Growing Out of Trouble? Corporate Responses to Liability Risk*

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Abstract

This paper analyzes corporate responses to the risk of large, adverse shocks. In particular, we study how a typical firm responds to an exogenous increase in liability risk arising from its workers' exposure to newly identified carcinogens. We find that firms, particularly those with weak balance sheets, tend to respond to such risks by undertaking aggressive growth through the acquisition of large, unrelated businesses with relatively high operating cash flows. By diversifying the firms' operations, the growth likely reduces expected costs of financial distress for shareholders, but also may be motivated by managers' *personal* exposure to their firms' risk. Consistent with an agency conflict driving some of this growth, the acquisitions are associated with negative abnormal returns and the extent of growth is related to firms' external governance, managerial stockholdings, and institutional ownership. The results suggest that the risk of large, adverse shocks can have a substantial impact on firms' financing and investment decisions, and that corporate governance can be particularly important when firms encounter a negative shock.

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This paper analyzes corporate responses to the risk of large, adverse shocks. In particular, we study how a typical firm responds to an exogenous increase in liability risk arising from its workers' exposure to newly identified carcinogens. We find that firms, particularly those with weak balance sheets, tend to respond to such risks by undertaking aggressive growth through the acquisition of large, unrelated businesses with relatively high operating cash flows. By diversifying the firms' operations, the growth likely reduces expected costs of financial distress for shareholders, but also may be motivated by managers' *personal* exposure to their firms' risk. Consistent with an agency conflict driving some of this growth, the acquisitions are associated with negative abnormal returns and the extent of growth is related to firms' external governance, managerial stockholdings, and institutional ownership. The results suggest that the risk of large, adverse shocks can have a substantial impact on firms' financing and investment decisions, and that corporate governance can be particularly important when firms encounter a negative shock.

1. Introduction

Every firm is exposed to business risks, including the possibilities of large, adverse shocks. Potential sources for such shocks abound – examples include new technologies that reduce barriers to entry, disruptive product innovations, the relaxation of international trade barriers, and changes in government regulation. Risks of such shocks are thought to fundamentally affect firms' choices regarding financing, investment, payout policy, and managerial compensation (e.g., Modigliani and Miller 1958; Jensen and Meckling 1976; Myers 1977; Grossman and Hart 1983). Some firms may adjust their business and financial strategies to reduce their exposure to these risks. Such actions, including growth, operational diversification, and reducing leverage, can create value for shareholders if they help reduce the possibility of costly financial distress (Maksimovic and Phillips 2002). Reducing these risks may also benefit managers personally by reducing their personal risk exposure (Jensen and Meckling 1976; Amihud and Lev 1981; Holmström 1999).

Although theory suggests that business risks play a central role in financial and investment policies, there is little empirical evidence of how firms actually respond to such risks. Empirical evidence is sparse in part because of the difficulty of isolating an exogenous shock to firms' business prospects that does not also affect other aspects of the firms, such as their current cash flows. Our paper overcomes this challenge by exploiting exogenous increases in legal liability that boost firms' (and managers') exposure to the risk of poor future corporate performance and even bankruptcy. By investigating firms' responses to these specific kinds of shocks, we shed light on how firms' investment and financing choices respond to business risks.

In particular, we focus on the legal liability that is created when a chemical to which a firm's workers are already exposed is newly identified as a carcinogen. Using this approach, we analyze how 2,209 firms in more than 100 SIC industries between 1980 and 2006 responded to the identification of 121 different chemicals as carcinogens. Despite the presence of the workers' compensation system, these exposures can carry significant corporate legal liability (Ringleb and Wiggins 1990). Discovery of a chemical's carcinogenicity increases the likelihood that a firm will need to spend large sums on legal

fees, damage payments, and insurance premiums in the future – if and when workers eventually fall ill. This increased potential for large cash outflows increases the likelihood of future poor corporate performance and financial distress, allowing us to cleanly identify a shock to firms' business prospects.

The most salient risk for these firms is that a chemical will become the next asbestos. Widespread workplace exposure to asbestos, whose medical dangers were known as early as the 1920s (well before the sample period of this study), have come to be regarded as "the worst occupational health disaster in U.S. history" (White 2004; Cauchon 1999). Litigation related to asbestos exposure has targeted more than 8,400 corporate defendants, has bankrupted at least 85 firms, and is projected to cost defendants $200 to $265 billion in total (Carroll et al. 2005; White 2004). Although the expected liability costs of a newly identified carcinogen are unlikely to approach those of asbestos, there is a chance that a firm that has exposed its workers to a carcinogen will be liable for a substantial payout.

The dominant finding of our analysis is that firms tend to undertake a period of aggressive growth via both capital investment and acquisitions after experiencing an adverse liability shock. Although firms that become exposed to the increased legal liability are very similar to other firms before the shock (including in size, market-to-book ratio, growth rate, financial leverage, payout rates, and other characteristics), exposed firms grow to become about 10 percent larger, on average, than unexposed firms within a few years following the shock. The exposed firms finance their growth primarily with equity, causing modest decreases in average leverage ratios, and the growth is concentrated among firms that seem to be more vulnerable to the realization of an adverse shock. For example, firms at high risk of bankruptcy (measured by Altman z-score) grow by an average of 38 to 48 percent more than otherwise similar firms after the increased liability is discovered. Firms at low risk of bankruptcy show no average growth. The growth is also associated with other indicators of financial vulnerability such as high leverage, low operating cash flows, zero dividends, and small overall size.

While some of the growth is achieved by an increase in capital expenditures, at least half stems from an increase in acquisitions. The discovery of a new carcinogen is associated with a 6 percent increase in the total number of acquisitions completed in exposed industries, and many of these

acquisitions diversify the firms' assets away from those causing the liability. In comparison with acquisitions undertaken by similar firms without such liability exposure, the targets acquired by the exposed firms can be described as "cash cows": they are, on average, 39 percent larger and have relatively high operating cash flows, recent growth, and total payout rates. Relative to acquisitions by firms without liability exposure, the exposed firms pay a 13.7-percentage-point greater takeover premium on average, and announcements of the deals are associated with abnormal returns on the acquirers' equity that average 1.3 percentage points lower.

These responses to the liability shock suggest that the firms are attempting to reduce their probability of future financial distress arising from the increased liability risk. Growing a firm by building or acquiring businesses with strong prospects for producing high cash flows provides the firm with deeper pockets from which to pay future liability costs. This may increase the total potential damage claims, but it is also likely to reduce the probability of financial distress. Funding the growth with equity rather than debt further lowers the probability of financial distress. Consistent with this motivation, the growth is concentrated among firms with already weak balance sheets before the shock, leaving them more vulnerable to financial distress.

There are multiple reasons why firms might seek to reduce the probability of financial distress after liability risk increases. First, if financial distress is costly, it may be in the interest of shareholders to grow or even diversify to avoid incurring these costs should the firm end up being liable for substantial damages. In order for the growth to benefit shareholders, the avoided costs of financial distress must be greater than the potential costs of diversification (Berger and Ofek, 1995, Lang and Stulz 1994) and any value lost from exposing the assets of the newly-acquired businesses to liability from the shock. A second possibility is that the growth is motivated by managers' *personal* exposure to their firms' risk. Managers who earn private benefits from maintaining control have an incentive to direct their firms to take costly investments that ensure the firms' long-run survival with themselves at the helm (Holmström 1999). From a purely financial perspective, a risk-averse manager who has a large fraction of his personal wealth tied to the firm also gains more from reducing idiosyncratic liability risk to the firms'

stock price than does a diversified shareholder (Hugonnier and Morellec 2007).

Additional results support the idea that agency motivations play a role in firms' responses to the shock. First, the negative average announcement returns associated with the acquisitions suggest that much of the growth is not in the interest of shareholders. Second, managers who grow their firms significantly in response to the liability are less likely to later lose their positions as CEO. Third, we find that firms' responses to the shock are related to various indicators for the degree of risk-related agency conflicts at these firms, specifically the strength of external governance (Jensen and Ruback 1983; Shleifer and Vishny 1989), the size of senior management's ownership stake in the firm (Parrino, Poteshman, and Weisbach 2005), and the degree of institutional equity ownership (Shleifer and Vishny 1986). We find that total assets grow by almost 35 percent after the shock at firms with weak external governance. Firm growth is also larger when senior management holds a larger equity stake in the firm, which increases their exposure to the firm's idiosyncratic risk, and when relatively few equity shares are held by institutional investors, who are thought to be more effective at monitoring managers.

At the same time, firms where agency conflicts are likely *less* severe – firms with strong external governance, low inside ownership, or high institutional ownership – do not grow after the liability shock. Instead, these firms increase their payouts to shareholders, suggesting that increasing payouts rather than growth may be shareholders' preferred response to the shock. In theory, an increase in payouts might benefit shareholders when the costs of financial distress are not too high. To the extent that the liability shock decreases the expected returns on new investments, shareholders may prefer that the firm reduce investments and increase payouts, all the more so if excess corporate liquidity increases expected damage awards. By paying out capital, investors can redeploy these funds more profitably to other firms that are not exposed to the liability.

Collectively, these results suggest that the risk of large, adverse shocks has the potential to dramatically affect corporate decisions and that managers' incentive to reduce their downside risk may play a role in these decisions. Our analysis complements cross-country comparisons presented by Acharya, Amihud, and Litov (2008), who find that firms are more likely to undertake diversifying

acquisitions and less risky investments in countries with stronger creditor rights, particularly rights that increase the likelihood of managers' removal in periods of financial distress.[1] Our evidence is also consistent with Tufano (1996, 1998) and Low (forthcoming), who argue that agency conflicts may be related to firms' risk management choices and stock volatility. In contrast to these papers, our paper provides evidence on how agency conflicts can affect firm financing and investment choices and shows for which firms this distortion appears to be more severe.

Our study also provides a complement to Blanchard, Lopez-de-Silanes, and Shleifer's (1994) examination of how eleven firms spend cash windfalls from lawsuits. Broadly speaking, firms have access to cash flows and investment opportunities. Whereas Blanchard et al. investigate the effect of an increase in cash flows that has little effect on investment opportunities, the analysis presented here examines the effect of a decrease in investment opportunities that has little effect on cash flows. In essence, both papers examine the impact of increasing the wedge between corporate cash flows and investment opportunities, and both papers find evidence that seems to fit an agency model of managerial behavior. Case studies of declining industries also point to managerial agency conflicts (e.g., Dial and Murphy 1995; Jensen 1986). However, while the empirical strategies employed by these other papers limit their analysis to only a handful of firms, our conclusions are based on the behavior of 2,209 affected firms. The size of our sample also allows us to perform formal statistical hypothesis tests and to explore how and why firms' responses to adverse shocks may vary.

The remainder of the paper is organized as follows. Section 2 discusses firms' legal liability for occupational carcinogens and how it is likely to affect the firms' cash flows and investment opportunities. Section 3 describes our empirical strategy and the data sources. Section 4 presents our results, and Section 5 discusses possible explanations. Section 6 concludes.

2. Liability for occupational carcinogens

In the United States, diseases – including cancers – that are contracted by workers in the course of

[1] Acharya, Baghai, and Subramanian (2008) also find that there is less innovation in countries where it is easier to terminate employees.

employment are covered by a legal institution known as the workers' compensation system. Under this system, employers are required to compensate workers for all job-related injuries irrespective of fault, and the injured workers are not eligible to sue their employers for negligence (for this reason, workers' compensation is called workers' "exclusive remedy"). Upon establishing that employment was at least a contributing factor in causing a disease, workers typically qualify for payment of their complete medical expenses as well as some compensation for lost wages (Peirce and Dworkin 1988). Because these payments accrue irrespective of employer negligence, the firm bears liability even if it had no knowledge of the danger (Schwartz 1985).

Damages related to carcinogenic exposures in the workplace can be significant. Treating cancer is expensive, and if a worker dies from the disease, surviving family members often qualify for death benefits. Furthermore, sick workers and their family members are entitled to sue employers directly for negligence, pain and suffering, and punitive damages if they can prove that their employer had "dual capacity" (for example, if the employer was also the producer of the substance causing the carcinogenic exposure) or committed "willful misconduct" (for example, if the employer took few precautions despite knowing the risks of exposure). Even a few such suits can lead to significant damage awards, and numerous suits can tax the financial assets of even large corporations (Ringleb and Wiggins 1990).

Thus, the discovery of the carcinogenicity of a chemical to which a firm's workers are exposed spells bad news for the firm. First, the probability of a severe *future* cash flow shock increases. This increases the likelihood of future financial distress and bankruptcy and decreases the value of the firm's assets. Second, the liability shock decreases the returns on new investments. Greater expected liability costs effectively raise the marginal costs of production: incremental carcinogenic exposure incurred with each unit of production increases the expected value of future damage awards.

Large firms often self-insure against these risks, thereby retaining the primary liability (LeRoy et al. 1989), and general liability and workers' compensation insurance are likely to provide firms with only limited protection from these claims. Third-party policies are often limited in scope and do not provide the firm with any protection against future premium increases due to changes in the firm's risk exposure,

and the premiums can become a significant cost of doing business (Williams 1986; Cummins and Olson 1974).[2,3] For example, a half-dozen surgeries for carpal tunnel problems and other injuries at a factory of 220 workers can lead to costs representing 2.5 percent of revenue ($4,900 per worker per year, or $2.50 for every hour that an employee works; Greenhouse 2009).

Using subsidiary corporate structures is also unlikely to shield firms from any major liability emerging from these claims because courts can "pierce the corporate veil" and hold a parent corporation responsible for its subsidiaries' liabilities. While there is no set rule or formula, it is generally understood that liability will be imposed on the parent "when it is necessary to promote justice or to obviate inequitable results" (Lattin 1971, p. 72), or when a subsidiary is set up to avoid paying foreseeable damages (because it is undercapitalized; Thompson 1991). Furthermore, using a subsidiary structure in the occupational injury context may actually increase the firm's total liability, because the exclusive remedy provisions of the workers' compensation system do not usually transfer to the parent corporation (Treece and Zuckerman 1983). Firms also cannot shield themselves from existing liability by spinning off the troubled assets. Although selling the assets can prevent additional expenses, the firms would still be liable to workers for damages already incurred.

Although the liability shock is bad news about the firm's future, it is unlikely to have much of an effect on its *current* cash flows. Damage awards are unlikely to affect cash flows right away because claims for past exposure to carcinogens typically take years to litigate. Moreover, damage payments to workers typically only accrue after worker injuries manifest themselves, because damages are usually

[2] Because of concerns about strong adverse selection, surplus liability insurance policies covering large risks were often unavailable during the period of this study, and insurance policies that were issued typically excluded many risks including "tail coverage" (i.e., the policies covered only damages from lawsuits actually filed during the policy period, excluding losses that would not manifest until much later; Winter 1991).

[3] Firms also warn about this risk in their financial reporting: "Our manufacturing operations are subject to…environmental hazards such as chemical spills, discharges or releases of toxic or hazardous substances or gases into the environment or workplace.… Furthermore, we could be subject to present and future claims with respect to workplace exposure, workers' compensation and other matters. Although we maintain property and casualty insurance of the types and in the amounts that we believe are customary for our industries, we cannot assure you that our insurance coverage will be adequate for liability that may be ultimately incurred or that such coverage will continue to be available to us on commercially reasonable terms. Any claims that result in liability exceeding our insurance coverage could have an adverse effect on our business, financial condition and results of operations." (Northwest Pipe Company 10-Q, September 2006, p. 18)

assessed only for actual – not speculative – damages (Ringleb and Wiggins 1990). Although premiums for third-party workers' compensation insurance are likely to eventually reflect the increased risk of a payout, they are unlikely to adjust right away (Williams 1986).[4]

The discovery that a chemical currently being used in a firm's production process – and to which the firm's workers are exposed – is a carcinogen thus has a distinctive feature: it represents a substantial adverse shock to a firm's asset value and investment opportunities that increases the likelihood of future financial distress and bankruptcy but has minimal concomitant effect on cash flows. Because the shock has little effect on current cash flows, which might directly influence investment (Fazzari, Hubbard, and Petersen 1988), we are able to isolate an exogenous increase in a firm's business risk. We exploit this unique feature in the analysis that follows to explore how firms' financing and investment decisions are affected by the risk of a large, adverse shock.

3. Empirical approach

Identifying workers' exposure to newly identified carcinogens requires the combination of information on (1) scientific discoveries related to chemical carcinogenicity and (2) which firms use these chemicals. For information about the timing of discoveries, we use the National Toxicology Program's (NTP) *Report on Carcinogens* (RoC). This report, which is published regularly by the U.S. Department of Health and Human Services under a 1978 congressional mandate, contains a list of all substances (1) that are known or may reasonably be anticipated to be human carcinogens, and (2) to which a significant number of persons residing in the United States are exposed. Nominations for listing in the report are evaluated by scientists from the NTP, other federal health research and regulatory agencies, and non-government institutions. The first two reports were published in 1980 and 1981, and the report has been updated approximately biannually since.

The addition of an agent to the RoC indicates an accumulation of new scientific evidence that the

[4] After learning about the increased risk, workers might demand higher wages as a sort of insurance against potential noneconomic harm, such as from pain and suffering. (Economic damages and lost wages would be covered by workers' compensation.) However, using the difference-in-difference framework described below, we do not find any evidence of wages increasing after the shock. Similar tests presented below find no immediate change in the ratio of cash flow to assets.

agent may be a carcinogen. In our empirical work, we focus on additions to the RoC after 1981 for two reasons. First, the initial report in 1980, which listed only 26 agents, was an incomplete listing of known carcinogens at that time; the second report, released only one year later, in 1981, contained 62 additional agents.[5] Second, our data source (described below) for identifying firms' chemical exposures is based on information collected between 1981 and 1983. To avoid the possibility that firms may have already eliminated exposures to carcinogens identified in the two reports prior to the survey, we rely on additions to the RoC beginning in 1983. This leaves 121 unique chemical agents.

While there are a number of potential sources for scientific developments related to possible carcinogens, we use the RoC because federal regulations specifically require U.S. firms to monitor the report and treat any substances listed as carcinogens. For example, firms are required to warn employees about their exposure to substances that are included in the RoC [U.S. Government Regulation 29 CFR, parts 1910.1200(b)(1) and (d)(4)]. Because of such regulations, it is likely that firms, and presumably employees, are aware of agents listed in the report. In fact, although it is not required, firms often note relevant changes in the RoC in their financial reporting. Nevertheless the listing of a substance in the RoC is not in itself a regulatory action that requires firms to limit exposures or uses of the substance in question, although it may prompt regulatory agencies to consider adopting such rules.

To identify firms in which workers were likely to have been exposed to the newly identified carcinogens, we use the National Occupational Exposure Survey (NOES). This survey was conducted by the National Institute for Occupational Safety and Health using on-site visits to 4,490 U.S. business establishments employing approximately 1.8 million workers between 1981 and 1983. In these visits, surveyors recorded all chemical, physical, and biological agents to which workers were observed to be exposed in each firm, the number of workers being exposed to each agent, and the number of these exposures that were uncontrolled. The survey is expansive and lists nearly 13,000 different agents,

[5] In the interest of "expeditiously initiating issuance of the first report," the decision was made to include only a limited number of chemicals that "represent substances historically viewed as associated with cancer in man" based on existing monographs prepared by the International Agency for Research on Cancer (National Toxicology Program 1980, pp. vi, 7). Subsequent reports also included chemicals recently identified as carcinogens, usually through animal studies.

including agents that were not known or thought to be hazardous at the time of the survey.[6] We obtained a custom extract of this data aggregated by 4-digit 1972 SIC code, covering 522 industries.

We determine whether a firm is affected by the listing of a newly classified carcinogen based on the firm's SIC code in Compustat in the year prior to each new listing.[7] We consider a firm affected if it operates in a 4-digit SIC code where at least 7.5 percent of workers were observed to be exposed to the carcinogen in NOES. The cutoff of 7.5 percent captures roughly the top quartile of observed exposures at the industry level, corresponding to the discoveries that are most likely to result in an increase in legal liability. Our findings are robust to using alternative measures of exposure, including lowering the exposure threshold or restricting treatment only to industries with observed "uncontrolled" exposures in the NOES. Our data on firms are from Compustat. To ensure a consistent sample of observations across specifications, we exclude observations with missing values for ln(assets), ln(sales), ln(capital expenditures+1), equity, ln(debt+1), and ln(dividends+1).

Figure 1 displays the timing of the liability shocks and the number of firms affected in each year. Using our measure of workers' exposures, shocks occurred in 1983, 1985, 1989, 1991, 2000, and 2004, with more than 100 firms affected by newly identified carcinogens in each of those years. In all, 106 different industries and 2,209 firms, representing 12 percent of non-financial firms covered by Compustat during the sample period, are affected by a newly identified carcinogen.[8] In addition to being robust to using alternative measures of workers' exposures, our findings are robust to excluding any chemical or any year in which a set of liability shocks occurred, including 1989.

For each new chemical's listing in the RoC, we construct a comparison group of unaffected firms

[6] Because the NOES survey was conducted between 1981 and 1983, it measures worker exposures to possible carcinogens before those chemicals were identified as dangerous by the RoC. Although it is possible that changes in production technologies between 1983 and a chemical's later listing in the RoC may have eliminated use of the dangerous chemical prior to the chemical's listing in the RoC, firms would still be liable for past exposures that occurred while the chemical was still in use. To the remaining extent that we do misclassify worker exposures, this sort of measurement error would only attenuate our estimates.

[7] We measure exposures at the industry level because data on exposures at the firm level are not available. The firm's SIC code in Compustat reflects its primary industry. Although it is possible that some firms have small operations in other industries causing us to miss some exposed firms, this only works against us finding an effect.

[8] Compustat covers 18,413 non-financial firms between 1982 and 2006, of which 2,209 firms experience an exposure. In an average year, 1.87 percent of previously unexposed firms suffer a new exposure.

(firms without observed exposures to any newly listed carcinogens) that were present in Compustat in the year prior to the RoC listing and were in the same Fama-French 48 industry classification as one of the affected firms. (Fama-French industries are collections of 4-digit SIC industries that are meant to represent broader industry categories.) This yields a comparison sample of 8,373 unexposed firms in 249 industries. Our results are also robust to using all unaffected firms in Compustat as our comparison group or to using 2-digit SIC codes instead of Fama and French (1997) industry classifications.

Firms with exposures to the newly identified carcinogens are very similar to our sample of unexposed firms in the year before the listing of a new carcinogen. The ex-ante characteristics of firms with exposures are reported in column (i) of Table I, and the ex-ante characteristics of firms without exposures are reported in column (ii). Even though we match firms based only on Fama-French industries, the two groups are similar in size, market-to-book ratio, recent growth, age, leverage, payout policy, capital intensity, and cash balances. We are unable to reject the null hypothesis that firms experiencing a liability shock are similar to other firms in all of these dimensions.

There is also no evidence of any relationship between the liability shock and current cash flows. Average cash flows for exposed and unexposed firms in the year before, the year of, and the year after new carcinogen listings are reported in Table II. In all three years, we are unable to reject the null hypothesis that there is no difference in average cash flows between affected and unaffected firms. This evidence supports the interpretation that the effects of the liability shock are caused by changes in the risk of a large adverse shock, rather than changes in current cash flows.

To estimate firms' responses to the liability shock, we compare changes in the exposed and unexposed firms' behavior around the time of each new carcinogen listing in the RoC. For each year that new carcinogens are listed in the RoC, we construct a cohort of exposed and unexposed firms using firm-year observations for the ten years before and the ten years after the listing. (We obtain similar findings if we instead compare the five years before with the five years after each listing.) We then pool the data across cohorts (i.e., across all new carcinogens listings) and estimate the average treatment effect. Specifically, we estimate the following firm-panel regression:

$$y_{ijct} = \beta_0 + \beta_1 Exposure_{jct} + \gamma_{ic} + \omega_{tc} + \varepsilon_{ijct}, \quad (1)$$

where y is one of several dependent variables of interest for firm i and year t, and *Exposure* is an indicator that equals 1 if at least 7.5 percent of employees in cohort c and industry j were observed to be exposed in the NOES to a known RoC carcinogen as of year t. For an exposed firm, this indicator changes from 0 to 1 when the chemical is identified in the RoC as a carcinogen. We also include firm-cohort fixed effects, γ_{ic}, to ensure that we estimate the impact of exposure after controlling for any fixed differences between firms; and we include year-cohort fixed effects, ω_{tc}, as a nonparametric control for any secular time trends. We allow the firm and year fixed effects to vary by cohort, because this approach is more conservative than including simple fixed effects. (Similar results are obtained in both specifications.) We deliberately do not control for any time-varying accounting variables in these regressions because these variables are likely affected by the shock and including them would confound estimates of β_1.[9] In any event, including the standard controls does not qualitatively affect the results (see appendix tables). To account for potential covariance among firm outcomes within the same 4-digit SIC code and over time, we cluster the standard errors at the industry level.

4. Results

4.1 Firm size, investment, and payout policy

To assess how the risk of large, adverse shocks can affect firms' investment and financing choices, we first analyze how overall firm growth responds to the liability shock. Theory suggests that firms may respond to increased business risks with diversifying growth (Maksimovic and Phillips 2002; Jensen and Meckling 1976; Amihud and Lev 1981). Such growth can reduce the possibility of costly

[9] Our identification assumption is that the incidence of the liability shock is as good as randomly assigned within our industry-matched sample; i.e., which firms' chemicals are discovered to be carcinogenic is uncorrelated with other determinants of the dependent variables after controlling for firm and year fixed effects. The results presented in Table I support this assumption. In this framework, β_1 in equation (1) measures the increase in the dependent variable caused by the liability shock. If we include endogenous controls, then β_1 would instead measure only the portion of the increase in the dependent variable caused by the liability shock that is not also correlated with the causal impact of the liability shock on the other variables. For example, suppose the liability shock leads firms to double in size by increasing capital expenditures by the same amount; then a regression of firm size on the exposure indicator and capital expenditures would yield a coefficient on the exposure indicator that is close to zero – even though exposure caused substantial growth.

financial distress and possibly benefit both managers and shareholders. Estimates of the shock's effect on log assets, log sales, and log capital expenditures are reported in Table III.

We find that, on average, firms grow following the shock. The estimates for log assets, reported in column (i), indicate that, after the liability shock, exposed firms grow total assets by an average of 10.3 percentage points more than unexposed firms.[10] One possibility is that this increase in assets reflects firms making investments in order to protect their workers from exposure to the newly identified carcinogens. However, we find that sales at these firms increase by a similar margin [column (ii)], suggesting that these firms are increasing their overall size and not strictly making capital investments to protect workers. These results are also not caused by survivorship bias. We find that firms affected and unaffected by the liability shock drop out of the sample at similar rates. The estimates are also robust to including controls for cash flows and the market-to-book ratio (see Appendix Table A-I).

The timing of the increase in size coincides with the increase in legal liability. Figure 2 plots the point estimates from a modified version of equation (1), where we allow the effect of *Exposure* to vary by year from five years before the shock through ten years after.[11] There is no indication of a difference in growth prior to the liability shock; exposed firms do not appear to be more or less likely to grow or shrink relative to other firms prior to the shock. But after the shock, firms with exposure to a newly identified carcinogen tend to grow their assets more than other firms. This growth begins during the year of the shock and continues for about two to three years. The precise timing of the growth suggests that it is in fact *caused* by the liability shock, rather than by any omitted firm or industry characteristic.

The growth's magnitude is also related to the degree of firms' liability exposure. If the growth is indeed caused by the newfound legal liability, then it should be greater among firms where more employees are exposed to carcinogens, such as in firms with more low-skilled labor. We verify this relation using data from the NOES on the fraction of employees exposed to each chemical. Figure 3 plots

[10] The increase in log assets is 0.098 log points, corresponding to an increase in assets of $e^{0.098} - 1 = 10.3$ percentage points. We use this method throughout the paper to interpret estimates from regressions with log dependent variables.

[11] The plotted coefficients measure the change in log assets (from its level six to ten years before the shock) for affected firms relative to other firms. The confidence intervals shown have much less power than estimates from equation (1) because they compare each year separately against the reference period.

estimates from a modified version of equation (1), where we allow the effect of *Exposure* to vary non-parametrically with the fraction of employees exposed. As expected, the increase in growth is positively related to the degree of firms' exposure to potential liability. The estimates indicate that the average growth in log assets following a liability shock increases initially with the fraction of employees with observed exposures, and then levels off with greater amounts of exposure.

To shed some light on how firms fund this aggressive growth, we examine the effect of the liability shock on log book equity, log debt, and the ratio of debt to assets. These results are reported in columns (i)-(iii) of Table IV. We find that the exposed firms are more likely to fund their growth with equity than with debt. Similar to the firm's assets and sales, the overall equity of the firm increases by 11 percent on average after the liability shock, and this increase is statistically significant at the 5 percent level. Total debt, however, does not exhibit a statistically significant increase, leaving firms with lower average ratios of debt to assets after the liability shock.

The increase in liability risk also affects payouts to shareholders. We define total payouts to shareholders as the sum of dividends and repurchases per hundred dollars of total assets and re-estimate equation (1). The estimates, reported in column (iv) of Table IV, find an average increase in overall payouts to shareholders. Total payouts per hundred dollars of assets increase by 30 percentage points – or roughly 16 percent relative to the sample mean reported in Table I. Both the leverage and payout results are robust to including typical controls, including the proportion of fixed assets, log sales, modified Altman z-score, and ROA (see Appendix Table A-II).

At first examination, it may seem odd that firms respond to the shock by both issuing equity and increasing payouts to shareholders. Further analysis presented below illustrates that these average responses actually obscure substantial heterogeneity: we find that some firms grow while others are more likely to pay out capital. Furthermore, we will show that the liability shock tends to increase firms' growth through the acquisition of high-cash-flow firms. Rather than these firms necessarily increasing their payouts from their existing lines of business, much of any increased payout may be coming from these newly acquired business units.

4.2 Connection with financial vulnerability

We next examine whether firms' responses to the shock are related to their ability to survive an adverse shock. In particular, we examine whether firms that are potentially more exposed to an adverse shock, as measured by a greater bankruptcy risk, respond differently to the shock. To do this, we calculate each firm's modified-Altman z-score in the year prior to each new listing in the RoC and then compare the response of exposed firms in the lowest quartile (highest bankruptcy risk) with that of unexposed firms in the same quartile, and then do the same comparison for firms in the highest quartile (lowest bankruptcy risk).[12] These results are reported in Table V.

We find that firms with high risk of bankruptcy tend to respond to the increase in liability risk by increasing growth sharply, whereas firms with relatively little bankruptcy risk do not. As reported in Panel A of Table V, column (i), exposed firms with the greatest bankruptcy risk grow total assets by 38 percent and sales by 48 percent, on average, after the liability shock relative to unexposed firms with similar bankruptcy risk. Firms with low bankruptcy risk, as reported in Panel B, do not exhibit any increase in growth, and the difference in growth between high- and low-risk firms is statistically significant at the 1 percent level for both assets and sales. The estimates also suggest that capital expenditures increase more for high-risk firms: there is an average increase of 13 percent for affected high-risk firms and no significant increase for low-risk firms.[13] Similar to the full sample, the timing of the growth among firms with a high risk of bankruptcy largely coincides with the publication of a new carcinogen in the RoC and does not seem to reflect a pre-existing trend (See Appendix Figure A-1).

To further test whether a firm's financial vulnerability affects its response, we divide the sample based on other measures of financial constraints. Following Kaplan and Zingales (1997), we use the following proxies: high leverage, low cash flows, zero dividends, and small size. Similar to before, we match firms within cohorts to compare the differential responses of firms in the top and bottom quartiles

[12] Following MacKie-Mason (1990), we calculate a modified-Altman z-score as 3.3*(EBIT/assets)+1.0*(sales/assets) +1.4*(retained earnings/assets)+1.2*(working capital/assets). Including the ratio of market equity to book debt decreases our sample size by about 20 percent. Instead, we examine the effect of leverage separately in Table VI.

[13] These results are robust to dividing the sample between liability shocks that occur before and after 1989 (see Appendix Tables A-III and A-IV).

for each variable, except for dividends, for which we compare those firms that paid dividends with those firms that did not. In all cases we measure the variable in the year prior to the liability shock. Estimates of the shock's effect on exposed firms' average log assets are reported in Table VI.

Similar to our analysis of bankruptcy risk, we find that firms that are more financially vulnerable to the adverse shock and thereby less able to bear liability risk tend to respond to the shock by growing, whereas less vulnerable firms do not. As reported in Table VI, firms with high leverage, low cash flows, zero dividends, or small size in the year prior to a liability shock exhibit an average increase in growth of about 19 to 23 percent. These increases are all statistically significant at the 5 percent level. On the other hand, firms with low leverage, high cash flows, positive dividends, and more assets do not exhibit a statistically significant increase in average growth following the shock.[14]

4.3 Acquisitions

Why do firms grow after the shock? One reason may be to reduce the probability of future financial distress (Maksimovic and Phillips 2002; Amihud and Lev 1981). To shed light on the motivations behind the growth, we examine the extent and nature of acquisition activity undertaken by exposed firms after the shock. The magnitude and quickness of the growth of financially vulnerable firms after the liability shock suggest that acquisitions may play an important role in this growth. The availability of detailed data on corporate acquisitions also enables us to analyze whether the liability shock affects the types of investments undertaken by exposed firms and whether these investments tend to diversify firms operations.

To analyze the liability shock's effect on acquisitions, we obtain the sample of all acquisitions of U.S. firms or subsidiaries that are recorded in the Securities Data Company's (SDC) U.S. Mergers and Acquisitions Database. The sample includes all acquisitions announced between 1980 and 2006. Following previous research, we exclude acquisitions meeting any of the following criteria: (1) the ratio of the deal size to market value of the acquirer's assets is less than 1 percent; (2) the acquiring firm

[14] Differences in ex-ante firm size alone cannot explain the bankruptcy risk results based on firms' z-scores reported above. Double-sorting the data based on z-score and firm size, we find evidence of increased growth even among large firms with low z-scores (high bankruptcy risk). These estimates are reported in Appendix Table A-V.

controlled more than 50 percent of the target prior to the announcement date or less than 100 percent after the acquisition was completed; (3) the ultimate parent of the acquirer and the target are the same (i.e., consolidations within holding companies); (4) either the acquirer or the target is a financial firm; or (5) the deal was not completed within 1,000 days of the announcement date.

To test for a change in total acquisition activity after a liability shock, we run the following industry-panel regression:

$$Ln(deals+1)_{jt} = b_0 + b_1 Exposure_{jt} + \alpha_j + \delta_t + e_{jt}, \quad (2)$$

where *Ln(deals+1)*, is the natural log of one plus the total number of deals completed in year *t* by firms whose primary line of business is industry *j*. We find similar results if we use the aggregate dollar volume of completed deals rather than the total number. *Exposure* is defined as in equation (1). Industry-level fixed effects, α_j, control for base differences in the level of acquisitions across industries, and year fixed effects, δ_t, control for any secular time trends and changes in the macroeconomy. As in the analysis reported above, we limit the sample to Fama-French industries that experience an exposure during the sample period. This restriction increases the comparability of exposed and unexposed industries in the sample, but it does not qualitatively affect the results. The standard errors are clustered at the industry level.

We find that industries in which workers were exposed to the newly identified carcinogens undertake more acquisitions after the chemical is listed in the RoC. These results are reported in Table VII. Exposed industries complete about 6.6 percent more deals on average, relative to industries without an exposure. Because the specification includes both industry and year fixed effects, the positive coefficient for b_1 indicates the increase in the overall number acquisitions following the liability shock, relative to both the typical number of completed deals in these industries prior to the shock and the concomitant growth in acquisition activity in unaffected industries.

The increase in acquisitions appears to account for a significant proportion of the growth in overall assets reported in Table III. The average aggregate value of acquisitions undertaken by firms with exposures in the ten years after a carcinogen is newly identified is $643 million greater than that of

unexposed firms, whereas the average aggregate increase in overall assets is $1,358 million greater. The ratio of these two values suggests that at least 47 percent of the asset growth observed in Table III is attributable to acquisitions. The overall contribution of acquisitions toward growth may be greater because the subsequent growth of an acquired firm is not captured by this estimate.

To examine whether these acquisitions are consolidating or diversifying in nature, we classify acquisitions based on the SIC codes of the acquirer and target firms. In addition to a firm's primary line of business, SDC lists up to nine other 4-digit SIC codes which represent "any small side lines the company is involved in" (Thomson Financial 1999). Using this information, we classify an acquisition into three distinct types: (1) "main line" if the primary SIC industry for the acquiring firm coincides with any SIC code of the target; (2) "side line" if an SIC code listed as a side line business for the acquirer matches any SIC code listed for the target, but the acquirer's primary SIC code does not match; and (3) "no match" if none of the target or acquirer's primary or side lines of business coincide. We then calculate the number of acquisitions at the industry-year-type level and re-estimate equation (2) for each type of acquisition. The results are reported in columns (ii)-(iv) of Table VII.

The results suggest that the exposed firms are both expanding existing side lines of business and expanding into completely new lines of business. As reported in column (iii), there is a statistically significant increase in side line acquisitions after a liability shock, consistent with firms using acquisitions to expand side lines of business. At the same time, there is also a 5.5 percent increase in acquisitions for which there is no apparent overlap between the target and acquirer's businesses, again measured relative to industries that do not have such exposures [column (iv)].

How does the increase in firm risk affect the type of firms being acquired – other than the increase in diversification? To shed some light on this question, we examine the subsample of acquisitions for which financial data are available in Compustat for the target firm.[15] We examine characteristics of the target firms based on their most recent financial data available in Compustat before

[15] We match the firms in SDC Platinum to Compustat using their CUSIPs. Unfortunately, historical CUSIPs are not available in Compustat, so we determine a firm's historical CUSIP by matching observations to CRSP using the CRSP/Compustat Merged Database, and then using the historical CUSIP reported by CRSP. When the historical CUSIP is missing, we use the CUSIP recorded in Compustat's header file.

the acquisition announcement using the following regression:

$$y_{ijt} = B_0 + B_1 Exposure_{jt} + \alpha_j + \delta_t + \eta_{ijt}, \quad (3)$$

where y is an ex-ante characteristic of target firm i, in industry j, for an acquisition announced in year t. We examine the following target characteristics as dependent variables: log total assets, five-year compounded annual growth rate for assets, the ratio of debt to assets, the ratio of cash flow to assets, and the ratio of the total payout to assets.[16] *Exposure* is defined as in equation (1). We include both industry and year fixed effects, and we cluster the standard errors at the industry level.

Liability exposure seems to affect the type of firms being acquired. In particular, the evidence suggests that the acquired firms are larger, have greater historical growth rates, and have less debt. The results are reported in Panel A of Table VIII. In terms of total assets, targets acquired by exposed firms are 39 percent larger, on average, than targets acquired by unexposed firms [column (i)]. Their growth rate in the five years before being acquired is 10.1 percentage points greater on average than for targets acquired by unexposed firms [column (ii)]. The targets in these deals also average 6.3 percentage points lower ratios of debt to total assets [column (iii)], which may indicate lower takeover gains for the acquirer (Israel 1991).

Exposed firms also tend to acquire targets that generate and pay out greater cash flows per dollar of total assets. Compared with targets acquired by unexposed firms, targets acquired by exposed firms average 8.3 percentage points greater ratios of operating cash flows to assets [column (iv)], and 3.4 percentage points greater ratios of total payouts to assets [column (v)]. These findings suggest that exposed firms may be seeking to acquire so called cash cows after experiencing the liability shock. These results may also explain some or all of the increase in the average ratio of total payout to assets for firms that grow following a liability shock. Rather than these firms necessarily increasing the payout ratio from their existing lines of business, it is possible that much of the increased payout is coming from the newly

[16] Except for the regression of log total assets, the regressions are estimated by weighted least squares, using the target firms' total assets as weights. Given the magnitude of the size differences between deals, weighting gives the estimates a more meaningful interpretation: the estimated coefficients represent the effect of liability exposure on characteristics associated with the average dollar of transaction value (rather than the average deal). For example, the regression of the ratio of cash flows to assets examines whether the ratio of the total cash flows across all acquired targets to the total assets acquired increases after the liability shock.

acquired high-cash-flow business units.

Exposed firms also pay more, on average, to complete these acquisitions and are more likely to finance the deals with stock. We calculate the takeover premium paid over the target firm's market value in each acquisition and estimate how it changes after liability exposure using equation (3). The results are reported in Panel B of Table VIII. We find that these acquisitions are associated with nearly 14 percentage point greater takeover premiums, on average, than the premiums paid on acquisitions by unexposed firms [column (vi)]. The share of financing using stock increases by 8 percentage points [column (vii)]. In sum, the liability exposure seems to lead firms to pay relatively high prices to undertake diversifying, stock-financed acquisitions of large, high-cash-flow-generating firms.

Investors also appear to perceive the announcements of these mergers as bad news for the firms' shareholders. Of the acquisitions analyzed in Table VIII, the average abnormal return over a three-day window (−1, +1) for acquisitions by exposed firms is −1.35 percent (standard error is 0.31).[17] Further analysis suggests that the negative abnormal return is attributable to the liability shock, rather than an industry or year characteristic. We estimate the effect of liability exposure on abnormal returns using equation (3). The estimate, reported in column (viii), suggests that acquisitions undertaken by exposed firms are associated with abnormal returns that are 1.3 percentage points lower. This decline in returns also holds after controlling for how the acquisitions are financed.

5. Interpretation

5.1 Possible explanations

The dominant finding of our analysis is that firms tend to grow and diversify in response to the liability shock, which represents an increased risk of a future, large, adverse shock (see Section 2). The growth is funded primarily with equity and appears largely driven by an increase in diversifying acquisitions of large cash cows. Two leading explanations for why firms respond in this way are costs of

[17] To estimate abnormal returns, we use standard event study methods (see MacKinlay 1997) and compute market model abnormal returns using CRSP equally weighted index returns. The parameters for the market model are estimated over the (−300, −46) day interval. The results are not sensitive to estimating the parameters for the market model over other conventional periods or to defining abnormal returns using net-of-market returns or using the value-weighted CRSP market return in the estimation of the market model.

financial distress and a managerial agency conflict.

Costly financial distress

If financial distress is costly, then reducing the likelihood that an adverse shock will cause financial distress can create value for shareholders (Froot, Scharfstein, and Stein 1993; Fluck and Lynch 1999). One potentially important cost of financial distress may be the loss of organizational capital. Organizational capital is productive capacity that derives from knowledge embedded in a firm's organization and its "people relationships" (Prescott and Visscher 1980; Tomer 1987). Because a firm's organizational capital is vested in the relationships among its workers, much of it may be lost if the firm undergoes significant downsizing in response to a large, adverse shock. To preserve shareholder value, it may be optimal for a firm to maintain its size by redirecting its operations to a new industry after the liability shock (Maksimovic and Phillips 2002).

This hypothesis matches many of our results. Increasing growth by undertaking diversifying acquisitions could be an optimal response that allows the company to maintain the ability to finance profitable investments and preserve organizational capital should large liability costs eventually materialize. Growth provides the firms with deeper pockets from which to pay future liability costs and may thereby provide insurance against negative future cash flow shocks affecting the firms' primary business. In further support of a costly financial distress explanation, the growth is also stronger among firms for which external finance would be more costly and is funded using equity rather than debt. The desire to avoid incurring these costs is also consistent with our finding that acquisitions shift towards firms with high cash flow, which may help the firm avoid future financial distress.[18]

There are a number of reasons to believe, however, that this growth may not improve shareholder value. First, the nature of the liability shock suggests that such growth is unlikely to create value for shareholders. Because acquired firms are considered assets of the parent company after a takeover, legal

[18] As a further test of the organizational capital explanation, we also classified firms as having high or low organizational capital using their accumulation of SG&A (Eisfeldt and Papanikolaou 2008). However, we find no difference in how these sets of firms respond to the liability shock (see Appendix Table A-VI). We also find no evidence that the effect is larger for firms with a larger market share – another proposed proxy for organizational capital (Lev and Radhakrishnan 2004; see Appendix Table A-VII).

liability extends to the target firm. (As a lawyer aptly put it to us, "If you are being sued by someone you hit with your car and then you win the lottery, it is the victim's lucky day, not yours.") If the potential damage payments are high enough, then extending the legal liability reduces the value of the target's assets. Second, the increased acquisitions are associated with negative announcement returns, suggesting that some of the growth may not be in shareholders' interests.

Managerial agency conflict

Because distress can be *personally* costly for managers, the growth may also be driven by managers trying to reduce the likelihood of financial distress (even if it was not in shareholders' interest). Negative corporate outcomes often adversely affect a manager's career prospects, even if poor corporate performance is caused by factors beyond their control (Gilson 1989; Jenter and Kanaan 2008). Consequently, managers may prioritize the value of their own human capital and the firm's long-run survival above shareholder value and take actions that will reduce the increased risk of a large, adverse shock. For example, managers may alter corporate investment (Holmström 1999) or diversify into new lines of business (Amihud and Lev 1981).

In the presence of these managerial agency conflicts, the increases in growth we observe after the liability shock may actually reduce shareholder value and provide an explanation for the negative abnormal returns associated with the increased acquisitions. The agency model of managerial behavior is also consistent with all of the corporate responses to the liability shock documented above. Managers' interest in insuring their career and personal wealth against a negative shock can explain why firms grow through acquisitions and why the growth is concentrated among firms with weak balance sheets, funded using equity, and targeted at cash cows holding less leverage and purchased at a premium. Diversification, lower leverage, and the acquisition of cash cows increase the likelihood that the firm (and the CEO's job) survives a potential future barrage of liability costs.[19]

[19] To increase its likelihood of survival, a firm could also self-insure by issuing equity and retaining the proceeds as cash. Our evidence suggests that this is not a common response to the liability shock. One potential explanation is that accumulating cash would arouse suspicion from investors and is linked empirically to proxy fights and executive turnover (Faleye 2004).

5.2 Empirical evidence

To further explore the plausibility of these possible interpretations, we first examine the relation between the growth of liability-exposed firms, their corporate governance, and their ownership structures. Under both models, firms grow and diversify after the shock to reduce the firms' exposure to the increased risk of future liability costs, but the agency problems are likely to be particularly severe for entrenched managers (Jensen and Ruback 1983; Shleifer and Vishny 1989) and for risk-averse managers who have much of their wealth tied to the value of the firm's assets (Holmström 1999; Parrino, Poteshman, and Weisbach 2005; Hugonnier and Morellec 2007). Although high managerial ownership may help reduce other agency conflicts by inducing a manager to work hard, it exacerbates the agency problem that we focus on, by giving the manager a greater incentive to reduce the firm's risk. Differences in the degree to which managers are monitored by large, institutional shareholders provide a third test of whether the diversifying growth is in shareholders' interest. Institutions are more likely than individuals to hold substantial blocks of shares and thereby to have a financial incentive to monitor management (Shleifer and Vishny 1986). If the increase in growth results from an agency conflict, then we might expect to find the growth concentrated among firms with few institutional shareholders.

To analyze the importance of governance and ownership for how firms respond to an increased risk of a large, adverse shock, we return to our original Compustat sample and estimate equation (1) separately for firms with different corporate governance, different shares of managerial ownership, and different shares of institutional ownership before the shock. In all cases, we classify firms based on their governance and ownership in the year prior to the chemicals' listings in the RoC.

To sort firms based on external governance, we use the Gompers, Ishii, and Metrick (GIM) governance index and compare the responses of firms with "weak" corporate governance, as measured by a GIM-index greater than or equal to 11, and firms with "strong" governance, as measured by an GIM-index less than or equal to 5.[20] Because the GIM-index is available only from 1990, we use firms'

[20] Our results are robust to using alternative cutoffs, including limiting the weak governance sample to firms with a GIM index ≥ 14 (Gompers, Ishii and Metrick 2003). Our results are also similar if we divide our sample based on the entrenchment index constructed by Bebchuk, Cohen, and Ferrell (forthcoming).

corporate governance in 1990 as a proxy for their governance in 1988, the year before the 1989 RoC report, to increase the number of carcinogenic discoveries that contribute to identification.[21] Our analysis here is limited to the 18 percent of firms for which we observe the GIM-index; these firms are relatively large, accounting for 43 percent of total assets in the full sample.

To sort firms based on inside ownership, we use the reported shares held by a firm's senior management as a fraction of the firm's total shares outstanding, as recorded by TFN Insider Filing Data.[22] We compare the responses of firms with high inside ownership, as measured by senior managerial stock ownership in the top quartile, and firms with low inside ownership, as measured by senior managerial stock ownership in the bottom quartile. Although the ownership data are available beginning in 1986, there are very few observations before 1996, limiting our sample to only 23 percent of firms in our full sample, corresponding to 39 percent of total assets.

To sort firms based on institutional ownership, we use the fraction of a firm's equity that is owned by institutional investors, based on 13(f) filings recorded in the TFN Institutional Holdings database. A 1978 amendment to the Securities and Exchange Act of 1934 requires all institutions with more than 100 million dollars of securities under discretionary management to report their holdings to the SEC through 13(f) filings. We compare the responses of firms with limited institutional monitoring, as measured by institutional ownership in the bottom quartile, and firms with high institutional monitoring, as measured by institutional ownership in the top quartile.

Estimates of how firms' growth response varies based on governance and ownership structures are reported in Table IX. We find that the growth is concentrated among firms with weak corporate governance, high inside ownership, and low institutional ownership. As seen in column (i) of Table IX,

[21] We do not backfill governance any earlier than 1989 because governance in 1990 is likely to be less correlated with governance in even earlier years.

[22] Although we would ideally measure the value of the insiders' shares relative to their personal total wealth, this information is not available and their share of firm ownership is a useful proxy. The share of ownership is calculated using the filings derived from Forms 3, 4, and 5 over the period 1986-2005. These filings originate from trades by firm insiders that must be reported to the SEC. The measure of managerial ownership reflects the average total holdings of the CEO, CFO, CIO, and COO in the year, adjusted for stock splits. We are grateful to Dimitris Papanikolaou for providing us with these data as well as the data on institutional ownership (discussed below). More details on the construction of both data sets are described in Panousi and Papanikolaou (2008).

firms with weak governance increase their average size dramatically following the increase in legal liability, relative to other weakly governed firms. Average total assets increase by about 34 percent, whereas strong governance firms do not grow on average after the liability shock, and they may even shrink. We also find evidence of a sharp increase in growth among firms with high inside ownership or low institutional ownership [columns (ii)-(iii)] whereas exposed firms with low inside ownership or high institutional ownership exhibit a much smaller, non-significant increase.

These governance and ownership results, combined with the negative returns after acquisition announcements, suggest that the growth of liability-exposed firms may be driven by managerial incentives rather than shareholders' interests. In fact, if the growth has negative NPV, then this growth may be one concrete example of how shareholder rights can affect corporate performance and firm value (as suggested by the correlations presented by Gompers, Ishii, and Metrick (2003) and others).

If the diversifying growth we observe is indeed driven by managerial private interests, then the growth should benefit managers. One way managers may benefit from the growth is if it provides them with greater job security. We examine this hypothesis in our setting by analyzing whether rapid growth following the liability shock is indeed associated with lower CEO separation rates and a reduced likelihood of firms exiting Compustat.[23] Specifically, we construct an indicator, *Firm exit*, which equals one if a firm is no longer covered in Compustat five years after the liability shock, and an indicator, *CEO exit*, which equals one if a firm is still covered in Compustat five years after the shock but the CEO has changed. We determine whether a CEO exit has occurred using data on CEO tenure and age provided in the Disclosure database used by Linck, Netter, and Yang (2008).[24] Using firms' asset growth from the year before to the year after the liability shock, we restrict our sample to exposed firms that were either in the top or bottom quartiles of growth and regress the two exit measures onto an indicator for being in the

[23] While there are a number of possible reasons why a firm may exit Compustat, most of them, such as bankruptcy or takeover, are often associated with managerial turnover.

[24] We greatly thank James S. Linck for providing us the data on CEO age and tenure. Using the CEO tenure information available in this data, we are able to construct a measure of when a CEO exit occurs. Because CEO tenure is not available for many firms, we also use changes in CEO age to determine when a CEO exit occurs. Specifically, we consider a firm exit to occur if CEO age declines from the previous year (which would indicate a new, younger CEO) or CEO age increases by more than two from the previous year (indicating a new, older CEO).

top quartile of growth. The estimates are reported in Table X.

Exposed firms that grow significantly after the liability shock are much less likely to exit Compustat or replace their CEO. Exposed firms in the top quartile of growth were nearly 15 percentage points less likely to exit Compustat within five years after the shock relative to exposed firms in the bottom quartile of growth [Table X, Column (i)]. Among firms still covered by Compustat five years after the liability shock, the average CEO exit rate was also 6.8 percentage points lower [Column (ii)]. Combining the two exit measures, exposed firms with significant post-liability shock growth have an average rate of CEO or firm exit that is 16 percentage points lower [Column (iii)].

Finally, we analyze whether governance and ownership structures are related to the observed increases in payouts shown in Table IV. If shareholders' costs of financial distress are not too high, then such an increase in payouts might benefit shareholders. To the extent that the liability shock decreases the returns on new investments, increasing payouts would allow investors to redeploy these funds more profitably to other firms that are not exposed to the liability. If the increase in payouts to shareholders after the liability shock is concentrated among firms with strong external governance, low inside ownership, and large institutional shareholders, then we might conclude that shareholders typically prefer that the manager pay out capital than grow the firm. The estimates for these regressions are reported in Table XI.

While strong governance, low inside ownership, and high institutional ownership firms do not grow following the liability shock, they do significantly increase their average total payouts to shareholders. Strong governance firms increase their total payout ratio by 45.9 percent relative to a sample mean of 2.54 for strong governance firms before the shock, and the increase is statistically significant at the 5 percent level [Table XI, Column (i)]. Low inside ownership and high institutional ownership firms exhibit similar increases in payouts [Table XI, Columns (ii)-(iii)]. Weak governance firms, high inside ownership, and low institutional ownership firms, on the other hand, do not exhibit

statistically significant increases in their payouts, and the point estimates are smaller.[25]

Overall, the corporate governance, managerial ownership, institutional monitoring, and CEO exit results show that managerial private interest can play a significant role in corporate responses to an adverse shock. Average growth is large when agency problems are more severe -- when firms have weaker external governance, when senior management holds a larger equity stake in the firm, and when relatively few equity shares are held by institutional investors. Firms that grow also exhibit fewer CEO turnovers suggesting that managers benefit from this growth. At the same time, firms where agency problems are milder – firms with strong external governance, low inside ownership, and high institutional ownership – do not grow; instead, they greatly increase their payouts to shareholders. These results suggest that much of the diversifying growth may not be in shareholders' interest, and that the average shareholder might prefer managers to pay out the excess cash.

5.3 Alternative interpretations

Two additional explanations for firms' financing and investment responses to the liability shock also merit careful consideration: asymmetric information and managerial effort.

Asymmetric information

If investors do not have as much information about the potential legal liability as the firms' managers, then the managers may be making money for existing shareholders by exploiting this asymmetric information to issue overvalued equity – through both secondary equity issues and stock acquisitions. While firms are required by law to warn employees about their exposure to substances that are included in the RoC, it is possible that the financial market does not pick up on these risks or systematically underestimates the firm's exposure to them. Huberman and Regev (2001) lend some

[25] Differences in ex-ante financial vulnerability do not appear to explain these results or the growth results. The average modified z-score for weak governance firms prior to the shock is 1.94, whereas the average modified z-score for strong governance firms is 2.06. The difference of 0.12 is only one-tenth of a standard deviation, and the p-value of the difference is 0.406. Firms with higher inside ownership also exhibit a lower average bankruptcy risk than firms with low inside ownership. Only in the case of institutional ownership do we find a possible concern in that average bankruptcy risk of firms with low institutional ownership is significantly lower than that of firms with high institutional ownership. However, after double-sorting the data based on bankruptcy risk and institutional ownership, we find that greater bankruptcy risk and less monitoring appear to be both independently related to firms' responses to the liability shock. These estimates are reported in Appendix Table A-VIII.

plausibility to this hypothesis by documenting a case in which the market did not price public scientific information (previously published in the journal *Nature* and various popular newspapers) until it appeared in a prominent article in the Sunday *New York Times*.

Asymmetric information, however, cannot easily explain all of our results.[26] It is unclear why information asymmetry would cause a shift towards acquisitions of firms with higher cash flows. Furthermore, if investors are unaware of the shock and managers are acting on their own, there is little reason to expect the growth to be concentrated among firms with weak external governance or high inside ownership. One possibility is that weak governance is correlated with superior CEO ability (e.g., Hermalin and Weisbach 1998), and that higher ability CEOs are more likely to exploit over-valued equity using stock acquisitions. However, even this explanation cannot explain why the growth is also concentrated among firms with low institutional ownership.

Managerial effort

Agency models of the firm provide another possible explanation for some of our results. As noted by Grossman and Hart (1983), fear of bankruptcy and employment loss can provide particularly strong incentives for managers to exert effort. Because large, future cash outflows pose a threat to a manager's employment, particularly for financially vulnerable firms, it is possible the liability shock induces managers to exert greater effort to improve firm value, which may in turn increase the likelihood of survival should litigation occur. Opportunities to improve effort may also be greater among weakly governed firms if managers at these firms were exerting less effort before the shock. It is possible that greater managerial effort would manifest itself as higher growth, more aggressive cost cutting, and

[26] In an attempt to examine whether the investors seem to be aware of the liability shock, we also looked at how firms' market-to-book ratios change after the shock. The estimates are small in magnitude and very noisy. The results are consistent with many investors not being aware of the shock, but other explanations are also possible. For example, the effects may vary across firms depending on their financial vulnerability: on average, the market-to-book ratio decreases by 0.15 percentage points after the shock among firms with high bankruptcy risk (standard error 0.56) and increases by 0.22 percentage points after the shock among firms with low bankruptcy risk (standard error 0.22). It is possible that the shock harms high bankruptcy risk firms by increasing the expected costs of financial distress, thereby benefiting the low bankruptcy risk firms indirectly by improving their competitive position in product markets (Bolton and Scharfstein 1990). In all, these estimates are too noisy to draw a clear conclusion either way.

improved profitability. In this scenario, the growth would be driven by managers' exposure to firm risk but would actually be in shareholders' interest.

There is little evidence, however, that the liability shock affects measures of firm performance that might indicate greater managerial effort. There is no evidence that firms' return on assets (ROA) or asset turnover (sales/assets) improve following the liability shock. There is also no evidence that wages or other costs decline significantly (see Appendix Table A-IX). Increased managerial effort also cannot explain a number of our other results. It does not explain why the growth would tend to diversify firms' operations or be targeted at acquiring cash cows. The negative announcements returns associated with these acquisitions are also not consistent with this growth being in shareholders' interest.

6. Conclusion

This paper examines how firms respond to exogenous increases in legal liability resulting from employees' exposure to carcinogens. Like many other business risks, the increase in legal liability represents an increased probability of large, adverse shocks in the company's future. We find that such firms tend to grow aggressively using both capital investment and acquisitions, and this growth is concentrated among firms that are more financially vulnerable to the realization of an adverse shock and funded primarily with equity. The acquisitions appear to diversify firms' assets and to target large firms with relatively high operating cash flows, recent growth, and total payouts. Relative to acquisitions undertaken by similar firms without liability exposure, these acquisitions are associated with higher takeover premiums and greater equity financing.

Firms' responses to the liability shock seem to be aimed at reducing the firms' exposure to the newfound risks. These actions can create value for shareholders if they reduce the probability of costly financial distress. Managers likely also benefit personally from reducing the liability risks, which can threaten the managers' private benefits, reputation, and future income even if the risks are caused by factors beyond their control (Gilson 1989; Jenter and Kanaan 2008). Empirically, managers' personal incentives appear to play a role. The increased growth is associated with less CEO turnover among

exposed firms, and when growth is announced, it is met with negative abnormal returns. We also find that firms with weak external governance grow by almost 35 percent on average after the liability shock, whereas firms with strong external governance do not grow. Firm growth is also larger both when senior management holds larger equity stakes in the firm (magnifying their sensitivity to firm risk) and when relatively few equity shares are held by institutional investors (who are thought to monitor managers). Instead of growing, firms likely to have few agency conflicts increase total payouts to shareholders, suggesting that shareholders of the *average* liability-exposed firm might prefer that managers pay out the excess cash rather than grow the firm.

Other examples of corporate responses to liability risk may be found in the growth of tobacco firms in the 1960s and '80s. The U.S. Surgeon General (1964) released its first report on the health consequences of smoking in 1964. Almost immediately, major American cigarette companies began expanding into nontobacco businesses, such as consumer packaged goods, dog food, whisky, corn-oil refining, and domestic crude oil and natural gas exploration. The industry experienced another round of diversification two decades later. The first academic medical study documenting the harmful effects of second-hand smoke was published in 1981 (Hirayama 1981), opening cigarettes to new regulation. Within a few years, R.J. Reynolds bought Nabisco and Philip Morris bought General Foods and eventually Kraft. Jensen (1986) points to these diversification programs as prominent examples of managers making investments that are contrary to shareholders' interests.

Our results have broad implications beyond the effects of legal liability. The liability shocks we study have characteristics similar to many other business risks that firms face in that they reduce firms' expected future cash flows and the expected returns on investments but have a limited effect on *current* cash flows. Roughly speaking, these characteristics are similar to a shock, such as a technological innovation, that increases the probability of future competitive entry into a firm's product market. If entry eventually occurs, the firm's cash flows will be reduced; this is similar to the reduction in cash flow that is likely to be realized when liability damages are eventually incurred. Additional parallels can be drawn to any number of other business risks that involve a decrease in expected future cash flows — for

example, the risk that tariffs will be eliminated or that new regulations will greatly increase a firm's marginal costs of production. Case studies of declining industries also document corporate behavior similar to that in our findings. Examples include the steel industry in the late 1970s (Hall 1997), the oil industry in the 1980s (Jensen 1986), and the defense industry after the cold war (Dial and Murphy 1995).

While we cannot be sure how managers might respond to other particular shocks, the results presented here suggest that the responses may not always coincide with shareholders' interests. To the extent that managerial agency conflicts play a role, our evidence offers insight into managerial preferences. Based on corporate responses to antitakeover legislation, Bertrand and Mullainathan (2003) conclude that the average manager does not have a preference for empire building or diversification. Although the average manager may be "reluctant to undertake cognitively difficult activities" (what Bertrand and Mullainathan also call the "quiet life"; p. 1067), our results suggest that many managers are willing to overcome this reluctance when the stakes are sufficiently high. Our finding that the intensive growth following an adverse shock is concentrated among financially vulnerable firms also suggests that managers' motivations for growing their firms may be more accurately characterized by "career concerns" than by a preference for empire-building per se. Putting these results together suggests that agency problems can play out quite differently in normal times than when times are tough.

An interaction between managerial agency conflicts and corporate financial vulnerability also has implications for a firm's optimal capital structure. Jensen (1986) describes the scope for using debt to reduce managerial agency problems at "firms that have stable business histories and substantial free cash flow" (p. 325). Our evidence reinforces the importance of Jensen's first condition, that the business be stable. If managers' objectives and shareholder interests can diverge as a firm approaches financial distress, then a high amount of financial leverage that moderates managerial agency problems in normal times may amplify another managerial agency conflict when the firm encounters an adverse shock. This potential cost of debt financing – and a broader interaction between agency conflicts with financial distress – has received little attention in the literature and presents an interesting area for future research.

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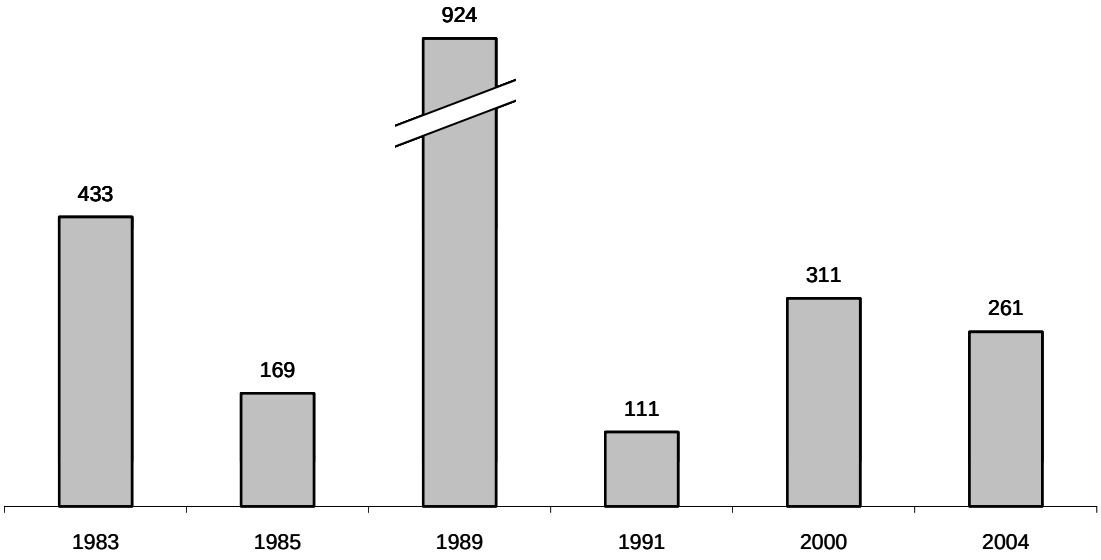


Figure 1-- Number of firms affected by liability shock by year
This figure graphs the number of firms newly affected by the liability shock by year. A firm is considered affected if at least 7.5 percent of employees in its industry were observed in the National Occupational Exposure Survey to be exposed to a chemical listed in the Report on Carcinogens in that year. A total of 2,209 firms are affected.

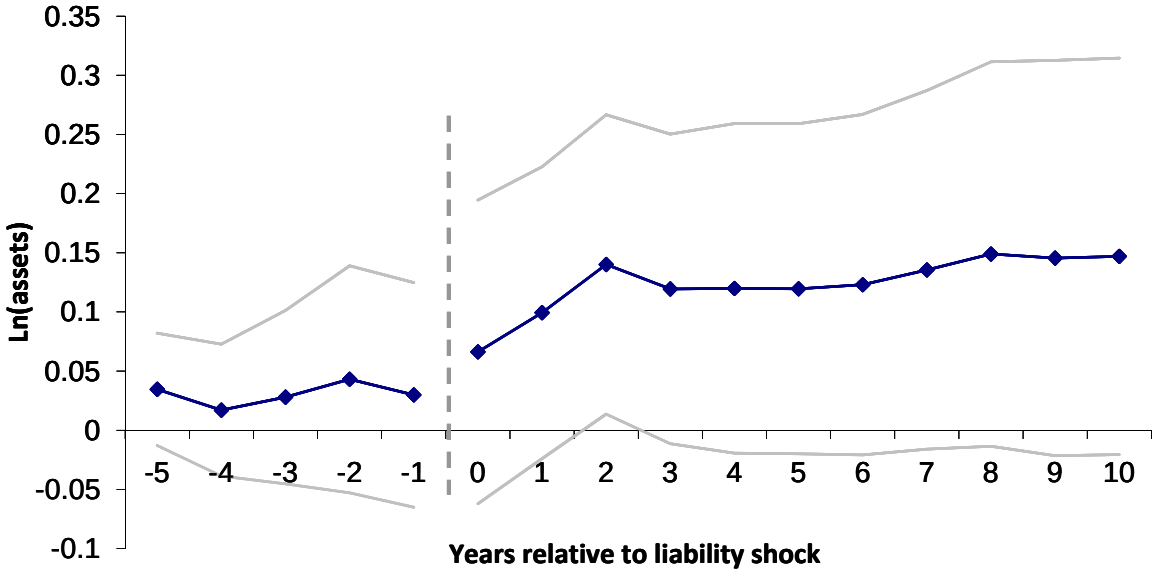


Figure 2 -- Effect of liability shock on growth by year
This figure reports the point estimates from a firm-panel regression of ln(assets) onto an indicator for liability exposure, firm-by-cohort fixed effects, and year-by-cohort fixed effects. The specification is the same as that reported in Table III except that the effect of liability exposure is allowed to vary by year for each year from five years before the shock through ten years after. Ninety-five percent confidence intervals, adjusted for clustering at the industry level, are also plotted.

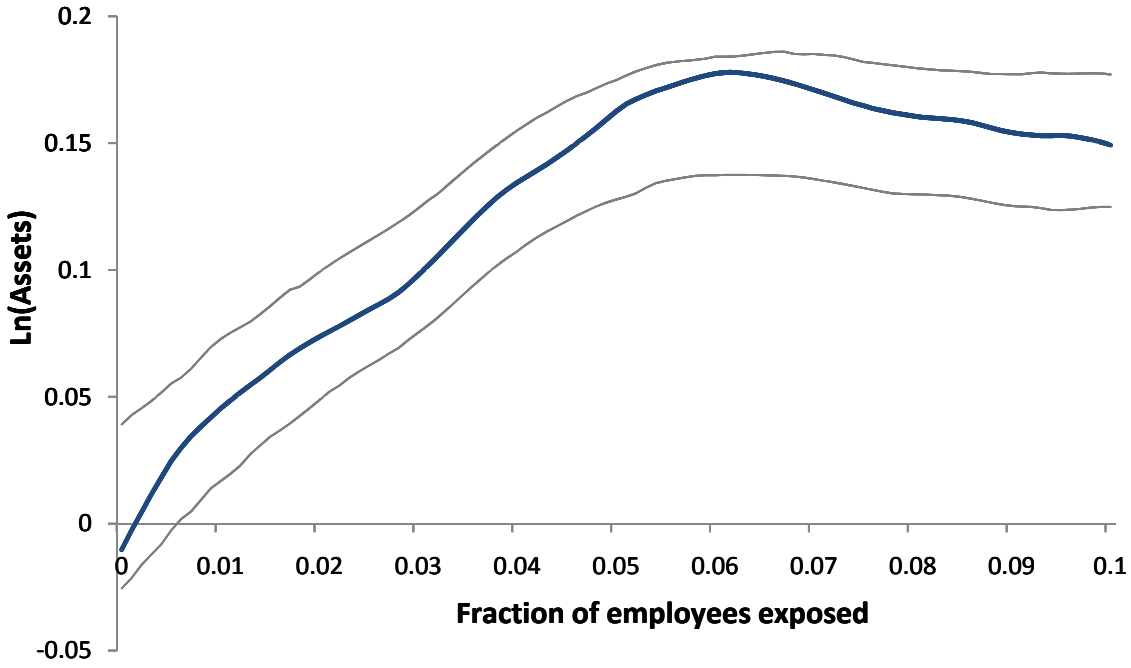


Figure 3 – Effect of liability shock on growth by the fraction of employees exposed
This figure plots estimates from a firm-panel semi-parametric regression of ln(assets) on the percent of employees exposed, firm-by-cohort fixed effects, and year-by-cohort fixed effects. The specification is the same as that reported in Table III except that the effect of liability exposure is allowed to vary non-parametrically with the fraction of employees exposed using a Gaussian kernel with a bandwidth of 0.01. Ninety-five percent confidence intervals, estimated using bootstrapping, are also plotted.

Table I
Ex-ante firm characteristics

This table reports summary statistics for firm characteristics in the year before a new chemical was added to the *Report on Carcinogens.* The mean and standard deviation (in parentheses) for each variable are reported separately for two samples of firms. Column (i) reports estimates for firms in 4-digit SIC industries for which more than 7.5% of employees were observed to be exposed to the chemical in the 1981-1983 National Occupational Exposure Survey. Column (ii) reports estimates for other firms in the same Fama-French 48 industry classification. Column (iii) reports the p-value from a t-test for the difference between exposed and unexposed firms, where the standard errors are clustered at the 4-digit SIC industry level. Firm age is the number of years since the firm's first information in Compustat. The sample is restricted to firms with nonmissing observations for ln(assets), ln(sales), ln(capital expenditures+1), equity, ln(debt+1), and ln(dividends+1).

	Exposed	**Unexposed**	**p-value of difference**
	(i)	(ii)	(iii)
Ln(Assets)	4.586	4.256	0.261
	(2.607)	(2.360)	
Market-to-book ratio	3.036	3.095	0.929
	(5.614)	(6.081)	
5-year asset CAGR (%)	13.83	13.16	0.622
	(20.61)	(20.22)	
Firm age	13.77	12.78	0.453
	11.32	11.43	
Leverage	0.285	0.285	0.983
	(0.252)	(0.269)	
Total payout / Assets * 100	1.856	1.813	0.830
	(3.525)	(3.643)	
Capex / Assets	0.086	0.081	0.228
	(0.076)	(0.085)	
Cash / Assets	0.093	0.094	0.981
	(0.148)	(0.151)	
Observations	2,209	8,373	
# of Industries	106	249	

Table II
Cash flows around time of liability shock

This table reports summary statistics for cash flows/assets in the years around a new chemical being added to the *Report on Carcinogens.* The mean and standard deviation (in parentheses) for cash flows in the years t = -1, t = 0, and t = 1, are reported separately for two samples of firms. Column (i) reports estimates for firms in 4-digit SIC industries for which more than 7.5% of employees were observed to be exposed to the chemical in the 1981-1983 National Occupational Exposure Survey. Column (ii) reports estimates for other firms in the same Fama-French 48 industry classification. Column (iii) reports the p-value from a t-test for the difference between exposed and unexposed firms, where the standard errors are clustered at the 4-digit SIC industry level. The sample is restricted to firms with nonmissing observations for ln(assets), ln(sales), ln(capital expenditures+1), equity, ln(debt+1), and ln(dividends+1).

Year relative to liability shock	Exposed	Unexposed	p-value of difference
	(i)	(ii)	(iii)
t = -1	0.048	0.048	0.981
	(0.258)	(0.255)	
t = 0	0.042	0.025	0.530
	(0.273)	(0.293)	
t = 1	0.049	0.037	0.649
	(0.273)	(0.287)	

Table III
Effect of liability exposure on firm size and investment

This table reports coefficients from firm-panel regressions of firm size and investment on an indicator for liability exposure, firm-by-cohort fixed effects, and year-by-cohort fixed effects. The liability exposure indicator equals 1 if more than 7.5% of employees in the firm's 4-digit SIC industry were observed to be exposed in the 1981-1983 National Occupational Exposure Survey to a chemical listed in the most recent edition of the *Report on Carcinogens* (RoC). The dependent variables are ln(assets), ln(sales), and ln(capex + 1). The data include firm-year observations in the 10 years before and 10 years after each new chemical listing in the RoC. Standard errors, clustered at the industry level, are reported in parentheses. * significant at 10% level, ** significant at 5% level.

Dep. Variable =	**Ln(Assets)**	**Ln(Sales)**	**Ln(Capex + 1)**
	(i)	(ii)	(iii)
Exposure	0.098*	0.105**	0.055
	(0.056)	(0.049)	(0.045)
Observations	144,650	144,650	144,650
# of Firms	10,582	10,582	10,582
R-Squared	0.32	0.27	0.14
Fixed effects:			
Firm-cohort	X	X	X
Year-cohort	X	X	X

Table IV

Effect of liability exposure on corporate financing decisions

This table reports coefficients from firm-panel regressions of firm financial choices regarding debt, equity, and payout policy on an indicator for liability exposure, firm-by-cohort fixed effects, and year-by-cohort fixed effects. The specifications are the same as those reported in Table III, but for different dependent variables: ln(equity + 1), ln(debt + 1), debt / assets, and total payout / assets * 100, where total payout is the sum of dividends and share repurchases. Standard errors, clustered at the industry level, are reported in parentheses. * significant at 10% level, ** significant at 5% level, *** significant at 1% level.

Dep. Variable =	**Ln(Equity + 1)**	**Ln(Debt + 1)**	**Debt / Assets**	**Total payout / Assets * 100**
	(i)	(ii)	(iii)	(iv)
Exposure	0.100**	0.0352	-0.017*	0.301***
	(0.050)	0.045	(0.010)	(0.104)
Observations	137,539	144,650	144,650	144,650
# of Firms	10,539	10,582	10,582	10,582
R-Squared	0.26	0.14	0.02	0.01
Fixed effects:				
Firm-cohort	X	X	X	X
Year-cohort	X	X	X	X

Table V

Bankruptcy risk and the effects of liability exposure

This table reports coefficients from firm-panel regressions of firm size and investment on an indicator for liability exposure, firm-by-cohort fixed effects, and year-by-cohort fixed effects. The specifications are the same as those reported in Table III, but Panel A restricts the sample to only firms with modified Altman z-scores in the bottom quartile while Panel B restricts the sample to only firms with modified Altman z-scores in the top quartile. The dependent variables are ln(assets), ln(sales), and ln(capex + 1). Standard errors, clustered at the industry level, are reported in parentheses. * significant at 10% level, ** significant at 5% level, *** significant at 1% level.

Dep. Variable =	**Ln(Assets)**	**Ln(Sales)**	**Ln(Capex+1)**
	(i)	(ii)	(iii)
A. High bankruptcy risk: z-score in bottom quartile at t = −1			
	[2,561 firms; 29,311 observations]		
Exposure	0.321***	0.390***	0.118**
	(0.073)	(0.086)	(0.058)
R-Squared	0.12	0.13	0.07
B. Low bankruptcy risk: z-score in top quartile at *t* = −1			
	[2,561 firms; 37,984 observations]		
Exposure	0.029	0.010	0.029
	(0.088)	(0.061)	(0.063)
R-Squared	0.51	0.45	0.27
Fixed effects:			
Firm-cohort	X	X	X
Year-cohort	X	X	X

Table VI
Financial vulnerability and the effects of liability exposure

This table reports coefficients from firm-panel regressions of Ln(Assets) on an indicator for liability exposure, firm-by-cohort fixed effects, and year-by-cohort fixed effects. The specifications are the same as those reported in Table III, but estimates are obtained for different subsamples of firms: firms with debt / assets in the top and bottom quartiles [column (i)], firms with operating cash flows / assets in the top and bottom quartiles [column (ii)], firms with zero or positive dividends [column (iii)], and firms with assets in the bottom and top quartiles [column (iv)]. Standard errors, clustered at the industry level, are reported in parentheses. * significant at 10% level, ** significant at 5% level, *** significant at 1% level.

***Dependent Variable* = Ln(Assets)**

	(i)	(ii)	(iii)	(iv)
	High leverage	**Low cash flow**	**Zero dividends**	**Small firms**
Exposure	0.198***	0.173**	0.184**	0.211***
	(0.075)	(0.073)	(0.072)	(0.076)
Observations	34,431	27,193	78,840	29,489
# of Firms	2,648	2,303	6,636	2,648
R-Squared	0.23	0.17	0.23	0.14
	Low leverage	**High cash flow**	**Positive dividends**	**Large firms**
Exposure	0.068	0.043	0.010	0.089
	(0.085)	(0.102)	(0.053)	(0.069)
Observations	34,074	35,285	65811	43,863
# of Firms	2,648	2,303	3946	2,648
R-Squared	0.36	0.44	0.55	0.49
Fixed effects:				
Firm-cohort	X	X	X	X
Year-cohort	X	X	X	X

Table VII

Effect of liability exposure on acquisition activity

This table reports coefficients from industry-panel regressions of ln(acquisitions+1) on an indicator for liability exposure, industry fixed effects, and year fixed effects. The liability exposure indicator equals 1 if more than 7.5% of employees in the firm's 4-digit SIC industry were observed to be exposed in the 1981-1983 National Occupational Exposure Survey to a chemical listed in the most recent edition of the *Report on Carcinogens* (RoC). We further classify acquisitions into three types: "main line" if the primary SIC industry for the acquiring firm coincides with any SIC code of the target; "side line" if the acquirer's primary SIC code does not match any SIC code listed for the target, but an SIC code listed as a side line business does; and "no match" if none of the target or acquirer's primary or side lines of business coincide. The sample includes all acquisitions announced between 1980 and 2006 that were recorded in SDC's Mergers and Acquisitions Database, but excludes acquisitions meeting any of the following criteria: (1) the ratio of the deal size to market value of the acquirer's assets is less than 1%; (2) the acquiring firm controlled more than 50% of the target prior to the announcement date or less than 100% after the acquisition was completed; (3) the ultimate parent of the acquirer and the target are the same (i.e., consolidations within holding companies); (4) either the acquirer or the target is a financial firm; or (5) the deal was not completed within 1,000 days of the announcement date. We also exclude Fama-French (1997) industries where none of the included 4-digit SIC codes experience an exposure during the sample period. Standard errors, clustered at the industry level, are reported in parentheses. * significant at 10% level, ** significant at 5% level.

Dependent Variable **= Ln(Number of Acquisitions + 1)**
[842 Industries; 22,734 Observations]

	Type of Acquistions			
	All	**Main line**	**Side line**	**No Match**
	(i)	(ii)	(iii)	(iv)
Exposure	0.064*	0.037	0.035*	0.054**
	(0.034)	(0.031)	(0.020)	(0.025)
R-Squared	0.22	0.15	0.07	0.14
Fixed effects:				
Industry	X	X	X	X
Year	X	X	X	X

Table VIII

Effect of liability exposure on the characteristics of acquisitions

This table reports coefficients from firm-panel regressions of acquisition and ex-ante target firm characteristics on an indicator for liability exposure, industry fixed effects, and year fixed effects. The liability exposure indicator equals 1 if more than 7.5% of employees in the firm's 4-digit SIC industry were observed exposed in the 1981-1983 National Occupational Exposure Survey to a chemical listed in the most recent edition of the *Report on Carcinogens* (RoC). In Panel A, the dependent variables are ex-ante target characteristics: log total assets, 5-year compounded annual growth rate (CAGR) for assets, the ratio of debt to assets, the ratio of cash flow to asset, and the ratio of the total payout to assets. In Panel B, the dependent variables are other characteristics of the acquisition: takeover premium, percent of stock used, and acquirer cumulative abnormal return over a three-day announcement window (CAR[-1,1]). The sample of acquisitions is the same as that used in Table VII, but further restricted to mergers with non-missing observations for premium, CAR, and log target assets, leaving 2,253 firms. Fewer observations are available for growth rate (1,526), cash flow (2,164), and percent stock (2,142). Target characteristics are from Compustat, and abnormal returns are computed using a market model and CRSP equally-weighted index returns, estimated over the (-300,-46) day interval. Estimates for growth rate, leverage, cash flow, and total payout are weighted by target firm size. Standard errors, clustered at the industry level, are reported in parentheses. * significant at 10% level, ** significant at 5% level, *** significant at 1% level.

	A. Target characteristics					**B. Acquisition characteristics**		
Dep. Variable =	**Ln(Assets)**	**5-year Assets CAGR**	**Debt / Assets**	**Cash flow / Assets**	**Payout / Assets * 100**	**Takeover premium**	**Percent Stock**	**Acquirer CAR [-1,1]**
	(i)	(ii)	(iii)	(iv)	(v)	(vi)	(vii)	(viii)
Exposure	0.331*	0.101**	-0.063***	0.083***	3.425***	0.137**	8.034*	-0.013*
	(0.178)	(0.045)	(0.020)	(0.030)	(1.307)	(0.067)	(4.389)	(0.008)
R-Squared	0.38	0.38	0.48	0.44	0.50	0.07	0.41	0.21
Fixed effects:								
Industry	X	X	X	X	X	X	X	X
Year	X	X	X	X	X	X	X	X

Table IX
Governance, ownership, and growth

This table reports coefficients from firm-panel regressions of Ln(Assets) on an indicator for liability exposure, firm-by-cohort fixed effects, and year-by-cohort fixed effects. The specifications are the same as those reported in Table III, but estimates are obtained for different subsamples of firms based on firm-level characteristics at time t-1: firms with weak and strong external governence (GIM >= 11 and GIM <=5 respectively) [column (i)], firms with managerial ownership in the top and bottom quartiles [column (ii)], and firms with institutional ownership in the top and bottom quartiles [column (iii)]. Standard errors, clustered at the industry level, are reported in parentheses. * significant at 10% level, ** significant at 5% level, *** significant at 1% level.

Dependent Variable **= Ln(Assets)**

	(i)	(ii)	(iii)
	Weak governance	**High inside ownership**	**Low institutional ownership**
Exposure	0.295***	0.523**	0.318***
	(0.109)	(0.258)	(0.092)
Observations	5,515	2,131	20,116
# of Firms	311	165	1,618
R-Squared	0.59	0.49	0.21
	Strong governance	**Low inside ownerhip**	**High institutional ownership**
Exposure	-0.037	0.195	0.077
	(0.189)	(0.128)	(0.083)
Observations	2,202	2,248	26,893
# of Firms	165	165	1,618
R-Squared	0.50	0.50	0.54
Fixed effects:			
Firm-cohort	X	X	X
Year-cohort	X	X	X

Table X
Growth and exit rates for exposed firms and their CEOs

This table reports coefficients from firm-level regressions of firm and CEO exit rates on an indicator for whether a firm was in the top quartile of growth in the years following the liability shock. Only firms experiencing a liability exposure between 1983 and 2000 that exhibit growth either in the top or bottom quartile are included in the regression. Liability exposure is determined as in Table III, and firm's growth response to the liability shock is measured using the percent change in assets between years t=-1 and t=1. The dependent variable, 'firm exit occurs by t=5', is an indicator equal to one if a firm is no longer found within Compustat five years after the liability shock, and zero otherwise. 'Firm or CEO exit by t=5' is an indicator equal to one if either a firm exit occurs or the CEO changes in the five years after the liability shock. 'CEO exit occurs by t=5' is an indicator equal to 1 if a change in the CEO occurs during the five year period following the liability shock for firms that have not exited within five years after the shock. All estimates include cohort fixed effects, and standard errors, clustered at the industry level, are reported in parentheses. * significant at 10% level, ** significant at 5% level, *** significant at 1% level.

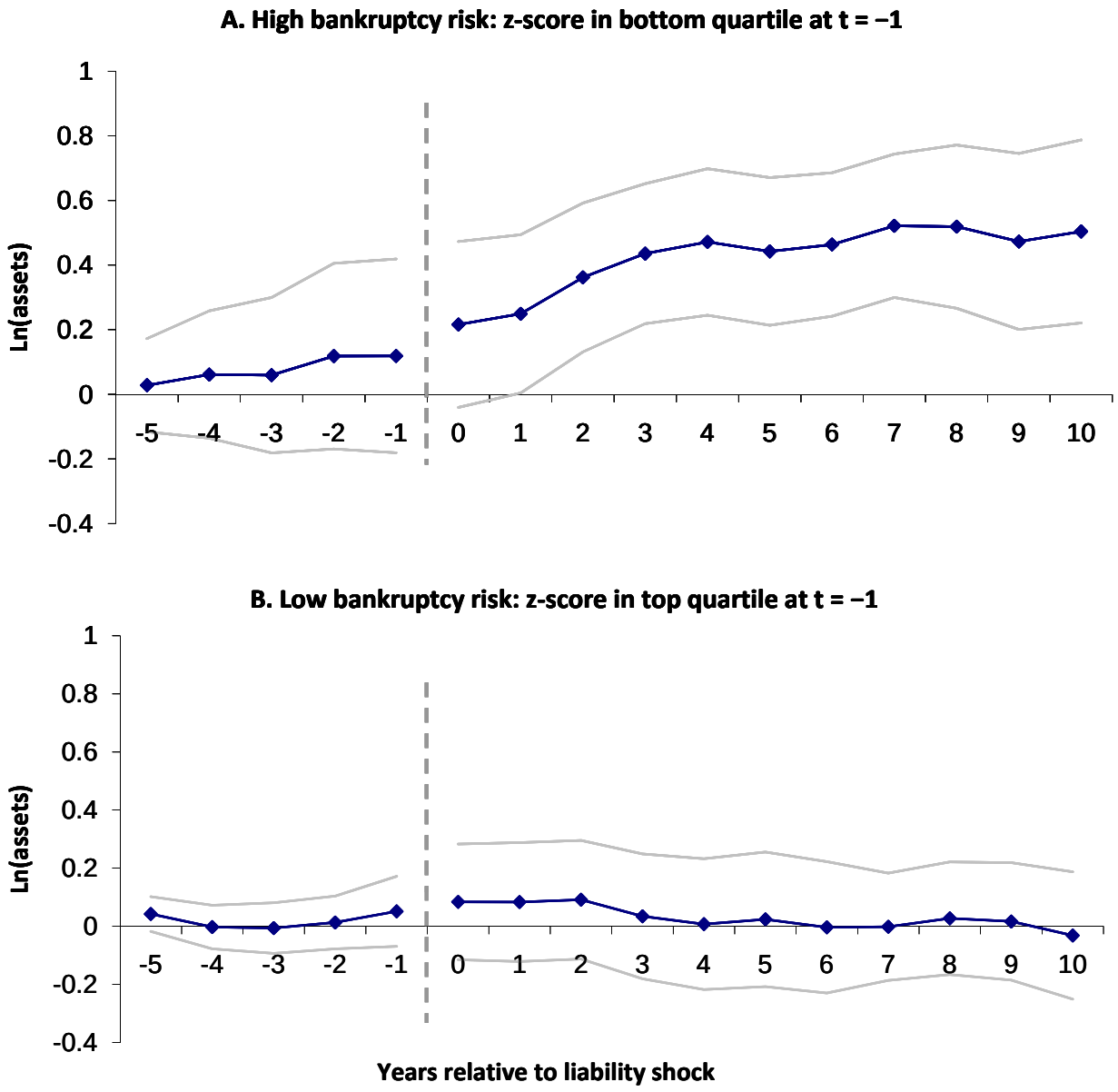
Dep. Variable =	**Firm exit occurs by t=5**	**CEO exit occurs by t=5**	**CEO or firm exit occurs by t=5**
	(i)	(ii)	(iii)
High Growth [t-1,t+1]	-0.147***	-0.069**	-0.160***
	(0.026)	(0.030)	(0.031)
Observations	912	674	912
R-Squared	0.04	0.06	0.06
Cohort fixed effects	X	X	X

Table XI
Governance, ownership, and payout policy

This table reports coefficients from firm-panel regressions of total payouts/assets * 100 on an indicator for liability exposure, firm-by-cohort fixed effects, and year-by-cohort fixed effects. The specifications are the same as those reported in Table III, but estimates are obtained for different subsamples of firms based on firm-level characteristics at time t-1: firms with weak and strong external governence (GIM >= 11 and GIM <=5 respectively) [column (i)], firms with managerial ownership in the top and bottom quartiles [column (ii)], and firms with institutional ownership in the top and bottom quartiles [column (iii)]. Standard errors, clustered at the industry level, are reported in parentheses. * significant at 10% level, ** significant at 5% level, *** significant at 1% level.

Dependent Variable **= Total payouts / Assets * 100**

	(i)	(ii)	(iii)
	Weak governance	**High inside ownership**	**Low institutional ownership**
Exposure	0.690	0.658	0.055
	(0.409)	(0.527)	(0.134)
Observations	5,515	2,131	20,116
# of Firms	311	165	1,618
R-Squared	0.07	0.05	0.01
	Strong governance	**Low inside ownerhip**	**High institutional ownership**
Exposure	1.165**	1.797*	0.470*
	(0.486)	(0.932)	(0.266)
Observations	2,202	2,248	26,893
# of Firms	165	165	1,618
R-Squared	0.04	0.07	0.04
Fixed effects:			
Firm-cohort	X	X	X
Year-cohort	X	X	X



Appendix Figure A-1 -- Effect of liability shock on growth by year and bankruptcy risk
This figure reports the point estimates from a firm-panel regression of ln(assets) on an indicator for liability exposure, firm-by-cohort fixed effects, and year-by-cohort fixed effects. The specification is the same as that reported in Table V except that the effect of liability exposure is allowed to vary by year for each year from five years before the shock through ten years after. Panel A restricts the sample to only firms with Altman z-scores in the bottom quartile while Panel B restricts the sample to only firms with Altman z-scores in the top quartile. Ninety-five percent confidence intervals, adjusted for clustering at the industry level, are also plotted.

Appendix Table A-I

Effect of liability exposure on firm size and investment, controlling for cash flows/assets and MTB

This table reports coefficients from firm-panel regressions of firm size and investment on an indicator for liability exposure, firm-by-cohort fixed effects, year-by-cohort fixed effects, lagged operating cash flows/assets, and lagged market-to-book ratio. The liability exposure indicator equals 1 if more than 7.5% of employees in the firm's 4-digit SIC industry were observed to be exposed in the 1981-1983 National Occupational Exposure Survey to a chemical listed in the most recent edition of the *Report on Carcinogens* (RoC). The dependent variables are ln(assets), ln(sales), and ln(capex + 1). The data include firm-year observations in the 10 years before and 10 years after each new chemical listing in the RoC. Standard errors, clustered at the industry level, are reported in parentheses. * significant at 10% level, ** significant at 5% level.

Dep. Variable =	**Ln(Assets)**	**Ln(Sales)**	**Ln(Capex + 1)**
	(i)	(ii)	(iii)
Exposure	0.099**	0.097**	0.046
	(0.042)	(0.040)	(0.047)
Cash Flows / Assets *[t-1]*	0.346***	0.503***	0.260***
	(0.051)	(0.042)	(0.027)
MTB *[t-1]*	0.007***	0.004***	0.012***
	(0.001)	(0.001)	(0.001)
Observations	105,710	105,710	105,710
# of Firms	9,673	9,673	9,673
R-Squared	0.33	0.28	0.15
Fixed effects:			
Firm-cohort	X	X	X
Year-cohort	X	X	X

Appendix Table A-II

Effect of liability exposure on corporate financing decisions, controlling for sales, ROA, bankruptcy risk, and proportion of fixed assets

This table reports coefficients from firm-panel regressions of firm financial choices regarding debt, equity, and payout policy on an indicator for liability exposure, firm-by-cohort fixed effects, year-by-cohort fixed effects, and lagged controls for fixed assets/total assets, Ln(sales), modified Altman-Z score, and ROA. The specifications are the same as those reported in Table III, but for different dependent variables: ln(equity + 1), ln(debt + 1), debt / assets, and total payout / assets * 100, where total payout is the sum of dividends and share repurchases. Standard errors, clustered at the industry level, are reported in parentheses. * significant at 10% level, ** significant at 5% level, *** significant at 1% level.

Dep. Variable =	**Ln(Equity + 1)**	**Ln(Debt + 1)**	**Debt / Assets**	**Total payout / Assets * 100**
	(i)	(ii)	(iii)	(iv)
Exposure	0.051	-0.003	-0.014**	0.275**
	(0.033)	(0.037)	(0.007)	(0.107)
Fixed Assets / Assets *[t-1]*	-0.163**	0.859***	0.182***	-1.144***
	(0.064)	(0.090)	(0.016)	(0.186)
Ln(Sales) *[t-1]*	0.495***	0.555***	0.025***	0.146***
	(0.023)	(0.022)	(0.003)	(0.045)
Modified Altman-Z Score *[t-1]*	0.028***	-0.030***	-0.019***	0.033***
	(0.005)	(0.006)	(0.002)	(0.007)
ROA *[t-1]*	0.0441	-0.298***	-0.075***	0.455***
	(0.066)	(0.020)	(0.014)	(0.095)
Observations	118,157	123,885	123,885	123,885
# of Firms	10,182	10,289	10,289	10,289
R-Squared	0.44	0.26	0.1	0.02
Fixed effects:				
Firm-cohort	X	X	X	X
Year-cohort	X	X	X	X

Appendix Table A-III
Bankruptcy risk and growth, Pre-1989

This table reports coefficients from firm-panel regressions of firm size and investment on an indicator for liability exposure, firm-by-cohort fixed effects, and year-by-cohort fixed effects. The specifications are the same as those reported in Table V, except that only liability shocks that occur prior to 1989 are included. The dependent variables are ln(assets), ln(sales), and ln(capex + 1). Standard errors, clustered at the industry level, are reported in parentheses. * significant at 10% level, ** significant at 5% level, *** significant at 1% level.

Dep. Variable =	**Ln(Assets)**	**Ln(Sales)**	**Ln(Capex+1)**
	(i)	(ii)	(iii)
A. High bankruptcy risk: z-score in bottom quartile at t = –1			
	[1,037 firms; 12,461 observations]		
Exposure	0.355***	0.311**	0.078
	(0.106)	(0.127)	(0.065)
R-Squared	0.12	0.10	0.05
B. Low bankruptcy risk: z-score in top quartile at *t* = –1			
	[1,037 firms; 16,019 observations]		
Exposure	-0.026	0.002	0.054
	(0.087)	(0.085)	(0.087)
R-Squared	0.56	0.51	0.31
Fixed effects:			
Firm-cohort	X	X	X
Year-cohort	X	X	X

Appendix Table A-IV
Bankruptcy risk and growth, post-1989

This table reports coefficients from firm-panel regressions of firm size and investment on an indicator for liability exposure, firm-by-cohort fixed effects, and year-by-cohort fixed effects. The specifications are the same as those reported in Table V, except that only liability shocks that occur in 1989 or later are included. The dependent variables are ln(assets), ln(sales), and ln(capex + 1). Standard errors, clustered at the industry level, are reported in parentheses. * significant at 10% level, ** significant at 5% level, *** significant at 1% level.

Dep. Variable	**Ln(Assets)**	**Ln(Sales)**	**Ln(Capex+1)**
	(i)	(ii)	(iii)
A. High bankruptcy risk: z-score in bottom quartile at t = −1			
	[1,524 firms; 16,850 observations]		
Exposure	0.297***	0.444***	0.145*
	(0.100)	(0.119)	(0.078)
R-Squared	0.11	0.15	0.08
B. Low bankruptcy risk: z-score in top quartile at *t* = −1			
	[1,524 firms; 21,965 observations]		
Exposure	0.055	0.014	0.017
	(0.121)	(0.080)	(0.084)
R-Squared	0.48	0.42	0.25
Fixed effects:			
Firm-cohort	X	X	X
Year-cohort	X	X	X

Appendix Table A-V
Heterogeneity based firm size and bankruptcy risk

This table reports coefficients from firm-panel regressions of firm size on an indicator for liability exposure, firm-by-cohort fixed effects, and year-by-cohort fixed effects. The specifications are the same as those reported in Table III, but Column (i) restricts the sample to firms with below median assets while Column (ii) restricts the sample to firms with above median assets. The estimates reported in the first row further restrict the sample to firms with an above median z-score, and the estimates reported in the second row further restrict the sample to firms with a below median z-score. The dependent variable is ln(assets). Standard errors, clustered at the industry level, are reported in parentheses. * significant at 10% level, ** significant at 5% level, *** significant at 1% level.

Dep. Variable =	**Ln(Assets)**			
	(i)	(ii)		
	Small Firm *[Below median assets at t=-1]*	**Large Firm** *[Above median assets at t=-1]*	**Number of firms** ***Number of observations***	
High Bankruptcy Risk *[z-score in bottom quartile at t=-1]*	0.382*** (0.096)	0.185* (0.102)	1,961 *20,012*	600 *9,299*
Low Bankruptcy Risk *[z-score in top quartile at t=-1]*	-0.030 (0.092)	0.080 (0.106)	1,234 *16,498*	1,327 *21,486*

Appendix Table A-VI
Effects of liability exposure based on stock of SG&A

This table reports coefficients from firm-panel regressions of firm size and investment on an indicator for liability exposure, firm-by-cohort fixed effects, and year-by-cohort fixed effects. The specifications are the same as those reported in Table III, but Panel A restricts the sample to only firms with an accumulation of SG&A, calculated using a 20% depreciation rate, in the bottom quartile at time t = -1, while Panel B restricts the sample to only firms with an accumulation of SG&A in the top quartile at time t = -1. See Eisfeldt and Papanikolaou (2008) for more details on the construction of this measure. The dependent variables are ln(assets), ln(sales), and ln(capex + 1). Standard errors, clustered at the industry level, are reported in parentheses. * significant at 10% level, ** significant at 5% level, *** significant at 1% level.

Dep. Variable =	**Ln(Assets)**	**Ln(Sales)**	**Ln(Capex+1)**
	(i)	(ii)	(iii)
A. Low organizational capital: stock of SG&A in bottom quartile at t = −1			
	[2,702 firms; 36,903 observations]		
Exposure	0.088	0.096	0.063
	(0.089)	(0.080)	(0.078)
R-Squared	0.38	0.34	0.16
B. High organizational capital: stock of SG&A in top quartile at *t* = −1			
	[2,648 firms; 37,775 observations]		
Exposure	0.098	0.132*	-0.004
	(0.074)	(0.068)	(0.047)
R-Squared	0.20	0.17	0.12
Fixed effects:			
Firm-cohort	X	X	X
Year-cohort	X	X	X

Appendix Table A-VII
Effects of liability exposure based on market share

This table reports coefficients from firm-panel regressions of firm size and investment on an indicator for liability exposure, firm-by-cohort fixed effects, and year-by-cohort fixed effects. The specifications are the same as those reported in Table III, but Panel A restricts the sample to only firms with a market share, calculated using sales at the 4-digit SIC level, in the bottom quartile at time t = -1, while Panel B restricts the sample to only firms with a market share in the top quartile at time t = -1. The dependent variables are ln(assets), ln(sales), and ln(capex + 1). Standard errors, clustered at the industry level, are reported in parentheses. * significant at 10% level, ** significant at 5% level, *** significant at 1% level.

Dep. Variable =	**Ln(Assets)**	**Ln(Sales)**	**Ln(Capex+1)**
	(i)	(ii)	(iii)
A. Low organizational capital: market share in bottom quartile at t = −1			
	[2,648 firms; 29,191 observations]		
Exposure	0.236***	0.161*	0.152***
	(0.073)	(0.083)	(0.055)
R-Squared	0.19	0.18	0.12
B. High organizational capital: market share in top quartile at *t* = −1			
	[2,648 firms; 41,789 observations]		
Exposure	0.043	0.070	0.068
	(0.054)	(0.056)	(0.049)
R-Squared	0.44	0.38	0.21
Fixed effects:			
Firm-cohort	X	X	X
Year-cohort	X	X	X

Appendix Table A-VIII
Heterogeneity based institutional ownership and bankruptcy risk

This table reports coefficients from firm-panel regressions of firm size and payout policy on an indicator for liability exposure, firm-by-cohort fixed effects, and year-by-cohort fixed effects. The specifications are the same as those reported in Table III, but Columns (i) and (iii) restrict the sample to firms with institutional ownership in the bottom quartile while Columns (ii) and (iv) restrict the sample to firms with an institutional ownership in the top quartile. The estimates reported in the first row further restrict the sample to firms with an above median z-score, and the estimates reported in the second row further restrict the sample to firms with a below median z-score. The dependent variables are ln(assets) and total payout / assets * 100, where total payout is the sum of dividends and share repurchases. Standard errors, clustered at the industry level, are reported in parentheses. * significant at 10% level, ** significant at 5% level, *** significant at 1% level.

Dep. Variable =	**Ln(Assets)**		**Total payout / Assets * 100**			
	(i)	(ii)	(iii)	(iv)		
	Low Monitoring *[inst. ownership in bottom quartile at t=-1]*	**High Monitoring** *[inst. ownership in top quartile at t=-1]*	**Low Monitoring** *[inst. ownership in bottom quartile at t=-1]*	**High Monitoring** *[inst. ownership in top quartile at t=-1]*	**Number of firms** ***Number of observations***	
High Bankruptcy Risk *[Above median z-score at t=-1]*	0.346*** (0.105)	0.193* (0.099)	0.132 (0.155)	0.092 (0.213)	1,071 *12,484*	580 *9,492*
Low Bankruptcy Risk *[Below median z-score at t=-1]*	0.266** (0.127)	0.025 (0.110)	-0.015 (0.299)	0.738** (0.358)	509 *7,222*	1,000 *16,781*

Appendix Table A-IX
Effect of liability exposure on firm performance

This table reports coefficients from firm-panel regressions of firm performance on an indicator for liability exposure, firm-by-cohort fixed effects, and year-by-cohort fixed effects. The specifications are the same as those reported in Table III, but for different dependent variables: ROA, asset turnover, COGS/sales, SG&A/assets, and ln(wages), where ROA is net income/assets[t-1] and asset turnover is sales / assets. Standard errors, clustered at the industry level, are reported in parentheses. * significant at 10% level, ** significant at 5% level, *** significant at 1% level.

Dep. Variable =	ROA	Asset Turnover	COGS / Sales	SG&A / Assets	Ln(Wages)
	(i)	(ii)	(iii)	(iv)	(v)
Exposure	0.001	0.008	-0.020	-0.004	0.026
	(0.010)	(0.030)	(0.020)	(0.007)	(0.019)
Observations	138,568	144,650	144,646	144,650	21,379
# of Firms	10,582	10,582	10,582	10,582	2,173
R-Squared	0.02	0.02	0.00	0.01	0.72
Fixed effects:					
Firm-cohort	X	X	X	X	X
Year-cohort	X	X	X	X	X