Beyond Internal Capital Markets: The In-House Transmission of Adverse Sales Shocks and the Collateral Channel[*]

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Abstract

We study how shocks to some business segments affect investment in a firm's non-shock segments. We find that subsequent investment in the non-shock segments is significantly lower compared to segments of firms that do not experience shocks. Surprisingly, lower availability of internal funds does not account for the lower investment. We find that segment shocks propagate within the firm by decreasing the value of collateral assets and reducing the availability of external finance. Our results support the operation of an external-finance *collateral* channel (Kiyotaki and Moore (1997)) previously discussed in the literature.

1. Introduction

Putting different industry segments under the same roof is likely to have real consequences — events in one segment of a firm may affect investment policies of, and resources allocated to, other segments. In a world of capital market imperfections, segment investment depends not only on investment opportunities in a particular segment, but also on the cash flows and asset values of the whole firm. Therefore, an unfavorable shock that decreases cash flows or asset values of a segment may reduce investment in the remaining segments. Shin and Stulz (1998) find that segment investment depends on the cash flow of the firm's other segments. Lamont (1997) reports that non-oil investment by oil companies declined following large decreases in the oil segments' cash flows.

Lamont's (1997) pioneering work was somewhat limited by the fact that the data came only from one particular industry episode, so that he could only look at 26 firms and 40 segments. Although focusing on the oil industry gave him a very clean "controlled experiment" in that the shock was unquestionably exogenous to the non-oil segments, the paucity of data meant that he could not investigate the mechanisms through which the shocks to the oil segments were transmitted to the non-oil segments. Disentangling the effects of alternative channels of transmission by utilizing the full sample of *Compustat* firms is one of the main contributions of this paper. We identify multi-segment firms that experience major sales declines (sales shocks) but where the decline in sales is confined to only some of the segments (the "shock" segments). We then investigate the effect of the sales shock on the subsequent investment in the segments that did not experience a contemporaneous decline in sales (the "non-shock" segments). We are especially interested in seeing whether the mechanism of

transmission goes beyond the obvious cash channel – i.e., lower availability of internal funds.

We find shock firms invest less in their "non-shock" segments relative to segments of firms that do not experience sales shocks. Contrary to what might be expected, however, our results suggest that the effect of a decrease in the overall availability of internal funds is not of first-order importance in explaining the lower investment by the non-shock segments of the affected firms. While a lower availability of internal funds – ceteris paribus – is expected to result in lower investment in the non-shock segments of financially constrained firms, the shock is also associated with a loss of investment opportunities in the shock segments. The latter implies that more internal funds are available for investment in the non-shock segments, which should cause the non-shock segments to invest more. Indeed, our results show that for the shock firms, these two effects typically tend to offset each other.

Importantly, even after controlling for the availability of internal funds, investment by the non-shock segments is significantly lower. It follows, therefore, that the transmission mechanism of the sales shocks goes beyond internal capital markets and the availability of internal funds, and other "non-cash" channels of transmission are at work. One potential candidate is the external financing channel. The cost of external financing could increase, and the availability of external funds could decrease, subsequent to the shock. There may be several specific channels through which this happens. For example, the debt overhang problem could become more severe as the firm becomes more likely to default, making it costly to raise new junior debt. We examine one particular channel of transmission, namely the "collateral channel".[1]

[1] See, for example, Irving Fisher (1933) for an early contribution of the study of how financial market imperfections can magnify an initial shock, Hubbard (1998) for a review, Kiyotaki and Moore (1997) for a recent theoretical analysis, Gan (2003), Almeida and Campello (2004) and Campello (2005) for recent empirical studies related to the collateral channel.

Financially constrained firms that depend on the collateralizable value of their fixed assets to raise external capital are especially vulnerable to adverse shocks that impair the resale value of these assets. A drop in collateral value will impair the ability of the firm to raise external capital, which in turn will lower investment in fixed assets, further reduce the ability of the firm to raise external capital, and so on (Kiyotaki and Moore (1997)). Therefore, we expect the investment cuts in the non-shock segments to be larger for firms with more collateralizable assets under conditions that will impair the value of these assets.

We find evidence consistent with a collateral channel of transmission. As a first step, we examine whether firms with a higher ratio of an estimate of fixed assets in the shock segments to total firm assets invest less in the non-shock segments (after controlling for the relative size of the shock segments). We find that non-shock segment investment is significantly lower for these firms, and the effect persists for at least three years after the shock. We then examine the possibility that firms may experience a drop in collateral value for different reasons, depending on whether or not the shock is primarily firm-specific, or industry-wide. We argue that the collateral value of the assets is most likely to be impaired after a shock if the firm's competitors (the potential buyers of these assets) are also experiencing negative shocks (Shleifer and Vishny (1992)). We find that a higher proportion of collateral that is impaired by an industry shock to the firm's total assets is associated with a bigger decline in investment in the non-shock segments when the firm is highly levered. We conjecture that the effect shows up only for high debt firms because managers may be more willing to sell assets when the shock is of industry origin (as such sales do not signal managerial mistakes (Boot (1992)), and this largely offsets the lower liquidation value of these assets for this type of shocks; however, for highly levered firms, the lower liquidation value has a more serious effect

on the firm's ability to raise external finance, leading to more severe decline in investment in the non-shock segments.

Our primary criterion for identifying shock firms is in the spirit of Lamont's (1997) classification, and similar to that in several other studies (Opler and Titman (1994), Bertrand and Mullainathan (2001), and Campello (2003)). We identify firms that are below-median in terms of sales growth and stock return in industries that experience adverse median sales growth and stock returns. Since the shocks in these instances are of industry origin, they are exogenous to the *non-shock segments* of the shock firms, i.e., those segments that experience a contemporaneous *increase* in sales. Our primary tests of the transmission mechanism and the collateral channel are based on this sample. However, to test hypotheses about the transmission of firm-specific versus industry-wide shocks, we need a different sample. Accordingly, we identify a sample of shock firms and non-shock segments based solely on a major drop in sales and significantly negative stock returns for the firm.[2] Since the latter sample comprises of both types of shocks, it allows us to contrast the ways in which they are transmitted to the non-shock segments.

The rest of the paper is organized as follows. Section 2 reviews the literature. Section 3 describes the data and our sample. Section 4 presents the empirical results. Finally, Section 5 concludes.

2. Relationship to Existing Literature

[2] There is clearly concern that for the second sample, a common factor could drive the adverse performance of both the shock segment and the non-shock segments at some lag. For example, the firm could have been performing poorly (as manifested by the poor stock returns), and as a result, was forced to sell assets. It is possible that for the same reason, it subsequently cut investment in the non-shock segments. However, while this might explain why the firm invests less in the segments identified as non-shock, it would not explain why the effect of the shock on the non-shock segments would be magnified by the proportion of fixed assets impaired by the shock (after controlling for the relative size of the shock segment).

2.1 The Cash Channel and Internal Capital Markets

Our work is closely related to a branch of research that studies the financial interdependence of segments in a firm. In a world of capital market imperfections, the level of segment investment depends on the internal capital market. Shin and Stulz (1998) document that in multi-segment firms, segment investment is sensitive not only to the segment's own cash flows, but also to the cash flows of the firm's other segments, although the extent of the latter sensitivity is lower than that of the former. This suggests that a shock that reduces the cash flow of a segment will decrease investment by other segments of the firm. Lamont (1997) provides empirical evidence in support of this hypothesis. In particular, Lamont studies the capital expenditures of oil companies' non-oil segments in response to the 1986 oil shock, in which oil prices fell by 50 percent. He finds that a large decrease in cash flow or collateral value in a firm's oil segment led to a reduction in its investment in non-oil segments. However, he is unable to untangle the effect of changes in cash flow and the effect of changes in collateral value because of the small sample size (26 firms and 40 segments). More recently, Campello (2002) finds that a small bank's loan growth is more sensitive to its cash flow when monetary policy tightens if it is a stand-alone bank, as opposed to being a part of a multi-bank holding company. Further, he finds that there is inefficient cross-subsidization when the holding company is financially constrained, but there is "winner-picking" when the latter is unconstrained, consistent with Scharfstein and Stein (2000). Dimitrov and Tice (2006) find that diversification alleviates financial constraints: in recessions, bank-dependent focused firms suffer bigger sales declines than diversified bank-dependent rivals.

2.2 The Collateral Channel

Besides cash flow, investment by one segment also depends on asset values of other segments. Collateral is important in raising financing in the presence of incentive problems and asymmetric information between the firm and capital markets. Therefore, a shock to one segment that reduces the collateral value of the firm may affect investment in the remaining segments. Theoretically, Kiyotaki and Moore (1997) show that a negative temporary shock that reduces the collateral value of a constrained firm can produce effects that persist and amplify via this "collateral channel". Following their argument, in our context, given that a firm's borrowing capacity depends on its collateral value, when the collateral value falls as a result of a shock to one segment, the firm will not be able to borrow as much as before. The financially constrained firm will be forced to cut back on investment, including investment in collateralizable assets. This in turn will further reduce its ability to borrow, and so on. The effects of the shock will thus be amplified and propagated to other non-shock segments. Investment in these segments will be significantly reduced and will become more reliant on internal cash flows of the firm.

Three recent studies find empirical evidence in support of the collateral channel. Gan (2004) studies the dramatic collapse in land prices in Japan in the 1990s — an exogenous shock that reduced the collateral value of Japanese firms. She finds that the pre-shock landholding of Japanese firms (a proxy for the exogenous shock to their collateral value) explains the reduction in firm investment and the increase in firms' reliance on internally generated funds. Based on Compustat manufacturing firms between 1971 and 2000, Almeida and Campello (2004) also show that pledgeable assets are important and significant determinants of investment for financially constrained

firms. In particular, they find that investment-cash flow sensitivities increase in asset pledgeability for financially constrained firms. Campello (2005) examines a related issue. He argues that providers of external finance will not have a credible threat to liquidate a firm's assets if asset tangibility is low. This will reduce the firm's ex-ante incentive to perform well. Using several alternative measures of asset tangibility, Campello (2005) finds that firms that rely more on external finance perform better if asset tangibility is higher. However, none of the above three papers study how a shock that originates in certain segments and reduces the collateral value of the firm's assets affects investment in other segments, as we do.

3. Data, Sample Selection and Summary Statistics

3.1 Data

Our samples consist of multi-segment firms that have financial reporting for two or more industry segments (see the definition below) from *Compustat* active and research Industry Segment Files. According to the Statement of Financial Accounting Standards No.14, an industry segment is a component that engages in providing a product or service, or a group of related products or services primarily to unaffiliated customers for 10 percent or more of the profit of the firm. The data files report segment-level SIC codes, net sales, operating profit/loss, depreciation, depletion and amortization, capital expenditures, and identifiable assets of U.S. firms, including those that were subsequently delisted from *Compustat* because of mergers, bankruptcies, liquidations, etc., over the period from 1979 to 1997. Our sample ends in 1997 because segment reporting requirements changed after 1997 (see Statement of Financial

Accounting Standards No. 131: Disclosures about Segments of an Enterprise and Related Information, June 1997).

To be included in our samples, each segment year must have complete information on net sales, operating profit/loss, depreciation, depletion and amortization, capital expenditure (hereafter investment), and identifiable assets. We exclude firms and segments in the financial sector (with a SIC code between 6000 and 6999) because of differences in accounting practice. To avoid the influence of coding errors, we also exclude a firm year if any of the firm's segments has either investment or the absolute value of cash flow (operating profit/loss plus depreciation) in excess of the book value of assets. We also require that for every segment, there is sufficient information to calculate the median Q of the corresponding 3-digit SIC industry.[3] To minimize the influence of coding errors or extreme observations, all variables are winsorized at the 1% level. However, our results are virtually unchanged if we keep all observations, or drop the extreme 1%.

3.2 Identifying Shock Firms

Our objective is to select a sample of firms that experience major sales declines in some of their segments (the "shock firms" and their "shock segments") and to study the investment behavior in the remaining segments that experience a contemporaneous *increase* in sales (the "non-shock segments"). There are two potential pitfalls to any design aimed at identifying shock firms and non-shock segments:

[3]Obviously, we cannot compute Qs for segments of multi-segment firms. The industry median Q of a segment in a given year is the median Q of all the single-segment firms that have the same 3-digit SIC code in the same fiscal year as that segment. Please see the Data Appendix for details regarding the construction of variables.

(i) We may misclassify a firm that experiences a drop in sales as a result of a voluntary decision to sell assets as one that experienced an exogenous shock to sales.

(ii) We may classify segments as non-shock segments when in fact a common factor is responsible for both the loss of sales in the shock segments and a decline in the growth potential of the segments classified as non-shock segments. We may be simply picking up a delayed reaction to a common factor that is responsible for the poor performance of all segments.

While both of these issues could potentially afflict our sample selection, the second one is a much more serious concern than the first. If we misclassify some firms engaged in voluntary asset sales as shock firms, and yet find significant results, our results will only understate the effect of the shocks; however, if we are unable to discern the presence of common factors, we will be wrongly attributing lower investment in the non-shock segments to in-house transmission or spillover of shocks when such a transmission does not in fact exist. Our criteria for selecting the shock samples are chosen to address both types of concern.

The samples are constructed as follows. Segments within the firm that share the same 3-digit SIC code are first aggregated and form the basic unit of analysis (henceforth, referred to as "a segment"). We first impose conditions that identify unfavorable shocks to the firm. Once a firm experiencing an unfavorable shock is identified, any segment that experiences a decline in sales in the same year is considered to be one that is likely to have experienced a shock and is not considered any further. Remaining segments that experience a sales increase in the same year are considered to be the non-shock segments that were not directly exposed to the same shock as the shock segments, and are singled out for further analysis.

Conditions that identify unfavorable shocks to the firm:

Our primary sample of shock firms is selected based on the following criteria:

I. Industry-Based Classification:

The 3-digit SIC industry median sales growth is negative in year *t* and 3-digit SIC industry median stock return is below negative 15% (-15%) in year *t.* Firm's sales growth and stock returns in year *t* are both below the industry median. If either of these two latter conditions does not hold, we require that the firm's sales growth is below -10% in year *t*, and that the stock price of the firm drops by 30% or more in year *t*. The sample of firms in which the shock firms are selected according to this criterion is henceforth referred to as sample A.

II. Combined Sales and Stock Price-Based Classification:

Firms experience a fall in stock price by 30% or more in year *t.* Firms also experience a fall in sales by 10% or more in year *t*. The sample of firms in which the shock firms are selected according to this criterion is henceforth referred to as sample B.

After excluding the financial segments, our initial sample consists of 26,200 firm years and 76,983 segment years (the corresponding numbers for 2 segment firms are 12,315 and 24,630). After reclassification based on aggregation at the 3 digit level segments, we have 17,056 segments that meet the data requirements for identifying shock segments for sample A, and 18, 926 for sample B (for 2 segment firms, these numbers are, respectively, 8627 and 9624). The number of initial shock firms is 191 and

611 for the two samples (70 and 260 for the 2 segment firms), respectively. The numbers of non-shock segments are 250 and 817 for the two samples. The number of shock firms that meet all the data requirements for regression analysis shrinks considerably – respectively, 110 and 260 firms (46 and 137) firms for 2-segment firms). The numbers of non-shock segments that meet all the data requirements are 121 and 283 for the two samples.

Condition I meets the requirement that the shock is an industry-wide phenomenon and thus exogenous to the other segments, and is "important" for the firm. Sample A, therefore, addresses the concern that, in looking at the non-shock segments, we might be picking up the delayed effect of a common factors *originating in the firm* and affecting both the shock segments and the non-shock segments.

Previous work has used similar identification strategies. Our approach is closest to that of Opler and Titman (1994), who study the effect of financial distress on firm performance. To mitigate the problem of reverse causality that poor performance itself may contribute to financial distress, these authors examine the effect of high pre-shock leverage on the sales growth and performance of firms experiencing exogenous shocks – that is, those that are in industries that have experienced "economic distress", as measured by median industry sales growth and stock returns. In his study of capital structure and product markets interactions, Campello (2003) extends this approach by examining periods of macroeconomic shocks. Bertrand and Mullainathan (2001), in examining the relationship between CEO compensation and "luck", use mean industry performance to capture favorable external shocks to individual firms.

Panel A in Table 1 shows that the shocks identified by condition I cluster in recession years, which is consistent with Campello (2003). Notice that this raises the possibility that the non-shock segments are also in industries that are experiencing

shocks. However, by virtue of our criteria for identifying the non-shock segments, these segments themselves experience *positive* sales growth during the shock year. Moreover, s*ince we control for industry fixed effects and year effects in our regressions*, lower segment investment cannot be attributed to the fact that the non-shock segments are in industries that are subject to shocks in particular periods. In fact, since our non-shock segments are required to have positive sales growth in the year in which the firm experiences a sales shock, if that particular industry is experiencing a sales decline due to general macroeconomic conditions, our method is biased *against* finding investment declines in the non-shock segments relative to other segments in the same industry.

By design, the shocks that identify sample A are industry-wide shocks. For some of our tests, we need to discriminate between shocks that are firm-specific as opposed to being industry-wide; moreover, for our tests in this regard to be reliable, a larger sample of shock firms than what is provided by sample A is also desirable. Sample B is chosen with these objectives in mind. One concern with identifying shocks based on sales drop is that it is unclear to what extent such a drop may be due to asset sales; the more than 30% drop in stock price is designed to rule out asset sales that are not driven by adverse shocks.

With firm-specific shocks, an identification strategy for shocks that are exogenous to the non-shock segments is admittedly more difficult. Our main tests on this sample, however, address the issue of whether or not proxies for a collateral channel of transmission affect the magnitude of the impact on the non-shock segments. If a common factor is responsible for a lagged effect on the segments identified as non-shock segments, one would not expect proxies for the collateral channel to explain the magnitude of the impact. In addition, to address the concern about a common factor, we examined whether or not the relative size of the shock segment mattered for the

investment decline in the non-shock segments. The case for a causal relationship between a sales shock to the affected segments and the investment decline in the segments identified as "non-shock" segments is strengthened if the investment declines are more pronounced when the biggest segments are among the shock segments. We find strong supportive evidence. Thus, it is unlikely that we are finding our results because the segments that are classified as "non-shock" are simply the ones that happen to be affected later by some common factor affecting all segments.[4]

3.3 Summary Statistics

Table 1 presents descriptive statistics for our samples. Panel A reports the distribution across years. It shows that the major shock years are 1982, 1983, 1985 and 1991 whereas 1980 is the year in which the smallest number of adverse shocks is identified.[5] For sample A, the shocks are less evenly distributed over the sample period, with a higher concentration on the recession years, due to the fact that this particular sample was constructed based on industry shocks. Panel B documents the distributions by major industries. A majority of the shocks occur in manufacturing industries. Panel C presents the distributions of the firm years by the number of industry segments. The proportion of 2-segment firms is the highest (although somewhat lower for samples A and B than the overall sample - 57% for the overall sample as opposed to 42% for sample A and 53% for sample B). However, the proportion of three and four segment firms is by no means negligible: in sample A, 40% of the firms are three-segment and

[4] We also found that prior relatedness (measured in terms of cash flow correlation) between the non-shock and shock segments is not associated with higher impact of the shock on non-shock segments. This is consistent with the idea that the investment decline in the non-shock segments is not caused by a common factor.

[5] November 1982 and March 1991 are also NBER recession periods.

9% are four-segment firms, while the corresponding numbers for sample B are 29% and 12%, respectively.

Panel A of Table 2 reports firm characteristics for the year before the shock for the different samples. All figures are "industry adjusted" by subtracting the 3-digit SIC industry median values from the firm's figure. For multi-segment firms in sample A, in the year before the shock (Year -1), the shock firms do not have significantly different capital expenditure-to-assets ratio, cash flow over asset ratio, Tobin's Q or sales growth. Thus, in terms of growth opportunities or profitability, there does not appear to be any difference between the shock firms in Year -1 and their industry counterparts, suggesting that the shocks are exogenous. Two-segment firms have marginally lower capital expenditures and somewhat lower cash flows, but also have higher total assets turnover than their industry counterparts. The financial ratios do not reveal any evidence that the shock firms are financially less healthy in year -1 than their industry counterparts. Overall, therefore, there does not appear to be any indication that the firms are underperforming the industry counterparts prior to the shock, consistent with the way in which this sample was selected and suggesting that the shocks were exogenous to the *firm*.

For firms in sample B, the picture is, as expected, less clear-cut. Capital expenditure and Tobin's Q do not appear to be significantly different; however, cash flows and sales growth are significantly lower than industry counterparts. The firms are also more levered and have lower interest coverage ratio, although Altman's Z score is not significantly different. Recall that sample B is selected with the explicit objective of accommodating shocks that may have been firm-specific in nature; therefore, indications of performance decline prior to the shocks are not unexpected. However, as

we noted above, unreported tests support the hypothesis that the shocks are exogenous to the *non-shock* segments.

We also study pre-shock segment characteristics. Panel B of Table 2 indicates that for samples A and B, there are no significant differences between the non-shock segments and their industry counterparts in the any of the three years before the shock that would suggest that the former are underperforming. The shock segments appear less profitable than industry counterparts in the year before the shock for sample B and for 2-segment firms in sample A; capital expenditure also is lower for sample B firms in the year before the shock.

4. Empirical Results

4.1 Investment Decline in Non-Shock Segments

In internal capital markets, investment in a particular segment can be financed by cash generated from other segments or external funds supported by collateralizable fixed assets of other segments. Consequently, an adverse shock reducing cash or collateral value of some segments may hinder investment in other segments (non-shock segments). We find supportive evidence. Table 3 reports, for the non-shock segments, the mean industry-adjusted change in investment scaled by the book value of the segment's assets. Consistent with Lamont (1997), we find that firms significantly reduce investment in their non-shock segments in the year following adverse sales shocks compared to the year of the shock. The average investment declines by about 5% of the segment assets for multi-segment firms for both samples A and B. The decline for 2-segment firms appears marginal for sample A, but much larger (10% of segment assets)

for sample B. In Panel B, we report the average of the year-on-year industry-adjusted change in investment (scaled by assets) for the three years after the shock. While the mean declines are smaller (suggesting that the investment cuts are less severe in the second and third years after the shock), the differences are still significantly negative for our two samples – both for two and multi-segment firms.

4.2 Reasons for the Investment Decline: The Cash Channel

Having established that there is a decline in investment in the non-shock segments after the sales shocks, we now turn to the reasons for the investment decline. We first consider the cash channel. As mentioned above, in internal capital markets, firms may use cash flows of one segment to finance investment in other segments. Consequently, adverse sales shocks reducing cash flows to one segment may reduce investment in the other segments. If this is the only explanation for the investment decline in the non-shock segments, then a model of segment-level investment that includes cash flow as an explanatory variable should completely explain the lower level of investment. Empirically, we consider the following model:[6]

$$\begin{aligned}\frac{Investment_{jkt}}{Total\ Assets_{k,t-1}} = {} & a_0 + g_0 D_S + a_1 \frac{Cash\ Flow_{jkt}}{Total\ Assets_{k,t-1}} + a_2 \frac{Other\ Cash\ Flow_{jkt}}{Total\ Assets_{k,t-1}} \\ & + g_1 \left(D_S \times \frac{Cash\ Flow_{jkt}}{Total\ Assets_{k,t-1}} \right) + g_2 \left(D_S \times \frac{Other\ Cash\ Flow_{jkt}}{Total\ Assets_{k,t-1}} \right) \\ & + a_3 Sales\ Growth_{jk,t-1} + a_4 Q_{jk,t-1} + a_5 Q_{k,t-1} + a_6 Debt\ Ratio_{k,t-1} + a_7 \frac{Fixed\ Assets_{k,t-1}}{Total\ Assets_{k,t-1}} \\ & + a_{8\cdots m} \cdot Year\ Dummies + a_{m+1\cdots n} \cdot Industry\ Dummies + e_{jkt} \qquad (1)\end{aligned}$$

[6] Our model is similar to that of Shin and Stulz (1998). The difference is that we additionally include firm's Q, the debt ratio, the fixed-to-total assets ratio, and the dummy to indicate whether a segment belongs to a "shock firm". We follow Shin and Stulz (1998) in scaling all investment and cash flow variables by the book value of the firm's assets. We replicated all our results by controlling for segment size. Our results were not changed in any important way.

where $Investment_{jkt}$ is the capital expenditures of segment *j* of firm *k* during year *t*. *Total* $Asset_{k,t-1}$ is the book value of total assets of firm *k* as of the end of year *t-1*. D_S is a dummy variable taking a value of 1 if segment *j* experiences no sales decline while *some* non-*j* segments of firm *k* experience a sales decline and the firm is classified as having experienced an adverse shock in year *t-1* (and taking a value of 0 otherwise). *Cash* $Flow_{jkt}$ is cash flow of segment *j* of firm *k* during year *t*. *Other Cash* $Flow_{jkt}$ is cash flow of all the non-*j* segments of firm *k* during year *t*. *Sales* $Growth_{jk,t-1}$ is sales growth of segment *j* of firm *k* over year *t-1*. $Q_{jk,t-1}$ is the median *Q* as of the end of year *t-1* of all the firms with the same 3-digit Standard Industry Classification (SIC) code as that of segment *j*. $Q_{k,t-1}$ is the *Q* of firm *k* as of the end of year *t-1*. *Debt* $Ratio_{k,t-1}$ is the ratio of total debt to total assets of firm *k* as of the end of year *t-1*. We incorporate *debt ratio* because leverage may affect corporate investment (Jensen and Meckling (1976) and Myers (1977)). The *fixed-to-total asset ratio* is the ratio of fixed assets to total assets of the firm. *Year Dummies* are dummy variables of fiscal years. *Industry Dummies* are industrial dummy variables based on 3-digit SIC code. e_{jkt} is the random error term. We exclude shock segments in all of our regression analysis.

We are also interested in examining whether or not the effect of the shock segments on the non-shock segments is persistent, i.e. lasts beyond the first year after the shock. With this in mind, we estimate the following model:

$$\frac{Investment_{jkt}}{Total\ Assets_{k,t-1}} = a_0 + g_0 D_L + a_1 \frac{Cash\ Flow_{jkt}}{Total\ Assets_{k,t-1}} + a_2 \frac{Other\ Cash\ Flow_{jkt}}{Total\ Assets_{k,t-1}}$$
$$+ g_1 \left(D_L \times \frac{Cash\ Flow_{jkt}}{Total\ Assets_{k,t-1}} \right) + g_2 \left(D_L \times \frac{Other\ Cash\ Flow_{jkt}}{Total\ Assets_{k,t-1}} \right)$$
$$+ a_3 Sales\ Growth_{jk,t-1} + a_4 Q_{jk,t-1} + a_5 Q_{k,t-1} + a_6 Debt\ Ratio_{k,t-1} + a_7 \frac{Fixed\ Assets_{k,t-1}}{Total\ Assets_{k,t-1}}$$
$$+ a_{8\cdots m} \cdot Year\ Dummies + a_{m+1\cdots n} \cdot Industry\ Dummies + e_{jkt} \qquad (2)$$

Here, we have replaced the dummy variable D_S in equation (1) by the dummy variable D_L which takes a value of 1 if segment *j* experiences no sales decline while *some* non-*j* segments of firm *k* experience a sales decline and the firm is classified as having experienced an adverse shock in year *t-2* or *t-3*; and takes a value of 0 otherwise. Notice that some firms exit the sample after the first year of the shock; if these are the ones that are most affected by financial constraints imposed by the shock, then our estimates of investment decline are likely to be biased downwards.

Regression results corresponding to equation (1) and (2) for our samples are reported in Table 4 for multi-segment and 2-segment firms separately.[7] Notice first that the coefficient of other cash flows for non-shock firms, i.e., a_2, is negative. This is not surprising – the literature on investment cash flow sensitivity has warned us that cash flows can be a proxy for growth opportunities. Investment in a particular segment could *increase* if cash flows in other segments decline, signifying a worsening of growth prospects in those segments, and thereby making more funds available from those segment for investment. Of course, if cash flows from other segments decline without a corresponding cut-back in investment in those segments, then the internal capital market will shrink for the remaining segments. Therefore, the sign of the coefficient of "other

[7] All our regressions in this and subsequent tables include industry and year dummies, and the standard errors are calculated from the Huber/White/sandwich heteroscedastic-consistent errors, which are also corrected for correlation across observations for a given firm.

cash flows" is an empirical matter. Our results show that the coefficient is negative, and this therefore implies *higher* segment investment when growth opportunities in other segments decline.

How are things different for shock firms? The coefficient g_2 is either insignificant or significantly positive. When it is positive, as is the case for both multi-segment and 2-segment firms in sample B, the implication is that a given reduction of funds from the other segments has a smaller positive impact on investment in the non-shock segments compared to segments of the non-shock firms. This could be because the investment cut-backs in the shock segments is not as much for this sample of shock firms, or the firm is more constrained and therefore segment investment is more reliant on internal funds. However, for sample A, g_2 is mostly insignificant for the t+1 and the combined t+2 and t+3 regressions.

Importantly, irrespective of the sign of the coefficient of "other cash flows" (i.e., the sum of a_2 and g_2) for shock firms, the coefficient g_0 is negative. This means that there is an unexplained investment decline that cannot be attributed to cash flow availability or any of the other firm and segment characteristics controlled for in equations (1) and (2).[8] In other words, the negative coefficient g_0 implies the existence of non-cash channels of transmission of the shocks to the non-shock segments.[9] The economic magnitude of the investment gap unexplained by the firm and segment-specific controls is significant, and amounts to about 1% of the firm's total assets for multi-segment firms and almost 3% of total assets for 2-segment firms in the year after the shock. Next, we explore further the channel of shock transmission responsible for the unexplained investment decline.

[8] In untabulated regressions, we included Altman's Z-score as an additional control. Our results did not change.

[9] The coefficient g_0 remains negative even when we do not include the interactions of the shock dummy with the cash flows. These results are not reported.

4.3 Transmission Mechanisms

The external financing channel is a potential channel through which the shock could be transmitted to the non-shock segments. Not only might the shock reduce the availability of internal funds – it might increase the cost or reduce the availability of external funds as well. Summary statistics reveal that a higher proportion of firms that experience sales shock experience rating downgrades in the following year than firms in the overall sample in a normal year, lending support to this possibility. In the year following the adverse shock, 15.4% of the shock firms in sample A and 31.0% for sample B experience rating downgrades. During a normal year, the proportion of the firms that experience rating downgrades is 12.5%.

However, it is difficult to establish any *causal* connection between a decline in investment and a simultaneous tightening of external financing constraints. First, both might be caused by a common factor. For example, a firm might invest less because it anticipates a decrease in the demand for its products as customers shy away, fearing a bankrupt firm may not be able to service its products[10]; this may cause the firm to invest less and its credit rating may also be simultaneously downgraded for the same reason. Second, a firm experiencing a shock might invest less in the shock segments and therefore raise less external financing – so it may be difficult to disentangle a supply effect (lower availability of external financing) from a demand side effect (firm requires less external capital as it invests less overall). Finally, attempts to test whether the shocks affect segments differently depending on pre-shock firm characteristics

[10] This is an example of customer-driven loss – an indirect bankruptcy cost (see Opler and Titman (1994)). Another possible source of loss is competitor-driven (Opler and Titman (1994)) – if financially stronger competitors take advantage of the firm's weakened financial condition to engage in predatory behavior.

reflecting financial constraints such as credit ratings, Z scores or the Kaplan-Zingales Index may not be meaningful since these characteristics may change after the incidence of the shocks, and the pre-shock characteristics may not be relevant for subsequent investment.

In this section, we test for a specific external financial channel of transmission – namely, the collateral channel. In Kiyotaki and Moore (1997), the collateral channel works as follows. The shocks will initially reduce cash flows, increase financial constraints, and retard investment – possibly through a combination of internal and external financing channels. This is the direct effect. However, this initial effect is magnified by an indirect effect: the investment decline, resulting in a decrease in fixed asset accumulation, will further tighten borrowing constraints, reducing investment even more. In turn, the lower investment will further tighten borrowing constraints, and so on. In this manner, the influence of the shocks is magnified.

When there is a shock to the collateral value of the assets, the Kiyotaki and Moore (1997) mechanism of shock transmission could be triggered by a decline in the value of these assets that is eventually magnified via the collateral channel. We have no direct measure of collateral value of firms' assets. Collateral value, however, is associated with fixed assets: the latter are often pledged as collateral when firms raise debt, since unlike cash and other liquid assets, fixed assets are difficult to "divert" (Myers and Rajan (1998)). The collateral value of fixed assets is likely to be impaired if the firm experiences a shock that is associated with a decline in the resale value of these assets.

Unfortunately, segment level data on fixed assets are not available in Compustat, although depreciation figures are. Accordingly, we use the depreciation figures for all single segment firms in a given 3-digit SIC industry and compute the median ratio of

fixed assets to depreciation. We then use the product of this median value and the segment level depreciation figures for the shock firms to estimate the segment level fixed assets.[11]

Our hypothesis is that firms with a higher ratio of fixed assets in the shock segments to the total firm assets will experience greater investment declines in the non-shock segments. We call this ratio a measure of the firm's *impaired collateral*. Since the measure itself is possibly noisy, we report all subsequent results both in terms of this variable as well as a discretized version of the same variable. To that end, we construct a dummy variable - *High impaired collateral dummy* - that takes a value of 1 if the firm's beginning (pre-shock) ratio of estimated fixed assets in the shock segments to total firm assets is above the median for all shock firms, and 0 otherwise. We estimate the following model:

$$\begin{aligned}\frac{Investment_{jkt}}{Total\ Assets_{k,t\text{-}1}} &= a_0 + h_0 D_S + h_0^{Col}\left(\text{Impaired Collateral}\ \times D_S\right) \\ &+ a_1 \frac{Cash\ Flow_{jkt}}{Total\ Assets_{k,t\text{-}1}} + a_2 \frac{Other\ Cash\ Flow_{jkt}}{Total\ Assets_{k,t\text{-}1}} \\ &+ h_1\left(D_S \times \frac{Cash\ Flow_{jkt}}{Total\ Assets_{k,t\text{-}1}}\right) + h_2\left(D_S \times \frac{Other\ Cash\ Flow_{jkt}}{Total\ Assets_{k,t\text{-}1}}\right) \\ &+ a_3 Sales\ Growth_{jk,t\text{-}1} + a_4 Q_{jk,t\text{-}1} + a_5 Q_{k,t\text{-}1} + a_6 Debt\ Ratio_{k,t-1} \\ &+ a_7 \frac{Fixed\ Assets_{k,t-1}}{Total\ Assets_{k,t-1}} + a_8 \frac{Shock\ Segment\ Total\ Assets_{k,pre-shock}}{Total\ Assets_{k,pre-shcok}} \\ &+ a_{9\cdots m} \cdot Year\ Dummies + a_{m+1\cdots n} \cdot Industry\ Dummies + e_{jkt} \end{aligned} \quad (3)$$

[11] We also estimate the segment level fixed assets based on the firm's overall fixed assets, assuming that the ratio of fixed assets to depreciation is the same across all segments. The advantage of this alternative method is that the sum of the estimated segment fixed assets will mechanically equal the firm's overall fixed assets, which is not guaranteed under our method. In fact, in 5% of the cases, the estimated impaired fixed assets over the firm's total fixed assets under the latter procedure exceed unity. In these cases, we reset the ratio to 1. The correlation between the estimated segment fixed assets using the two different methods is 0.7, and our results are virtually unchanged if we use the alternative method.

When we use the dummy, the continuous variable "Impaired Collateral" is replaced by the Impaired Collateral dummy.

If the collateral channel is at work, h_0^{Col} will be significantly negative. Notice that there might be a concern that the impaired collateral variable is capturing the effect that a bigger proportion of the firm's assets are affected by the shock (i.e., the effect of the shock is more pervasive within the firm). To mitigate this concern, we control for the ratio of the shock segments' total assets to the firm's total assets in the regression.

Table 5 reports our regression results for investment in year *t+1*.[12] We report the results for the discrete collateral measure in Panel A and for the continuous version in Panel B. The coefficient h_0^{Col} is significantly negative in all the samples except one (the exception is multi-segment firms in sample B, where the effect is marginally below conventional levels of significance when the dummy variable is used). Notice that the relative size of the shock segments variable picks up the effect of the shock itself, and renders the shock dummy insignificant in all the regressions[13]. To see the economic significance of the collateral effect, consider the following comparison. Suppose that in each of two 2-segment firms, the shock segment contributes 70% of the total assets. However, in one, the shock segment contributes 50% of the fixed assets, and in another, it contributes 70% of the fixed assets. Then the additional investment decline in the non-shock segment for the latter firm is as much as 1% of the firm's total assets.

We now explore further how a shock to one of the segments is transmitted to the other segments via the collateral channel. We hypothesize that a shock manifests itself as a decrease in the collateral value of the assets, since the assets are now less profitable.

[12] We only report results for t+1 in subsequent tables because both the collateral base as well as the financial structure of the company change in period t+1, and this potentially complicates the task of identifying a channel of transmission to periods t+2 and t+3. However, as we discuss later, our results are both qualitatively and quantitatively very similar for the latter two periods.

[13] Dropping the "relative size of the shock segment" variable restores the significance of the shock dummy.

However, even though the assets are unprofitable in one firm, they may be valuable to other firms. Thus, the effect of a collateral channel will manifest itself more strongly when the shock is in the nature of an industry shock – in the latter case, the firm's competitors are also likely to be financially constrained and not in a position to bid for the firm's impaired assets (Shleifer and Vishny (1992)). Managerial incentives and the presence of debt, however, may add nuances to this basic story. Managers may be reluctant to divest assets when the shocks are firm-specific because that would signal past mistakes (Boot (1992)). In this case, even though shocks that are of industry origin are associated with lower collateral value, managers' relative willingness to divest such assets may not lead to a stronger adverse effect on the non-shock segments compared to firm-specific shocks. However, if the firms are highly levered, then the more severe decline in collateral value associated with industry shocks will impair the firm's ability to raise external financing much more. In this case, industry shocks will be associated with bigger investment cuts in the non-shock segments.

We now discuss how we modify our empirical specification to test these hypotheses. First, we identify whether a shock segment is in a 3-digit SIC industry that is itself experiencing negative median growth in sales (i.e., the shock to that segment is industry-wide). Next, we compute the ratio of the estimated fixes assets in the segments with negative median industry growth in sales (henceforth called the "industry shock" segments) to that in all the shock segments - a high value of this ratio indicates that a higher proportion of the affected fixed assets are in industries experiencing a shock. The product of the measure of impaired collateral (fixed assets in shock segment over total firm assets) and the proportion of shock segments fixed assets that are in industry shock segments is simply the ratio of fixed assets in industry shock segments to the firm's total assets. This is the continuous version of our measure of "Industry Shock Impaired

Collateral". We also use a discretized version, and introduce an additional dummy variable - the "high industry shock impaired collateral dummy" - to distinguish high and low values of this ratio (conditional on the impaired collateral being also above median).[14] To get sufficient variation in the nature of the shock, we do these tests on sample B.

We augment the specification in equation (3) in the following way: We add the impaired collateral variable and the industry shock impaired collateral variable, plus the interactions of each of the above two variables with a dummy variable which takes a value of one if the firm's debt ratio is in the upper 75th percentile among all shock firms, and zero otherwise.[15] We also include the other control variables in equation (3). In addition, we compute the pre-shock segment-asset-weighted median industry sales growth of all shock segments, and include this sales growth as a control in our regressions. In a slightly different specification, instead of continuous collateral variables, we include the high impaired collateral dummy, the high industry shock impaired collateral dummy, and the interaction of both of these with the high debt dummy. The high debt dummy (as well as the total debt ratio – a continuous variable) are both included as controls in the regressions.

The results are presented in Table 6. The first two columns correspond to the discrete collateral measure, and the next two to the continuous measure. The key variables of interest are the high impaired collateral and high industry shock impaired collateral variables, and their interactions with the debt dummy. The impaired collateral variable is negative, and significant in three of the four regressions, consistent with Table 5. The impact of the shock does not appear to be different when the shock is an

[14] In other words, the dummy is defined to take a value of 1 if the high impaired collateral dummy takes a value of 1 *and* the ratio of industry shock segment fixed assets to all shock segment fixed assets is above median, and zero otherwise.

[15] As the shocks are unanticipated and exogenous to the non-shock segments, possible endogeneity of the pre-shock total debt ratio is not a serious concern for our analysis.

industry shock for low debt firms. However, the interaction of the industry impaired collateral and the high debt dummy (or the high industry shock impaired collateral dummy and the debt dummy) is consistently negative and significant in all the regressions. This is supportive of the hypothesis that collateral value is most impaired when the shock is industry-wide, and for firms with high pre-existing debt, this loss of collateral value constrains the ability to raise external finance and affects investment in the non-shock segments. It is worthwhile to point out that the debt dummy is itself insignificant in all the regressions; thus, the interaction term is not simply picking up a pure leverage effect.

The regressions with collateral dummies are particularly useful in understanding the economic magnitude of the impact of the loss of collateral value due to an industry shock for highly levered firms. Compared to a firm with above median impaired collateral but below median ratio of industry impaired fixed assets to impaired fixed assets, a firm for which the latter ratio is above median experiences an additional loss in investment in the non-shock segments by as much as 4% of total assets for multi-segment firms, and 7% of total assets for two-segment firms, when its debt is above the 75^{th} percentile among all shock firms. Thus, the effects are economically large.

Robustness Checks

Since construction of a proxy for collateral is key to our empirical strategy, we tested the key empirical result (equation (3)) using an alternative measure of collateral. Campello (2005) modifies a measure used by Berger et al. (1996) which captures the proportion of asset value that is recovered in liquidation. He defines *asset tangibility* as

Tangibility = Cash holding + 0.715 × Receivables + 0.547 × Inventory + 0.535 × Capital (all scaled by the book value of the total assets).

While asset tangibility is not the same as our notion of collateral value, from the perspective of lenders, impaired asset tangibility is likely to have a similar effect as impaired collateral value, since lenders care about what can be recovered in liquidation. However, none of the required variables are available at the segment level. We therefore follow a procedure similar to that described above for our measure of segment level fixed assets to obtain segment level estimates of all the necessary variables. This allows us to come up with a measure of segment level tangibility of assets and the proportion of impaired tangible assets. Table 7 presents the results. The main coefficients of interest are very similar to those reported in Table 6. One noticeable difference, however, is that the industry shock impaired collateral variable has a positive significant effect in all regressions. This is consistent with the view that managers are more likely to divest assets in the shock segments if the shock is of industry origin, as opposed to being firm-specific.

We did a number of additional robustness checks on the results reported in Table 6.[16] First, although our tests of the transmission mechanism via the collateral channel are cleaner for the year after the shock (since collateral value changes after the shock), we also replicated the results for Table 6 for periods t+2 and t+3 combined. The results were very similar. One interesting difference is that while the interaction of the industry impaired collateral and debt remains negative and significant, that between the impaired collateral and debt is positive and usually significant. The results are stronger when the debt is short term rather than long term. This suggests that debt holders may play a role

[16] Results are available on request.

in forcing liquidation of the assets when the shocks are firm-specific and managers are reluctant to liquidate – although this takes place with a lag.

In addition, we examined the robustness of the results in Table 6 by conducting 5 sets of analyses based on 5 different combinations of debt and collateral measures. The 5 combinations are: (1) a continuous total debt measure and discrete collateral measures, (2) a continuous total debt measure and continuous collateral measures, (3) a continuous short-term debt measure and discrete collateral measures, (4) a continuous short-term debt measure and continuous collateral measures, and (5) a discrete short-term debt measure and continuous collateral measures. The results are qualitatively the same for all these combinations as those in Table 6 except (2), in which the interaction between the debt measure and the industry impaired collateral measure, while still negative, is not significant at conventional levels.

4 Conclusions

We document that multi-segment firms experiencing adverse sales shocks to some segments reduce investment in their remaining segments (the non-shock segments). We find that that the affected firms invest less in the non-shock segments relative to other firms with segments in these same industries. Our multivariate regressions show that the lower investment by the affected firms in the non-shock segments persist for at least three years after the shocks, controlling for cash flows, investment opportunities, capital structure, industrial and macroeconomic conditions. This suggests that the transmission mechanism of shocks to the non-shock segments goes beyond internal capital markets and the availability of internal funds. We examine a specific external financing channel, namely, the collateral channel. We find that firms with higher ratio of shock segment fixed assets to the firm's total assets prior to the

shock invest less in the non-shock segments. This suggests that a fall in the collateral value of assets contributes to the increase in financial constraints faced by these firms and the decline in investment in the non-shock segments.

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Appendix 1: Data

Variable	Data Item(s) in COMPUSTAT
Assets in 1997 million $ (Book Value)	data6* CPI(1997)/CPI(t) where CPI is the consumer price index obtained from Datastream
Capital Expenditures/Assets	(sum of sdata4 of all segments)/(sum of sdata5 of all segments)
Cash Flow/Assets	(sum of (sdata2+sdata3) of all segments)/(sum of sdata5 of all segments)
Current Debt/Total Debt	data34/(data34+data9)
Debts/Assets	(data9+data34)/data6
Dividends/Assets	data127/data6
Interest Coverage	(data15+data18)/data15
Firm's Q	(data9+data34+data25*data199+data130)/data6
Sales/Assets	(sum of sdata1 of all segments)/(sum of sdata5 of all segments)
Sales Growth	(sum of all segment's sdata1(t-1))/(sum of all segments' sdata1(t-2))-1
Altman's Z	0.012*X1*+0.014*X2*+0.033*X3*+0.006*X4*+0.999*X5* for manufacturing firms 6.56*X1*+3.26*X2*+6.72*X3*+1.05*X4*+3.25 for non-manufacturing firms
X1: Working Capital/Assets	(data4-data5)/data6
X2: Retained Earnings/Assets	data36/data6
X3: EBIT/Assets	data178/data6
X4: Market Value of Equity /Total Liabilities	(data25*data199+data56)/data181
X5: Sales/Assets	data12/data6

Appendix 1: Data (continued)

Regression Variable	**Data Item(s) in COMPUSTAT**
I: Segment's Investment	sdata4
A: Segment's Assets (Size)	sdata5
Cash flow(t)	(sdata2(*t*)+sdata3(*t*))/*Assets*(*t-1*)
Other cash flow(t)	[sum of (sdata2(*t*)+sdata3(*t*)) of all other segments in the firm]/*Assets*(*t-1*)
Sales growth(t-1)	(sdata1(*t-1*)/sdata1(*t-2*))-1
Q(t-1)	median *Q(t-1)* of all the firms with the same 3-digit SIC as the segment
Firm's Q(t-1)	see the definition above
Firm's debt ratio(t-1)	(data9+data34)/data6 as of the end of year *t-1*
Shock segment-to-firm assets ratio	pre-shock [(sum of sdata5 of all shock segments)/(sum of sdata5 of all segments)]
Industry sales growth of shock segments	asset-weighted 3-digit SIC industry sales growth of shock segments of the shock year
Altman's Z(t-1)	see the definition above
Relatedness	correlation between c*ash flow* of the segment and *cash flow* of the shock segments over the five years before the year of the sales shock

Appendix 2: Sample

This appendix shows how we arrive at the numbers of firm years included in our regression analysis for sample A, sample B and the intersection of samples A and B (A ∩ B). The corresponding numbers of segment years are given in parentheses. Sample A consists of shock firms that have both sales growth and stock return below the 3-digit SIC industry median in a particular year when the industry median sale growth is negative and the industry median stock return is less than -15%. Sample B consists of shock firms that experience a fall in sales by 10% or more in a particular year when the stock return also falls by 30% or more. Non-shock segments are those segments experiencing an increase in sales when some other segments are experiencing a decline in sales and the firm is identified as a shock firm.

	Multi-segment firms			**Two-segment firms**		
	Sample A	**Sample B**	**(A ∩ B)**	**Sample A**	**Sample B**	**(A ∩ B)**
Original COMPUSTAT segments						
1. Initial data:						
a. Number of firm years	33111			14394		
b. Number of segment years	(100806)			(28788)		
2. Excluding financial segments or firms:						
a. Number of firm years	26200			12315		
b. Number of segment years	(76983)			(24630)		
Segments re-configured based on the 3-digit primary SIC code of the original segments						
3. Meeting data requirements used to select the shock sample:						
a. Number of firm years	17056	18926		8637	9624	
b. Number of shock firms	191	611	125	70	260	48
c. Number of non-shock segments	(250)	(817)	(159)	(70)	(260)	(48)
4. Meeting data requirements for regression analysis:						
a. Number of firm years	10619			5740		
b. Number of segment years	(25957)			(11480)		
c. Number of shock firms	110	260	66	46	137	31
d. Number of non-shock segments	(121)	(283)	(68)	(46)	(137)	(31)

Table 1

Descriptive Statistics

Panel A: Distribution By Year

	Multi-segment firms				Two-segment firms			
	Sample A		Sample B		Sample A		Sample B	
Year	No. of shock firms	%	No. of shock firms	%	No. of shock firms	%	No. of shock firms	%
1982	36	32.7	46	17.7	10	21.7	16	11.7
1983	12	10.9	28	10.8	6	13.0	10	7.3
1984	0	0.0	7	2.7	0	0.0	5	3.6
1985	18	16.4	32	12.3	9	19.6	19	13.9
1986	3	2.7	17	6.5	1	2.2	9	6.6
1987	2	1.8	11	4.2	0	0.0	5	3.6
1988	2	1.8	20	7.7	2	4.3	12	8.8
1989	0	0.0	5	1.9	0	0.0	5	3.6
1990	1	0.9	14	5.4	0	0.0	10	7.3
1991	32	29.1	36	13.8	17	37.0	18	13.1
1992	1	0.9	7	2.7	1	2.2	4	2.9
1993	0	0.0	5	1.9	0	0.0	3	2.2
1994	0	0.0	9	3.5	0	0.0	7	5.1
1995	2	1.8	9	3.5	0	0.0	5	3.6
1996	1	0.9	10	3.8	0	0.0	5	3.6
1997	0	0.0	4	1.5	0	0.0	4	2.9
Total	110	100.0	260	100.0	46	100.0	137	100.0

Table 1 (concluded)

Descriptive Statistics

Panel B: Distribution By Major Industry

			Multi-segment firms				Two-segment firms			
	Overall Sample		Sample A		Sample B		Sample A		Sample B	
2 digit SIC Industries	No. of Firm Years	%	No. of Firm Years	%	No. of Firm Years	%	No. of Firm Years	%	No. of Firm Years	%
(10-14)[1]	691	5.2	22	20.0	32	12.3	8	17.4	14	10.2
(20-39)[2]	8311	62.2	69	62.7	155	59.6	33	71.7	77	56.2
(40-49)[3]	1653	12.4	1	0.9	16	6.2	0	0.0	7	5.1
(50-51)[4]	733	5.5	8	7.3	17	6.5	4	8.7	10	7.3
(52-59)[5]	700	5.2	0	0.0	17	6.5	0	0.0	14	10.2
(70-89)[6]	976	7.3	3	2.7	20	7.7	1	2.2	12	8.8

Panel C: Distribution By Number of Segments

			Multi-segment firms			
	Overall Sample		Sample A		Sample B	
Number of segments	No. of Firm Years	%	No. of Firm Years	%	No. of Firm Years	%
2	6055	57.02	46	41.82	137	52.69
3	2984	28.10	44	40.00	77	29.62
4	1114	10.49	10	9.09	31	11.92
5	329	3.10	7	6.36	12	4.62
6	103	0.97	2	1.82	2	0.77
7	28	0.26	1	0.91	1	0.38
8	2	0.02	0	0.00	0	0.00
9	1	0.01	0	0.00	0	0.00
10	3	0.03	0	0.00	0	0.00

1: Mining; 2: Manufacturing; 3: Transportation, Communication, Electric, Gas and Sanitary Services; 4: Wholesale Trade; 5: Retail Trade; 6: Services.

Table 2

Pre-Shock Firm and Segment Characteristics

Panel A reports means and medians of industry-adjusted firm characteristics for the year before the shock year. The characteristics are described in the Data Appendix. Industry adjustment is made by subtracting the 3-digit SIC industry median from the firm's figure. Panel B and C report the means and medians of pre-shock industry-adjusted characteristics of the non-shock segments and shock segments, respectively. The non-shock segments are industry segments that experience no decline in sales when their firms experience adverse sales shocks. The shock segments are the segments that contribute to the adverse sales shocks. The industry-adjusted measure is computed by subtracting industrial figure from the segment's figure. The industrial figure is the median of all the segments with the same 3-digit SIC code. ***, **, * indicate 1%, 5%, 10% level of significance, respectively, for the null hypothesis that the median or the mean is not different from zero

Panel A: Pre-Shock Firm Characteristics

	Sample A				Sample B				
Number of segments of firms:	Multiple		Two		Multiple		Two		
Assets in the year 1997 million $	1156.35	**	136.18		238.29		-425.39	*	mean
(book value)	0		-37.28	***	-1.85	**	-41.01	***	median
Capital Expenditures/Assets	-0.0016		-0.0146		0.0038		0.0044		mean
	0		-0.0036	*	0		0		median
Cash Flow/Assets	-0.0141		-0.0369	**	-0.0435	***	-0.0688	***	mean
	0		-0.0284	**	-0.0189	***	-0.0425	***	median
Current Debt/Total Debt	0.0315		0.0576		0.055	***	0.0326		mean
	0		-0.0209		0		-0.0202		median
Total Debt/Assets	0.0197		0.0159		0.0769	***	0.0721	***	mean
	0		0.0039		0.0269	***	0.0433	***	median
Dividend/Assets	0.0098	*	0.0144		0.0031		0.0038		mean
	0		-0.0006		0		-0.0015	***	median
Altman's Z	1.5187		3.1403		0.5630		0.9681		mean
	0.0091		0.0182		0		0		median
Interest Coverage	0.7834		0.0504		1.8879	*	2.2578		mean
	0		-0.1518		-0.37	***	-0.5199	***	median
Firm's Q	0.0559		0.0415		0.12	**	0.0587		mean
	0		0		0		0.0049		median
Sales/Assets	-0.0008		0.1320	*	0.0843	*	0.2021		mean
	0		0.0656		0		0		median
Sales Growth	0.0067		0.0137		-0.0634	***	-0.0603	**	mean
	-0.0017		-0.0035		-0.0226	***	-0.0353	**	median
Stock Return	0.0678		0.101		0.798		0.0269		mean
	0.0349		0.0356		-0.0106	***	0		median

Table 2 (continued)

Pre-Shock Firm and Segment Characteristics

Panel B: Pre-Shock Non-Shock Segment Characteristics								
	Sample A				Sample B			
Number of segments of firms:	Multiple		Two		Multiple		Two	
Investment(t-3)/Assets(t-4)	0.0410	**	0.0153		0.0084		0.0166	mean
	0.0001		-0.0019		0		0.0009	median
Investment(t-2)/Assets(t-3)	0.0967	**	0.1299		0.0043		0.0030	mean
	0.0049		-0.0015		-0.002		-0.0009	median
Investment(t-1)/Assets(t-2)	0.0479	***	0.0422	**	-0.0027		-0.0105	mean
	-0.0014		-0.0088		-0.0169	*	-0.0198	median
Cash flow(t-3)/Assets(t-4)	0.0968	***	0.1660	**	-0.0565		-0.0547	mean
	0.0388	**	0.0842	***	0		-0.0078	median
Cash flow(t-2)/Assets(t-3)	0.0420		0.0246		-0.0236		0.0051	mean
	0.0175		0.0216		0.0136		0.0187	median
Cash flow(t-1)/Assets(t-2)	-0.0089		-0.0463		-0.0504		-0.0261	mean
	-0.0011		-0.0246		-0.0149		0.0032	median
Lagged sales growth(t-3)	0.0921	*	0.0857		0.0207		0.0453	mean
	0.0200		0.0154		0		-0.0020	median
Lagged sales growth(t-2)	0.1004		0.0522		0.049		-0.0249	mean
	0.0249		0.0176		0		-0.0050	median
Lagged sales growth(t-1)	0.1124		0.0519		0.1181	**	0.1329	mean
	-0.0184		-0.0298		0		0	median

Table 2 (concluded)

Pre-Shock Firm and Segment Characteristics

Panel C: Pre-Shock Shock Segment Characteristics

	Sample A				Sample B				
Number of segments of firms:	Multiple		Two		Multiple		Two		
Investment(t-3)/Assets(t-4)	0.0882	***	0.0473		0.0290	*	0.0103		mean
	0.0107	*	0.0073		0		-0.0035		median
Investment(t-2)/Assets(t-3)	0.0516	***	0.0726	**	0.0081		0.0017		mean
	0.0022		0		-0.0053		-0.0086		median
Investment(t-1)/Assets(t-2)	0.0314	***	0.0016		0.0002		-0.0054		mean
	0		-0.0042		-0.0054	***	-0.0087	***	median
Cash flow(t-3)/Assets(t-4)	0.0511	**	-0.0145		-0.0111		-0.059		mean
	0.0074		-0.0327		-0.0384		-0.0673		median
Cash flow(t-2)/Assets(t-3)	0.0482	***	0.0060		-0.0256		-0.0254		mean
	0.0189	**	-0.0147		-0.0141		-0.0115		median
Cash flow(t-1)/Assets(t-2)	0.0220		-0.0356	*	-0.0593	***	-0.0592	***	mean
	0		-0.0243	**	-0.0321	***	-0.0578	***	median
Lagged sales growth(t-3)	0.2745	*	0.0461		0.0722		0.0556		mean
	0		-0.0422		-0.0014		-0.0358		median
Lagged sales growth(t-2)	0.1552	***	0.1410		0.1431	***	0.2191	**	mean
	-0.0005		-0.0625	*	0		0		median
Lagged sales growth(t-1)	0.1824	***	0.1868		0.0753	**	0.0964	*	mean
	0.0292	***	0.0021		0		0.0250		median

Table 3

Changes in Annual Industry-Adjusted Investment of the Non-shock Segments

The non-shock segments are the segments that experience no decline in sales when their firms experience adverse sales shocks. Panel A reports the industry adjusted change in investment of a segment from year *t* to *t*+1 per a dollar of assets of segment as of the end of year *t*+1, where *t* is the year in which the sales shock occurs. Panel B reports the average of the corresponding change form year *t* to year *t*+1, form year *t*+1 to year *t*+2, and from year *t*+2 to year *t*+3. The industry adjustment measure is computed by subtracting the ratio of the industry form the ratio of the segment. The former is the ratio of the sum of investment of all the segments with the same 3-digit SIC code to the sum of their assets. Sign tests test the null hypothesis that the median of changes in industry-adjusted investment is zero. T tests test the hypothesis that the average of changes in industry-adjusted investment is zero.

Panel A: One Year After Adverse Sales Shocks

	Multiple Segment Firms		Two Segment Firms	
	Sample A	Sample B	Sample A	Sample B
mean	-0.0508	-0.0659	-0.0127	-0.1094
p value (t test)	0.0314	0.0078	0.1392	0.0349
p value (sign test)	0.01	0	0.1831	0.0005

Panel B: Over Three Years After Adverse Sales Shocks

	Multiple Segment Firms		Two Segment Firms	
	Sample A	Sample B	Sample A	Sample B
mean	-0.0286	-0.0365	-0.0104	-0.0574
p value (t test)	0.0063	0.0002	0.0684	0.0201
p value (sign test)	0	0	0.1118	0

Table 4

Tests of Non-Cash Channels

The table reports results of eight regressions: the estimated coefficients, their repective absolute *t* statistics corrected for heteroskedasticity and firm-level clustering (in parentheses), adjusted R^2, and the number of segment years. The dependent variable is investment in segment *j* for year *t* divided by the book value of total assets of the firm as of the end of year *t*-1. The dummy variable D_S (in Panel A) takes a value of 1 if the segment experiences no decline in sales when the firm experiences an adverse sales shock in year *t*-1, and 0 otherwise. The dummy variable D_L (in Panel B) takes a value of 1 if the segment experiences no decline in sales when the firm experiences an adverse sales shock in year *t*-2 or year *t*-3, and 0 otherwise. Cash flow is cash flow of the segment for year *t* divided by the book value of total assets of the firm as of the end of year *t*-1. Other cash flow is cash flow from other non-*j* segments of the firm for year *t* divided by the book value of total assets of the firm as of the end of year *t*-1. Sales growth is the sales growth of the segment from year *t*-2 to year *t*-1. *Q* is the median *Q* as of the end of year *t*-1 of all firms with the same 3-digit SIC code as that of the segment. Firm' *Q* is the firm-level *Q* measured as of the end of year *t-1*. Firm's debt ratio is the total debt-to-total assets ratio of the firm as of the end of year *t*-1. Fixed-to-total assets ratio is the ratio of the fixed assets-to-total assets of the firm as of the end of year *t*-1. Dummy variables for years and 3-digit SIC code industries are included in the regressions. The estimated coefficients of the dummies are not reported for brevity. ***, **, * indicate 1%, 5%, and 10% level of significance, respectively.

Panel A: Year t+1

	Sample A		Sample B	
Number of segments of firms:	Multiple	Two	Multiple	Two
D_S	-0.012***	-0.027***	-0.011***	-0.026***
	(2.90)	(2.85)	(4.12)	(4.44)
*D_S*Other cash flow*	0.040	-0.099	0.085***	0.146***
	(1.26)	(1.06)	(4.48)	(3.48)
Other cash flow	-0.080***	-0.080***	-0.089***	-0.092***
	(15.71)	(10.72)	(16.00)	(11.33)
*D_S*Cash flow*	0.008	0.340**	-0.115***	-0.087*
	(0.15)	(2.49)	(3.01)	(1.77)
Cash flow	0.193	0.154***	0.193***	0.155***
	(16.51)	(10.57)	(16.61)	(10.69)
Sales growth	0.006***	0.007***	0.006***	0.007***
	(6.46)	(4.00)	(6.41)	(3.99)
Q	0.012***	0.023***	0.012***	0.023***
	(3.61)	(3.23)	(3.57)	(3.22)
Firm's Q	0.008***	0.008***	0.008***	0.008***
	(7.06)	(5.33)	(7.19)	(5.41)
Firm's debt ratio	-0.023***	-0.036***	-0.023***	-0.036***
	(8.23)	(7.51)	(8.07)	(7.49)
Fixed-to-total assets ratio	0.033***	0.039***	0.033***	0.039***
	(11.26)	(7.07)	(11.25)	(6.95)
Number of segment years	25957	11480	25957	11480
Adjusted R-squared	0.3203	0.3163	0.3236	0.3202

Table 4 (concluded)

Tests of Non-Cash Channels

Panel B: Year t+2 and Year t+3				
	Sample A		Sample B	
Number of segments of firms:	Multiple	Two	Multiple	Two
D_L	-0.015**	-0.042***	-0.010**	-0.022***
	(2.52)	(3.66)	(2.51)	(3.02)
D_L*Other cash flow*	0.023	0.094*	0.111***	0.222***
	(0.62)	(1.85)	(4.66)	(5.34)
Other cash flow	-0.081***	-0.073***	-0.090***	-0.087***
	(15.71)	(10.16)	(16.08)	(10.53)
D_L*Cash flow*	0.127	0.404***	-0.061	-0.071
	(0.86)	(3.09)	(0.79)	(0.94)
Cash flow	0.192***	0.162***	0.193***	0.165***
	(16.45)	(10.11)	(17.21)	(11.41)
Sales growth	0.006***	0.009***	0.006***	0.008***
	(6.44)	(3.80)	(6.37)	(3.79)
Q	0.012***	0.017**	0.012***	0.017**
	(3.62)	(2.29)	(3.61)	(2.21)
Firm's Q	0.008***	0.007***	0.008***	0.008***
	(7.09)	(4.70)	(7.19)	(4.83)
Firm's debt ratio	-0.023***	-0.037***	-0.023***	-0.038***
	(8.21)	(7.93)	(8.30)	(8.12)
Fixed-to-total assets ratio	0.033***	0.035***	0.033***	0.035***
	(11.27)	(6.11)	(11.32)	(6.11)
Number of segment years	25957	11480	25957	11480
Adjusted R-squared	0.3205	0.3297	0.3237	0.3356

Table 5

Tests of the Collateral Channel for Year t+1

The table reports results of eight regressions: the estimated coefficients, their respective absolute *t* statistics corrected for heteroskedasticity and firm-level clustering (in parentheses), adjusted R^2, and the number of segment years. The dependent variable is investment in segment *j* for year *t* divided by the book value of total assets of the firm as of the end of year *t*-1. The dummy variable D_S takes a value of 1 if the segment experiences no decline in sales when the firm experiences an adverse sales shock in year *t*-1, and 0 otherwise. The high impaired collateral dummy is 1 if the ratio of estimated pre-shock fixed assets of the shock segments to the pre-shock total assets of the firms is above the median ratio for all shock firms, and 0 otherwise. Impaired collateral, used in Panel B, is measured by the ratio of estimated pre-shock fixed assets of the shock segments to the pre-shock total assets of the firms. Shock segment to firm assets ratio is the pre-shock ratio. Cash flow is cash flow of the segment for year *t* divided by the book value of total assets of the firm as of the end of year *t*-1. Other cash flow is cash flow from other non-*j* segments of the firm for year *t* divided by the book value of total assets of the firm as of the end of year *t*-1. Sales growth is the sales growth of the segment from year *t*-2 to year *t*-1. *Q* is the median *Q* as of the end of year *t*-1 of all firms with the same 3-digit SIC code as that of the segment. Firm's *Q* is the firm-level *Q* measured as of the end of year *t-1*. Firm's debt ratio is the total debt-to-total assets ratio of the firm as of the end of year *t*-1. Fixed-to-total assets ratio is the fixed assets-to-total assets ratio of the firm as of the end of year *t-1*. Dummy variables for years and 3-digit SIC code industries are included in the regressions. The estimated coefficients of the dummies are not reported for brevity. ***, **, * indicate 1%, 5%, and 10% level of significance, respectively.

Panel A: Discrete Collateral Measure

	Sample A		Sample B	
Number of segments of firms:	Multiple	Two	Multiple	Two
*D_S*High impaired collateral dummy*	-0.015**	-0.032**	-0.009	-0.027***
	(2.30)	(2.38)	(1.59)	(2.59)
D_S	0.014	0.008	0.007	0.001
	(1.20)	(0.34)	(0.89)	(0.04)
Shock segment-to-firm assets ratio	-0.028**	-0.019	-0.028***	-0.017
	(2.15)	(0.59)	(2.56)	(0.78)
*D_S*Other cash flow*	0.028	-0.107	0.120***	0.159***
	(0.84)	(1.12)	(5.41)	(4.11)
Other cash flow	-0.081***	-0.079***	-0.083***	-0.081***
	(15.67)	(10.71)	(14.30)	(10.77)
*D_S*Cash flow*	-0.039	0.243***	-0.121***	-0.109**
	(0.59)	(2.63)	(2.83)	(2.51)
Cash flow	0.193***	0.154***	0.180***	0.157***
	(16.49)	(10.57)	(14.68)	(10.92)
Sales growth	0.006***	0.007***	0.007***	0.007***
	(6.48)	(4.00)	(5.56)	(3.97)
Q	0.012***	0.023***	0.015***	0.024***
	(3.57)	(3.26)	(3.52)	(3.26)
Firm's Q	0.008***	0.008***	0.008***	0.008***
	(7.06)	(5.31)	(6.39)	(5.28)
Firm's debt ratio	-0.023***	-0.036***	-0.027***	-0.036***
	(8.22)	(7.55)	(8.13)	(7.43)
Fixed-to-total assets ratio	0.033***	0.039***	0.033***	0.038***
	(11.27)	(7.05)	(8.85)	(6.90)
Number of segment years	25957	11480	25957	11480
Adjusted R-squared	0.3204	0.3163	0.3183	0.3185

Table 5 (concluded)
Tests of the Collateral Channel for Year t+1

Panel B: Continuous Collateral Measure

	Sample A		Sample B	
Number of segments of firms:	Multiple	Two	Multiple	Two
D_S**Impaired collateral*	-0.028***	-0.054***	-0.021**	-0.043***
	(2.87)	(2.91)	(2.07)	(2.60)
D_S	0.015	0.013	0.003	-0.002
	(1.25)	(0.48)	(0.60)	(0.09)
Shock segment-to-firm assets ratio	-0.026*	-0.031	-0.016**	-0.019
	(1.88)	(0.92)	(2.21)	(0.81)
D_S**Other cash flow*	0.029	-0.051	0.098***	0.143***
	(0.85)	(0.55)	(5.26)	(4.29)
Other cash flow	-0.081***	-0.080***	-0.082***	-0.082***
	(15.69)	(10.73)	(15.52)	(10.87)
D_S**Cash flow*	-0.038	0.214**	-0.124***	-0.106**
	(0.55)	(2.07)	(2.97)	(2.52)
Cash flow	0.193***	0.154***	0.195***	0.156***
	(16.47)	(10.54)	(16.96)	(10.84)
Sales growth	0.006***	0.007***	0.006***	0.007***
	(6.47)	(3.96)	(6.42)	(3.95)
Q	0.012***	0.023***	0.012***	0.024***
	(3.58)	(3.25)	(3.55)	(3.35)
Firm's Q	0.008***	0.008***	0.008***	0.008***
	(7.06)	(5.34)	(7.05)	(5.34)
Firm's debt ratio	-0.023***	-0.034***	-0.022***	-0.036***
	(8.19)	(7.52)	(7.95)	(7.39)
Firm's fixed-to-total assets ratio	0.033***	0.039***	0.033***	0.038***
	(11.31)	(7.08)	(11.20)	(6.89)
Number of segment years	25957	11480	25957	11480
Adjusted R-squared	0.3207	0.3168	0.3223	0.3198

Table 6

Further Tests of the Collateral Channel for Sample B

The table reports results of four regressions: the estimated coefficients, their respective absolute *t* statistics corrected for heteroskedasticity and firm-level clustering (in parentheses), adjusted R^2, and number of segment years. The dependent variable is investment in segment *j* for year *t* divided by the book value of total assets of the firm as of the end of year *t-1*. The dummy variable *D* takes a value of 1 if the segment experiences no decline in sales when the firm experiences an adverse sales shock in year *t-1* for the regressions for year *t*+1 and in year *t-2* or year *t*-3 for the regressions for years *t*+2 & *t*+3, and 0 otherwise. The discrete impaired collateral measures are dummy variables. The high impaired collateral dummy is 1 if the ratio of the estimated pre-shock fixed assets of the shock segments to the pre-shock total assets of the firm is above the median ratio of all shock firms, and 0 otherwise. The high industry shock impaired collateral dummy takes a value of 1 if (i) the ratio of the estimated pre-shock fixed assets of the industry shock segments to the estimated pre-shock fixed assets of all shock segments of the firm is above the median ratio of all shock firms *and* (ii) the ratio of the estimated pre-shock fixed assets of the shock segments to the pre-shock total assets of the firm is above the median ratio of all shock firms. The continuous impaired collateral measure is the ratio of the estimated pre-shock fixed assets of the shock segments to the pre-shock total assets of the firm. The continuous industry-shock impaired collateral measure is the estimated pre-shock fixed assets of the segments experiencing a shock when the corresponding 3-digit SIC industry is also undergoing a shock over the pre-shock total assets of the firm. The high debt dummy takes a value of 1 if the pre-shock debt ratio is above the 75^{th} percentile of the ratios of all the shock firms. Shock segment-to-firm assets ratio is the pre-shock ratio.Industry sales growth of shock segments is the asset-weighted average industry sales growth of the shock segments of the shock year where industry sales growth is the median sales growth in the 3-digit SIC industry in which the shock segment is doing business in the year of the shock.

Cash flow is cash flow of the segment for year *t* divided by the book value of total assets of the firm as of the end of year *t-1*. Other cash flow is cash flow from the other non-*j* segments of the firm for year *t* divided by the book value of total assets of the firm as of the end of year *t-1*. Sales growth is the growth of sales of the segment from year *t-2* to year *t-1*. *Q* is the median *Q* as of the end of year *t-1* of all the firms with the same 3-digit SIC code as that of segment *j*. Firm's *Q* is the firm-level *Q* measured as of the end of year *t-1*. Firm's debt ratio is the total debt-to-total assets ratio of the firm as of the end of year *t-1*. Firm's fixed-to-total assets ratio is the ratio of the fixed assets-to-total assets of the firm as of the end of year *t-1*. Dummy variables for years and 3-digit SIC code industries are included in the regressions. The estimated coefficients of the dummies are not reported for brevity. ***, **, and * indicate 1%, 5%, and 10% level of significance, respectively.

Table 6 (concluded)

Further Tests of the Collateral Channel for Sample B

Impaired Collateral:	*Discrete Measure*		*Continuous Measure*	
Number of segments of firms:	Multiple	Two	Multiple	Two
Shock segment-to-firm assets ratio	-0.041	0.407**	-0.032	0.331**
	(1.53)	(2.15)	(1.25)	(1.98)
Industry sales growth of shock segments	0.039*	0.030	0.002	0.030
	(1.70)	(0.46)	(0.08)	(0.54)
D	-0.010***	-0.020***	-0.007**	-0.019***
	(3.45)	(3.25)	(1.99)	(2.92)
*D*Impaired collateral*	-0.010**	-0.025**	-0.022	-0.053*
	(2.06)	(2.16)	(1.44)	(1.84)
*D*Industry shock impaired collateral*	0.011	0.002	-0.005	0.012
	(1.28)	(0.13)	(0.32)	(0.38)
*D*High debt dummy*	0.003	0.015	0.013	0.022
	(0.25)	(0.41)	(0.91)	(0.49)
*D*High debt dummy*Impaired collateral*	-0.008	-0.030	-0.029	-0.018
	(0.52)	(0.74)	(0.91)	(0.22)
*D*High debt dummy*Industry shock impaired collateral*	-0.043***	-0.071**	-0.230***	-0.345***
	(3.11)	(2.45)	(3.61)	(3.52)
*D*Other cash flow*	0.102***	0.160***	0.100***	0.138***
	(4.93)	(3.11)	(5.16)	(3.32)
Other cash flow	-0.085***	-0.082***	-0.085***	-0.087***
	(15.21)	(10.11)	(15.21)	(10.78)
*D*Cash flow*	-0.124***	-0.112***	-0.148***	-0.146***
	(2.86)	(2.57)	(4.50)	(5.28)
Cash flow	0.196***	0.158***	0.196***	0.157***
	(17.04)	(10.78)	(17.04)	(10.79)
Sales growth	0.006***	0.007***	0.006***	0.008***
	(5.78)	(3.38)	(5.78)	(3.48)
Q	0.013***	0.024***	0.013***	0.025***
	(3.64)	(3.27)	(3.61)	(3.32)
Firm's Q	0.008***	0.008***	0.008***	0.008***
	(6.95)	(4.78)	(6.95)	(5.21)
Firm's debt raio	-0.022***	-0.031***	-0.022***	-0.035***
	(7.47)	(5.85)	(7.47)	(6.81)
Firm's fixed-to-total assets ratio	0.034***	0.303	0.034***	0.039***
	(11.16)	(0.76)	(11.16)	(6.78)
Number of segment years	25957	11480	25957	11480
Adjusted R-squared	0.3127	0.3016	0.3127	0.308

Table 7

Further Tests of the Collateral Channel for Sample B: Robustness Checks

The table reports results of four regressions: the estimated coefficients, their respective absolute *t* statistics corrected for heteroskedasticity and firm-level clustering (in parentheses), adjusted R^2, and number of segment years. The dependent variable is investment in segment *j* for year *t* divided by the book value of total assets of the firm as of the end of year *t-1*. The dummy variable *D* takes a value of 1 if the segment experiences no decline in sales when the firm experiences an adverse sales shock in year *t-1* for the regressions for year *t*+1 and in year *t-2* or year *t*-3 for the regressions for years *t*+2 & *t*+3, and 0 otherwise. The discrete impaired tangible asset measures are dummy variables. The high impaired tangible asset dummy is 1 if the ratio of the estimated value of the pre-shock tangible assets of the shock segments to the pre-shock total assets of the firm is above the median ratio of all shock firms, and 0 otherwise. The high industry shock impaired tangible asset dummy takes a value of 1 if (i) the ratio of the estimated value of the pre-shock tangible assets of the industry shock segments to the estimated pre-shock fixed assets of all shock segments of the firm is above the median ratio of all shock firms *and* (ii) the ratio of the estimated value of the pre-shock tangible assets of the shock segments to the pre-shock total assets of the firm is above the median ratio of all shock firms. The continuous impaired tangible asset measure is the estimated value of the pre-shock tangible assets of the shock segments to the pre-shock total assets of the firm. The continuous industry-shock impaired tangible asset measure is the estimated value of pre-shock tangible assets of the segments experiencing a shock when the corresponding 3-digit SIC industry is also undering a shock over the pre-shock total assets of the firm. The high debt dummy takes a value of 1 if the pre-shock debt ratio is above the 75th percentile of the ratios of all the shock firms. Shock segment-to-firm assets ratio is the pre-shock ratio. Industry sales growth of shock segments is the asset-weighted average industry sales growth of shock segments of the shock year where industry sales growth is the median sales growth in the 3-digit SIC industry in which the shock segment is doing business in the year of the shock.

Cash flow is cash flow of the segment for year *t* divided by the book value of total assets of the firm as of the end of year *t-1*. Other cash flow is cash flow from the other non-*j* segments of the firm for year *t* divided by the book value of total assets of the firm as of the end of year *t-1*. Sales growth is the growth of sales of the segment from year *t-2* to year *t-1*. *Q* is the median *Q* as of the end of year *t-1* of all the firms with the same 3-digit SIC code as that of segment *j*. Firm's *Q* is the firm-level *Q* measured as of the end of year *t-1*. Firm's debt ratio is the total debt-to-total assets ratio of the firm as of the end of year *t-1*. Firm's fixed-to-total assets ratio is the ratio of the fixed assets-to-total assets of the firm as of the end of year *t*-1. Dummy variables for years and 3-digit SIC code industries are included in the regressions. The estimated coefficients of the dummies are not reported. ***, **, and * indicate 1%, 5%, and 10% level of significance, respectively.

Table 7 (concluded)

Further Tests of the Collateral Channel for Sample B: Robustness Checks

Impaired tangible assets:	*Discrete Measure*		*Continuous Measure*	
Number of segments of firms:	Multiple	Two	Multiple	Two
Shock segment-to-firm assets ratio	-0.039	0.168	-0.043*	0.204
	(1.62)	(1.20)	(1.67)	(1.61)
Industry sales growth of shock segments	0.047**	0.088	0.041*	0.104*
	(2.14)	(1.57)	(1.88)	(1.75)
D	-0.010***	-0.031***	-0.007	-0.029**
	(3.11)	(3.39)	(1.46)	(2.50)
*D*Impaired tangible assets*	-0.012***	-0.002	-0.026**	-0.011
	(2.59)	(0.23)	(2.10)	(0.49)
*D*Industry shock impaired tangible assets*	0.018**	0.013	0.017**	0.026
	(2.10)	(0.79)	(2.07)	(1.08)
*D*High debt dummy*	0.004	0.006	0.014	-0.086
	(0.32)	(0.14)	(0.56)	(0.88)
D High debt dummy*Impaired tangible assets*	0.002	0.037	-0.035	0.382
	(0.15)	(0.88)	(0.52)	(1.29)
*D*High debt dummy*Industry shock impaired tangible assets*	-0.043***	-0.112***	-0.053**	-0.334***
	(2.73)	(4.96)	(2.44)	(2.84)
*D*Other cash flow*	0.100***	0.129***	0.104***	0.134***
	(4.97)	(2.90)	(5.04)	(2.90)
Other cash flow	-0.085***	-0.087***	-0.085***	-0.087***
	(15.21)	(10.79)	(15.20)	(10.78)
*D*Cash flow*	-0.121***	-0.109**	-0.120***	-0.107**
	(2.93)	(2.48)	(2.93)	(2.48)
Cash flow	0.196***	0.157***	0.196***	0.157***
	(17.03)	(10.78)	(17.03)	(10.78)
Sales growth	0.006***	0.008***	0.006***	0.008***
	(5.79)	(3.48)	(5.80)	(3.49)
Q	0.013***	0.025***	0.013***	0.025***
	(3.66)	(3.34)	(3.65)	(3.34)
Firm's Q	0.008***	0.008***	0.008***	0.008***
	(6.96)	(5.20)	(6.95)	(5.20)
Firm's debt ratio	-0.022***	-0.035***	-0.022***	-0.035***
	(7.47)	(6.82)	(7.46)	(6.82)
Firm's fixed-to-total-assets ratio	0.033***	0.039***	0.034***	0.039***
	(11.16)	(6.76)	(11.16)	(6.78)
Number of segment years	25957	11480	25957	11480
Adjusted R-squared	0.3127	0.3076	0.3127	0.3077