

Inter-firm Linkages and the Wealth Effects of Financial Distress along the Supply Chain*

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Abstract

Extant research examines the extent to which bankruptcy has intra-industry valuation consequences. This study broadens the investigation by examining the wealth effects of distress and bankruptcy filing for suppliers and customers of filing firms. On average, important wealth effects occur prior to and at bankruptcy filings and extend beyond industry competitors along the supply chain. Specifically, distress related to bankruptcy filings is associated with negative and significant stock price effects for suppliers. Supplier wealth effects are more negative when intra-industry contagion is more severe. We also investigate the importance of industry structure, specialized product nature, and leverage on supply chain effects.

Classification: G30, G33

Keywords: Bankruptcy; Financial Distress; Contagion; Supply Chain

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1. Introduction

The nature and extent of linkages between firms in the economy is of broad interest. This is especially so in the case of financial distress. Financial distress at one firm can have valuation implications for firms that are linked in the product market (industry rivals) and for firms that are connected along the supply chain (customers and suppliers). Moreover, feedback effects can arise when rivals, customers and suppliers respond to a linked firm's distress. Existing research examines the extent to which bankruptcy has intra-industry valuation consequences,¹ but offers little evidence on the effect of distress and bankruptcy on distressed firms' customers and suppliers. In this paper, we extend previous research by examining the wealth effects of distress on customers and suppliers, and by considering how these effects interact with the wealth effects for industry rivals.

Our investigation is motivated by several strands of research in finance. One line of research considers whether financial distress affects rivals in the same industry. An important early study by Lang and Stulz (1992) finds that, on average, industry rivals suffer negative stock price effects (*contagion effects*) around the time that a competitor files for bankruptcy.² Lang and Stulz also show that, for a subset of filings, rivals experience positive stock price effects (*competitive effects*) which may be driven by shifts in market share and, possibly, increased market power of the remaining firms. Our analysis of filing firm suppliers and customers provides insights into the nature of intra-industry effects as well as providing new evidence on the extent to which contagion effects extend beyond industry competitors along the supply chain.

Economic links to suppliers and customers during financial distress are also central to theoretical and empirical work on capital structure. For example, in discussions of the trade-off theory,

¹ See Warner (1977), Lang and Stulz (1992), Ferris, Jayaraman, Makhija (1997), Hertzel and Smith (1993), Kang and Stulz (2000) and Slovin, Sushka, and Polonchek (1999).

² Lang and Stulz (1992) note that there are two views of contagion that are difficult to distinguish empirically. One view is that contagion is caused by customers and suppliers backing away from otherwise healthy industry rivals and, therefore, socially costly. The alternative, more benign, view is that contagion is simply due to an information effect which imposes no social costs.

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.³ Suppliers can impose costs by failing to supply trade credit, backing away from entering into long-term contracts, delaying shipments, and sourcing new customers and/or shifting sales away from the distressed firm and to existing customers. Customers wary of product quality, reduced value of warranties, continuity of supply, and serviceability impose costs by reducing purchases.⁴ 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.⁵ While we do not directly measure the magnitude of these costs to the distressed firm, our analysis of customers and suppliers 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.

In addition to examining supply chain effects, our analysis also extends previous research by considering, in addition to the effects of bankruptcy filings, the effects of *pre-filing* distress on rivals, suppliers, and customers. One motivation for this is that financial distress is typically widely known well in advance of the bankruptcy filing such that a focus solely on the filing date may miss important contagion effects in the period leading up to bankruptcy. Moreover, firms in financial distress often take actions prior to filing that have direct consequences for rivals, suppliers, and customers. In addition, if suppliers and customers take actions to protect themselves after a linked firm has become

³ In the trade-off 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) notes that: "... 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."

⁴ Titman (1984) argues that the price a firm can charge for a product that may need future servicing 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 that model, reluctance is due to concerns about the incentive to reduce product quality and not honor implicit contracts.

⁵ See Cutler and Summers (1988) for anecdotal evidence and examples from the Texaco bankruptcy.

distressed (but before it files for bankruptcy) then the wealth effects are likely to be most evident around pre-filing distress events.

The central finding of our study is that significant pre-filing and filing date contagion effects impact industry rivals and extend beyond industry competitors along the supply chain to suppliers of the filing firms. This finding suggests that financial distress has greater economy-wide effects than previously documented and that effects occur prior to the filing date as well as at the time of bankruptcy. We find that customers of filing firms generally do not experience contagion effects, which may reflect an asymmetry in our sample selection process, i.e., suppliers that are reliant on the filing firm are more readily identified than customers that are reliant on the filing firm. However, we also find insignificant customer contagion effects for a subsample of customers that *ex ante* appear to be particularly reliant on the filing firms. Evidence that customers do not suffer contagion effects suggests that customers anticipate and/or cause the financial distress of a supplier (i.e., contagion effects spread *upstream*, as well as horizontally.)

A second key finding is that supplier (and, to a lesser extent, customer) contagion effects are more severe when the filing firm industry also suffers contagion. We attribute this to fewer opportunities for suppliers to switch to different customers when the entire industry is impaired, and to the likelihood that suppliers to the filing firm also have contracts with rivals of the filing firm which suffer when industry contagion exists. In contrast, we find that suppliers and customers exhibit insignificant stock price effects when industry rivals have positive stock price reactions to the filing firm distress. This finding suggests that shifts in market share, and not increased market power, explain the positive industry response to a competitor's distress.

The above evidence of supply chain contagion is for suppliers that are particularly reliant on the filing firms and, therefore, more likely to be adversely affected. As such, the results can not be reliably extrapolated to other suppliers or potential suppliers of the filing firms. To provide additional evidence on the extent of contagion effects, we examine whether contagion is evident in the *industries* of our

individual customers and suppliers. This analysis shows that contagion effects spread beyond reliant suppliers and major customers to firms in their respective industries.

Finally, we examine whether various cross-sectional characteristics of the filing firms, customers, and suppliers affect customer and supplier returns. For example, Titman and Wessels (1988) suggest that suppliers of unique or specialized products (as measured by R&D intensity) suffer greater harm around the time of the bankruptcy filing of a customer. Furthermore, we would expect contagion effects for suppliers and customers to be more severe when the filing firm does not successfully emerge from bankruptcy as an independent entity. This analysis does not yield significant findings, which we believe is likely due to the small size of our sample, the considerable cross-sectional variation in customer and supplier returns, and the coarseness of proxies used to capture the characteristics we consider.

In summary, we believe this to be the first paper to provide direct evidence on how distress (leading to bankruptcy) affects distressed firms' customers and suppliers, how these effects are evident at different points in the progression from distress to bankruptcy, and how they interact with the effects on the filing firms' horizontal rivals. Overall, our findings provide insight into the nature and extent of contagion and a more complete picture of the overall wealth effects associated with financial distress and bankruptcy.

The rest of the paper is organized as follows. Section 2 describes the sample of filing firms, customers, and suppliers we investigate, as well as our definition of the pre-filing distress period. Section 3 develops and describes our method of measuring the interaction of supply chain and horizontal rival effects and provides summary information on the effects of distress and bankruptcy filing on rivals to our sample of impaired firms. Section 4 reports the abnormal returns to suppliers and customers of filing firms around distress and filing dates. Section 5 presents the abnormal returns to the industries in which the filing-firm's suppliers and customers operate. Section 6 contains our cross-sectional findings relating returns for suppliers and customers to characteristics of the supplier or customer, the filing firm, or the bankruptcy. Section 7 concludes.

2. Sample selection, pre-filing distress, and filing firm abnormal returns

2.1. Identifying filing firms, customers, and suppliers

We first obtain a preliminary sample of 1695 bankruptcy filings between 1978 and 2004 from Bankruptcy DataSource Index. We next follow the approach of Fee and Thomas (2004) in identifying suppliers and customers of the filing firms. This approach is based on the requirement, stipulated in various financial accounting standards, that public firms disclose the amount of revenue derived from each customer if that customer accounts for at least 10% of total revenue.⁷ These disclosures are available from the Compustat segment files, however these files only list a text abbreviation for customers' names. Many of the customers listed are governments or regions (e.g. Pacific, or Mexican Government), which we discard.

To form our sample of filing-firm suppliers, we identify all Compustat firms that list a filing firm as a “major” customer by employing a text-matching program to match the text abbreviation for the

⁷ This requirement was initially established by Statement of Financial Accounting Standards No. 14 (FAS 14) issued by the Financial Accounting Standards Board in 1976. The requirement was amended in 1979 by FAS 30, and both FAS 14 and FAS 30 were superseded by FAS 131 in 1997. Interestingly, despite the growing number of academic papers relying on data provided pursuant to one of these standards, FAS 131 states that: “The enterprise need *not* disclose the identity of a major customer or the amount of revenues that each segment reports from that customer” (emphasis added). FAS 14 contained slightly looser wording, stipulating only that “... the amount of revenue from each such customer shall be disclosed,” but not specifying whether the identity of the customer need be disclosed. FAS 30 corrected this omission three years later by stipulating that: “The identity of the customer need *not* be disclosed...” (emphasis added). Therefore, while Compustat contains a field purporting to report the identity of major customers, this field is frequently unpopulated, and, as described below, when the field is populated the contents are often difficult to interpret. The weakness in this data appears to stem, therefore, from the weakness in the reporting regime rather than lack of coverage by Compustat.

customer's name to one of the filing firms.⁸ Following the text matching by computer we visually inspect 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. All matches are restricted to the five years prior to (and including) the filing year. If the matching process produces multiple matches between firm-pairs over the five-year pre-filing period, we choose the match-year closest to the filing year.⁹ Because the filing firms account for more than 10% of each supplier's total sales, this procedure yields a set of suppliers that is, by definition, *reliant* on the filing firm.

To form our sample of filing-firm customers, we reverse the text-matching process and identify all Compustat firms listed by our filing firms as major customers. While this procedure identifies customers that are important to the filing firms, it is not necessarily the case that these customers are, in turn, *reliant* on the filing firms. Thus, there is an asymmetry in our customer and supplier datasets in that suppliers are more reliant than customers on the filing firms. This asymmetry suggests we are much less likely to observe contagion effects for our sample of customers. We, therefore, also examine a subset of *reliant customers* defined as those for which purchases from the filing firm scaled by total cost of goods sold is greater than 1%.¹⁰

Our sample selection procedure results in a total of 250 filing firms that have at least one customer or one supplier, and the distribution of these observations over time is documented in Panel A of Table 1. The sample contains 118 filing firms that have at least one supplier, 154 filing firms that have at least one customer, and 22 filing firms that have at least one customer and one supplier. The sample bankruptcy filings are concentrated in the time period 1999 to 2004 which contains 205 of the

⁸ The text-matching code was kindly provided by Vance Anthony.

⁹ We also examine subsamples of customers and suppliers for which the number of years between filing and the customer/supplier match from Compustat is two years or less. The results are qualitatively similar to those reported in the paper, but with reduced statistical significance (most likely because of reduced sample size). The same is true when we condition on the *number* of matches during the relevant five-year interval, as the typical filing firm in our sample lists each customer only once or twice during the pre-filing five year period and the typical supplier lists the filing firm only once or twice in the same interval.

¹⁰ We discuss in the text, but do not separately tabulate, results for the subsample of *Reliant Customers* as only 38 customers exceed the 1% cutoff. Fee and Thomas (2004) use a cutoff of 5%; however only 10 firms in our sample exceed this threshold.

250 filings, or 82% of the total sample. There are 36 filings (14.4% of the sample) over the rest of the 1990's and 9 filings (3.6% of the sample) in the 1980's. The time distribution of our sample of filings is not representative of total filings over this period (as reported in the first column of the table), which breaks down over the same time periods as 41.8%, 37.2%, and 21.0% respectively. The time-clustering of our sample could reflect variation in firms voluntarily reporting the identity of major customers (which is required for our matching process) or changes in completeness of the Compustat files over time.

For the full sample of 250 filing firms, we identify a total of 311 customers and 275 suppliers. However, our analysis of supply chain contagion effects is based on separate portfolios of customers and suppliers for each bankruptcy filing and for each pre-filing distress event. The majority of the customer and supplier portfolios have only one or two firms. More specifically, 84% of the supplier portfolios and 75% of the customer portfolios have only one or two firms. As reported in the table, the average numbers of customers and suppliers per bankruptcy are 2.0 and 2.2. The largest supplier portfolio (for the K-mart bankruptcy) contains 49 firms, and the largest customer portfolio (for APW Ltd.) contains 10 firms.

Panel B of Table 1 provides summary information on the sample distribution by industry using the Fama-French 12 broad industry categories.¹¹ The computers/software, wholesale, and manufacturing industries contain the largest fractions of filings in our sample.

2.2. Pre-filing distress period

2.2.1. Rationale for investigating pre-filing distress

In addition to examining the wealth effects associated with bankruptcy filings, we also investigate the effects of *pre-filing* distress on rivals, suppliers, and customers. We examine wealth effects at pre-filing distress dates because we believe that measures of contagion based solely on filing-date stock price

¹¹ See Ken French's website:
http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/Data_Library/det_12_ind_port.html

effects will underestimate the overall contagion effect of financial distress for three reasons. First, financial distress is typically widely known well in advance of the filing of the bankruptcy petition, suggesting that substantial wealth effects for linked firms may also be evident in the pre-filing period. Second, firms in financial distress often take actions prior to filing that have direct consequences for linked firms. For example, in response to financial difficulties in 2001-2002, U.S. Airways announced reductions in the number of flights along some routes and the cancellation of other routes entirely months prior to petitioning for bankruptcy court protection from creditors, and these pre-filing cuts may have had substantial effects on the firm's suppliers. 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, renegotiated labor agreements, and a reduction in the salaried work force. Perhaps of greatest relevance to our study, nine months prior to filing a 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.

Third, the filing date itself marks the beginning of the Chapter 11 process and, often, the *resolution* of financial distress. Thus, filing date stock returns may reflect both the market's assessment of the effect of the Chapter 11 process on customers and suppliers and, perhaps to a lesser degree, the contagion effects of financial distress. For example, while financial distress of an important customer would seem to be unambiguously bad news for suppliers, when that customer enters the Chapter 11 process suppliers may benefit if debts are more likely to be repaid, or if protection from other creditors allows the filing firm to maintain business operations. In a similar vein, horizontal rivals may be disadvantaged when a competitor receives the protection that Chapter 11 process affords.¹² To the extent that filing date stock returns reflect the resolution of financial distress and/or the effects of debtor protection, they are a less reliable measure of contagion.

¹² The Eastern Airlines case provides an example of how bankruptcy protection disadvantages industry rivals (Weiss and Wruck (1998)).

2.2.2. Identifying pre-filing distress

We know of no previous research that systematically investigates the valuation implications for rivals, customers, and suppliers of pre-filing distress events. Thus, we develop our own procedure for identifying pre-filing distress dates to examine for contagion effects. Our approach is motivated, in part, by the fact that long-run cumulative abnormal returns to rivals, customers, and suppliers leading up to bankruptcy filings contain too much noise to serve as useful measures of pre-filing contagion effects. Therefore, we look for pre-filing contagion effects around the date of the most significant abnormal drop in the market value of the filing firm in the year leading up to the bankruptcy filing. To implement this approach, we search the CRSP database over the year prior to the Chapter 11 filing date and find the day on which the filing firm has the most negative *dollar* abnormal return. This day represents the day on which the filing firm experiences the largest abnormal 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 five-trading-day period centered on the distress date.^{13, 14} Similarly, we define the *filing period* as the five-trading-day period centered on the filing date.

2.3. Filing- and distress-period abnormal returns to filing firms

Of the 250 filing firms in our final sample, 150 are delisted from an exchange prior to the filing date – for those 150, the average (median) length of time from delisting to the filing date is 354 (108) days. Although we are unable to measure filing-period returns to these filers, we are still able to measure horizontal and vertical contagion effects in the filing period. By construction, we do not identify a distress date whenever the filing firm delists more than one year before the filing date (37 cases). For

¹³ 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 filing-firm-specific events, e.g., debt downgrades, earnings warnings, missed earnings expectations, firm-specific lawsuits, and so on.

¹⁴ Our results are qualitatively unchanged if we (i) redefine the criteria for identifying “distress” as the five-day window in the year prior to filing for which the filing firm has the most negative dollar abnormal returns; or (ii) cumulate returns over two-day or three-day windows (instead of the five-day windows reported in the tables).

the cases where we identify a distress date, the average time between the pre-filing distress date and the Chapter 11 filing date is 183 trading days, which corresponds to distress dates approximately 9 months prior to the filing date on average.

Abnormal returns are computed using the market-adjusted returns method (Brown and Warner, 1985), where the daily abnormal return is the firm-specific return minus the value-weighted market return from CRSP. Abnormal daily dollar returns (used for identifying pre-filing distress dates) are computed as the abnormal percent return on the corresponding day multiplied by the market-capitalization from CRSP for the prior day.

The average filing-period abnormal return for our sample of bankrupt firms is -19% (96 firms). This finding shows that bankruptcy filings have significant valuation effects that are not fully anticipated by the market. The average distress-day abnormal return for our filing firms is -26% which translates into an average dollar abnormal return of -\$118m. This return is negative and large in magnitude by construction.

3. Measuring the interaction of supply chain and horizontal rival effects

3.1. Conditioning on rival portfolio returns

Our investigation builds on and ties into previously documented evidence that financial distress and bankruptcy can result in *contagion* and *competitive* effects for horizontal rivals of filing firms. Contagion effects arise when distress at one firm has adverse implications for the performance of industry rivals or conveys unfavorable information about industry prospects. Competitive effects can arise when firm-specific distress allows rivals to capture market share or act in an oligopolistic fashion.

To analyze how vertical supply chain effects interact with horizontal contagion and competitive effects, we examine customer and supplier stock price effects conditional on whether distress- and filing-period abnormal returns to portfolios of industry rivals are less than or greater than zero. Conditioning on the filing firm industry stock price reaction allows us to consider several issues. First, many of the individual suppliers and customers of our filing firms may also have contracts with the

filing firms' competitors. To the extent that horizontal contagion (rival portfolio return less than zero) suggests that the effects of distress are industry-wide, customers and suppliers will also suffer in their dealings with other firms in the filing firm industry. Furthermore, even among 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 impaired. In sum, if contagion spreads along the supply chain to customers and suppliers, we expect it will be most pronounced when the filing-firm industry experiences contagion.

Second, 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*, the impact on the filing firm's customers and suppliers may be limited to the cost of switching to other firms in the industry (with whom they may have existing business). Alternatively, if the wealth gains among surviving rivals reflect an increase in *market power*, the elimination of the filing firm may allow surviving rivals to achieve collusive pricing (bad for customers) and restrict output (bad for suppliers). Also, the related *buying power* hypothesis (discussed in Shahrur, 2004) suggests that increased concentration allows for more aggressive pricing from suppliers with no necessary consequences for customers. Focusing on the subsample of filings where horizontal rivals appear to gain a competitive advantage (rival portfolio return greater than zero) allows us to address these issues.

3.2. The effect of distress and bankruptcy on industry rivals

To compute the wealth effects of pre-filing distress and the bankruptcy filing on a bankrupt firm's competitors, we follow Lang and Stulz and form a value-weighted portfolio of all firms in the same four-digit SIC code as the filing firm. To be included in the analysis, rivals must have sufficient returns on the CRSP file around either the filing date or pre-filing distress date. Of the 250 filing firms that have at least one customer or one supplier, 231 have at least one four-digit SIC rival with sufficient

returns on the CRSP file around the time of the bankruptcy filing. The average (median) number of rivals per filing firm is 52 (20).

Table 2 reports the distress- and filing-period abnormal returns to the rivals of the filing firm. The average return to the industry portfolios is the equally-weighted average of the individual value-weighted portfolio returns formed for each bankruptcy. Panel A reports results for the full sample and Panel B reports results for the subsample of 112 filing firms that have more than \$120 million in debt outstanding at the time of the filing. Lang and Stulz use the \$120 million cutoff to restrict attention to larger bankruptcies with greater potential for industry-wide effects.

Focusing first on the filing-period returns, it is clear that contagion effects are more prominent for the larger bankruptcies. For example, the average abnormal return for the event window including days -1 and 0 is -1.68% (significant at the 1% level) for the large bankruptcies as compared to -0.64% for the full sample. The table also shows that industry rivals suffer significant contagion effects *prior* to the bankruptcy filing. Distress-period industry abnormal returns are negative and significant for both the full sample and for the subsample of larger bankruptcies; again, the contagion effect is more pronounced for the larger bankruptcies. This evidence of pre-filing stock price effects is one of the contributions of our study, and highlights the fact that focusing on the filing date alone provides an incomplete picture of contagion effects.

Lang and Stulz (1992) report that rivals in more competitive industries (lower Herfindahl indices) experience significantly more negative filing-period returns.¹⁶ They argue that this is observed because competitive benefits to rivals are more prominent in low-concentration (high Herfindahl) industries, and that contagion therefore dominates in competitive industries. For purposes of comparison with Lang and Stulz (1992), Table 2 also reports results broken out by filing firm industry

¹⁶ Industry concentration is measured using Herfindahl indices, computed as the sum of squared industry market shares using sales data for all firms in the same 4-digit SIC code from Compustat.

concentration. We find similar results, and note that the below-median-Herfindahl effect is also evident in the pre-filing distress period.

4. Distress- and filing-period returns to suppliers and customers

Table 3 contains average distress- and filing-period abnormal returns to suppliers and customers. For each bankruptcy, equal-weighted customer and supplier portfolios are formed; the average supplier and customer returns are the equal-weighted averages of these portfolio returns. We report average supplier and customer portfolio returns for the full sample and for two subsamples formed according to whether the respective rival portfolio abnormal returns (Table 2) are greater than or less than zero.

4.1. Abnormal returns to filing-firm suppliers

Turning first to the suppliers, Table 3 shows evidence of significant contagion effects in the filing period and the pre-filing distress period. The average filing-period abnormal return for supplier portfolios is -1.94% (significant at the 5% level). The percentage of supplier portfolios with negative filing-period returns is 63%, which is significant at the 5% level. The average distress-period abnormal return is -0.81% (significant at the 10% level), and the percentage of negative returns is equal to 60% (significant at the 10% level). These findings provide new evidence that contagion effects extend beyond industry rivals to suppliers of filing firms and occur both prior to filing as well as at the filing date.

We also find evidence that supplier contagion effects are more severe when there are horizontal contagion effects in the filing firm industry. Suppliers experience an average abnormal filing-period return of -4.76% (significant at the 1% level) for the subsample of filings where horizontal rivals have negative filing-period abnormal returns. This compares to an insignificant average abnormal return of 1.95% for the subsample with non-negative rival abnormal returns. We find similar results for the pre-filing distress period: the average supplier abnormal return is -1.94% (significant at the 5% level) when

rival distress-period abnormal returns are negative and 1.80% (and insignificant) when rival abnormal returns are greater than or equal to zero.

We attribute the more negative supplier response in the presence of industry contagion to fewer opportunities for suppliers to switch to different customers when the entire industry is impaired, and to the likelihood that the filing firm suppliers also have contracts with rivals of the filing firm which suffer when industry contagion exists.¹⁷

4.2. Abnormal returns to filing-firm customers

Table 3 shows that customers do not suffer significant wealth effects in either the filing or the pre-filing distress period. Furthermore, we are unable to detect wealth effects for filing-firm customers even in the case where horizontal contagion effects are evident in the filing firm industry. However, we do observe a positive and significant distress-period abnormal return of 1.0% to customers when the filing firm industry responds favorably to the distress of the filing. At first blush, this finding (and the positive, albeit insignificant, supplier response in the same subsample) is puzzling as it is difficult to explain why a customer or supplier would benefit from shifts in market share within the distressed firm industry. However, these findings are of interest 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, customers (and suppliers) 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.¹⁸

¹⁷ Even if customers and suppliers take action to avoid harm from a linked firm's distress, such actions are not costless, and may impose substantial negative wealth effects even if alternative sources of supply or alternative customers are found (switching costs). This suggests that observed stock price reactions for the distressed firm's customers and suppliers will reflect the effect of the harm caused to customers or suppliers (including any switching costs) net of the losses avoided by taking protective actions (such as changing suppliers or selling to alternative customers). It is an empirical question as to how large these net effects are, but Table 3 suggests that they can be statistically and economically significant.

¹⁸ To provide additional evidence on this, we divided the subsample of positive industry responses into above and below median Herfindahl index subsamples. Consistent with the lack of market power effects, we find no evidence that customers or suppliers are adversely affected when a highly concentrated industry responds favorably to the distress of a rival.

As mentioned in section 2.1., one potential explanation for the generally insignificant findings for customers is that although we identify “major” customers of the filing firms, the customers may not, in turn, be reliant on the filing firms. However, we find that our subsample of reliant customers (defined in section 2.1.) also fail to show any evidence of contagion effects. Specifically, for the subsample of 38 reliant customer portfolios, the average distress-period abnormal return is -2.73% ($t = -1.11$) and the average filing-period abnormal return is 0.42% ($t = 0.28$).

There are several potential explanations for the lack of significant customer contagion effects. One possibility is that we have not successfully identified the economically relevant customer firms. Another possibility is that for our sample (and, perhaps, more generally) financial distress largely reflects a shift in demand away from the filing firm and, possibly, the filing firm industry. According to this view, contagion due to distress (and here, *economic distress*, may be the operative term) spreads upstream such that suppliers are hurt because of a reduction in the *derived* demand for their output. Here, customers are not affected by the distress as much as they are the source of the distress. Clearly, customers that are more closely tied to the filing firm and/or the filing firm industry (inelastic demanders, those with fewer good substitutes, those buying specific products) may suffer negative consequences associated with higher costs of switching. However, the switching cost argument does not apply to customers who have already shifted, or are shifting, away from the output of the filing firm industry.¹⁹

4.3 Post-filing period abnormal returns to suppliers and customers

A recent paper by Cohen and Frazinni (2006) provides evidence of supplier return predictability for a large sample of customer-supplier pairs identified, as we do in this study, using the Compustat segment files. Specifically, they find that a strategy of buying suppliers whose customers had the most positive returns and selling those suppliers whose customers had the most negative returns yields abnormal

¹⁹ It is also the case, in this setting, that switching costs will be more consequential for suppliers who are losing customers. That is, unsatisfied demand from customers should ultimately be met. However, suppliers will not necessarily have an outlet for their product.

returns of over 20% per year. The authors argue that the success of this “customer momentum” strategy constitutes evidence that investors display limited attention by failing to take into account “...publicly available and often longstanding relationships between firms....” For our purposes, if investors suffer this particular cognitive bias (or any other bias that leads to investor underreaction) then our estimates of supply chain contagion effects are downward biased (i.e., we understate the true effect of a firm’s bankruptcy on linked customers or suppliers). We, therefore, examine post-filing returns to suppliers and customers for evidence of investor underreaction.

To measure long-run post-filing stock price performance we follow Jaffe (1974), Mitchell and Stafford (2000) and Brav, Geczy and Gompers (2000), among others, and estimate calendar-time factor regressions. Every month from January 1984 to May 2005, we form a portfolio of suppliers to firms that file for bankruptcy within the past year. Returns to the individual suppliers are averaged (equal-weight) for each bankruptcy event and averaged (equal-weight) across bankruptcy events in the supplier portfolio to obtain the portfolio return for the given month, and we use the Fama and French (1993) three-factor model and the Carhart (1997) four-factor model to explain the excess return of supplier portfolio returns over the one-month T-bill rate. We follow the same approach for customers using the December 1982 to October 2005 time period. For brevity, our results are not tabulated.²⁰ While we do find negative intercepts in the regressions described above, consistent with investor underreaction, none are statistically significant. One possibility is that the lack of significance is due to small sample size. Another possibility is that bankruptcy filings are significant events which attract sufficient attention of investors in related firms. In either case, the results here do not suggest that filing-period returns understate contagion effects for suppliers and customers.

5. Distress- and filing-period returns to supplier and customer industries

The significant contagion effects we document in the previous section are for suppliers that are most reliant on the filing firms and, thus, most likely to be adversely affected by the distress of the filing firm.

²⁰ These results are available from the authors by request.

Therefore, extrapolation of these effects to suppliers of filing firms that do *not* meet the 10% of revenue threshold for required reporting would overstate the effects of contagion. On the other hand, if we were to assume that other suppliers (because we can not directly identify them) were unaffected then we might be understating the supply chain effect. In this section, we investigate whether contagion effects are evident in the *industries* of the major customers and reliant suppliers studied in the previous section.

There are at least two reasons to expect that other firms in the supplier and customer industries may be affected by the distress and bankruptcy of the filing firm. First, as just suggested, firms in these industries may be direct suppliers or customers of the filing firm even if not identified in FAS 14 disclosures. Second, firms in these industries may be suppliers or customers of other firms in the filing firm industry, such that horizontal contagion can have direct consequences for industries along the supply chain.

To measure wealth effects for supplier and customer industries, we form value-weighted portfolios of all firms with the same four-digit SIC code as our identified suppliers and customers, respectively. In cases where filing firms have multiple suppliers or customers, we equal-weight the individual value-weighted supplier or customer industry portfolios for each bankruptcy. Table 4 contains average distress- and filing-period abnormal returns to the supplier and customer industries. As we do in Table 3, we report results for the full sample and for two subsamples formed according to whether the respective horizontal rival portfolio abnormal returns are greater than or less than zero.

The results in Table 4 show evidence that contagion effects spread beyond reliant suppliers and major customers to their respective industries. Panel A shows that supplier industries suffer negative and significant filing- and distress-period abnormal returns for the subsample of filings where horizontal contagion effects are present, as well as negative and significant distress-period abnormal returns for the full sample. Panel B reports a similar finding for customer industries. These findings bolster our evidence on individual suppliers and customers and constitute new evidence on the extent of contagion effects of financial distress and bankruptcy.

6. Cross-sectional determinants of the returns to suppliers and customers

In this section, we consider factors that extant theory suggests might lead to cross-sectional differences in the nature and extent of supplier and customer contagion. Specifically, we examine the effect of supplier and customer leverage, supplier and filing firm product specificity, filing firm industry concentration, and the outcome of the bankruptcy process.

6.1. Hypothesized cross-sectional effects

Customer and supplier leverage. For several reasons we expect contagion effects to be larger for suppliers or customers that have greater leverage. First, contagion effects apply to a firm's total value; firms with greater leverage have a greater elasticity of equity value with respect to total firm value. Second, to the extent that leverage reduces the flexibility of customers and suppliers to respond to the distress of the filing firm, it increases contagion.²¹ We examine the effects of both leverage and industry-adjusted leverage (difference from the median industry leverage) on customer and supplier returns. We use unadjusted leverage to investigate elasticity effects and industry-adjusted leverage to consider the financial flexibility hypothesis.

Product specificity. We expect that suppliers that sell specialized products to the filing firm are more likely to experience contagion than suppliers of less specialized products because of the likelihood of greater contractual ties to the filing firm and higher costs of rerouting output to alternative customers. Similarly, we expect that customers that purchase specialized products from the filing firm are more likely to experience contagion than customers of filing firms that sell less specialized products. Following Titman and Wessels (1988), we use R&D intensity as a proxy for the specialization of a

²¹ Stulz (1990) presents a model that shows the tradeoff between the disciplinary benefits of debt and the negative effects on the firm's ability to take on positive NPV projects when these come up unexpectedly and are difficult for outsider investors to assess. Also Bolton and Scharfstein (1990) provides a model where a firm with little debt can prey on a highly levered firm due to the latter's lack of "flexibility to respond to changes in market conditions."

firm's product. We measure R&D intensity as the ratio of R&D expense to sales using Compustat data for the year prior to the distress date.²²

Industry concentration. Suppliers and customers of filing firms in more concentrated industries face fewer switching alternatives for re-routing supply or demand, respectively, and thus are more likely to suffer greater contagion effects.²³ Furthermore, if (as claimed in Lang and Stulz) competitive benefits to horizontal rivals are more likely to occur in concentrated industries, then suppliers or customers are more likely to suffer if those competitive benefits take the form of increased market (and therefore pricing) power for the remaining rivals (as discussed above).

Outcome of bankruptcy process. We expect that contagion effects will be greater when the filing firm does not successfully emerge from the bankruptcy process as an independent entity. To determine the outcome of the bankruptcy process, we hand-collect initial Chapter 11 resolution dates from Commerce Clearing House Capital Changes Reporter, Lexis/Nexis, and Factiva and classify firms into two emergence-related categories. Specifically, our “emerge” indicator variable is set equal to one for filings where we can identify an effective reorganization plan; is set equal to zero otherwise (including those Chapter 11 filings that are converted to Chapter 7 liquidations, result in the sale or acquisition of the firm, are still being resolved at the end of our sample period, or have unpublicized outcomes).²⁴ We also require that emerging filing firms have data on Compustat in the year following reorganization.

6.2. Cross-sectional evidence and discussion

Overall, our empirical analysis shows very little evidence of predictable cross-sectional variation in pre-filing and filing-period abnormal returns to customers and suppliers. We try a number of approaches. We conduct univariate tests comparing abnormal supplier and customer filing- and distress-period

²² Set equal to zero if R&D data is not reported on Compustat and equal to one if the ratio is above one.

²³ Our measure of industry concentration is described in Section 3.

²⁴ In theory, liquidation and acquisition are separate outcomes. Practically speaking, however, a piecemeal vs. an intact asset sale is not a binary distinction. In fact, many reorganization plans that allow for the emergence of an independent, Compustat-covered firm also include a substantial sale of firm assets. A classification rule dependent on the percentage of firm assets that remain intact is further complicated by time-horizon considerations.

returns for subsamples based on below- and above-median measures of the characteristics described above. The only potentially interesting cross-sectional findings that we uncover are that supplier returns are substantial and negative on average when the filing-firm has high R&D intensity (indicating the production of specialized products and, presumably, the purchase of specialized inputs from suppliers) and when the filing firm does not emerge from bankruptcy as an independent entity. However these univariate differences are not statistically significant. We also conduct multivariate regressions including specifications, motivated by findings in Lang and Stulz (1992), that interact leverage and industry concentration, and run weighted-least-squares regressions where the observations are weighted by measures of reliance on the filing firm ((sales to filing firm / total sales) for suppliers and (purchases from filing firm / total cost of goods sold) for customers). None of these multivariate approaches delivers statistically significant results as anticipated above.

We attribute the lack of statistical significance of our tests to small sample sizes, noisy abnormal returns (especially in the case of customers) and the coarseness of the proxies used to capture the characteristics we are considering. We note that in our sample, for example, leverage and R&D intensity are significantly negatively correlated such that each could potentially proxy for certain aspects of product specificity in a way that is apparently immune to being resolved in a multivariate regression. Most importantly, however, our hypotheses primarily concern the relations between firms and their suppliers or customers, and such relations are often complex, and, moreover, specific to the firm-pair in question. This complexity is significantly enhanced by the bankruptcy process itself. For example, in Chapter 11 proceedings some suppliers are given preferential status over others depending on how critical the bankruptcy court believes that the provision of goods or services by the supplier is to the successful reorganization of the filing firm.²⁵ These idiosyncrasies clearly impair our ability to explain the cross-section of supplier and customer abnormal returns to distress and bankruptcy events.

²⁵ The rules governing the treatment of suppliers in bankruptcy were substantially overhauled by the Bankruptcy Abuse Prevention and Consumer Protection Act, signed into law in April, 2005.

7. Conclusion

We believe this to be the first paper to provide direct large-sample evidence on how financial distress and bankruptcy affect a firm's customers and suppliers. We examine the wealth effects of bankruptcy filing and pre-filing distress on 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 suppliers and customers, we focus on pre-filing distress in addition to filing date effects.

We identify some important and economically relevant results. Supplier abnormal returns around both the distress and bankruptcy filing of a major customer are significantly negative on average, especially so when the filing firm's horizontal rivals appear to experience contagion. Furthermore, neither suppliers nor customers appear to be significantly impaired by the so-called competitive benefits of a filing firm's bankruptcy – supplier and customer average abnormal returns are insignificantly different from zero when horizontal rivals experience positive returns in the filing period. This evidence suggests that competitive benefits to rivals are likely due to increased market share rather than market (or pricing) power. Lastly, we identify significantly negative abnormal returns to portfolios of firms in supplier and customer industries when the filing-firm's industry appears to suffer contagion, suggesting that contagion from a linked firm's distress and bankruptcy has wider economic consequences.

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.

One avenue for future research is to consider how the *nature* of 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 *strictly financial* distress, but conceivably also economic). Classifying bankruptcies by type of distress

may be one way to provide insights on the difference between financial and economic distress, and the implications of both for rivals, customers, and suppliers.

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Table 1. Summary Statistics

Panel A reports the distribution of bankruptcy events by year. Panel A shows the distribution by year. The first column shows all bankruptcy filings between 1978 and 2004 from Bankruptcy DataSource Index. The second column reports the number of filing firms that have at least one customer or supplier around filing day or distress day. The last two columns report the number of filing firms with filing day or distress day customer portfolios and supplier portfolios, respectively. The numbers in parentheses are average number of customers/suppliers in the portfolio. Panel B reports the distribution of filing firms by industry (industry definitions available at: http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/Data_Library/det_12_ind_port.html).

Panel A. Sample distribution by year

Year	# of bankruptcies	# with customer/supplier match	# with customer portfolio	# with supplier portfolio
1978	1			
1979				
1980	6			
1981	12	1	1 (1.0)	
1982	24			
1983	24	1		1 (1.0)
1984	36	1		1 (1.0)
1985	41			
1986	41	1	1 (1.0)	1 (1.0)
1987	37	2		2 (2.5)
1988	53	1		1 (2.0)
1989	81	2	1 (1.0)	1 (1.0)
1990	98	5		5 (1.4)
1991	107	5	1 (1.0)	4 (1.3)
1992	81	4		4 (2.3)
1993	70	4	2 (1.0)	2 (1.0)
1994	42	2	1 (2.0)	1 (1.0)
1995	54	4	1 (4.0)	3 (2.0)
1996	52	7		7 (3.4)
1997	50	3	2 (1.0)	1 (1.0)
1998	76	2	2 (1.5)	
1999	108	18	8 (2.6)	12 (1.1)
2000	123	25	16 (1.5)	11 (1.1)
2001	203	64	41 (2.0)	29 (2.2)
2002	142	54	38 (2.1)	21 (4.6)
2003	93	31	27 (2.0)	9 (1.0)
2004	40	13	12 (2.2)	2 (1.0)
Total	1695	250	154 (2.0)	118 (2.2)

Panel B. Sample distribution by industry

Industry	# with customer/supplier		# with customer portfolio	# with supplier portfolio
	match			
1. Consumer non-durables	17		14 (2.3)	6 (1.5)
2. Consumer durables	11		9 (1.9)	4 (1.0)
3. Manufacturing	39		29 (2.2)	14 (1.6)
4. Energy	9		6 (2.2)	3 (2.3)
5. Chemicals	3		2 (1.5)	1 (1.0)
6. Computers software, etc.	57		46 (1.8)	19 (1.6)
7. Telephone and TV	27		9 (1.6)	20 (2.4)
8. Utilities	2			2 (2.0)
9. Wholesale	43		13 (1.5)	32 (3.7)
10. Medical	11		8 (1.3)	3 (1.0)
11. Finance	6		4 (2.5)	2 (1.0)
12. Other	25		14 (2.4)	12 (1.2)
Total	250		154 (2.0)	118 (2.2)

Table 2. Rival abnormal returns

This table contains average cumulative filing- and distress-period abnormal returns for filing firm rivals, and for rival sub-samples based on below- and above-median filing industry Herfindahl indices. Rivals are identified as all firms with the same four-digit SIC code as the filing firm (excluding the filing firm itself, and any firm that has been identified as a customer or supplier) from CRSP. Filing firm Herfindahl indices are also based on four-digit SIC code. Abnormal returns are cumulated for the indicated windows relative to the filing- and distress- day, and abnormal returns are calculated using Market Adjusted Returns (MAR) with value weighted CRSP index as the market index. The average cumulative abnormal return to rivals is the equally-weighted average of value-weighted portfolios of rival returns formed for each filing firm. Panel A shows rival reaction for all sample around filing day and distress day, while Panel B shows rival reaction for filing firms with debt of at least \$120 million. Debt is calculated as current liabilities (data5) plus long term debt from Compustat. Standard errors are computed as described in Patell (1976). ***, **, or * indicates that the statistic is significantly different from zero (using a two-sided t-test) at the 1%, 5%, or 10% level (respectively).

Panel A. Rival reaction for full sample

	Filing-period abnormal returns			Distress-period abnormal returns		
	Herfindahl indices			Herfindahl indices		
	Full sample	Below median	Above median	Full sample	Below median	Above median
(-2,+2)	-0.49% (231)	-1.11%** (116)	0.13% (115)	-1.29%*** (201)	-1.32%*** (101)	-1.27% (100)
(-1,0)	-0.64% (231)	-1.17%** (116)	-0.10% (115)	-0.99%*** (201)	-1.23%*** (101)	-0.76%* (100)
(-5,+5)	-0.39% (231)	-1.04% (116)	0.26% (115)	-1.73%*** (201)	-1.53%* (100)	-1.93%* (100)

Panel B. Rival reaction if filing firm debt >=120 million

	Filing-period abnormal returns			Distress-period abnormal returns		
	Herfindahl indices			Herfindahl indices		
	Full sample	Below median	Above median	Full sample	Below median	Above median
(-2,+2)	-1.86%*** (112)	-3.05%*** (56)	-0.67% (56)	-1.71%*** (99)	-2.06%*** (50)	-1.36% (49)
(-1,0)	-1.68%*** (112)	-2.96%*** (56)	-0.40% (56)	-1.33%*** (99)	1.67%*** (50)	-0.99% (49)
(-5,+5)	-2.99%*** (112)	-4.41%*** (56)	-1.58% (56)	-2.95%*** (99)	-3.70%*** (50)	-2.18%* (49)

Table 3. Supplier and customer abnormal returns

This table contains average cumulative filing- and distress-period abnormal customer and supplier portfolio returns for the sample of filing firms in Table 1. Customers and suppliers are identified through FAS 14 pre-distress disclosures intended to detail any material (greater than 10% of sales) for any firm. Customers (in any year) of the filing firms are directly identified in this way, and any firm listing the filing firm in the prior five years as a customer is labeled a supplier to the filing firm. FAS 14 disclosures are obtained from COMPUSTAT. Equal weighted customer and supplier portfolios are formed from the individual customers and suppliers for each filing. 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 value weighted CRSP index as the market index. The full sample is also divided into two sub-samples based on whether the cumulative abnormal returns to rivals to the filing firm are greater than (or equal to) zero or less than zero. Rivals are identified as described in Table 2. The sample of customers and suppliers is then bisected on the sign of the value-weighted cumulative abnormal return to the rival portfolio over the filing or distress period (for the respective filing- and distress-period returns to customers and suppliers). Standard errors are computed as described in Patell (1976). ***, **, or * indicates that the statistic is significantly different from zero (using a two-sided t-test) at the 1%, 5%, or 10% level (respectively). The numbers in parentheses are the numbers of observations.

	Average cumulative abnormal returns					
	Filing-period			Distress-period		
	Full sample	Rival abnormal return ≥ 0	Rival abnormal return < 0	Full sample	Rival abnormal return ≥ 0	Rival abnormal return < 0
Suppliers	-1.94%** (115)	1.95% (45)	-4.76%*** (63)	-0.81%* (94)	1.80% (35)	-1.94%** (54)
Customers	-0.19% (152)	0.40% (77)	-0.67% (64)	-0.73% (130)	1.00%** (53)	-1.93% (70)

Table 4. Supplier and customer industry abnormal returns

This table contains average cumulative filing- and distress-period customer and supplier industry portfolio abnormal returns for the sample of filing firms in Table 1. 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 value weighted CRSP index as the market index. Firms in the customer or supplier industry are identified as all firms with the same four-digit SIC code as the customers or suppliers in Table 3. The customer or supplier industry portfolio return for each bankruptcy event is the equal-weighted average of the value-weighted portfolio return for all firms each four-digit SIC code industry. Customer or supplier industry portfolios are also divided into two sub-samples based on whether the cumulative abnormal returns to rivals to the filing firm are greater than (or equal to) zero or less than zero. Rivals are identified as described in Table 2. The first row shows returns for the full sample of suppliers, while the second row shows returns for a sub-sample of filing events for which the filing firms has debt of at least \$120 million. Standard errors are computed as described in Patell (1976). ***, **, or * indicates that the statistic is significantly different from zero (using a two-sided t-test) at the 1%, 5%, or 10% level (respectively).

Panel A. Supplier industry abnormal returns

	Average cumulative abnormal returns					
	Filing-period			Distress-period		
	Full sample	Rival abnormal return ≥ 0	Rival abnormal return < 0	Full sample	Rival abnormal return ≥ 0	Rival abnormal return < 0
Full sample of supplier industries	-0.41% (115)	1.06% (45)	-1.81%*** (63)	-1.33%** (94)	0.62% (35)	-2.13%*** (54)
Supplier industries for filing firms with debt ≥ \$120m	-0.81% (67)	1.06% (22)	-1.72%** (45)	-0.85%** (57)	0.63% (22)	-1.78%** (35)

Panel B. Customer industry abnormal returns

	Average cumulative abnormal returns					
	Filing-period			Distress-period		
	Full sample	Rival abnormal return ≥ 0	Rival abnormal return < 0	Full sample	Rival abnormal return ≥ 0	Rival abnormal return < 0
Full sample of customer industries	-0.58% (152)	-0.14% (77)	-0.95%** (64)	-0.32% (130)	1.07% (53)	-1.26%** (70)
Customer industries for filing firms with debt ≥\$120m	0.04% (61)	0.50% (30)	-0.40% (31)	-0.23% (55)	1.09% (22)	-1.11% (33)