Risk Shocks and Corporate Policies: A Text-based Analysis

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ABSTRACT

We originate a firm-level risk measure through textual analysis of corporate annual reports and assess its implications for corporate policies. Our measure captures managerial perception of downside possibilities characterizing firm's fundamentals. We show that increasing risk predicts long-lasting reductions in leverage, investment, R&D, employment, dividend payouts, and stock repurchases along with increasing cash reserves. Moreover, policy responses display considerable sensitivity to firm size, profitability, and credit ratings. Relative to existing risk measures, our text-based measure provides strikingly robust and persistent implications for corporate policies, which are more consistent with corporate finance theories and comprehensive surveys in the field.

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1. Introduction

Corporate environment dynamically, and often unexpectedly, evolves with changing business conditions. In response, financial economists have studied the impact of risk on various corporate policies using return volatility or earnings volatility as the ultimate measure of risk. Past work typically studies the cross-sectional relation between risk and a single corporate policy, while the empirical evidence is often mixed, possibly due to the limitations of the existing risk measures and the distinct empirical formulations applied.[1]

This paper originates a risk measure based on managerial perception of risk as reflected through 76,676 annual reports covering 10,940 distinct firms for the period January 1994 through September 2015. A measure for risk level is defined as the ratio of downside risk-relevant keywords to total meaningful words in those reports, while a measure for risk shock is the annual change in the text-based risk level. Using the new risk shock measure, we are able to study, in a unified framework, the adjustment of multiple corporate decisions to changing risk. The policies examined include capital structure, investment, R&D, employment, cash holdings, dividend payouts, and stock repurchases. Focusing on changes in corporate policies rather than levels helps control for firm-level time-invariant unobservable factors such as executive traits, corporate culture, and writing styles of the annual reports, among others.

Indeed, the newly proposed risk measure delivers strikingly consistent, robust, and long-lasting implications for all corporate policies examined here. For one, the coefficient estimates of the risk shock measure are strongly statistically significant for all corporate policies: risk shocks are followed by diminishing leverage, capital expenditure, R&D, employment, and dividend payouts and stock repurchases, along with increasing cash holdings. Such strong significance is recorded after controlling

[1] See, for example, Harris and Raviv (1991) and Frank and Goyal (2009) on firm leverage, Panousi and Papanikolaou (2012) on investment, Hoberg and Prabhala (2009), Hoberg, Phillips, and Prabhala (2014), and Gao, Hartford, and Li (2014) on dividend payouts and corporate cash holdings.

for year and industry fixed effects and then implementing robust standard errors clustered at both the firm and year levels.

Moreover, the economic significance of policy adjustments stands out. Controlling for previously identified determinants and changes in return volatility, we show that about 17.27%, 26.95%, 7.83%, 8.77%, and 111% of the annual median changes in the book leverage ratio, capital expenditure, R&D, employment, and cash holdings, respectively, emerge following a median risk shock. Further, as the risk shock exceeds the sample median by one standard deviation, the likelihood of dividend omission advances by 19.46%, and the likelihood of large stock repurchases (over 1% of total assets) diminishes by 8.94%. In comparison, the relation between changes in return volatility and the vast majority of corporate decisions is insignificant with the exception that firms increase cash holdings and cut dividends following rising volatility.

The overall implications of risk shocks for corporate policies are persistent. Capital structure, capital expenditure, R&D, employment, and cash holding adjustments could last over three years following the shocks, while adjustments in dividends and stock repurchases last over two years. In that perspective, the evidence here complements the findings in Bloom (2009) that risk shocks exert long-lasting impact on economy-wide investment and employment. Furthermore, we find that firms take on defensive actions when downside risk rises and reverse these policies when risk resolves. The evidence is consistent for all the corporate policies examined, suggesting that the text-based risk shock measure detects information on deteriorating business conditions with potential severe consequences.

Our results also show that firm characteristics play a major role in shaping the relations between risk shocks and corporate policies. Large, profitable, and high credit rating firms are more responsive to risk shocks in leverage decisions. The presence of a median risk shock explains 25.63%, 30.20%, and 34.33% of the median change in leverage for large, profitable, and high credit rating firms, respectively. In comparison, the relation between risk shock and leverage adjustment is insignificant for small, non-profitable, and low credit rating firms. One interpretation is that it is relatively easier for large and

high credit rating firms to raise external equity even when their risk level rises. Moreover, profitable firms can generate capital internally, making them more capable of weathering through shocks with a lower level of debt. These firms, therefore, are more likely to reduce their debt when bankruptcy costs increase following downside risk shocks. In contrast, small, non-profitable, and low credit rating firms are more likely to cut investment and payouts to retain financial resources following risk shocks, as they either lack financial flexibility or they face higher financing costs, making them most susceptible to the negative consequences of risk shocks when accessing external capital markets.

Notably, the proposed new measure displays unique advantages. First, it is extracted from descriptions of corporate fundamentals and therefore is less prone to behavioral biases and investor sentiment (Baker and Wulger, 2007; De Long et al., 1990; Shiller, 1981) that could potentially affect stock prices and thus return volatility. Second, it is constructed from keywords with negative tones, while existing measures are derived from second moments capturing both upside potential and downside possibilities. The new measure, therefore, highlights the downside feature of corporate risk. Third, it is forward-looking in capturing the perceived business outlook unlike earnings volatility that reflect historical outcomes.[2] Furthermore, descriptions in annual reports must be representative, significant, and meaningful in order to meet the regulatory standards and avoid legal consequences such as class-action lawsuits, making the text-based measures less subject to specification and measurement errors.

We further illustrate the intuition of the new risk measure and its merits in capturing the effects of changing business conditions. The text measure indicates that the financial, insurance, and real estate industries display the highest risk exposure during the sample period, while agriculture and utility firms exhibit the lowest risk due to stringent regulations and various subsidy and insurance programs. Next, the sources of the largest risk shocks in our sample arise from the 2008 financial crisis, negative

[2] Earnings volatility measure is also known to have less variation as investors prefer smooth cash flows in making capital allocation decisions (Rountree, Weston, and Allayannis, 2008), and is subject to accrual management (Dichev and Tang, 2009; Donelson and Resuteck, 2015).

demand shocks from upstream industry, industry consolidation, manufacturing overcapacity, and increasing volatility in product and raw material prices. Overall, our text measure reflects substantially different information from existing measures. First, its correlation with stock return volatility and earnings volatility is only 7.76% and 5.42%, respectively. In addition, as noted earlier, the volatility measures fail to predict adjustments in leverage and investment decisions, and their significance in predicting adjustments in cash holdings and payouts considerably attenuates in the presence of our measure.

Our evidence is robust to a comprehensive battery of robustness checks. First, we account for the potential effects of CEO traits on their risk perceptions and annual reports, as Graham, Harvey, and Puri (2013) show that such traits also affect corporate decisions. Second, we account for potential implications of hedging activities for the relation between risk shocks and corporate decisions. Indeed, while hedging activities affect a wide range of decisions, such as leverage, investment, cash holdings, and payouts, both hedging and non-hedging firms significantly respond to risk shocks. Third, our results are robust to using a matching firm approach to address the possibility that firms experiencing risk shocks may be fundamentally different from those firms that are not subject to risk shocks. Particularly, we compare corporate responses of each firm experiencing a risk shock with that of a matching firm belonging to the same industry and with similar size and profitability prior to the risk shock. Fourth, based on our text measure, some of the largest risk shocks appear for financial firms during the global financial crisis. Nonetheless, our results are robust to excluding financial firms as well as robust to excluding the 2007-2008 period featuring the financial crisis. Fifth, following Campbell et al. (2014) and Hoberg, Prabhala, and Phillips (2014), we consider alternative risk measures based on different sections of the annual reports. Last, we make sure that our risk measure does not merely capture the negative sentiment characterizing firms which undergo deteriorating profitability.

Our paper adds to the literature on risk and corporate polices. A large body of finance theory (e.g.,

Hennessy, Levy, and Whited, 2007; Bolton, Chen, and Wang, 2011, 2013) along with field surveys (e.g., Brav, Graham, Harvey, and Michaely, 2005; Lintner, 1956) suggests that firms comprehensively adjust investment and financial policies in response to risk shocks. However, existing empirical evidence is mostly mixed, as noted earlier. By proposing a new outlook on firm-level risk, we are able to obtain robust empirical evidence consistent with both theory and field surveys. One potential explanation is that our new measure focuses on information related to firms' fundamentals. This explanation is supported by the finding that our text-based measure is robustly associated, unlike existing measures, to leverage and investment decisions, both of which are tightly related to firms' fundamentals than market sentiment. Furthermore, we show that the implications of risk shocks for these policies last longer than other policies.

Several papers using text analysis are also related to ours. Hoberg, Phillips, and Prabhala (2014) develop a textual measure of product market fluidity as a proxy for product market risk, and relate it to dividend payouts, share repurchases, and cash holdings. Li (2006) and Kravet and Muslu (2013) develop textual measures of corporate risk, respectively, and show that change in risk exposure predicts future stock return, volatility, and trading volume. Tetlock (2007) and Tetlock, Saar-Tsechansky, and Macskassy (2008) employ Harvard psychosocial dictionary to characterize the tone of Wall Street Journal articles and corporate annual reports, and find that the tones of these texts predict future stock returns and earnings. Loughran and McDonald (2011) construct their own dictionary of negative tone words, and relate them to stock returns, trading volume, and unexpected earnings. Here, we focus on the analysis of downside risk for an ecosystem of corporate policies. Examining simultaneously various polices helps one identify the intra-dependence and priority order of corporate decision-making for firms with different characteristics in response to changing business conditions.

2. *M*easuring Risk Using a Texted-Based Approach

2.1. Textual Analysis

We develop a web crawling program to collect 10-K corporate filings from the Security and Exchange Commission's EDGAR website. Our sample spans the January 1994 through September 2015 period. Merging the corporate filings with CRSP and COMPUSTAT databases leaves us with 76,676 filings corresponding to 10,940 distinct firms. To analyze the textual content of the filings, we delete numbers, tables, graphs, propositions, articles, and pronouns. We further decompose the texts into word stems, hence, our analysis is based on the underlying meaning of words regardless of their different tenses or formats.

We employ the text analysis methodology to create a dictionary of keywords characterizing managerial perception of downside risk. Our dictionary is composed of 29 risk-related keywords (see Appendix 1). The risk-based dictionary includes various formats of the word "risk" (e.g., risky, risks) as well as other words characterizing downside possibilities (e.g., loss, adverse, and pressure) and specific types of firm's risk (e.g., competition, downgrade). We consider those other words since the word "risk" itself is subject to the criticism of being boilerplate (Kravet and Muslu, 2013). Our risk-related keywords are consistent with the Merriam-Webster dictionary's definition of risk: "*Risk is the possibility that something bad or unpleasant (such as an injury or a loss) will happen"*.

We define risk level as the ratio of risk-relevant keywords to total meaningful words in those reports. Risk shock is the annual change in the risk level. To examine the direction of changes in risk, we define a rising risk shock as one where a firm experiences a larger-than-median increase in risk. In contrast, a resolving risk shock emerges if the firm experiences decreasing risk in an absolute magnitude larger than the sample median.

As noted earlier, studying the relation between changes, rather than levels, in risk and subsequent changes in corporate policy alleviates concerns about latent factors and reverse causality (see, e.g., Li,

2010) since it controls for time-invariant unobservable firm characteristics, such as management style, corporate culture and business strategy. It also helps mitigate the effects of persistent differences in writing styles (for example, some firms tend to use more cautionary tone or write relatively longer section on risk).

2.2. Distribution by Industry and Firm Characteristics

Panel A of Table 1 presents the distribution of average risk levels by industry groups. We divide the sample into ten broad industry groups based on SIC codes and compute the average risk for all groups. Risk levels are typically different across industries. Finance, insurance, and real estate groups exhibit the highest risk, consistent with the notion that the financial sector plays a crucial role in consolidating and managing risks emerging from real activities. In contrast, firms in the utility and agriculture industry are associated with lower level of risks due to stringent regulations and various subsidy and insurance programs.

Insert Table 1 here

Panel B of Table 1 presents the distribution of the text-based risk measure by firm characteristics including credit ratings, profitability (EBIT/Asset), tangibility, and existing risk measures. We find that less profitable firms face higher risk levels, consistent with the notion that such firms are more likely to be financially constrained and thus are prone to liquidity risk related to external financing. Similarly, firms with low credit ratings and less tangible assets have higher financing costs in the external capital markets and thus face higher level of risk.

2.3. Examples of Extreme Risk Shocks

To better comprehend the proposed risk measure, Table 2 lists examples of firms with the largest risk shock. Our results highlight the severe impact of the 2007-2008 global financial crisis, as 11 out of the 15 extreme risk shocks are attributable to that period. In particular, seven commercial banks and

insurance companies (e.g., First Financial and BB&T) faced substantial increases in credit risk and liquidity risk. Construction, TV and radio broadcast, and hotel industries were also challenged by severe liquidity concerns, in addition to sharp drop in their product demand (e.g., the broadcast companies were impacted by diminishing advertising expenses, especially by the financial sector). Other sources of extreme risk shocks include large demand shocks from upstream industry, industry consolidation, manufacturing overcapacity, and increasing volatility in product and raw material prices.

Insert Table 2 here

While extreme shocks seem to concentrate in the financial industry and during the crisis period, we show, in Section 5, that our main results are not driven by financial firms or by the global financial crisis. Particularly, we obtain similar results when we exclude financial firms from our sample, when we restrict our sample to manufacturing firms, or when we exclude the years of 2007-2008.

3. Data and Variable Construction

Our sample consists of 76,676 observations of risk shocks, involving 10,940 distinct firms spanning 68 two-digit SIC industries. Policy variables, i.e., leverage, capital expenditure, employment, R&D, cash holdings, dividend payouts, and stock repurchases, are from COMPUSTAT. Firm-level control variables, such as stock returns, credit ratings, and sales growth, are from CRSP and COMPUSTAT. The macro control variables including option-implied volatility (*VIX*), industrial production growth, and constant one-year maturity Treasury bill yield are from the website of the Federal Reserve Bank of St. Louis.

Below we describe the construction of data, both corporate policy and control variables at the firm and economy-wide levels. More detailed descriptions are in Appendix 2. We use the book leverage ratio, measured by the ratio of total liabilities to total assets, as a proxy for capital structure. The main independent variable, active change in book leverage ($dlev_{t+1}$), is then computed as change in book leverage ratio from year t to $t+1$, excluding the effects of change in retained earnings. Our control

variables in capital structure regressions include: (1) lagged book leverage ratio; (2) change in stock return volatility; (3) log of sales as a proxy for size; (4) annual stock return; (5) tangibility measured by the ratio of gross properties, plant, and equipment (PPE) to total assets; (6) market-to-book ratio as a proxy for growth; (7) EBIT divided by total assets (*ROA*) as a proxy for profitability; (8) effective corporate tax rate; (9) short-term solvency measured by the ratio of cash to interest expenses; (10) dividend yield measured by the ratio of common equity dividends to the market value of common equity; (11) external financing, measured by financial deficit normalized by sales.[3] We also control for macro conditions including the annual S&P 500 value-weighted return, constant one-year maturity Treasury bill yield, default risk premium measured by the yield difference between the Moody's Baa and Aaa rated corporate bonds, *VIX*, and industrial production growth.

Next, we compute the percentage change in capital expenditure from year *t* to *t+1*, $\%dcapx_{t+1}$, as one primary policy variable in investment regressions. We also compute $\%demp_{t+1}$ as the percentage change in employment to proxy for firms' investment in human capital. The percentage change in R&D expenses and advertising expenses, $\%dxrd_{t+1}$ *and* $\%dxad_{t+1}$, establishes longer-term investment in R&D and product development. The following control variables are considered in assessing capital expenditure, employment, and R&D policies: (1) ratio of cash flow (measured as earnings before extraordinary items plus depreciation) to PPE; (2) Tobin's Q computed as the ratio of market and book value of assets; (3) change in return volatility; (4) market leverage, measured as total liabilities divided by the sum of total liabilities and market value of equity; (5) log of sales; (6) ROA; (7) tangibility measured by the ratio of gross properties, plant, and equipment (PPE) to total assets; (8) market-to-book ratio as a proxy for growth.

We define change in cash holdings, $dcash_{t+1}$, as the change in the ratio of the sum of cash and short-term investments to total assets. Following previous literature (e.g., Bates, Kahle, and Stulz, 2009;

[3] We follow Chen, Wang, and Zhou (2014) to compute financial deficit as the difference between cash outflow and internally generated cash flow. In particular, cash outflow includes investment in PPE and intangible assets, and increase in working capital. Internally generated cash flow is the sum of net income, depreciation and amortization, and deferred tax minus dividend payouts.

Hoberg, Phillips, and Prabhala, 2014; Gao, Harford, and Li, 2014), we incorporate the following control variables: (1) lagged cash as the sum of cash and short-term investments ($cash_{i,t}$); (2) lagged change in cash holdings ($dcash_{i,t}$); (3) ratio of working capital (measured as net working capital minus cash and short-term investments) to total assets; (4) *Dividend Dummy*, which equals one if common dividends are paid and zero otherwise; (5) ratio of R&D expenses to sales; (6) ratio of capital expenditure to total assets; (7) log of sales; (8) change in stock return volatility; (9) book leverage ratio; (10)market-to-book ratio as a proxy for growth; (11) ratio of cash flow (measured as earnings before extraordinary items plus depreciation) to PPE.

As in Hoberg, Phillips, and Prabhala (2014), we develop four measures to examine changes in dividend payout policy: (i) *Dividend Initiation* $_{i,t+1}$, which equals one if a firm initiates dividend payments and zero otherwise; (ii) *Dividend Omission* $_{i,t+1}$, which equals one if a firm terminates dividends and zero otherwise; (iii) *Dividend Increase* $_{i,t+1}$, which equals one if a firm increases dividend payments and zero otherwise; (iv) *Dividend Decrease* $_{i,t+1}$, which equals one if a firm decreases dividend payments and zero otherwise. The first two measures capture abrupt changes in dividend policy, while the follow-ups reflect moderate adjustment in payouts. We consider the following control variables in the dividend policy regressions: (1) log firm age where age is the number of years since the date of IPO; (2) sales growth as percentage change in net sales; (3) *Negative Earnings Dummy* equals one if net income is negative and zero otherwise; (4) ratio of retained earnings to total assets as a proxy for firm maturity; (5) log of sales; (6) ratio of R&D to sales; (7) market-to-book ratio; (8) change in stock return volatility; and (9) ROA.

We construct an indicator variable, *Repurchase More than 1% Asset Dummy*, which equals one if the value of net stock repurchases is over 1% of total assets, and zero otherwise. Following Hoberg, Prabhala, and Phillips (2014), we define the value of net repurchases as purchase of common and preferred stocks less the reduction in the value of outstanding preferred stocks. We also use the value of net repurchases as an alternative policy variable. We use the same set of control variables as in the

dividend policy regressions.

The descriptive statistics of key variables are reported in Table 3. All continuous variables, except for macro variables, are winsorized at the 1% and 99% level. The median and standard deviation of book leverage are 55.03% and 27.45%, respectively. The median active change in book leverage is 0.12%. The median annual percentage changes in capital expenditure, employment, R&D and advertising expenses are 1.27%, 1.35%, 2.41%, and 3.95%, respectively, suggesting that American corporations have evolved to be more research-oriented.

Insert Table 3 here

The median change in the ratio of cash to assets is -0.03%, with a standard deviation of 8.09%. About 1%–2% of the sample firms initiate or omit dividends, while 28% of the firms increase dividends and 9% of the firms shrink dividends. Further, 32% of the firms are engaged in stock repurchase whose value exceeds 1% of total assets, consistent with the recognition that stock repurchases have become a more popular form of payouts (e.g., Bliss, Cheng and Deni, 2015; Floyd, Li and Skinner, 2015). Overall, statistics of our key variables are similar to those reported in past work.

4. The Empirical Evidence: Risk Shocks and Corporate Policies

This section examines adjustments in leverage, investment, employment, R&D, cash holdings, and payout policies in response to risk shocks. For leverage, investment, employment, R&D, and cash holdings, we apply the OLS panel regression analysis, while we apply logistic panel regression for policies characterized by dummy variables such as dividend payouts and repurchases. The policy regression is formulated as

$$\triangle POLICY_{i,t+1} = \alpha + \beta_1 RISKSHOCK_{i,t} + \beta_j CONTROL_{i,j,t} + \varepsilon_{i,t}, \quad (1)$$

where i is a firm-specific subscript, $\triangle POLICY_{i,t+1}$ represents future annual change in various corporate policies, and $RISKSHOCK_{i,t}$ denotes risk shocks. Control variables for each distinct policy are listed in the data section. We further control for year and industry fixed effects. Since large risk

shocks can reflect changes in aggregate fundamentals, standard errors may be correlated across firms. We therefore compute standard errors clustered by both firm and year throughout the paper to address that concern.

4.1. Capital Structure

The trade-off theory (Modigliani and Miller, 1958; Merton, 1974) asserts that firms choose capital structure to balance the benefits of debt financing and the direct and indirect costs associated with financial distress. Risk shocks essentially lead to higher default probability and thus to increasing borrowing costs, which could induce corporations to reduce debt. In addition, more volatile cash flows reduce the likelihood that tax shields will be fully utilized. Thus, risk shocks are likely to exert an adverse effect on leverage.

Table 4 reports the results. We examine the impact of risk shocks on the book leverage ratio (Panel A), as well as debt and equity adjustments (Panel B). Risk shocks are followed by a significant downward adjustment in leverage, consistent with the trade-off theory. The impact of risk shocks on leverage is economically significant, as 17.27% of the median absolute change in leverage can be explained by the presence of a median risk shock. More strikingly, a one standard deviation increase in risk shock results in a drop in the book leverage ratio in a magnitude of 4.14 times of the average change in leverage in our sample. The impact of rising and resolving risk shocks on leverage is symmetric. The absolute values of coefficient estimates and significance level are similar, indicating that the economic impact of rising and resolving shocks is similar.

Insert Table 4 here

The statistical and economic power of our text-based risk measure in predicting leverage adjustments is considerably stronger than that of change in stock return volatility, as none of the coefficient estimates of change in volatility are statistically significant. A large number of past studies focusing on earnings volatility (e.g., Titman and Wessels, 1988; Kester, 1986) or return volatility (e.g.,

Frank and Goyal, 2009) also document a weak relation between risk and leverage ratio, further highlighting the predictive power of our new text-based measure.[4]

The coefficient estimates of firm characteristics, such as leverage, size, ROA, are consistent with past work. Large firms are more likely to increase their leverage (e.g., Graham and Leary, 2011; Frank and Goyal, 2009; Faulkender and Petersen, 2006). In addition, firms with higher equity returns are associated with reducing leverage (e.g., Welch, 2004; Faulkender and Petersen, 2006). The leverage ratio is negatively correlated with future change in leverage, confirming that leverage ratios are mean-reverting (Fama and French, 2002; Baker and Wurgler, 2002; Leary and Roberts, 2005).

We then decompose the change in the book leverage ratio into change in debt and change in equity, and analyze the effects of risk shocks on these two components. Panel B of Table 4 reports the results. Risk shocks significantly and negatively affect subsequent changes in debt. Furthermore, such changes are symmetric in response to rising versus resolving risk shocks. On the other hand, risk shocks are not significantly correlated with subsequent change in equity, suggesting that their impact on leverage is attributable to the debt channel.

In sum, firms substantially reduce debt and leverage when risk increases, and correspondingly increase debt and leverage ratio when risk resolves. Meanwhile, firms in general tend not to significantly change their equity level when they face risk shocks. Our evidence here is largely consistent with the trade-off theory. Further, the negative relation between risk shocks and firm debt is due to demand-side factors. That argument is established based on analysis reported in Table 9. In particular, the negative effect of risk shocks on debt is largely concentrated among large, profitable, and investment grade firms, all of which are mostly financially flexible.

4.2. Investment decisions

[4] Bradley, Jarrell, and Kim (1984) and Friend and Long (1988) document a negative relation between earnings volatility and leverage. These papers focus on the cross-sectional effects (i.e., investigating the relation of contemporary risk level to leverage ratio), while our paper analyzes changes in leverage after experiencing risk shocks.

Bolton, Chen, and Wang (2011, 2013) show theoretically that corporate investment will be reduced following risk shocks. However, empirical findings are mixed on the sign and significance of the investment-stock return volatility relation, where researchers typically measure investment by capital expenditure.[5] In this section, we employ the text-based risk shock measure to investigate the relation between risk shock and adjustments in a wide range of investment decisions including capital expenditure, employment, and R&D decisions.

Table 5 reports the relation between risk shocks and adjustments in capital expenditure in Panel A. Risk shocks are negatively correlated with future changes in capital expenditure. The reduction in capital expenditure due to a median risk shock accounts for 26.95% of the median percentage change in capital expenditure, while changes in the conventional volatility-based risk measure cannot significantly explain adjustments in capital expenditure decisions. Furthermore, a one standard deviation increase in risk shock is associated with a decrease in investment with a magnitude of 13.57% of the sample average. The overall negative relation between risk shocks and capital expenditure displays symmetric response to rising versus resolving shocks.

Insert Table 5 here

Employment can be regarded as investment in human capital. Panel A also reports adjustments of employment decisions. Experiencing risk shocks, firms lower not only their capital expenditure but also employment. A median level of risk shock leads to an 8.77% of median annual change in employment. More strikingly, a one standard deviation increase in risk shock implies a drop in employment in a magnitude of 25.18% of the sample average. In comparison, the volatility-based measure is insignificant across the board. The overall impact of our risk shock measure on employment is symmetric for rising versus resolving shocks.

While R&D expenses may not yield immediate profitability, they are crucial for innovation and long-term growth prospects. R&D projects exhibit higher probability of failure and their ultimate

[5] Please see Panousi and Papanikolaou (2012) for a comprehensive review of the empirical literature.

outcome is largely uncertain. To obtain a more complete outlook of corporate investment, we examine the impact of risk shocks on R&D as measured by R&D expenses and advertising expenses, respectively, in Panel B. We include advertising expenses because it is shown to be related to product development and R&D investment by previous studies. In addition, data on advertising expenses involve less missing observations.[6]

Our results reveal that firms significantly reduce R&D and advertising expenses upon experiencing risk shocks. The economic impact is as follows: a median risk shock results in a 7.83% median change in R&D expenses. Alternatively, a one standard deviation increase in risk shock implies a drop in R&D in a magnitude of 7.52% of the sample average. Firms also respond symmetrically to rising versus resolving shocks. They increase their R&D when risk rises, and diminish their R&D when risk resolves.

4.3. Cash Holdings

Past work shows that firms primarily hold cash for precautionary motives to hedge against adverse risk shocks. For instance, Bates, Kahle, and Stulz (2009) attribute the rising cash holdings of US manufacturing firms to increasing cash flow risk. Table 6 reports the effect of risk shocks on cash holdings. A median risk shock explains almost 111% of the median annual change in cash-to-assets ratio during the sample period. Meanwhile, a one standard deviation increase in risk shock leads to an increase in cash-to-assets ratio in a magnitude of 15.72% of the sample average. That is consistent with Opler et al. (1999) and Bates, Kahle, and Stulz (2009), who show that the ratio of cash to total non-cash assets is higher for firms with riskier cash flows.

Insert Table 6 here

Economic implications of change in volatility on cash holdings are smaller even when the relation between change in volatility and cash holdings is statistically significant. To illustrate, a

[6] Following previous literature, we replace missing values of R&D expenses with zero in our analysis.

median risk shock and a median increase in volatility explain 111% and 28.47%, respectively, of the median change in the cash-to-asset ratio. Consistent with previous studies, large firms with more net working capital tend to increase their cash holdings. In contrast, firms with higher level of cash or with large increase in cash-to-asset ratio are more likely to reduce subsequent cash holdings. Analyzing rising versus resolving shocks reveals symmetric response. Increasing risk leads to increasing cash holdings and vice versa.

4.4. Payout Policy

Classic field surveys (Lintner, 1956; Brav, Graham, Harvey, and Michaely, 2005) indicate that risk is an important consideration for managers in making payout policies. Empirical evidence generally supports this view. For example, Hoberg and Prabhala (2009) and Hoberg, Phillips, and Prabhala (2014) show that firms with higher risk exposure are associated with less dividend payouts and stock repurchases. Bliss, Cheng, and Deni (2015) also document significant reductions in dividends and repurchases during the global financial crisis.[7] In this section, we use our text-based measure to comprehensively examine dividend payout policies, including dividend initiations, omissions, increases, and decreases, as well as share repurchases, following risk shocks.

Table 7 reports the results on dividends, while Table 8 focuses on repurchase decisions. Panel A of Table 7 presents the logistic regressions where the dependent variable is a dummy variable reflecting dividend initiation, dividend omission, dividend increase, and dividend decrease, respectively. The evidence shows that risk shocks are positively and significantly correlated with dividend omission and decrease, and negatively correlated with dividend initiation and increase. As the risk shock increases by one standard deviation above the sample mean, there are 19.46% and 10.34% increases in the likelihood of dividend omission and dividend decrease, respectively. Such increases in risk shocks are also associated with 12.86% and 4.62% decreases in the likelihood of dividend initiation and dividend

[7] Floyd, Li, and Skinner (2015), however, find that banks have a higher propensity to pay dividends and resist cutting dividends as the 2007–2008 financial crisis begins, implying that banks use dividends to signal financial strength.

increase, respectively.

Insert Table 7 here

It should be noted that the change in volatility is also statistically significant in predicting dividend policies, and it is of similar economic magnitude to our text-based measure. For example, increasing the annual stock return volatility by one standard deviation above the sample mean leads to a 15.46% decrease in the propensity of dividend initiation. Taking together, we find that stock return volatility has better predictive power in explaining dividend policies than investment and other policies, suggesting that dividend policies are likely to be affected by market-wide factors along with firm level fundamentals.

Panels B examines whether rising and resolving shocks affect dividend policy in the same manner. Our results show that firms respond to rising risk shocks by substantially adjusting dividend policy along multiple dimensions. In particular, dividend-paying firms are less likely to increase dividends. Some of them may choose to moderately reduce dividend payouts, while others dramatically terminate dividend payouts. On the other hand, when risk shocks resolve, no-dividend firms are more likely to initiate dividends, while dividend-paying firms are more likely to increase dividends and less likely to reduce or terminate dividends payouts.

Share repurchases is as an alternative way to pay dividends. Jagannathan, Stephens, and Weisbach (2000) and Guay and Harford (2000) find that repurchases is used to distribute cash flow shocks that are primarily transient, while dividend changes typically follow cash flow shocks with a relatively large permanent component. Table 8 reports the results on stock repurchases.

Insert Table 8 here

The impact of risk shocks on share repurchases is quite similar to that on dividend payouts, suggesting that our text-based risk shock measure captures both permanent and transient component of cash flow shocks. First, we show that risk shocks are followed by a significant reduction in the propensity of large stock repurchases. Particularly, a one standard deviation increase in the risk shock

leads to an 8.94% decrease in the probability of large stock repurchases. Moreover, the net value of repurchase is negatively related to risk shocks. A median risk shock explains about 14.81% median change in the net value of stock repurchases in our sample. In contrast, change in stock return volatility cannot significantly predict either net repurchases or the likelihood of large repurchases. Our results also reveal that firms' repurchase policies adjust to rising risk shocks and resolving risk shocks with a similar magnitude.

Our empirical results on payout policies are largely consistent with the idea that an increase in risk increases the precautionary demand for cash. Thus, managers, being characterized as conservative in field surveys (Lintner, 1956; Brav, Graham, Harvey, and Michaely, 2005), would reduce payouts and retain cash for future investment. In later section (Table 9), we further show that the negative relation between risk shocks and payouts is largely concentrated among small, negative earning, and low credit rating firms, all of which are more prone to the adverse impacts of risk shocks.

4.5. Interactions with Firm Characteristics

We employ OLS and logit regression models to examine how firm size, profitability, and credit conditions interact with the impact of risk shocks on the various corporate policies examined earlier. We use the following specifications

$$\triangle \text{POLICY}_{i,t+1} = \alpha + \beta_1 \text{RISKSHOCK}_{i,t} + \beta_2 \text{ RISKSHOCK}_{i,t} \text{ x FIRM DUMMY}_{i,t} + \beta_3 \text{ FIRM DUMMY}_{i,t} + \beta_j \text{CONTROL}_{i,j,t} + \varepsilon_{i,t} \quad (2)$$

The additional explanatory variables here are the interaction terms between risk shocks and dummy versions of firm size, profitability, and credit ratings, and the standalone variables of firm dummies. In particular, *FIRM DUMMY* equals one if the firm's assets are larger than the sample median, if the firm's earning (EBIT) is negative, or if the firm's S&P long term bond rating is higher than or equal to BBB. For each policy examined, we use the same control variables as in previous analyses, except that in

regressions related to firm size, we drop log sales as the control variable to avoid the potential collinearity issue between log sales and the dummy variable of firm size.

Table 9 reports the results. The dependent variables are change in the book leverage ratio (Panel A), percentage change in capital expenditure, employment and R&D measured by advertising expenses (Panel B), change in cash-to-asset ratio (Panel C), dividend payout dummies (Panel D), and net repurchases (Panel E), respectively.

Insert Table 9 here

Size Effects. We find that only large firms reduce leverage in the presence of risk shocks. The coefficient of the interaction term between risk shock and *Large Firms Dummy* is -1.662, with a t-statistics of -2.42, indicating that the presence of a median risk shock explains 25.63% of the median absolute change in leverage for large firms, while the relation between risk shock and adjustment in leverage is insignificant for small firms. Further, we find that when risk shock arises, only large firms significantly reduce their debt, suggesting that large firms are capable of cutting debt when debt financing costs increase.

Smaller firms are associated with larger reductions in investment and payout policies as risk increases. In particular, smaller firms reduce capital expenditure and advertising expenses to a greater degree when risk increases. The presence of a median risk shock explains 42.39% (11.55%) of the median percentage change in capital expenditure (advertising expenses) for small firms, but only 22.63% (3.78%) for large firms. In addition, small firms are more likely to cut their dividends upon experiencing risk shocks. There are no significant differences between large and small firms with respect to cash holding policies.

Profitability Effects. We show that profitability plays an important role in affecting capital structure and dividend policy in response to risk shocks. Firms with positive earnings reduce leverage to a greater degree in the presence of risk shocks. The presence of a median risk shock explains 30.20% of the median absolute change in leverage for profitable firms, while the relation between risk shock

and adjustment in leverage is insignificant for firms with negative earnings. In further analysis, we find that the reduction in leverage by profitable firms is mostly through reduction in debt.

Negative earnings firms, in contrast, are more responsive to risk shocks through reducing dividend payouts. Such firms are more likely to reduce divide payouts after experiencing risk shocks. Since profitable firms have greater financing independence and flexibility, our results suggest that financial constraints play significant roles in shaping up both financing and payout policies.

Credit Rating Effects. Investment grade firms react more prominently to the presence of risk shocks with reduction in leverage. The coefficient estimate of the interaction term between risk shock and *Investment Grade Dummy* is -1.523, indicating that the presence of a median risk shock explains 34.33% of the median absolute change in leverage for investment grade firms, while the relation between risk shock and adjustment in leverage is insignificant for non-investment grade firms.

Non-investment grade firms lay off more employees upon experiencing risk shocks. The coefficient estimate of the interaction term between risk shock and *Investment Grade Dummy* is statistically significant at the 10% level, with a meaningful economic impact. In particular, the presence of a median risk shock explains about 10.67% (3.21%) of the median percentage change in employment for non-investment (investment) grade firms. Credit ratings also play an important role in affecting payout policies upon experiencing risk shocks. High credit risk firms are more likely to reduce dividends and are less likely to repurchase stocks after experiencing risk shocks.

4.6. Duration of the Impact of Risk Shocks

We examine the duration of the impact of risk shocks on corporate policies by including lagged terms of shocks measured at time *t*, *t*-1, and *t*-2, while keeping the control variables observed at time *t*. More specifically, we use the following specifications

$$\triangle POLICY_{i,t+1} = \alpha + \beta_1 RISKSHOCK_{i,t} + \beta_2 RISKSHOCK_{i,t-1} + \beta_3 RISKSHOCK_{i,t-2} + \beta_j CONTROL_{i,j,t} + \varepsilon_{i,t} \quad (3)$$

Table 10 reports the results for risk shocks. Panels A through E present the results on leverage, investment, cash holdings, dividend payouts, and stock repurchases, respectively. The evidence shows that the impact of risk shocks on payout policies including dividends and repurchases persists for two years, while the impact on leverage, investment, and cash holdings lasts for at least three years after the introduction of risk shocks.

Insert Table 10 here

Taking together the findings exhibited in Tables 10, we show that the impact of risk shocks on corporate policies exists not only in terms of scale and strength, but also in terms of duration. We argue that the impact of risk shocks is persistent as they create clear expectations on changing long-term business prospects, rather than short-lasting investor sentiment or biases in investors' expectations. Managers, therefore, are more likely to make persistent adjustment decisions following such shocks. This argument is further supported by our finding that adjustments in payout policies are less persistent than investment and capital structure policies that are shown to be less affected by market-based return volatility.

5. Robustness Checks

This section implements a comprehensive battery of robustness checks. First, we account for potential effects of CEO traits on our study. Graham, Harvey, and Puri (2013) document that CEOs and CFOs around the world possess different personal traits such as risk aversion and optimism, which could affect corporate leverage and investment decisions. In our context, there is a possibility that risk averse managers overestimate a firm's risk level and in the meantime undertake less debt. Therefore, risk aversion or other CEO personal traits, rather than risk per se, may affect corporate leverage among other decisions. By studying the effect of change in risk on change in corporate policies, we mitigates such concerns, as long as CEO traits are time-invariant, or CEO traits lead to systematic under or over-evaluation of corporate risk.

We further account for potential effects of CEO characteristics by adding controls for CEO gender, age, education, and experience, as younger and male CEOs, and CEOs with MBA degrees and longer financial industry experience may adopt more aggressive financial policies (Graham, Harvey, and Puri, 2013). We measure CEO education from a variety of dimensions, including whether the CEO has a bachelor, master, or PhD degree, whether the CEO graduates from an Ivy-league college, whether the CEO obtains an MBA degree, whether the CEO obtains an MBA degree from the "US News (2010)" top 20 MBA programs, and whether the CEO obtains a Master of Finance degree. We also account for CEO prior experience by examining the number of years the CEO has worked in the finance industry, the number of years the CEO has worked for the same industry as the current firm, the number of years the CEO has worked in the same firm, and the number of working years in general. Our results are essentially the same after controlling for all the above noted CEO characteristics.

Our next robustness check accounts for potential effects of hedging activities on the relation between risk shocks and corporate decisions. Past work shows that some corporations manage their risk by implementing hedging to stabilize their earnings and cash flows, lower their bankruptcy costs, and ease their credit and financial constraints (see, for example, Campello, Lin, Ma, and Zou, 2011). Managerial risk tolerance may also play a role in corporate hedging decisions ((Bodnar, Giambona, Graham, and Harvey, 2014). Depending on hedging activities, mangers facing risk shocks may adjust corporate policies differently.

We construct a text-based measure of corporate hedging by counting the frequency of hedge-related word stems, including different forms of the word "hedge" and "derivative", in the 10-K reports. Our main variable, *Hedge*, is then computed as the frequency of hedge-related word stems divided by the total number of word stems in the 10-K reports. To examine the effect of hedging activities, we first add the change in the variable *Hedge (*i.e., *dHedge)* as a control in our baseline regressions. We also construct an interaction term between *dHedge* and risk shock to test whether the relation between risk shocks and corporate decisions differs for hedging corporations.

Hedging activities indeed affect a wide range of corporate decisions, such as leverage, investment, cash holding and payout policies. Specifically, an increase in hedging activities is associated with an increase in leverage and employment, and a decrease in cash holdings and dividend payouts. Ultimately, however, the documented relation between risk shocks and corporate decisions is robust to considering hedging. Both hedging and non-hedging firms significantly adjust their corporate policies subsequent to risk shocks, yet hedging firms adjust their corporate policies more mildly.

Our results are robust to using a matching-firm approach to address the possibility that firms experiencing risk shocks may be fundamentally different from firms that are not subject to such shocks. Thus, the differences in corporate reactions might be caused by the pre-shock difference rather than the risk shock itself. We thus restrict our sample to matched firms. Specifically, for each firm (treatment firm) experiencing a risk shock in the full sample, we select one matched firm (control firm) during the year prior to the risk shock according to three criteria: (1) the matched firm must belong to the same industry as characterized by the three-digit SIC code; (2) the market capitalization of the matched firm is within the range of 80% to 120% of that of the treatment firm; (3) the profitability (EBIT/asset) of the matched firm is within the range of 80% to 120% of that of the treatment firm. We find similar results based on the matched sample. Furthermore, the reduction in leverage following risk shocks is substantially stronger when compared to matched firms in the same industry and with similar market capitalization and profitability.

One possible concern is that our main results are attributable to financial firms since the 15 extreme risk shock examples are concentrated in the finance industry. We conduct subsample analyses on different industry groups and obtain similar results when restricting our sample to nonfinancial firms or manufacturing firms. Interestingly, financial firms are more responsive to risk shocks through reduction in leverage and are non-responsive through adjustments in cash holdings. Furthermore, unlike Floyd et al. (2015), we find that financial firms are more likely to terminate their dividends following risk shocks than nonfinancial firms. In comparison, manufacturing firms and firms in the

service industry cut capital expenditure and R&D to a greater degree following risk shocks. Our results are also robust to excluding the 2007-2008 period of the global financial crisis, during which we find firms reduce leverage to a greater extent than the rest of the sample period.

We also examine alternative risk measures based on different sections of 10-K texts. In particular, Item 7 and 7a (Managerial Discussions & Analysis) in 10-K filings contain comprehensive managerial discussions on corporate risk profile and business prospects. Using a risk shock measure derived solely from Item 7 and 7a texts, our results remain unchanged. Moreover, Hoberg, Prabhala, and Phillips (2014) find that product market risk information extracted from Item 1 (Business) can predict future cash holdings and payout policies. Here, we find that a risk shock measure based on Item 1 yields similar results as our benchmark measures. Finally, since listed companies are mandated by SEC to include Item 1a to discuss "the most significant factors that make the company speculative or risky" after 2005 December, we analyze risk information embedded in Item 1a separately. Our overall evidence remains unchanged, supporting the finding in Campbell et al. (2014) that risk disclosure in Item 1a is firm-specific, meaningful, and relevant to different types of risks, both systematic and idiosyncratic.

Our results are robust to using market leverage and adjusted book and market leverage as the proxy for capital structure decision. We also derive similar results using the absolute change in capital expenditure and employment, rather than the percentage change in these measures, as dependent variables. Regarding payout policies, we further investigate the impact of risk shocks on the percentage increase or decrease in dividend and repurchase payouts. We find similar results upon using these continuous measures, rather than the dummy variables.

Our text-based measure of risk shocks could merely capture deteriorating profitability. Managers tend to use more negative and cautionary words in annual reports when profitability diminishes (Li, 2006). A plausible story is that profitability drop, rather than rising risk, leads to the reduction in leverage, investment, dividend payouts, and the increase in cash holdings. To alleviate

such concerns, we add controls for change in earnings (i.e., EBIT/Assets) or change in earnings volatility in all regressions. Controlling for these variables, risk shocks still significantly predict changes in leverage, investment, employment, cash holdings, and dividend and repurchase policies. Meanwhile, change in earnings volatility performs even worse than change in return volatility in predicting these policies. Risk shocks remain significant statistically and economically also when we include in policy regressions changes in the following alternative risk measures: (1) implied volatility of individual stock options; (2) realized S&P 500 index return volatility.

6. Conclusion

This paper develops a novel methodology to measure firm-level risk through analyzing the textual contents of corporate 10-K reports. It then examines adjustments of various corporate policies in response to shocks to the surrounding risk environments.

Our new measure is based on keywords characterizing managerial perception of risk in 76,676 10-Ks for the period January 1994 through September 2015. Compared with existing risk measures such as stock return and earnings volatility, the text-based measure focuses exclusively on downside possibilities and information related to firms' fundamentals. Using this measure, we show that risk shocks are followed by persistent reductions in leverage, capital expenditure, R&D, employment, and dividend payouts and stock repurchases, along with increasing cash holdings. Small, non-profitable, and high credit risk firms are more responsive to risk shocks through investment and payout policies, while large, profitable, and low credit risk firms are more responsive through reduction in leverage.

The text-based measure substantially outperforms existing risk measures in predicting capital structure and investment decisions, as the relation between changes in stock return and earnings volatility and changes in leverage and investment is shown to be non-significant. Furthermore, the impact of risk shocks on these policies lasts for over three years, implying that our text-based measure is based on clear information about fundamental business conditions. This is further supported by the

finding that firms actively adjust their leverage, investment, cash holdings, and payout policies when downside risk rises and reverse these policies when risk resolves. Taking together, using the text-based risk measure, we obtain strikingly consistent, robust, and long-lasting implications for a wide range of corporate policies in response to changing business conditions. Relative to existing measures, our text based risk measure provides results that are more consistent with theories in corporate finance and comprehensive surveys in the field.

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Table 1: Characteristics of the Text-Based Risk Measure

This table describes the text-based risk measure. Panel A presents average measures for ten industry groups. Panel B considers above- and below-median size, market-to-book, credit rating, earnings, stock return volatility and cash flow volatility firms. Reported are the average, difference in average, and its *t*-statistics (in parentheses). The sample consists of U.S. listed companies that filed 10-K reports over the time period of 1994 January and 2015 September. Risk level is the ratio of risk-related keywords to total meaningful words in 10K files. Definitions of all variables are provided in Appendix 2.

Panel A: Distribution of Risk by Industry Groups

Industry Group	Obs.	Mean	Range	
			Min	Max
Agriculture, Forestry, and Fishing	147	0.84%	0.07%	1.57%
Mining	2,829	0.94%	0.10%	2.20%
Construction	835	1.01%	0.04%	1.99%
Manufacturing	28,899	1.00%	0.02%	2.89%
Transportation, Communications, Electric, Gas, and Sanitary Services	5,962	0.87%	0.01%	2.49%
Wholesale Trade	2,331	0.90%	0.04%	2.26%
Retail Trade	4,341	0.87%	0.04%	2.10%
Finance, Insurance and Real Estate	17,176	1.32%	0.03%	3.89%
Services	11,605	1.06%	0.03%	2.62%
Conglomrates	490	1.06%	0.23%	2.35%
Total	76,676	1.06%	0.01%	3.89%

Panel B: Distribution of Risk by Firm Characteristics

	Mean Risk Levl		
	Above-the-median Firms	Below-the-median Firms	Difference (1)-(2)
Firm Characteristics	(1)	(2)	(3)
Return Volatility	1.083%	1.033%	0.050% (14.54)
Cash Flow Volatility	1.112%	1.104%	0.008% (2.00)
Credit Ratings	0.985%	1.063%	-0.078% (-12.07)
EBIT/Asset	0.897%	1.220%	-0.324% (-104.55)
Tangibility	0.903%	1.211%	-0.308% (-99.94)

Table 2: Examples of Extreme Risk Shocks

This table describe 15 examples of the largest risk shocks. The sample consists of U.S. listed companies that filed 10-K reports over the time period of 1994 January and 2015 September. Firms are sorted in descending order based on the value of risk shocks.

Rank	Fiscal Year	Company Name	Industry Group	Risk Shock Factors
1	2005	SUPERIOR INDUSTRIES INTL	Industry Manufacturing	reductions in the forecast of new vehicle productions by customers; continued consolidation of the automotive industry; global pricing pressure driven by competiters and cost-cutting initiatives of customers; the need to seek a buyer for the aluminum suspension components business due to significant losses incurred by this invest project; whether the cost-cutting innitives could be achieved.
2	2009	FNB UNITED CORP	Financial Services	an increase in nonperforming real estate loans; incapability of renewing or accepting brokered deposits without prior regulatory approval and the possibility of paying higher insurance premiums to the FDICa due to decline in the bank's capital position; inability to access the capital markets.
3	2008	FIRST FINL BANCORP INC/OH	Financial Services	massive writeoffs due to credit performance of real estate related loans; inability to access capital because of the tightening of credit market; impairment of goodwill due to unpredecended market volatilities and disruptions; credit risk imposed by the default events of financial institutions.
4	2007	D R HORTON INC	Construction	declines in demand for new homes; elevated sales cancellation rate, reduction in availability of mortgage financing; declines in profit margine because the company offers higher levels of incentives and price concessions in attempts to stimulate demand.
5	2009	CITIZENS COMMUNITY BANCORP	Financial Services	deteriorating credit quality; ability to maintain the required capital levels and adequate source of funding and liquidity; further writedowns in residential mortgage backed securities portfolio; ability to implement the cost-savings innitiatives; potential impairment of investment securities, goodwill and other intangible assets; high volatility of stock price since the stocks are thinly traded.
6	2009	BB&T CORP	Financial Services	credit deterioration related to the commercial real estate and contruction loan porfolios of the newly acquired Colonial Bank and the residential mortgage loans of the bank itself; the ability to expand into the new areas after the acquisition of Colonial Bank; decreases in real estate values, primarily in Georgia, Florida and metro Washington, D.C..
7	2009	SOUTH FINANCIAL GROUP INC	Financial Services	a series of risk factors related to a restatement process: downgrades in credit ratings; acceleration of public debt securities and other debt arrangements due to inability to comply with certain reporting covenants; material weaknesses in internal control over financial reporting; not able to access the public capital markets until all of its filings with the SEC are up to date; incapbility of attractting and retaining key employees.
8	2004	DORAL FINANCIAL CORP	Financial Services	difficulty in obtaining additional borrowings or issuing additional equity due to market conditions and recent downgrades of credit ratings; subject to regulatory enforcement actions if not adequately capitalized; failure to comply with the Nasdaq one-dollar minimum bid price requirement; a net increase in Federal income tax if there is an "ownership change" due to new equity issuance or other events; credit losses and impairment charges.

Table 2: Examples of Extreme Risk Shocks (Continued)

Rank	Fiscal Year	Company Name	Industry Group	Risk Shock Factors
9	2008	FIFTH THIRD BANCORP	Financial Services	systematic risk faced by the entire industry; increases in compeitition due to recent consolidation of the financial industry; inability to hire or retain the most qualified senior managers due to the CPP's restrictions on the compensations of senior managers.
10	2002	PROGRESS ENERGY INC	Utility	energy crisis in California during 2001; the recent volatility of natural gas prices in North America; increased amount of public and regulatoryscrutiny due to the the bankruptcy filing by the Enron Corporation and recently discovered accounting irregularities of certain public companies; downgradings of senior unsecure debt by S&P and Moody's; drought conditions and related water restrictions in the southeast United States.
11	2002	FIBERCORE INC	Materials and Related Products	manufacturing overcapacity due to decreased growth in telecommunication industry; a significant and continuing downturn in the South American market; intense competition with several competitors having significantly greater resources and associated pricing pressure; the ability to achieve the cost reduction plans; low cash reserves and limited ability to gain additional capital; possibility of being delisted from Nasdaq due to failure to comply with the one-dollar minimum bid price requirement.
12	2007	AMBAC FINANCIAL GROUP INC	Financial Services	inablility to write new financial guarantee business due to a downgrade of financial strength rating by S&P; an increase in borrowing costs due to downgrades of long term credit rating by multiple rating agencies; a substantial increase in credit risk related to residential mortgage backed securities and CDOs of ABS; potential disruptions caused by decsions to suspend and discontinue certain business..
13	2009	SALEM COMMUNICATIONS CORP	Tele-communications	a significant decrease in advertising by customers in financial services and automotive industries; impairment of braodcast liscences, mastheads and goodwill balances due to increased cost of capital and a decline in the estimated terminal or exit values as a result of industry wide declines in radio station transaction multiples and magazines; ability to integrate the operations and management of two newly acquired radio stations; high credit risk due to substantial previous and new debt obligations.
14	2008	JOURNAL COMMUNICATIONS	Tele-communications	impairment of goodwill, tv and radio broadcast licenses, other intangible assets and property, plant and equipment due to deteriorating market conditions and a further decline in the stock price;the adverse impact of changing economic and financial market conditions on liquidity and the availability of capital; the possbility of violating the financial covenants of revolving credit facility;decreases in advertising spending in automotive industry, political advertising and professional sports contracts.
15	2009	MARRIOTT INTL	Services	significantly reduced demand for hotel rooms and timeshare products around the world; the growing risks of doing business internationally due to growing significance of operations abraod; a downgrade of long-term debt ratings by the three major agencies in 2009; the anticipation that many of the jurisdictions in which the company does business will review tax and other revenue raising laws in response to recent economic crisis; weakened sales of timeshare loans due to disruptions in the credit markets; significant restructuring costs and impairment charges of the timeshare segment.

Table 3: Summary Statistics

This table reports summary statistics for text-based variables, firm-level corporate policy variables and control variables, and macro-wide control variables in Panel A, B, C, and D, respectively. All continuous variables, except those in Panel D, are winsorized at the 1% and 99% level. Definitions of these variables are provided in Appendix 2. The sample consists of U.S. listed companies that filed 10-K reports over the time period of 1994 January and 2015 September.

Variable	Obs.	Mean	Median	Std. Dev.	Skewness	Kurtosis
Panel A: Text-based Variables						
Total Meaningful Words in 10K Files	76,676	21,410	19,468	12,742	0.86	3.63
Risk-related Words in 10K Files	76,676	251	208	207	1.48	5.85
Risk Level	76,676	1.06%	1.04%	0.45%	0.50	3.25
Risk Shock	58,607	0.04%	0.02%	0.16%	0.93	10.67
Rising Risk Shock	58,607	0.28	0.00	0.45	0.96	1.91
Resolving Risk Shock	58,607	0.65	1.00	0.48	-0.64	1.41
Panel B: Corporate Policy Variables						
Book Leverage	76,676	55.15%	55.03%	27.45%	0.14	2.37
Active Change in Book Leverage (dlev)	57,442	0.04%	0.12%	8.61%	-0.88	8.97
% Change in Debt (dDebt)	58,585	19.84%	5.72%	60.93%	3.97	22.68
% Change in Equity (dEquity)	57,441	14.03%	1.23%	54.49%	4.58	28.04
Capital Expenditure (millions)	71,713	113.63	8.91	354.68	5.08	30.96
% Change in Capital Expenditure (%dcapx)	51,439	20.18%	1.27%	134.64%	3.86	21.77
Employment (thousands)	74,085	6.90	0.98	17.99	4.61	26.54
% Change in Employment (%demp)	55,360	3.76%	1.35%	21.91%	1.42	9.03
R&D Expense (millions)	76,676	27.24	0.00	110.43	6.28	45.08
% Change in R&D Expense (%dxrd)	22,694	5.02%	2.41%	29.91%	2.73	15.30
Advertising Expense (millions)	76,676	15.21	0.00	69.84	6.35	45.45
% Change in Avertising Expense (%dxad)	19,540	11.08%	3.95%	65.44%	3.06	18.29
Cash (millions)	76,665	289.24	35.79	949.21	5.75	38.90
Cash/Assets	76,665	18.00%	7.96%	22.48%	1.67	5.03
Change in Cash/Assets (dcash)	58,596	-0.39%	-0.03%	8.09%	-0.41	7.14
Dividends (per share)	76,357	0.33	0.00	0.60	2.39	8.94
Dividend Innitiation	58,357	0.02	0.00	0.15	6.39	41.77
Dividend Omission	58,357	0.01	0.00	0.12	8.44	72.26
Dividend Increase	58,357	0.28	0.00	0.45	1.00	2.01
Dividend Decrease	58,357	0.09	0.00	0.28	2.92	9.53
Net Repurchases (millions)	50,868	72.77	0.03	278.68	5.63	37.09
Repurchase More than 1% Asset Dummy	66,180	0.32	0.00	0.47	0.76	1.58

Table 3: Summary Statistics (Continued)

Variable	Obs.	Mean	Median	Std. Dev.	Skewness	Kurtosis
Panel C: Corporate Control Variables						
Stock Return Volatility	69,806	53.69%	45.07%	31.95%	1.46	5.29
Change in Stock Return Volatility	52,060	-0.32%	-0.82%	21.44%	0.38	8.20
Earnings Volatility	64,522	5.13%	2.65%	6.77%	2.54	10.09
Change in Earnings Volatility	49,510	0.15%	0.00%	3.11%	1.23	32.55
Stock Return	58,086	13.01%	2.97%	65.51%	2.53	12.84
Sales (millions)	76,562	1,848.79	240.81	5,165.31	4.92	29.71
Assets (millions)	76,676	3,592.47	461.28	11,028.17	5.48	36.15
Market leverage	75,963	41.95%	37.68%	28.30%	0.34	1.89
Tangibility	73,822	0.23	0.14	0.24	1.20	3.47
M/B Ratio	75,962	2.86	1.82	4.09	3.45	20.45
ROA	75,340	0.02	0.06	0.19	-2.71	13.01
Effective Tax Rate	76,560	0.21	0.30	0.33	-2.21	15.42
Cash/Interest Expenses	57,879	160.96	4.66	690.86	6.40	46.35
Dividend Yield	76,028	0.01	0.00	0.02	2.70	11.44
Financial Deficit/Sales	39,183	0.49	0.00	2.58	7.11	55.84
Cash Flow/PPE	67,462	-0.51	0.30	6.49	-5.07	35.11
Tobin's Q	75,800	1.94	1.33	1.73	3.28	15.73
Net Working Capital/Assets	59,544	0.07	0.05	0.18	0.10	3.52
R&D/Sales	75,670	19.39%	0.00%	97.24%	7.24	57.57
Firm Age (years)	40,142	7.99	7.00	5.32	0.57	2.80
Sales Growth	57,959	14.43%	7.49%	41.26%	3.40	20.12
Neg. Earn. Dummy	76,553	0.28	0.00	0.45	0.98	1.95
Retained Earnings/Assets	75,181	-0.29	0.06	1.47	-4.23	23.28
Panel D: Macroeconomic Variables						
S&P 500 Return	76,513	9.52%	12.78%	18.33%	-0.83	3.19
Default Spread between Baa and Aaa Bonds	73,057	1.02%	0.95%	0.54%	3.21	14.33
Constant 1-year Maturity Treasury Bill Yield	76,251	2.98%	3.34%	2.29%	0.01	1.37
VIX	76,251	21.21%	21.68%	7.12%	0.99	4.74
Industrial Production Growth	76,676	1.97%	3.98%	9.30%	-2.64	12.04

Table 4: Risk Shocks and Capital Structure

This table reports estimation results of the capital structure regressions. In panel A, the dependent variable is the book leverage ratio adjustment, while Panels B focuses on debt and equity adjustments, respectively. Specifically, the dependent variables are active change in book leverage ratio from year t to t+1 ($dlev_{t+1}$) in Panel A, and percentage change in total liabilities ($\%dDebt_{t+1}$) and common equity after adjusting for changes in retained earnings ($\%dEquity_{t+1}$) in Panels B. The main independent variables in both panels include risk shocks and rising and resolving risk shocks from year t-1 to t. Risk shock refers to the change in percentage of total words that are risk related from last year. Rising (resolving) risk shock is an indicator that equals one if the firm experiences increasing (decreasing) risk in a magnitude larger than the sample median, and zero otherwise. Other controls include M/B ratio, effective tax rate, cash/interest expenses, dividend yield, financial deficit/sales, S&P 500 return, industrial production growth, option-implied volatility (VIX), default spread between Baa and Aaa bonds, constant 1-year maturity treasury bill yield, industry fixed effects (industry dummies by the first two-digit SIC code), and year fixed effects. The sample consists of U.S. listed companies that filed 10-K reports over the time period of 1994 January and 2015 September. Definitions of all variables are provided in Appendix 2. The numbers in parentheses are *t*-statistics with robust standard errors two-way clustered at the firm and year level.

Panel A: Book Leverage Ratio Adjustment

	$dlev_{t+1}$		
	Shocks	Rising Shocks	Resolving Shocks
	(1)	(2)	(3)
Risk Shock	-1.036	-0.004	0.004
	(-2.93)	(-3.57)	(4.14)
Log Sales	0.005	0.005	0.005
	(6.69)	(6.49)	(6.53)
Book Leverage	-0.086	-0.086	-0.086
	(-8.86)	(-8.82)	(-8.90)
Stock Return	-0.005	-0.005	-0.005
	(-4.28)	(-4.22)	(-4.17)
ROA	0.116	0.116	0.12
	(10.26)	(10.55)	(10.31)
Tangibility	0.008	0.009	0.009
	(1.36)	(1.61)	(1.65)
Change in Volatility	-0.004	-0.004	-0.004
	(-0.96)	(-0.96)	(-0.98)
Other Controls	Yes	Yes	Yes
Observations	22,311	22,311	22,311
Adj. R-sq	0.215	0.215	0.215

Table 4: Risk Shocks and Capital Structure (Continued)

Panel B: Debt versus Equity Adjustment

	%dDebt $_{t+1}$			%dEquity$_{t+1}$		
	Shocks	Rising shocks	Resolving Shocks	Shocks	Rising shocks	Resolving Shocks
	(1)	(2)	(3)	(4)	(5)	(6)
Risk Shock	-10.640	-0.027	0.025	-0.439	0.003	-0.006
	(-4.49)	(-2.81)	(2.58)	(-0.16)	(0.33)	(-0.78)
Log Sales	-0.001	-0.002	-0.001	-0.017	-0.017	-0.017
	(-0.06)	(-0.11)	(-0.08)	(-5.27)	(-5.25)	(-5.17)
Book Leverage	-0.374	-0.373	-0.375	0.047	0.046	0.046
	(-6.83)	(-6.76)	(-6.83)	(1.32)	(1.31)	(1.31)
Stock Return	0.022	0.023	0.023	0.025	0.025	0.024
	(2.05)	(2.05)	(2.03)	(1.70)	(1.73)	(1.68)
ROA	0.063	0.063	0.068	-0.457	-0.454	-0.457
	(0.79)	(0.78)	(0.85)	(-6.05)	(-5.99)	(-6.08)
Tangibility	0.022	0.028	0.029	0.036	0.039	-0.457
	(0.74)	(0.72)	(0.75)	(0.99)	(0.99)	(1.01)
Change in Volatility	-0.035	-0.037	-0.038	0.003	0.003	0.002
	(-1.00)	(-1.07)	(-1.08)	(0.15)	(0.12)	(0.10)
Other Controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	22,680	22,680	22,680	22,311	22,311	22,311
Adj. R-sq	0.072	0.071	0.071	0.194	0.194	0.194

Table 5: Risk Shocks and Investment Decisions

This table reports estimation results of the investment decisions. The sample consists of U.S. listed companies that filed 10-K reports over the time period of 1994 January and 2015 September. In Panel A, the dependent variable denotes percentage change in capital expenditure ($\%dcapx_{t+1}$) and employment ($\%demp_{t+1}$) from year t to t+1 in Columns 1–3 and Columns 4–6, respectively. In Panel B, the dependent variable denotes percentage change in R&D ($\%dxrd_{t+1}$) and advertising expense ($\%dxad_{t+1}$) from year t to t+1 in Columns 1–3 and Columns 4–6, respectively. The main independent variables are risk shocks, and rising and resolving risk shocks from year t-1 to t. Risk shock refers to the change in percentage of total words that are risk related from last year. Rising (resolving) risk shock is an indicator that equals one if the firm experiences increasing (decreasing) risk or uncertainty in a magnitude larger than the sample median, and zero otherwise. Other controls include market leverage, cash flow/PPE, ROA, M/B ratio, industry fixed effects (industry dummies by the first two-digit SIC code), and year fixed effects. Definitions of all variables are provided in Appendix 2. The numbers in parentheses are *t*-statistics with robust standard errors two-way clustered at the firm and year level.

Panel A: Capital Expenditure and Employment

	%dcapx $_{t+1}$			%demp $_{t+1}$		
	Shocks	Rising Shocks	Resolving Shocks	Shocks	Rising Shocks	Resolving Shocks
	(1)	(2)	(3)	(4)	(5)	(6)
Risk Shock	-17.110	-0.041	0.048	-5.918	-0.013	0.011
	(-3.87)	(-3.88)	(4.88)	(-6.19)	(-4.18)	(3.37)
Log Sales	-0.069	-0.069	-0.069	-0.006	-0.006	-0.006
	(-13.19)	(-13.07)	(-13.16)	(-4.84)	(-4.92)	(-4.93)
Tangibility	-0.466	-0.467	-0.465	-0.038	-0.039	-0.038
	(-5.17)	(-5.17)	(-5.13)	(-2.41)	(-2.46)	(-2.40)
Stock Return	0.263	0.263	0.263	0.033	0.034	0.034
	(6.65)	(6.64)	(6.63)	(4.96)	(4.84)	(4.97)
Tobin's Q	0.024	0.024	0.024	0.016	0.016	0.016
	(2.00)	(1.99)	(1.99)	(5.81)	(5.77)	(5.80)
Change in Volatility	-0.036	-0.040	-0.039	-0.016	-0.017	-0.018
	(-0.75)	(-0.83)	(-0.80)	(-1.31)	(-1.42)	(-1.48)
Other Controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	34,592	34,592	34,592	34,542	34,542	34,542
Adj. R-sq	0.076	0.079	0.076	0.089	0.088	0.088

Table 5: Risk Shocks and Investment Decisions (Continued)

Panel B: R&D and Advertising Expense

	%dxrd $_{t+1}$			%dxad $_{t+1}$		
	Shocks	Rising Shocks	Resolving Shocks	Shocks	Rising Shocks	Resolving Shocks
	(1)	(2)	(3)	(4)	(5)	(6)
Risk Shock	-9.428	-0.020	0.019	-13.450	-0.030	0.024
	(-4.36)	(-2.50)	(2.90)	(-4.14)	(-2.66)	(2.26)
Log Sales	-0.015	-0.015	-0.015	-0.017	-0.017	-0.017
	(-5.36)	(-5.43)	(-5.18)	(-4.77)	(-4.69)	(-4.86)
Tangibility	-0.211	-0.212	-0.212	-0.050	-0.052	-0.047
	(-4.23)	(-4.29)	(-4.19)	(-0.81)	(-0.86)	(-0.76)
Stock Return	0.057	0.057	0.058	0.088	0.088	0.089
	(3.88)	(3.90)	(3.89)	(4.86)	(4.84)	(4.82)
Tobin's Q	0.024	0.024	0.024	0.021	0.021	0.021
	(9.39)	(9.27)	(9.54)	(1.40)	(1.39)	(1.40)
Change in Volatility	-0.055	-0.056	-0.056	-0.013	-0.016	-0.017
	(-0.28)	(-0.31)	(-0.35)	(-0.32)	(-0.40)	(-0.42)
Other Controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	15,321	15,321	15,321	12,209	12,209	12,209
Adj. R-sq	0.083	0.083	0.083	0.051	0.051	0.050

Table 6: Risk Shocks and Cash Holdings

This table reports estimation results from cash holdings regressions. The sample consists of U.S. listed companies that filed 10-K reports over the time period of 1994 January and 2015 September. The dependent variable $dCash_{t+1}$ denotes change in cash/assets from year t to t+1. The main independent variables are risk shocks, and rising and resolving risk shocks from year t-1 to t. Risk shock refers to the change in percentage of total words that are risk related from last year. Rising (resolving) risk shock is an indicator that equals one if the firm experiences increasing (decreasing) risk in a magnitude larger than the sample median, and zero otherwise. Other controls include M/B ratio, cash flow/PPE, capital expenditure/assets, book leverage, industry fixed effects (industry dummies by the first two-digit SIC code), and year fixed effects. Definitions of all variables are provided in Appendix 2. The numbers in parentheses are *t*-statistics with robust standard errors two-way clustered at the firm and year level.

	%dCash $_{t+1}$		
	Shocks	Rising Shocks	Resolving Shocks
	(1)	(2)	(3)
Risk Shock	1.549	0.004	-0.003
	(5.75)	(3.15)	(-2.73)
Log Sales	0.003	0.003	0.003
	(4.10)	(4.12)	(4.06)
Net Working Capital/Assets	0.054	0.055	0.054
	(4.10)	(4.11)	(4.13)
R&D/Sales	-0.002	-0.002	-0.002
	(-1.59)	(-1.59)	(-1.61)
Dividend Dummy	-0.004	-0.004	-0.004
	(-5.37)	(-5.34)	(-5.77)
dCash $_t$	-0.143	-0.142	-0.142
	(-9.48)	(-9.54)	(-9.42)
Cash	-1.850	-1.850	-1.860
	(-2.43)	(-2.42)	(-2.41)
Change in Volatility	0.010	0.010	0.010
	(2.21)	(2.30)	(2.33)
Other Contrrols	Yes	Yes	Yes
Observations	30,456	30,456	30,456
Adj. R-sq	0.064	0.063	0.063

Table 7: Risk Shocks and Dividend Policy

This table reports the logistic estimation results on the impact of risk shocks on dividend policy. The sample consists of U.S. listed companies that filed 10-K reports over the time period of 1994 January and 2015 September. The main dependent variables in Columns 1–4 are dividend initiation, dividend omission, dividend increase, and dividend decrease at year t+1. Dividend initiation (dividend omission) is an indicator that equals one if the company initiates (omits) dividends in a certain year. Dividend increase (dividend decrease) is an indicator that equals one if the company increases (decreases) dividends in a certain year. The main independent variables are risk shocks from year t-1 to t in Panel A, and rising and resolving risk shocks from year t-1 to t in Panel B. Other controls in Panel A include industry fixed effects (industry dummies by first two-digit SIC code), year fixed effects. Other controls in Panel B include industry and year fixed effects, M/B ratio, ROA, and log sales. The definitions of all variables are provided in Appendix 2. The numbers in parentheses are *t*-statistics with robust standard errors two-way clustered at the firm and year level.

Panel A: The Impact of Risk Shocks

	Dividend Initiation$_{t+1}$	Dividend Omission$_{t+1}$	Dividend Increase$_{t+1}$	Dividend Decrease$_{t+1}$
	(1)	(2)	(3)	(4)
Risk Shock	-86.590	72.790	-31.090	62.400
	(-2.02)	(2.41)	(-1.81)	(2.79)
Log Firm Age	-0.103	0.147	0.096	0.129
	(-0.49)	(1.19)	(1.29)	(1.73)
Sales Growth	0.058	-0.900	-0.118	-0.618
	(0.18)	(-1.60)	(-0.72)	(-1.92)
Neg. Earn. Dummy	-0.937	1.216	-1.444	0.608
	(-3.24)	(5.32)	(-11.06)	(4.21)
R&D/Sales	-2.031	-7.928	-6.229	-8.217
	(-1.48)	(-4.84)	(-2.90)	(-3.77)
Retained	0.087	0.372	0.605	0.415
Earnings/Assets	(0.65)	(1.78)	(2.64)	(3.63)
M/B Ratio	-0.018	-0.004	-0.001	-0.020
	(-0.60)	(-0.11)	(-0.05)	(-1.02)
ROA	2.080	0.654	2.053	1.470
	(1.45)	(0.55)	(1.84)	(1.92)
Log Sales	0.001	-0.028	0.282	0.057
	(0.02)	(-0.38)	(6.96)	(1.38)
Change in Volatility	-1.022	1.859	-0.418	1.488
	(-2.19)	(2.81)	(-1.72)	(2.44)
Other Controls	Yes	Yes	Yes	Yes
Observations	18,189	17,946	18,633	18,479

Table 7: Risk Shocks and Dividend Policy (Continued)

Panel B: Rising versus Resolving Risk Shocks

	Dividend Initiation$_{t+1}$		Dividend Omission$_{t+1}$		Dividend Increase$_{t+1}$		Dividend Decrease$_{t+1}$	
	Rising	Resolving	Rising	Resolving	Rising	Resolving	Rising	Resolving
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Risk Shock	-0.147	0.213	0.306	-0.268	-0.191	0.189	0.253	-0.212
	(-1.04)	(1.92)	(2.43)	(-1.98)	(-3.13)	(3.16)	(2.54)	(-1.93)
Log Firm Age	-0.055	-0.061	0.147	0.159	0.177	0.100	0.125	0.131
	(-0.47)	(-0.51)	(1.19)	(1.30)	(1.89)	(1.34)	(1.69)	(1.76)
Sales Growth	0.105	0.096	-0.963	-0.956	-0.124	-0.113	-0.614	-0.617
	(0.29)	(0.26)	(-1.50)	(-1.49)	(-0.76)	(-0.69)	(-1.92)	(-1.94)
Neg. Earn. Dummy	-0.920	-0.940	1.209	1.175	-1.416	-1.441	0.602	0.643
	(-3.19)	(-3.13)	(5.60)	(5.86)	(-10.33)	(-11.56)	(4.08)	(4.10)
R&D/Sales	-1.946	-1.951	-7.951	-8.002	-6.241	-6.187	-8.244	-8.217
	(-1.22)	(-1.21)	(-4.95)	(-4.91)	(-2.90)	(-2.88)	(-3.77)	(-3.77)
Retained	0.087	0.091	0.309	0.297	0.857	0.843	0.417	0.425
Earnings/Assets	(0.67)	(0.70)	(1.59)	(1.59)	(3.34)	(3.27)	(3.50)	(3.60)
Change in Volatility	-1.033	-1.023	1.855	1.860	-0.397	-0.394	1.488	1.494
	(-2.19)	(-2.18)	(2.76)	(2.85)	(-1.50)	(-1.48)	(2.39)	(2.36)
Other Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	18,189	18,189	17,946	17,946	18,633	18,633	18,479	18,479

Table 8: Risk Shocks and Stock Repurchases

This table reports the estimation results on the impact of risk shocks on stock repurchases. The sample consists of U.S. listed companies that filed 10-K reports over the time period of 1994 January and 2015 September. The main dependent variables in Columns 1–3 and in Columns 4–6 are, respectively, Net Repurchases (OLS regressions) and Repurchase More than 1% Asset Dummy (logistic regressions), all measured at year t+1. Following Hoberg, Prabhala, and Phillips (2014), the value of net repurchases is defined as purchases of common and preferred stocks less the reduction in the value of preferred stocks outstanding. Repurchase More than 1% Asset Dummy equals one if the value of net repurchases is more than 1% of total assets and zero otherwise. The main independent variables are risk shocks from year t-1 to t (Columns 1 and 4), rising risk shocks from year t-1 to t (Columns 2 and 5), and resolving risk shocks from year t-1 to t (Columns 3 and 6). Risk shock refers to the change in percentage of total words that are risk related from last year. Rising (resolving) risk shock is an indicator that equals one if the firm experiences increasing (decreasing) risk in a magnitude larger than the sample median, and zero otherwise. Other controls include industry fixed effects (industry dummies by the first two-digit SIC code), and year fixed effects. Definitions of all variables are provided in Appendix 2. The numbers in parentheses are *t*-statistics with robust standard errors two-way clustered at the firm and year level.

	Net Repurchases$_{t+1}$ (OLS)			Repurchase More than 1% Asset Dummy$_{t+1}$ (LOGIT)		
	Shocks	Rising Shocks	Resolving Shocks	Shocks	Rising Shocks	Resolving Shocks
	(1)	(2)	(3)	(4)	(5)	(6)
Risk Shock	-2221.500	-11.990	9.902	-18.180	-0.090	0.089
	(-3.56)	(-3.57)	(2.99)	(-1.94)	(-2.26)	(2.40)
Log Sales	6.298	55.680	55.640	0.214	0.215	0.213
	(1.63)	(6.46)	(6.44)	(4.60)	(4.61)	(4.53)
Sale Growth	-12.350	-12.380	-12.340	-0.382	-0.380	-0.377
	(-3.85)	(-3.87)	(-3.88)	(-2.45)	(-2.42)	(-2.39)
R&D/Sales	24.670	24.640	24.680	0.134	0.134	0.135
	(5.45)	(5.47)	(5.46)	(1.68)	(1.71)	(1.72)
Retained	-8.669	-8.625	-8.635	0.082	0.081	0.081
Earnings/Asets	(-2.66)	(-2.63)	(-2.64)	(1.85)	(1.82)	(1.80)
Log Firm Age	6.298	6.288	6.267	0.191	0.193	0.190
	(1.63)	(1.63)	(1.62)	(3.19)	(3.21)	(3.20)
M/B Ratio	2.477	2.457	2.463	0.049	0.049	0.050
	(3.10)	(3.08)	(3.09)	(5.57)	(5.52)	(5.52)
ROA	-38.680	-38.610	-38.650	1.993	1.987	1.992
	(-1.49)	(-1.49)	(-1.49)	(4.83)	(4.82)	(4.82)
Neg. Earn. Dummy	-0.451	-14.730	-15.400	-0.451	-0.451	-0.467
	(-6.31)	(-3.84)	(-4.20)	(-6.31)	(-6.58)	(-7.09)
Change in Volatility	7.180	7.702	7.476	-0.399	-0.396	-0.396
	(0.63)	(0.69)	(0.66)	(-1.57)	(-1.56)	(-1.56)
Other Controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	16,577	16,577	16,577	16,627	16,627	16,627

Table 9: Interactions with Firm Characteristics

This table examines interaction effects between risk shocks and firm characteristics. The sample consists of U.S. listed companies that filed 10-K reports over the time period of 1994 January and 2015 September. We examine change in leverage in Panel A, investment in Panel B, cash holdings in Panel C, and dividend and repurchase policy in Panel D and E, all measured at year t+1. The key independent variables include risk shock, firm dummy, and the interaction term between risk shock and firm dummy, all measured at year t. We control for the same set of variables as in the benchmark regressions, except that we exclude log sales in Column 1 and ROA in Column 2 to alleviate the collinearity issue. Firm dummy is an indicator that equals one if the firm's asset is larger than sample median asset level in Columns 1, if the firm's earning (EBIT) is negative in Column 2, or if the firm's S&P long term bond rating is higher than or equal to BBB, and zero otherwise in Column 3. The numbers in parentheses are *t*-statistics with robust standard errors two-way clustered at the firm and year level.\

	Large Firms	Negative Earning	Investment Grade
	(1)	(2)	(3)
	Panel A: Leverage ($dlev_{t+1}$)		
Risk Shock	0.124	-1.812	-0.537
	(0.20)	(-3.17)	(-0.84)
Risk Shock *Firm Dummy	-1.662	4.679	-1.523
	(-2.42)	(5.49)	(-2.18)
	Panel B: Investment		
	Capital Expenditure ($\%dcapx_{t+1}$)		
Risk Shock	-26.920	-8.089	-20.760
	(-3.99)	(-1.60)	(-3.03)
Risk Shock *Firm Dummy	12.550	-14.790	8.007
	(1.84)	(-1.53)	(1.10)
	Employment ($\%demp_{t+1}$)		
Risk Shock	-6.307	-3.944	-7.220
	(-4.91)	(-3.48)	(-4.58)
Risk Shock *Firm Dummy	0.287	-0.245	5.047
	(0.17)	(-0.13)	(1.92)
	R&D ($\%dxad_{t+1}$)		
Risk Shock	-22.810	-10.060	-11.720
	(-4.51)	(-2.43)	(-1.83)
Risk Shock *Firm Dummy	15.350	-4.761	7.849
	(3.28)	(-0.61)	(0.98)
	Panel C: Cash Holdings ($dCash_{t+1}$)		
Risk Shock	1.860	1.174	1.683
	(3.80)	(4.17)	(2.91)
Risk Shock *Firm Dummy	-0.639	0.189	-1.132
	(-0.96)	(0.27)	(-1.63)

Table 9: Interactions with Firm Characteristics (Continued)

	Large Firms	Negative Earning	Investment Grade
	(1)	(2)	(3)
		Panel D: Dividend Policy	
		Dividend Initiation $_{t+1}$ *(Logit Model)*	
Risk Shock	-72.880	-86.500	-112.200
	(-1.27)	(-2.19)	(-1.84)
Risk Shock *Firm Dummy	-27.320	35.630	96.140
	(-0.33)	(0.36)	(0.55)
		\Dividend Omission $_{t+1}$ *(Logit Model)*	
Risk Shock	28.010	24.980	108.500
	(0.66)	(0.44)	(1.99)
Risk Shock *Firm Dummy	82.230	81.000	-121.000
	(1.26)	(0.95)	(-0.39)
		Dividend Increase $_{t+1}$ *(Logit Model)*	
Risk Shock	-31.990	-32.320	15.500
	(-1.06)	(-1.92)	(0.38)
Risk Shock *Firm Dummy	5.122	-21.52	14.59
	(0.16)	(-2.45)	(0.23)
		Dividend Decrease $_{t+1}$ *(Logit Model)*	
Risk Shock	89.970	30.680	100.200
	(2.17)	(1.11)	(2.62)
Risk Shock *Firm Dummy	-25.34	81.26	-150.9
	(-1.89)	(2.08)	(-1.98)
		Panel E: Repurchase Policy	
		Net Repurchases $_{t+1}$	
Risk Shock	-3871.8	-3042.0	-2177.9
	(-4.50)	(-2.72)	(-3.56)
Risk Shock *Firm Dummy	820.4	1938.9	495.3
	(0.77)	(1.07)	(1.92)

Table 10: Duration of the Impact of Risk Shocks

This table examines the duration of the impact of risk shocks on a variety of corporate decisions. The sample consists of U.S. listed companies that filed 10-K reports over the time period of 1994 January and 2015 September. We examine change in leverage in Panel A, investment in Panel B, cash holdings in Panel C, and dividend and repurchase policy in Panel D and E, all measured at year t+1. The key independent variables include risk shock at year t, at year t-1, and at year t-2. We control for the same set of variables as in the benchmark regressions. In addition, we control for change in volatility at year t, year t-1, and year t-2 in corresponding regressions. The numbers in parentheses are *t*-statistics with robust standard errors two-way clustered at the firm and year level.

Row	Risk Shock(t)	Risk Shock(t-1)	Risk Shock(t-2)	Controls	Observations
		Panel A: Leverage Adjustment			
		Dependent Variable: dlev $_{t+1}$			
(1)	-1.036			Yes	22,311
	(-2.93)				
(2)	-0.864	-0.373		Yes	17,137
	(-2.19)	(-2.96)			
(3)	-1.067	-0.184	-1.209	Yes	13,168
	(-2.77)	(-2.37)	(-2.45)		
		Panel B: Investment Adjustment			
		Dependent Variable: %dcapx $_{t+1}$			
(4)	-17.110			Yes	34,592
	(-3.87)				
(5)	-14.690	-6.062		Yes	26,291
	(-3.07)	(-3.33)			
(6)	-13.980	-4.754	-1.228	Yes	20,002
	(-2.41)	(-2.96)	(-2.34)		
		Dependent Variable: %demp $_{t+1}$			
(7)	-5.918			Yes	34,542
	(-6.19)				
(8)	-4.828	-3.988		Yes	26,279
	(-4.88)	(-6.10)			
(9)	-5.313	-4.579	-3.124	Yes	19,987
	(-5.07)	(-4.93)	(-3.25)		
		Dependent Variable: %dxrd $_{t+1}$			
(7)	-9.428			Yes	15,321
	(-4.36)				
(8)	-7.511	-4.542		Yes	11,595
	(-3.25)	(-2.03)			
(9)	-5.047	-5.315	-3.552	Yes	8,793
	(-2.16)	(-1.86)	(-1.81)		
		Panel C: Cash Holdings			
		Dependent Variable: dcash $_{t+1}$			
(10)	1.549			Yes	30,456
	(5.75)				
(11)	1.052	0.805		Yes	24,579
	(3.01)	(1.92)			
(12)	1.454	0.755	1.035	Yes	19,098
	(4.23)	(1.75)	(4.33)		

Table 10: Duration of the Impact of Risk Shocks (Continued)

Row	Risk Shock(t)	Risk Shock(t-1)	Risk Shock(t-2)	Controls	Observations
			Panel D: Dividend Policy		
			Dependent Variable: Dividend Initiation $_{t+1}$ (Logistic Model)		
(13)	-86.590			Yes	18,189
	(-2.02)				
(14)	-84.650	15.990		Yes	13,248
	(-1.77)	(0.47)			
(15)	-72.340	34.140	10.930	Yes	9,426
	(-1.16)	(1.00)	(0.25)		
			Dependent Variable: Dividend Omission $_{t+1}$ (Logistic Model)		
(16)	72.790			Yes	17,946
	(2.41)				
(17)	79.150	74.270		Yes	12,952
	(2.30)	(1.45)			
(18)	53.850	53.730	-67.330	Yes	8,735
	(1.11)	(0.79)	(-1.18)		
			Dependent Variable: Dividend Increase $_{t+1}$ (Logistic Model)		
(19)	-31.090			Yes	18,633
	(-1.81)				
(20)	-25.700	-21.490		Yes	13,517
	(-1.18)	(-0.99)			
(21)	-8.480	-2.818	17.780	Yes	9,823
	(-0.37)	(-0.11)	(0.79)		
			Dependent Variable: Dividend Decrease $_{t+1}$ (Logistic Model)		
(22)	62.400			Yes	18,479
	(2.79)				
(23)	60.120	12.050		Yes	13,384
	(2.31)	(1.48)			
(24)	62.270	12.330	11.770	Yes	9,705
	(2.04)	(2.36)	(1.04)		
			Panel E: Repurchase Policy		
			Dependent Variable: Net Repurchase $_{t+1}$		
(25)	-2221.500			Yes	16,577
	(-3.56)				
(26)	-2868.300	-1687.900		Yes	12,177
	(-3.15)	(-3.40)			
(27)	-3531.300	-1692.500	-508.700	Yes	8,952
	(-3.72)	(-2.19)	(-0.58)		

Appendix 1: List of Risk Related Keywords

This table present the list of key word stem and corresponding key words for constructing the risk measure.

Key Word Stem	Key Words
accid	accident accidents
advers	adverse adversely adversity adversities
compet	compete competent competing competes competencies competence competency competed competently
competi	competition competitions
competit	competitive competitiveness competitively
competitor	competitors competitor
crisis	crisis
difficult	difficult
difficulti	difficulties difficulty
downgrad	downgrade downgraded downgrades downgrading
downturn	downturn downturns
downward	downward
fail	fail fails failed failing
failur	failure failures
impair	impairment impaired impair impairments impairing impairs
inconsist	inconsistent inconsistency inconsistencies inconsistently
lose	lose losing loses
loss	loss losses
lost	lost
neg	negative negatively negatives
nonperform	nonperforming nonperformance
pressur	pressure pressures pressured pressurized pressurization pressuring pressurizer pressurize
risk	risk risks risked risking
riski	risky riskiness
slowdown	slowdown slowdowns
unabl	unable
weaken	weakening weakened weaken weakens
weaker	weaker
weak	weaknesses weakness

Appendix 2: Variable Definitions

Variable	Definitions
Text-based Risk Variables	
Total Meaningful Words in 10K Files	Total number of meaningful word stems in the entire 10k file.
Risk-related Words in 10K Files	Total number of risk related word stems (shown in Appendix 1) in the entire 10k file.
Risk Level	The ratio of risk-related words to Total Meangingful Words in 10K files.
Risk Shock	Annual change in Risk Level.
Positive Risk Shock	A dummy variable that equals one when the firm experiences increasing risk in a magnitude larger than the sample median, and zero otherwise.
Negative Risk Shock	A dummy variable that equals one when the firm experiences decreasing risk in a absolute magnitude larger than the sample median, and zero otherwise.
Corporate Policy Variables	
Book Leverage	Total liabilities/total assets.
Active change in Book Leverage (dlev)	total liabilities$_t$/(total assets$_t$-(retained earnings$_t$- retained earnings$_{t-1}$))- total liabilities$_{t-1}$/total assets$_{t-1}$
% Change in Debt (%dDebt)	Annual percentage change in total liabilities: (total liabilities$_t$-total liabilities$_{t-1}$)/total liabilities$_{t-1}$
% Change in Equity (%dEquity)	Annual increase in stockholders' equity minus annual increase in retained earnings divided by stockholders' equity last year: (shareholder's equity$_t$-shareholder's equity$_{t-1}$-(retained earnings$_t$- retained earnings$_{t-1}$))/shareholder's equity$_{t-1}$
Capital Expenditure	Capital expenditure in million dollars.
% Change in Capital Expenditure (%dcapx)	Percentage change in capital expenditure.
Employment	Number of employees in thousand dollars.
% Change in Employment (%demp)	Percentage change in Employment.
R&D	Research and development expenses. We replace missing values with zero.
% Change in R&D (%dxrd)	Percentage change in R&D.
Advertising Expense	Research and development expenses. We replace missing values with zero.
% Change in Advertising Expense (%dxad)	Percentage change in advertising expense.
Cash	Cash and short term investments in million dollars.
Cash/Assets	Cash and short term investments divided by total assets.
Change in Cash/Assets (dcash)	Annual change in Cash/Assets.
Dividends (millions)	Dividends declared on common equities in million dollars.
Dividend Initiation	A dummy variable that equals one if the company innitiates dividends and zero otherwise.
Dividend Omission	A dummy variable that equals one if the company omits dividends and zero otherwise.
Dividend Decrease	A dummy variable that equals one if the company decreases dividends and zero otherwise.
Dividend Increase	A dummy variable that equals one if the company increases dividends, and zero otherwise.
Net Repurchases	Purchases of common and preferred stock (Compustat item "prstkc") less the reduction in the value of preferred stocks outstanding (Compustat item "pstkrv").
Repurchase More than 1% Asset	An indicator variable that equals one if Net Repurchases is more than 1% of total assets

Appendix 2: Variable Definitions (Cont.)

Variable	Definitions
Corporate Control Variables	
Assets	Total assets in million dollars.
Cash Flow/PPE	Earnings before extraordinary items plus depreciation normalized by the amount of property, plant, and equipment.
Cash/Interest Expenses	Cash and short term investments divided by interest expense.
Credit Rating	An indicator variable for S&P Domestic Long Term Issuer Credit Rating. It ranges from 2
Dividend Yield	Dividends per share divided by fiscal year end stock market price.
Earnings Volatility	Standard deviation of operating income/total asset using past five year data.
Effective Tax Rate	Income tax divided by pretax income.
Financial Deficit/Sales	Difference between cash outflow and internally generated cash flow. Cash outflow includes investment in PPE, intangible assets, and increase in net working capital. Internally generated cash flow includes net income plus depreciation and amortization and deferred tax minus dividends.
Firm Age	Number of years since date of IPO.
Market Leverage	(total assets - stockholders' equity)/(total assets - stockholders' equity + market value of equity).
M/B Ratio	Market value of equity divided by book value of equity.
Neg. Earn. Dummy	A dummy variable that equals one if net income is negative, and zero otherwise.
Net Working Capital/Assets	Net working capital divided by total assets.
R&D/Sales	R&D divided by net sales.
Retained Earnings/Assets	Retained earnings divided by total assets.
ROA	EBIT divided by total assets.
Sales	Net sales in million dollars.
Sales Growth	Percentage of change in net sales.
Stock Return	Annualized daily stock return in the fiscal year.
Stock Return Volatility	Annualized daily stock return volatility including dividend.
Tangibility	Net property, plants and equipments divided by total assets.
Tobin's Q	The sum of total liabilities and market value of equities divided by book value of assets.
Macroeconomic Variables	
Default Spread between Baa and Aaa Bonds	Default Spread between Baa and Aaa rated Bonds.
Industrial Production Growth	Industry production growth from one year ago.
Constant 1-year Maturity Treasury Bill Yield	Constant 1-year Maturity Treasury Bill Rate .
S&P 500 Return	Annual return of S&P 500 index.
VIX	CBOT option-implied annaulized volatility.