rivals reflect an increase in *market power*, the expected effect on customers and suppliers is less ambiguous. The elimination of one competitor may allow surviving rivals to

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<sup>17</sup> We investigate these determinants in the multivariate framework in the next section.

achieve collusive pricing (bad for customers) by cutting supply (bad for suppliers).<sup>18</sup> Also related is the *buying power* hypothesis (discussed in Shahrur (2004)) that holds that increased concentration allows for better pricing from suppliers with no necessary consequences for customers. Breaking our sample into subsamples based on rival returns in Table 3 allows us to provide evidence on these hypotheses.

The first column in Table 3 identifies the number of distressed firms for which we were able to identify customer and supplier industries and individual customers and suppliers that are material to the distressed firm. For the customer and suppliers industries, the second column reports the *average* number of customers or suppliers in those portfolios. For the specific customers and suppliers, the second column reports the *total* number of material customers or suppliers (identified in FAS 14 disclosures). So, for example, we form customer industry portfolios for 401 distressed firms and those portfolios contain, on average, 212 customers each. Separately, we obtain 105 total customers material to 64 specific distressed firms.

The remaining columns report median distress period abnormal returns for the full sample and for the subsamples formed according to the sign of the rival portfolio return. Returns to the customer and supplier industry portfolios appear in rows one and three, respectively. Although the median portfolio abnormal returns are not significantly different from zero in the full sample, we find significant results in the two subsamples. Turning first to the subsample where industry contagion appears evident (rival portfolio return less than zero) we find that customer and supplier portfolio returns are negative and significant, albeit only marginally for the customer industry portfolio.<sup>19</sup> This finding suggests that the contagion associated with the distress of an individual firm extends beyond industry rivals to the related supplier and customer industries. To the extent that contagion reflects customers and suppliers backing away from

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<sup>18</sup> We expect this most likely among concentrated industries and consider the role of industry concentration in the next section.

<sup>19</sup> We are in the process of conducting more powerful tests that focus on the more important customer and supplier industry groups.

otherwise healthy industry rivals, these findings provide new evidence of more widespread social costs.<sup>20</sup> Alternatively, if the contagion is due to an information effect, our findings provide some insight on how economic distress may ripple through the economy, or more specifically the supply chain.<sup>21</sup>

Turning to the subsample which contains competitive industry effects (rival portfolio return greater than zero) we find that customer and supplier industry portfolios earn positive and significant abnormal returns. At face value, these results are puzzling as it is difficult to explain why the customer and supplier industries would benefit from shifts in market share within the distressed firm industry.<sup>22</sup> However, these results are interesting in that they do not provide support for the view that the gains that rivals experience at the demise of a competitor reflect increased market power. Under the market power hypothesis, suppliers and customers should have negative stock price reactions because surviving rivals gain by cutting back industry output (and thereby demand for factors of production) and raising product price to customers. As evident in the cross-sectional analysis in section 4, however, analyzing these customer and supplier abnormal returns using the industry-concentration and leverage factors identified in Lang and Stulz (1992) as most likely to be consistent with competitive gains for rivals does provide some evidence that market-power gains for rivals do adversely affect customer and supplier industries.

We expect to find the greatest impact of distress among those specific firms with material business relationships with the distressed firms. Rows two and four of Table 3 support this assertion. Median distress period abnormal returns to the specific customers and suppliers material to our distressed firms are more negative than the returns to the portfolios of customers and suppliers to the industry. These returns are strongly significantly negative in the full sample

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<sup>20</sup> Because distress is marked by a series of events and because stock price effects reflect partial anticipation and measure costs net of benefits, the wealth effects that we document are only a lower bound on what appear to be a substantial overall wealth effect for customers and suppliers.

<sup>21</sup> At this stage, we are unable to distinguish between the two alternative types of contagion.

<sup>22</sup> One possibility is that the positive returns here reflect the normal cross-correlation of returns between the rival, customer, and supplier industries. Because this is also a problem for our analysis of contagion effects, we will control for normal cross-correlation in future tests.

and among the subsample of distressed firms where rivals have negative abnormal returns. Specifically, the full-sample median distress period abnormal return to material customers is -1.2% (significant at the 1% level), and to material suppliers the median is -2.3% (again significant at the 1% level). This evidence suggests that, on average, both customers and suppliers are significantly impaired by distress in our sample of eventually-bankrupt firms.<sup>23</sup>

Similar to the results from the portfolios of industry-wide suppliers, returns to specific suppliers material to the distressed firms differ significantly between the subsamples based on rival returns: -3.77% abnormal return (significant at the 1% level) in the subsample with negative rival returns compared to an insignificant -1.05% abnormal return to material suppliers in the subsample with non-negative rival returns. We attribute this to fewer opportunities for customers and suppliers to switch to different suppliers or customers (respectively) when the entire industry is impaired, and to the likelihood that material suppliers and customers also have contracts with rivals of the distressed firm which suffer when industry contagion exists.

Unlike the industry-wide portfolios of customers and suppliers, neither specific customers nor specific suppliers material to the distressed firms experience positive abnormal returns in the subsample of non-negative rival returns. As indicated earlier, we offer no explanation for why the industry-wide customers and suppliers should experience significantly positive abnormal returns. But whatever the reason, these gains are not experienced by the firms with known direct supply-chain links to the eventually-bankrupt firms themselves.

Overall, we conclude the following from Table 3. Contagion among rivals associated with pre-bankruptcy distress (documented in Table 2) spreads along the supply chain to customers and suppliers. Contagion reaches the customers and suppliers to the distressed firm industry, but is most severe among those with known direct supply-chain links to the distressed

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<sup>23</sup> We offer one note regarding the magnitude of these negative abnormal returns. Modern theories of the indirect costs of distress predict that customers and suppliers will take actions to avert losses caused by upstream or downstream distress. To the extent that this distress is partially anticipated, these returns are “net” damage after attempts to find alternate vendors or shift their output.

firms. Further, contagion effects along the supply chain appear worse when there is contagion among rivals, which we attribute, in part, to greater cost of switching vendors and redirecting product when alternate sources and outlets also face distress. Finally, the significant positive abnormal returns to the portfolios of industry-wide customers and suppliers in the subsample of rivals who experience competitive effects do not suggest that these wealth gains to rivals are attributable to an increase in market power among surviving rivals.

#### **4. Cross-sectional determinants of customer and supplier returns.<sup>24</sup>**

In the previous section we presented evidence that the contagion associated with the distress of an individual firm extends beyond industry competitors along the supply chain to (i) individual customers and suppliers that have material relations with the distressed firm and (ii) to the industries that supply and purchase from the distressed firm's industry. In this section we consider factors that explain cross-sectional differences in the nature and extent of supplier and customer contagion. Our purpose is to determine whether the suppliers and customers who, according to various theories, should suffer greater contagion effects do indeed experience more negative distress period stock price effects.

In Panel A of Table 4 we examine how the abnormal returns to customer and supplier industries are affected by the distressed firm's industry concentration and financial slack. These factors are important because Lang and Stulz (1992) identify industry concentration and leverage as important determinants of whether rivals in the distressed firm's industry are also adversely affected by the distress (contagion – an industry-wide, or systematic, distress factor) or can take competitive advantage of the impending demise of a member of the industry to capture market share or act in a more oligopolistic fashion: reducing demand for inputs (harming suppliers) and increasing output prices (harming customers).

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<sup>24</sup> Section 4 is exploratory and incomplete.

The first two rows of Panel A in Table 4 divide the full sample of distressed firms into two subsamples, based on whether the distressed firm's industry has leverage and/or industry concentration (measured by the Herfindahl index) above or below the sample median of the characteristic. The returns to customers are significantly worse in the subsample of observations where rivals are characterized by higher than sample median leverage than in the lower leverage group. This is consistent with the notion that the higher leverage rivals are at greater risk for additional future bankruptcies. However, the difference is not observed in returns to suppliers.

The last two rows of Panel A demonstrate the interaction between industry leverage and concentration, by conditioning on either above- or below-median industry average leverage before splitting the sample according to industry concentration. This division of the sample by leverage and concentration follows from the results in Lang and Stulz (1992), who suggest that competitive effects allowing the remaining rivals to behave in more oligopolistic fashion are more likely to be found in industries that are highly concentrated (Herfindahl index above the sample median) and where the remaining rivals have the financial slack (below median average leverage) to take advantage of product-market opportunities.

Panel A demonstrates that when rivals are most likely to be able to obtain market-power gains from the distressed firm's demise (above median Herfindahl index, below median industry leverage), supplier industries experience the most negative median abnormal returns. Specifically, supplier industry abnormal returns in the third row of Panel A are -0.32% at the median, which is significantly different from zero at the 5% level, and significantly more negative than supplier median returns in industries with low concentration and low industry leverage. This result complements the conclusions drawn from Table 3. While we concluded there that it is difficult to explain from a market-power perspective why supplier industry portfolios earn positive median abnormal returns when rivals appear to gain from the distress, Panel A shows that we find *negative* abnormal returns in situations where the rival gains are most likely attributable to increases in market-power. Interestingly, this makes the positive and significant supplier returns

in Table 3 even more difficult to understand, as it is likely that those positive returns are attributable to situations where rivals obtain some benefit from the demise of a competitor that is *not* associated with the ability to exploit less industry competition at the expense of suppliers.

The customer returns in Panel A are harder to interpret. Customer industries appear to be significantly more impaired when distressed firm industry concentration is high, consistent with the reasoning of Lang and Stulz that rivals in highly concentrated industries are able to take advantage of one member's distress to behave oligopolistically. However, this effect only appears when interacted with high average distressed firm industry leverage – exactly when the remaining rivals would seem to lack the financial slack to exploit product-market opportunities.

In Panel B of Table 4 we present OLS regressions explaining the cross-sectional determinants of customer and supplier industry portfolio distress period abnormal returns (from the IO matrix), akin to the rival return regressions in Table 2. The explanatory variables we consider are the Lang and Stulz (1992) leverage and industry concentration measures, the market share of the distressed firm, the number of rivals in the distressed firm's industry, and the number of suppliers to the distressed firm.

The market share of the distressed firm can proxy for several factors. We expect that the distress of a firm with a large market share is more likely to reflect factors that are common to the industry and, thereby, more likely to be associated with industry contagion. This expectation, in addition to the fact that a firm with a large market share sells to more customers and purchases from more suppliers, suggests that the distress of a firm with a larger market share has more negative consequences for customer and supplier industry portfolios. Alternatively, the distress of a firm with a larger market share may benefit customers and suppliers if it leads to a reduction market power in the distressed firm's industry. The empirical implication of distress firm market share on customer and supplier industry returns is therefore indeterminate.

The number of rivals in the distressed firm industry potentially affects customer and supplier industry returns because it may measure the alternative buying and selling opportunities

of customers and suppliers, respectively, and is also a measure of competition in the distressed firm's industry. Based on these interpretations we expect contagion effects for customers and suppliers to be smaller as the number of rivals in the distressed firm's industry increases. However, it is also likely that a greater number of rivals to the distressed firm implies that a greater fraction of the pool of suppliers and customers are adversely affected in cases of industry contagion (financial "linkage"). We separate customer and supplier portfolios based on rival returns to address the latter point.

The number of suppliers to the distressed firm is used as a proxy for the degree of product specialization in the supplier industries; more suppliers suggesting less specialized products. Product specialization is likely to be an important determinant of supplier returns because product specialization represents a bond between suppliers and their customers (the distressed firms), and is related to the ease of finding alternate industries to sell to: commodities generally have a wider variety of uses than specialty inputs. However, the number of suppliers may also proxy for the number of *industries* that supply the distressed firm industry: under the IO matrix approach we take all firms in all industries that supply more than 5% of the distressed firm's inputs as suppliers. If the number of firms per supply industry were fixed, the number of suppliers would vary directly with the number of industries identified for each distressed firm. Greater number of supply *industries* potentially indicates a more specialized production process at the distressed firm, and hence greater product specialization by suppliers.

The regressions in Panel B demonstrate that the Herfindahl index and average industry leverage do not have any significant explanatory power for either the customer or supplier industry abnormal returns. In fact, the only significant explanatory variable for customer industry returns is the distressed-firm market share. Distressed firm market share is significantly negatively related to customer abnormal returns, suggesting that the negative effect of the distress impacting a wider web of customers via the higher market share outweighs any positive impact potentially experienced by customers as a result of a more competitive supply industry.

For the full sample of supplier industries, we find that supplier abnormal portfolio returns are significantly negatively associated with the number of rivals to the distressed firm. As evident in the last two columns, however, this negative effect is concentrated in the subsample of distressed firms for which the distress firm industry appears impaired (negative rival average abnormal returns). We interpret this as evidence of financial linkage – when an entire industry is affected by a distress event it is likely that more of the pool of suppliers to the industry is also affected, leading to our finding of significantly more negative supplier abnormal returns. Indeed, the impact of the number of potential customers for our supplier pool (that is, the number of rivals to the distress firms) on supplier abnormal returns is significantly *positive* in the subsample where rivals experience positive abnormal returns. This is strongly consistent with our hypothesis that suppliers are less affected by downstream competitive behavior (evidenced by positive average rival returns) when the number of rivals is large and hence the market-power of any of those rivals is diminished.

Panel B also illustrates that supplier portfolio abnormal returns are significantly positively related to the number of potential suppliers (measured by the number of firms in the supplier portfolio), especially when distressed firm industry contagion is likely. This result is consistent with a greater number of suppliers suggesting that the supply industries produce less specialized products (e.g. commodities). Lower product specialization implies fewer binding ties to the distressed firm industry, which is, on the margin, beneficial to suppliers when that industry is experiencing distress.

Table 5 contains OLS regressions explaining distress period abnormal returns<sup>25</sup> for the specific customers material to the distressed firms we identify using FAS 14 disclosures. The first three regressions use the full sample with appropriate data, and the last two regressions again use sub-samples based on whether rivals appear to benefit from (average abnormal returns greater than or equal to zero) or are impaired by (average abnormal returns less than zero) the distress

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<sup>25</sup> Not in a portfolio.

event. Three explanatory variables are considered: distressed-firm market share, distressed-firm R&D intensity, and distressed-firm share of sales to the customer. As discussed in Titman and Wessels (1988), R&D intensity can be used as a proxy for the specialization of a firm's product. Like Opler and Titman (1993), "we expect customers to be more reluctant to purchase products from a distressed firm with very specialized products that require future servicing."<sup>26</sup> In the context of our study, this suggests that material customers of distressed firms making specialized products are more likely to experience contagion from the distressed firm than customers of distressed firms making less specialized products because the material customer has contractual supply ties to the distressed firm and switching costs are higher when products are specialized. R&D intensity is measured as the ratio of R&D expense to sales using COMPUSTAT data for the year prior to the distress date, and is set equal to zero if R&D data is missing on COMPUSTAT and equal to one if the ratio is above one. The distressed-firm share of sales to the customer is the fraction of total distressed-firm sales (measured from COMPUSTAT the year prior to the distress date) to the identified customer. Customer-specific sales are in FAS 14 disclosures for all customers representing more than 10% of a firm's sales, and are available on COMPUSTAT.

We find that material customer abnormal returns are significantly positively related to the pre-distress market-share of our distressed firm (suppliers to these customers), particularly for the sub-sample of events where rivals appear to experience competitive benefits from the distress. This coefficient is strongly significant, and of the *opposite* sign to that reported in Table 4. We note that the dependent variable in the regressions in Table 4 is a customer portfolio return, and we hypothesized in the discussion preceding that table that distressed firm market share could imply either (i) a greater web of customers adversely affected by the distress; or (ii) lower market-power and competitive opportunities for remaining rivals. The first explanation would affect a *portfolio* of customers (but not necessarily an individual customer's abnormal return), and the negative effect of market share on customer industry returns is evident in Table 4. In the

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<sup>26</sup> P.1029.

current regressions, however, the only return being examined is that belonging to an identifiable customer and the significantly more positive abnormal returns to customers when the distressed firm has greater market share favor the second explanation. That is, the distress of a dominant firm suggests that remaining rivals possess less ability to take advantage of the distress by increasing prices charged to customers.

Customer abnormal returns are also significantly negatively related to distressed-firm R&D intensity, supporting the notion that customers are more likely to experience contagion from the distressed firm when the distressed firm sells specialized products, because customers purchasing specialized inputs are potentially faced with the possibility of re-tooling their production process or costly switching to alternate input providers. Furthermore, this coefficient is only significantly negative when rivals have positive distress-period returns: with the distressed firm's business in decline, customers' switching costs are arguably higher if the remaining rivals have greater collusive opportunities. The significantly negative coefficient on the customer sales shares reflects the notion that more important customers are harmed to a greater extent than less important customers when a supplier experiences a distress-related event.

Table 6 contains OLS regressions analyzing the determinants of material supplier abnormal returns. In these regressions we use supplier R&D intensity as an explanatory variable, and this variable is measured in the same way that R&D intensity is measured for the distressed firms. We expect this supplier-specific variable to have a significantly negative effect on supplier abnormal returns, because specialized products have fewer alternate uses than commodities, and finding alternate customers (to replace the distressed firm) is likely more difficult when the product is specialized, implying higher switching costs).

Our results, however, do not support this hypothesis. Specifically, we find that suppliers have more positive returns around the distress date when *both* the supplier and distressed firm have greater R&D intensity (i.e. greater *joint* product specialization). This is particularly true when the rivals in the industry containing the distressed firm experience negative distress period

returns. Furthermore, this result varies strongly with the degree of concentration in the distressed firm's industry: the interaction of supplier and distressed firm R&D intensity varies significantly negatively with the Herfindahl index of the distressed firm's industry, indicating that joint product specialization results in more positive abnormal returns to suppliers when rivals also appear to be impaired in an industry with low concentration.

We also find that the number of potential customers for this set of suppliers (i.e. the number of rivals in the distress firm industry) is negatively associated with supplier abnormal returns – a greater number of potential customers to switch product sales to appears to imply more negative abnormal distress-period returns. This result is also counter-intuitive, but may reflect the fact that these specific suppliers also supply other firms in the distressed firm's industry, and therefore the effect of contagion on suppliers is increasing in the number of rivals affected by the industry-wide distress.

## **5. Conclusion and future research.**

We believe this to be the first paper to provide direct large-sample evidence on how distress (leading to bankruptcy) affects a firm's customers and suppliers. For a large sample of eventually-bankrupt firms, we examine the wealth effects of distress on their customers and suppliers. Because we believe that distress may be widely known well in advance of the actual bankruptcy petition and because we expect the pre-bankruptcy distress catalysts themselves to be of consequence to rivals, suppliers, and customers, we focus on initial distress dates rather than bankruptcy filing dates.

We first consider the wealth effects to the pools of all customers of and suppliers to the distressed firm industries, identified using the Department of Commerce's input-output matrix. We then consider the wealth effects to those specific customers and suppliers material to our eventually-bankrupt firms, identified from corporate disclosure required under FAS 14. We also consider how these effects interact with the wealth effects for the bankrupt firms' rivals.

We find evidence that important contagion effects extend beyond industry competitors along the supply chain: distress is associated with negative and significant stock price effects for rivals, customers, and suppliers alike. Specifically, suppliers and customers suffer more significant stock-price declines when rivals are also adversely affected by the distress. Even in cases where rivals benefit from the distress, via assumed market share and/or market power, we find that customers and suppliers also experience significantly negative abnormal returns. However, precise implications for firms along the supply chain depend on the structure of the distressed firm's industry and the nature of the products exchanged between the industries in question.

The effect of distress on customers and suppliers provides evidence on the extent of "financial linkage" in the economy and provides us with a better understanding of how impairment at one firm can ripple through other layers of the supply chain. This, in turn, provides perspective on how expectations of distress at one level in the supply chain may influence corporate policy (e.g. capital structure, product-market behavior) at another.

We intend to further this research by providing finer partitions of the input-output matrix data. For example, while we currently choose all industries that supply to or consume from the distressed firm's industry, without consideration of importance as long as the industry passes the 5% threshold, our tests may have more power if we choose the biggest customer and supplier industry or if we introduce quantitative metrics for the importance of inter-industry trade. We also intend to provide much greater evidence on how the *nature* of the distress affects contagion and competition along the supply chain. This paper raises the possibility that industry-wide distress (likely *economic* distress) is more costly to suppliers and customers than firm-specific distress (potentially *financial* distress, but conceivably also economic). Classifying our sample by type of distress and providing finer partitions of our data based on pre-distress operating performance at the eventually-distressed firm will hopefully allow us to have much more to say about the

difference between financial and economic distress, and the implications of both for rivals, customers, and suppliers.

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**Table 1: Sample of distressed firms.**

This table contains details of a sample of eventually-bankrupt firms, by year of distress. The distress date is the date in the calendar year up-to-and-including the bankruptcy filing date on which the eventually-bankrupt firm has the most negative abnormal dollar return (Malatesta, 1983). The market capitalization of the distressed firm is measured in thousands of dollars one day prior to the distress date. The distress period abnormal return is the distress date abnormal return. The *percent* abnormal return is the difference between the distressed firm's return and the value-weighted CRSP market return, and the *dollar* abnormal return is the firm-specific abnormal return multiplied by the firm's market capitalization from the prior day. Lag is the number of trading days between the distress date and the bankruptcy filing date.

Distress year	# of distressed firms	Avg. market capitalization (\$'000s)	Avg. distress-date abnormal return (%)	Avg. distress-date abnormal return (\$'000s)	Avg. lag
1980	1	74,204.88	-11.65	-8,643.68	222.0
1981	2	42,085.75	-13.56	-6,683.34	144.5
1982	2	142,149.00	-12.77	-16,591.12	32.5
1983	6	22,101.26	-22.73	-4,705.72	123.8
1984	14	20,048.56	-20.79	-3,578.92	159.6
1985	19	33,318.53	-20.94	-5,896.52	133.5
1986	12	70,916.64	-33.49	-28,464.01	59.9
1987	31	398,735.43	-22.99	-47,164.64	124.5
1988	34	42,416.00	-24.19	-9,645.76	159.5
1989	51	46,138.16	-28.90	-10,217.53	120.5
1990	65	58,646.67	-35.32	-15,001.99	133.3
1991	54	182,746.20	-33.87	-27,526.13	114.3
1992	35	60,102.30	-27.42	-15,194.85	141.6
1993	38	50,541.84	-29.54	-16,778.16	109.5
1994	31	89,630.92	-31.04	-24,137.64	110.4
1995	36	63,838.36	-30.31	-15,044.01	127.3
1996	33	177,661.25	-23.00	-40,011.01	150.3
1997	40	111,820.30	-32.54	-33,009.10	151.5
1998	78	208,104.70	-25.25	-40,379.57	151.6
1999	55	171,655.48	-27.75	-43,507.58	165.2
2000	103	530,648.26	-23.02	-97,940.77	178.2
2001	63	1,261,564.06	-31.33	-209,560.15	140.2
2002	2	4,464.68	-50.66	-2,520.81	5.5
Total	805	262,739.91	-28.01	-48,832.68	140.9

**Table 2: Distress period abnormal returns to rivals.**

Panel A contains equal- and value-weighted distress period abnormal returns to rivals of the distressed firms in Table 1. Portfolios of rivals are formed by taking all firms in the same 4-digit primary SIC as the distressed firm (excluding the distressed firm) from CRSP. If that portfolio of rivals contains fewer than 5 firms, the portfolio is expanded to include all firms in the same 3-digit primary SIC as the distressed firm (excluding the distressed firm). The table reports the average number of rivals in each portfolio and the distress period abnormal returns. The distress period abnormal returns are either equal- or value-weighted to produce portfolio returns; the last two columns contain medians of those portfolio returns. Panel B contains cross-sectional OLS regressions explaining the determinants of the rival portfolio (equal- or value-weighted) distress period abnormal returns. The regressions in Panel B include abnormal returns to single- and multi-segment rivals, and White-corrected standard errors. Distressed firm industry Herfindahl index is the sum of squared market shares for the industry containing the distressed firm, and Distressed-firm market share is the distressed firm's market share (a component of the Herfindahl index). Distressed firm industry leverage is the average book-value of leverage ((long-term debt + debt in current liabilities)/book value of assets) for the industry containing the distressed firm. All accounting data is from COMPUSTAT in the year prior to the distress date, and industries are defined at the 4-digit SIC level from COMPUSTAT. The first three dummy variables use the full-sample median Herfindahl indices and industry leverage to define "high" and "low." The number of rivals in the distressed firm industry is the number of firms in the rival portfolios. \*\*\*, \*\*, or \* indicates (in both panels) that the relevant statistic is significantly different from zero (using a Wilcoxon signed-rank test for the medians) at the 1%, 5%, or 10% level (respectively). White-corrected standard errors are in brackets.

Panel A: Median distress period abnormal returns to rivals.

	# of distressed firms	Avg. # of rivals	Median distress period abnormal return	
			Equal-weighted	Value-weighted
<i>Rivals</i>				
Single-segment	620	43	-0.21% **	-0.22% **
Single- and multi-segment	737	43	-0.17% ***	-0.17% ***

Panel B: The determinants of distress period abnormal returns to rivals.

	Distress period abnormal returns to rivals			
	Equal-weighted		Value-weighted	
Constant	-0.0070 <sup>***</sup> (0.0023)	0.0033 (0.0043)	-0.0071 <sup>***</sup> (0.0023)	0.0036 (0.0052)
1 if high industry leverage / high Herfindahl index; 0 otherwise	0.0039 (0.0030)		0.0037 (0.0031)	
1 if low industry leverage / high Herfindahl index; 0 otherwise	0.0070 <sup>*</sup> (0.0036)		0.0048 (0.0035)	
1 if low industry leverage / low Herfindahl index; 0 otherwise	0.0052 (0.0035)		0.0048 (0.0042)	
Distressed firm industry Herfindahl index		0.0197 <sup>**</sup> (0.0084)		0.0115 (0.0083)
Distressed firm industry leverage (average)		-0.0231 <sup>**</sup> (0.0113)		-0.0194 (0.0128)
Distressed-firm market share		-0.0208 <sup>*</sup> (0.0114)		-0.0397 <sup>**</sup> (0.0178)
Number of rivals in distressed firm industry		-0.0001 <sup>**</sup> (0.0000)		-0.0001 <sup>*</sup> (0.0000)
Number of portfolios	707	672	707	672
Adjusted-R <sup>2</sup>	0.00	0.03	-0.00	0.02

**Table 3: Distress period abnormal returns to customers and suppliers.**

This table contains equal and value-weighted distress period abnormal returns for customers and suppliers for the sample of distressed firms in Table 1. We consider two groups of customers and suppliers. First, using the U.S. Department of Commerce “Use” IO matrix, we construct portfolios of customers and suppliers to the distressed firm industry. The *average* number of customers or suppliers in each portfolio is in the 3<sup>rd</sup> column. The distress period abnormal returns are then either equal- or value-weighted to produce portfolio returns. The last four columns contain medians of those portfolio returns; the last two columns split the sample based on rival abnormal distress period returns and use value-weighted portfolio returns where appropriate. Separately, we consider specific customers and suppliers material to our sample of distressed firms, identified through FAS 14 pre-distress disclosures. The *number* of customers or suppliers in these groups is found in the 3<sup>rd</sup> column. <sup>\*\*\*</sup>, <sup>\*\*</sup>, or <sup>\*</sup> indicates that the median is significantly different from zero (using a Wilcoxon signed-rank test) at the 1%, 5%, or 10% level (respectively). <sup>a</sup>, <sup>b</sup>, or <sup>c</sup> indicates that median customer and supplier abnormal returns are significantly different between the negative and nonnegative rival return subsamples.

	# of distressed firms	(Avg.) # of customers or suppliers	Median distress period abnormal return:			
			Full sample (equal-weighted)	Full sample (value-weighted)	Rival ab. ret. $\geq 0$ (#)	Rival ab. ret. $< 0$ (#)
<i>Customers:</i>						
Of the distressed firm industry	401	212	0.07%	0.01%	0.28% <sup>**</sup> (185)	-0.20% <sup>b</sup> (190)
Material to distressed firms	64	105	-1.17% <sup>***</sup>		-1.01% (35)	-1.61% <sup>***</sup> (65)
<i>Suppliers:</i>						
To the distressed firm industry	662	156	0.01%	-0.05%	0.14% <sup>*</sup> (285)	-0.22% <sup>** a</sup> (318)
Material to distressed firms	76	120	-2.30% <sup>***</sup>		-1.05% (42)	-3.77% <sup>*** c</sup> (72)

**Table 4: The determinants of distress period abnormal returns to supplier and customer industries (IO matrix).**

This table contains cross-sectional analysis of customer and supplier value-weighted portfolio distress period abnormal returns. In Panel A customer (top line) and supplier (bottom line) median abnormal returns are presented for various subsamples of the data based on whether the distressed firm industry has leverage or industry concentration below/above the sample median of that characteristic. All returns presented in Panel A are medians of value-weighted portfolio returns. \*\*\*, \*\*, or \* indicates that the median is significantly different from zero using a Wilcoxon two-sided signed-rank test at the 1%, 5%, or 10% level (respectively). <sup>a</sup>, <sup>b</sup>, or <sup>c</sup> indicates that the median customer or supplier return for the “above” distressed-firm industry subsample is significantly different from the median customer or supplier return for the “below” distressed-firm industry subsample using a Wilcoxon two-sided signed-rank test at the 1%, 5%, or 10% level (respectively). Panel B contains OLS regressions explaining the determinants of customer and supplier industry abnormal returns identified using the IO matrix. The number of suppliers to the distressed firm industry is the number of firms in the supplier IO matrix portfolio. All other independent variables are defined in previous tables. Standard errors are corrected for heteroskedasticity using the White method. \*\*\*, \*\*, or \* indicates that the regression coefficient is significantly different from zero at the 1%, 5%, or 10% level (respectively). White-corrected standard errors are in brackets.

Panel A: Median customer (top line) and supplier (bottom line) abnormal returns

Distressed-firm industry characteristics	# of customer/supplier portfolios below/above the sample median of distressed-firm industry characteristics	Median customer (top line) and supplier (bottom line) abnormal returns for subsamples based on distressed-firm industry characteristics below/above the sample median	
		Below	Above
Leverage	215/169	<b>0.09%</b>	<b>-0.24%</b> <sup>c</sup>
	338/301	-0.04%	-0.07%
Herfindahl index	182/202	0.02%	-0.06%
	310/329	<b>0.01%</b>	<b>-0.12%</b> <sup>*</sup>
Herfindahl index / Leverage below the median	100/115	0.03%	0.29%
	149/189	<b>0.11%</b>	<b>-0.32%</b> <sup>** , b</sup>
Herfindahl index / Leverage above the median	82/87	<b>0.02%</b>	<b>-0.43%</b> <sup>** , c</sup>
	161/140	-0.12%	0.03%

Panel B: Determinants of customer and supplier industry returns

		Value-weighted portfolio distress period abnormal returns					
		Customers			Suppliers		
Sample:	Full	Rival ab. ret. $\geq 0$	Rival ab. ret $< 0$	Full	Rival ab. ret. $\geq 0$	Rival ab. ret $< 0$	
Constant	0.0048 (0.0046)	-0.0022 (0.0057)	0.0073 (0.0066)	-0.0051 (0.0047)	-0.0030 (0.0058)	-0.0074 (0.0066)	
Distressed firm industry Herfindahl index	0.0067 (0.0071)	0.0068 (0.0090)	0.0081 (0.0115)	-0.0004 (0.0064)	0.0042 (0.0086)	-0.0060 (0.0085)	
Distressed firm industry leverage (average)	-0.0133 (0.0197)	0.0273 (0.0209)	-0.0385 (0.0300)	0.0116 (0.0126)	0.0038 (0.0155)	0.0175 (0.0179)	
Distressed-firm market share	-0.0265* (0.0156)	-0.0142 (0.0147)	-0.0401 (0.0257)	0.0010 (0.0106)	-0.0071 (0.0129)	0.0186 (0.0137)	
Number of rivals in distressed firm industry	-0.0000 (0.0000)	-0.0000 (0.0000)	0.0000 (0.0000)	-0.0001** (0.0000)	0.0001** (0.0000)	-0.0001*** (0.0000)	
Number of suppliers to distressed firm				0.00002*** (0.00001)	0.00000 (0.00001)	0.00002*** (0.00001)	
Number of portfolios	343	169	174	559	268	291	
Adjusted-R <sup>2</sup>	-0.00	-0.02	0.03	0.04	0.01	0.15	

**Table 5: The determinants of material customer abnormal returns (FAS 14).**

This table contains cross-sectional OLS regressions explaining the determinants of distress period abnormal returns to specific customers material to distressed firms, identified using FAS 14 disclosures (explained in Table 3). Distressed-firm R&D intensity is the ratio of distressed-firm research-and-development expense to sales in the year prior to the distress date (accounting data from COMPUSTAT). R&D intensity is set equal to zero if R&D data is missing on COMPUSTAT and equal to one if the ratio is greater than one. Distressed-firm sales share to customer is the fraction of the distressed firm's total sales (from COMPUSTAT for the year prior to distress) that are made to the identified customer. All other independent variables are defined in previous tables. Standard errors are corrected for heteroskedasticity using the White method. \*\*\*, \*\*, or \* indicates that the regression coefficient is significantly different from zero at the 1%, 5%, or 10% level (respectively). White-corrected standard errors are in brackets.

Sample:	Distress period abnormal returns				
	Full	Full	Full	Rival ab. ret. >=0	Rival ab. ret < 0
Constant	-0.0223*** (0.0068)	-0.0170*** (0.0059)	-0.0099 (0.0063)	-0.0122 (0.0103)	-0.0156 (0.0110)
Distressed-firm market share	0.0798** (0.0382)			0.3834** (0.1778)	0.0435 (0.0433)
Distressed-firm R&D intensity		-0.0379 (0.0659)		-0.1873* (0.1062)	-0.0378 (0.0623)
Distressed-firm sales share to customer			-0.0572* (0.0346)	-0.0447 (0.0649)	-0.0500 (0.0317)
Number of observations	102	105	90	33	51
Adjusted-R <sup>2</sup>	0.00	-0.00	0.04	0.19	-0.02

**Table 6: The determinants of material supplier abnormal returns (FAS 14).**

This table contains cross-sectional OLS regressions explaining the determinants of distress period abnormal returns to specific suppliers material to distressed firms, identified using FAS 14 disclosures (explained in Table 3). Supplier R&D intensity is the ratio of supplier research-and-development expense to sales in the year prior to the distress date (accounting data from COMPUSTAT). R&D intensity is set equal to zero if R&D data is missing on COMPUSTAT and equal to one if the ratio is greater than one. All other independent variables are defined in previous tables. Standard errors are corrected for heteroskedasticity using the White method. \*\*\*, \*\*, or \* indicates that the regression coefficient is significantly different from zero at the 1%, 5%, or 10% level (respectively). White-corrected standard errors are in brackets.

	Distress period abnormal returns					
	Sample:	Full	Full	Full	Rival ab. ret. >=0	Rival ab. ret < 0
Constant		-0.0254** (0.0104)	-0.0067 (0.0168)	-0.0114 (0.0164)	0.0287 (0.0413)	-0.0210* (0.0109)
(Supplier R&D intensity)*(Distressed-firm R&D intensity)		0.0680 (0.4018)		1.1250*** (0.4069)	-0.4340 (1.0392)	2.1557*** (0.2432)
(Supplier R&D intensity)*(Distressed-firm R&D intensity)* (Distressed firm industry Herfindahl index)				-1.8675*** (0.6227)	0.4107 (1.4585)	-9.7716*** (3.6827)
Distressed-firm market share			-0.0380 (0.0259)		-0.3821 (0.4082)	-0.0213 (0.0291)
Number of rivals in distressed firm industry			-0.0003* (0.0001)	-0.0003** (0.0002)	-0.0004 (0.0003)	-0.0002* (0.0001)
Number of observations		120	114	114	42	72
Adjusted-R <sup>2</sup>		-0.01	0.03	0.01	-0.05	0.02