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Abstract

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JEL Classification: G32, G34

Keywords: unemployment risk, Human Capital, Executive compensation, Risk Taking, leverage

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Abstract

We investigate the impact of workers' exposure to unemployment risk on the design of CEO incentive compensation. Through its impact on risk-taking activities, option-based compensation is likely to also influence unemployment risk which is internalized by the firm. Exploiting state-level changes in unemployment benefits as a source of variation in workers' unemployment costs, we find that after unemployment insurance benefits become more generous boards increase the CEOs' convex payoff structure. This behavior is consistent with the view that CEO's risk-taking incentives are amplified by the board to take advantage of lower costs associated with unemployment risk. The increase in convexity payoff structures is stronger when CEO wealth is tied closely to firm performance, more pronounced in labor-intensive industries, and attenuated by the strength of unionization. Changes in the incentive structures are associated with riskier investment and financing strategies and better performance. Results suggest that executive compensation is one mechanism used by boards to internalize labor market frictions in firms' decisions.

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Stock options promise executives all of the benefits of share price increases with none of the risk of share price declines…Stock options can encourage excessive risk taking and prompt executives to pursue corporate strategies designed to promote short-term stock price gains to the detriment of long-term performance and stability.[1]

- American Federation of Labor and Congress of Industrial Organizations

I. Introduction

Firms' nonfinancial stakeholders, especially workers, can play a significant role in affecting corporate financial and investment policies. Workers' claims are sizeable: in 2014 the defined benefit pension liabilities for S&P 500 firms alone stood at $1.7 trillion.[2] The magnitude of these claims is likely to influence important firm decisions. Several studies show, both theoretically and empirically, that unemployment risk faced by rank-and-file employees is one of the drivers of firms' leverage decision (Titman, 1984; Berk, Stanton, and Zechner, 2010; Bae, Kang, and Wang, 2011; Agrawal and Matsa, 2013). By choosing a more conservative leverage ratio, firms decrease the probability of financial distress and mitigate workers' exposure to unemployment risk. If firms choose to take conservative decisions to mitigate its workforce's unemployment concerns, then boards, acting in the interests of diversified shareholders, will naturally want to take on higher risks when workers' unemployment risk decreases. Recent evidence by Agrawal and Matsa (2013) shows that this is the case: Using changes in state-level unemployment insurance benefits as shocks to unemployment costs, they find evidence that as workers' unemployment risk decreases, firms respond by increasing the use of debt.

However, much less is known about the channel through which changes in workers' exposure to unemployment risk produce changes in firms' risk-taking behavior, such as higher leverage. This is especially important when considering the managers' risk preferences. Unlike diversified shareholders, managers are risk-averse because they have their human capital and a large portion of their personal wealth

[1] Comments provided by the "AFL-CIO" on the proposed rule on incentive-based compensation arrangements under Section 956 of the Dodd-Frank Wall Street Reform and Consumer Protection Act. See 'http://www.sec.gov/comments/s7-12-11/s71211-705.pdf'.

[2] The 2015 Wilshire Consulting Report on Corporate Pension Funding Levels.

closely tied to their companies' performance. As a result, managers usually prefer to take an amount of risk that falls below the level desirable for shareholders (Jensen and Meckling, 1976; Amihud and Lev, 1981; Smith and Stulz, 1985; Holmstrom, 1999; Gormley and Matsa, 2016). A more generous public provision of unemployment insurance should lead boards to increase risk-taking but this course of action will meet the obstacle engendered by the agency conflict arising from the managerial risk preferences. Any change in the public provision of unemployment insurance will significantly affect workers' concern over unemployment risk but leaves unchanged the incentives of risk-averse top-ranking managers who are tasked with taking firm decisions.

The question that naturally arises is how managers can be incentivized to overcome their natural risk aversion and career concerns and increase the firm's risk-taking activities following decreases in the unemployment costs borne by rank-and-file employees. In this paper we fill this gap in the literature by investigating whether boards of directors adjust the structure of the Chief Executive Officer's compensation, specifically the convexity payoff through the option-based compensation, to change the CEOs' risk-taking incentives following changes in the state-level unemployment insurance benefits.

Option-based incentive compensation has long been suggested as a solution to the risk-related agency problem that risk-averse managers tend to pass up risky but positive net present value projects that are desired by diversified shareholders (Smith and Stulz, 1985; Heron and Lie, 2016). Consistent with this conjecture, extant research has examined the *ex-post* economic consequences of the incentive compensation and found a positive association between risk-taking incentives in managerial compensation and various proxies of firm risk (Guay, 1999; Coles, Daniel, and Naveen, 2006; Gormley, Matsa, and Milbourn, 2013). Although it is beneficial for shareholders to mitigate managerial risk aversion via the use of option-based compensation, the increased risk-taking behavior and financial instability induced by the convex payoff structure of stock options can be detrimental to the firm's rank-and-file employees whose job security can be adversely affected when the risk of financial distress goes up as the quote above suggests. A more generous provision of unemployment benefits should attenuate workers' concerns and allow boards to relax the constraints on risk-taking via a more powered compensation structure.

For boards to internalize workers' concerns it must be the case that they are important for firms' performance. Studies from labor economics have shown that workers bear substantial costs in the process of involuntary unemployment. For example, those who are laid-off involuntarily experience reductions in personal consumption (Gruber, 1997), go through delays and costly searching before finding another job (Katz and Meyer, 1990), fail to maintain previous wage level even after reemployment (Farber, 2005), and also endure psychological and social costs (Kalil and Ziol-Guest, 2008).[3] Anticipating the significant costs during unemployment, employees care about unemployment risk and *ex ante* require a premium in salaries or other benefits to compensate for the high level of unemployment risk they face (Abowd and Ashenfelter, 1981; Topel, 1984; Chemmanur, Cheng, and Zhang, 2013). They also take the financial stability and unemployment risk into consideration when they screen the potential employers (Brown and Matsa, 2016).

Given the increasing importance of employees' human capital and firms' reliance on the specific investments made by labor forces (Zingales, 2000), firms bear non-trivial costs of exposing workers to significant unemployment risk. First, the labor costs represent a large proportion of a firm's total expenses and the premium wages a firm has to offer to compensate for the potential job loss increase with the risk environments of a firm's operations. Second, high unemployment risk could reduce employees' willingness to undertake specific human capital investments and undermine firms' productivity to utilize assets in place and exploit future growth opportunities (Titman, 1984; Zingales, 2000). Since the risk-taking incentives embedded in managerial incentive compensation have a crucial impact on a firm's risk environment (see Gormley, Matsa, and Milbourn (2013) for a review of the relevant literature), the board should weigh the benefits of providing risk-averse managers with proper incentives to take more risk and the costs of exposing employees to significant unemployment risk when designing the CEO's compensation package.[4]

[3] See the comment letters from displaced workers filed with the SEC describing their losses and sufferings during the economic turmoil, part of which was attributed to risk-taking induced by incentive-based managerial compensation, 'http://www.citizen.org/documents/Public-Citizen-Comments-SEC-956.pdf'.

[4] In the United States, the Constituency laws extend the fiduciary duty of board of directors to consider the interests of non-shareholder stakeholders when making business decisions.

Empirically verifying the above conjecture proves challenging due to the lack of an appropriate proxy for labor unemployment risk and the difficulty to establish causality. To mitigate these potential issues, we follow Agrawal and Matsa (2013) and exploit the state-level changes in unemployment insurance benefits as a source of variation in the costs borne by employees during unemployment spells.

State unemployment insurance (henceforth "UI") benefit laws provide temporary income to eligible workers who become involuntarily unemployed and are still actively looking for new job positions. Although the basic framework of the unemployment insurance provision is set up commonly across the nation, individual states have the autonomy to decide on the specific parameters of the program, such as the eligibility of the applicant, the duration for which the insurance is provided, and the maximum amount of weekly benefits paid. The labor economics literature has shown that state UI benefits have a significant impact on workers' economic behaviors and the aggregate labor supply (Topel, 1984; Meyer, 1990, 1995; Hsu, Matsa, and Melzer, 2014). More specifically, more generous state unemployment benefits reduce workers' *ex-post* costs during unemployment spells and can partially mitigate their *ex-ante* concern and required compensation for unemployment risk. As workers become more tolerant of the risk of financial distress, the board of directors can reshape the risk environment of the firm by providing managers with more risk-taking incentives as a way to mitigate the risk-related agency conflicts and better align the interests of executives with those of shareholders.

We empirically test this hypothesis using a comprehensive sample of 32,561 firm-year observations between 1992 and 2013. Following the compensation literature (e.g. Guay, 1999), we measure the risk-taking incentives provided in the CEO compensation package by the sensitivity of the CEO's wealth to a firm's stock return volatility (*vega*). We calculate vega based on the CEO's compensation flows (*flow vega*) since this dimension of the compensation package can be adjusted by boards of directors immediately following a shock to workers' exposure to unemployment risk (Hayes, Lemmon, and Qiu, 2012; Gormley, Matsa, and Milbourn, 2013).

Our multivariate regression analysis shows that boards do adjust the convexity payoff in the year *following* a change in state-level UI benefits along the maintained hypothesis: CEO flow vega increases

following an increase in state UI benefits. This result is robust to controlling for a wide array of firm-specific characteristics and state-level economic conditions, as well as industry (and industry-year), firm-level, CEO-level, and firm-CEO fixed effects that will absorb any unobserved characteristics at the industry (and industry-year), firm, CEO, or firm-CEO levels that may drive the compensation structure choices. Importantly, we also include (headquarters) state fixed effects that should absorb any state-level effects that could affect both UI benefit changes and firm-level compensation choices and that are not captured by the state observables we use as controls. We also explore whether the state-level political cycle, specifically gubernatorial elections, may drive our results and find no evidence for this explanation. The positive impact of UI benefit generosity on CEO flow vega is also significant economically. A one-standard-deviation increase in the logarithm transformation of maximum UI benefits leads to a 12.8% increase in CEO flow vega. We further examine the channel of the increase in CEO flow vega and find that the increase is driven by stock options rather than restricted stocks in the CEO annual compensation package.

These results lend support to our hypothesis that more generous public UI reduces workers' concerns over job security and thereby leaves boards of directors more room to increase risk-taking incentives provided to top executives.[5] Naturally, boards responding to UI benefit changes should adjust the payoff convexity the most when the CEO's risk aversion is highest. One widely used measure for the CEO's risk aversion is the compensation delta (Knopf, Nam, and Thornton, 2002). We find that CEOs whose wealth is most sensitive to stock prices (i.e. higher delta in their compensation package) experience the largest adjustment in their flow vega after the UI benefit increase. While we mostly focus on the payoff convexity of the most powerful executive, it is to be expected that a significant change in the risk-taking behavior may be a decision taken by the entire executive team. In that case, the board should not only adjust the convexity payoff of the CEO but of the entire executive team as well. That is precisely what we find when we investigate the flow vega of the top executives.

[5] To address the concern that using the UI benefits of the headquarters state likely causes measurement errors when firms have geographically-dispersed workforce, we obtain the geographic distribution of a firm's employees across states from the LexisNexis Corporate Affiliations Database and find that our results continue to hold using a refined measure of state UI benefits.

To further establish the causal relationship between state UI benefits and CEO flow vega, we conduct two falsification tests on the timing and location of the UI policy change. An examination on the timing of the relationship between the UI benefit change and CEO flow vega suggests that boards adjust the level of risk-taking incentives provided in CEO compensation *only after* the change of UI benefits. No contemporaneous or reverse patterns are revealed in the data, suggesting that the effect we document is not due to omitted economic conditions or local investment opportunities that tend to be persistent and sticky over time. In the second test, we examine whether the board responds to changes in UI provisions in states that are adjacent to the firm's headquarters state where local economic conditions tend to be similar. We find that bordering states' UI policies do not have any significant impact on CEO flow vega.

A further Difference-in-Differences investigation confirms these results and show that the treatment firms headquartered in states (counties) that experience a large increase in UI benefits significantly increase the CEO flow vega relative to a group of control firms headquartered in neighboring states (contiguous counties located in a neighboring state) that do not experience such large increases in UI benefits. Overall, these findings support the causal interpretation of the positive effect of UI benefits on CEO flow vega and indicate that it is unlikely driven by some omitted variables related to local economic development and investment opportunities.

To further explore the mechanism behind our results, we examine whether the positive relation between the generosity of state UI policy and CEO vega exhibits any cross-sectional variations in terms of labor market characteristics as the hypothesis would predict. If the channel through which UI benefits generosity affects CEO vega is the influence on employees' unemployment risk that is internalized by the board, then we expect its effect to be more pronounced when labor is more important as a production input factor. Consistent with this conjecture, we find that the positive effect of UI benefits on CEO vega is more pronounced for firms operating in labor-intensive industries. Furthermore, we also find that this effect is significantly weaker for firms operated in unionized industries, consistent with unionized workforce having strong collective bargaining power and thus the strength to significantly attenuate the board's ability to reshape the risk environment of the firm in the first place.

Finally, we examine whether the higher convexity in CEO compensation following the UI policy change induces more corporate risk-taking behavior. Consistent with Agrawal and Matsa (2013), we find that higher UI benefits lead to higher leverage ratios. The effects are not confined to leverage: we also find that firms invest more on R&D, less in capital expenditures and liquid assets, are less likely to conduct diversifying acquisitions following increases in UI benefits. More importantly, the adjustment in corporate risk-taking behavior is confined to firms where CEO flow vega has experienced a larger increase. Overall, these effects suggest that the boards' objective following an increase in UI benefits is reached because managers respond to such incentives. Importantly, the higher risk-taking activities are associated with significant improvement in companies' operating performance.

Our study makes two major contributions to the literature. First, we contribute to a growing literature on labor and finance. Existing studies of labor and finance (Titman, 1984; Berk, Stanton, and Zechner, 2010; and Agrawal and Matsa, 2013) show that unemployment risk faced by workers is one of the drivers of firms' financial policies. We are the first to show that one channel through which employee unemployment risk is internalized by boards and ends up affecting corporate policies is the adjustment of managerial risk-taking incentives embedded in executive compensation. One interpretation of our results is that boards do consider rank-and-file workers' unemployment risk and adjust the risk-taking incentives given to the top management to reflect such risks. Importantly, this board strategy appears to emerge mostly when workers constitute an important input in the firms' production function and is attenuated by workers' bargaining power.

Second, we add a new dimension to the executive compensation literature by showing that worker unemployment risk, a salient feature of labor market frictions, can play a significant role in the design of CEO pay. Prior research such as Smith and Watts (1992) and Guay (1999) show that firms tend to use stock options to encourage managers to take more risk when there are more investment opportunities. Recent studies exploit shocks to a firm's risk environment (Gormley, Matsa, and Milbourn, 2013; De Angelis, Grullon, and Michenaud, 2015) or regulatory changes (Low, 2009; Hayes et al., 2012; Cohen, Dey, and Lys, 2013) and investigate how boards adjust CEO risk-taking incentives accordingly. We extend this

literature by highlighting the role of rank-and-file employees in affecting the level of risk-taking incentives provided to managers. Our findings suggest that workers' exposure to unemployment risk is an important factor to consider when boards design the incentive contracts for managers.

The rest of the paper is organized as follows. Section II describes the sample selection procedure, the construction of key variables, and presents summary statistics for variables used in the paper. The empirical results are presented in Section III. Section IV concludes the paper.

II. Sample construction and variable definition

A. Sample construction

We obtain the executive compensation information from the Compustat ExecuComp database. Our sample period spans from 1992 to 2013 since ExecuComp began covering executive compensation information of S&P 1500 firms in 1992. We obtain firm financial information from Compustat and stock return data from CRSP. Information on companies' historical headquartering states is from WRDS SEC Analytics Suite database which records the location of firms' historical headquarters based on their 10-k filings. Our final sample consists of 3,050 unique firms and 32,561 firm-year observations.

B. Measuring unemployment insurance (UI) benefits

We manually collect the amount of UI benefits for each state-year from the "Significant Provisions of State UI Laws" published by the U.S. Department of Labor.[6] Although the basic framework of the UI provision is set up by the joint federal-state system, the specific program parameters and hence the generosity of UI provision varies significantly across different states and time periods. Two upper bounds of the parameters specified by the state legislation are especially important in determining the generosity of the UI policy. Specifically, the amount of benefits an eligible claimant can receive during the process of

[6] The information is available on the following website: http://workforcesecurity.doleta.gov/unemploy/statelaws.asp.

unemployment is capped by the allowed maximum amount of weekly benefit and the maximum benefit duration. Therefore, we follow Agrawal and Matsa (2013) and measure the generosity of each state's UI system by the product of the maximum dollar amount of weekly benefit, measured in 2002 constant dollars using the Consumer Price Index, and the maximum benefit duration. While these unemployment benefits can be considered as sizeable when compared to the wage earned by the rank-and-file employee, they pale in comparison to the compensation given to top executives.[7] Hence, their impact should influence the behavior of rank-and-file workers but not that of CEOs or top executives. Note that since we adjust UI for inflation, our results will not be driven in any way by the mechanical adjustments made to UI benefits due to inflation.

C. Measuring managerial risk-taking incentives

To capture the risk-taking incentives inherent in a CEO's compensation package, we follow prior studies (e.g., Guay, 1999; Core and Guay, 2002; Coles et al., 2006) and we start by calculating the compensation vega of the CEO's stock and option portfolio in the firm. Specifically, vega is the dollar change in the value of a CEO's stock and option portfolio per 0.01 increase in the annualized standard deviation of a firm's stock returns. To the extent that vega captures the convexity of the relation between a CEO's wealth and the firm's stock performance, it provides a straightforward measure of the CEO's incentive to undertake financing and investment policies that will increase firm risk (Smith and Stulz, 1985; Guay, 1999).

Our objective is to explore the actions initiated by the board in adjusting the manager's current pay following the change in UI benefits. Since the *current* stock and option grants through annual compensation packages are under more direct control of the board, we focus on the newly granted equity incentives, i.e. flow vega, based on a CEO's equity grants in the current fiscal year (Hayes et al., 2012; Gormley, Matsa,

[7] According to the statistics in Panel C of Table 1, the maximum UI benefits can replace about 50% of the worker's average semi-annual wages. In contrast, the maximum UI benefits only represent 0.2% of the total compensation of the average CEO in our sample.

and Milbourn, 2013). Prior studies also have shown that the risk-taking incentive provided by the current portion of outstanding compensation can be quickly adjusted in response to regulatory changes (Low, 2009) or shocks to firms' risk environment (Gormley, Matsa, and Milbourn, 2013; De Angelis, Grullon, and Michenaud, 2015).[8]

D. Summary statistics

Table 1 reports the summary statistics of the variables used in our analysis. We convert *all variables*, including UI benefits, into 2002 constant dollars using the Consumer Price Index.

[Insert Table 1 here]

As shown in Panel A of Table 1, CEO flow vega has a mean of $26,172 and a median of $6,864. Both numbers are broadly consistent with those (a mean of $29,264 and median of $9,866) reported in Hayes et al. (2012) whose sample period is from 2002 to 2008. A break-down of the equity-based incentive compensation indicates that stock options are the largest component of a CEO's equity grants. The value-based (number-based) portion of stock options represents approximately 70.2% (75.5%) of the newly-granted equity awards. In dollar terms, cash-component of CEO compensation in the form of salary and bonus accounts for about 44.5% (37.9%) for the average (median) firm in the sample.

Panel B of Table 1 presents the summary statistics of firm and CEO characteristics. The average (median) firm in our sample has a book value of total assets of $10,420 ($1,418) million, a market-to-book ratio of 1.933 (1.478), a return on assets (ROA) of 0.036 (0.043), and a tangible-to-total assets ratio of 0.273 (0.202). CEO tenure has a mean of 7.5 years and a median of 5 years. 56.3% of CEOs are also chairman of the board. As for firms' investment and financial policies, the average (median) firm in our sample has a leverage ratio of 22.0% (20.2%), a ratio of R&D to total assets of 2.8% (0%), a ratio of capital expenditure to total assets of 5.4% (3.9%), and a ratio of cash holdings to total assets of 14.1% (7.0%). We also obtain

[8] In unreported results, we find that a CEO's vega from her complete stock and option portfolio is also positively related to the generosity of UI benefits but the relationship is not statistically significant at the conventional level. This result is consistent with the conjecture that vega from a CEO's complete stock and option portfolio takes time to change while flow vega from the annual stock and option grants respond much more quickly to external shocks.

information on firms' acquisition activities from SDC and find that 74.2% of our sample firms acquired targets from a different industry during the sample period. As a measure of the riskiness of a firm's assets, the annualized standard deviation of daily stock returns has a mean of 43.0% and a median of 38.2%.

Summary statistics of the state-level variables are reported in Panel C of Table 1. On average, a state permits a maximum amount of wage benefit of approximately $359 per week and that benefit allowance can be received by an eligible claimant for as long as 26 weeks. Our key variable of interest, the generosity of the UI policy, constructed by multiplying the maximum amount of weekly benefit with the maximum benefit duration, has a mean of $9,470 and a median of $9,002. As an alternative measure of UI generosity, we calculate the wage-replacement rate, defined as the dollar amount of UI benefits scaled by the industry mean or median semi-annual wage. The average replacement rate ranges from 50.5% to 61.8%, depending on whether industry mean or median worker wage is used. To account for local economic conditions that may be correlated with state UI benefits, we control for GDP growth rate and unemployment rate in each state-year. The state GDP growth rate has a mean (median) of 2.287% (2.325%) and the state unemployment rate has a mean (median) of 6.022% (5.400%).

III. Empirical results

A. Univariate analysis

We start the empirical analysis with an exploration of the cross-sectional correlation between CEO vega and several proxies for the labor unemployment risk at the industry or state level. Firms across different industries may have different propensity to dismiss workers. Their dependence on labor as a major input could also vary with production technologies in different sectors. If boards of directors trade off the benefit of incentivizing managers to take risk and the cost of exposing workers to high unemployment risk, we should observe a lower level of risk-taking incentive provided in CEO compensation in those industries characterized with higher layoff propensity and labor intensity. Following Agrawal and Matsa (2013), we measure layoff propensity as the long-run layoff separation rates from the "Mass Layoff Statistics" constructed by U.S. Bureau of Labor Statistics. Specifically, the layoff propensity is calculated as the ratio

of workers affected by a mass layoff to total industry employment at the two-digit NAICS level. As for labor intensity at the industry level, we calculate the median ratio of total labor expenses (XLR) to sales (SALE) for all Compustat firms in each two-digit NAICS industry. Then we plot the industry average CEO vega, against these two industry characteristics in 2002, a year in the middle of our sample period. The results are presented in Figure 1 and 2.

[Insert Figure 1 and 2 here]

Consistent with our prediction, there is a negative correlation between industry average CEO vega and layoff separation rate in Figure 1, suggesting that boards tend to provide less risk-taking incentive when companies operate in industries with high layoff propensities. The negative relationship is also observed in Figure 2 when we use labor intensity to capture the importance of labor among the production inputs. The pattern from these two figures suggests that when designing CEO incentive compensation, boards tend to provide less risk-taking incentives when the unemployment concern for workers is nontrivial.

Besides the industry-specific characteristics, a worker's exposure to unemployment risk is also affected by the generosity of state-level UI policy. A generous UI provision can to a large extent reduce the ex-post costs that workers experience when unemployed. Similar to Figure 1 and 2, we plot the average CEO vega for firms operating in each state against the state-level UI generosity in Figure 3A. We observe a positive relationship between CEO vega and state UI generosity measured by the natural logarithm of the maximum total unemployment insurance benefit under the state's unemployment insurance system. The positive correlation is consistent with the argument that more generous UI benefits reduce workers' concerns over unemployment risk and hence allow firms to provide more risk-taking incentives for their managers. To ensure that the positive correlation between state average CEO vega and state UI benefit is not driven by omitted geographical factors, such as regional economic conditions, we conduct a placebo test and plot in Figure 3B the state average CEO vega against the UI generosity in bordering states, since bordering states tend to have similar macroeconomic conditions. Very interestingly, there is no clear pattern in Figure 3B, suggesting that the positive correlation shown in Figure 3A is not driven by the regional economic environment.

[Insert Figure 3A and 3B here]

B. Baseline regressions

Although the univariate analysis presented above is straightforward and informative on how some industry- or state-specific proxies of labor unemployment concerns are correlated with CEO incentive compensation, it is difficult to draw any casual conclusion. To establish causality, we follow Agrawal and Matsa (2013) and exploit the state-level changes in unemployment insurance benefits as a source of variation in the costs borne by employees during unemployment. The setting is ideal for testing our hypotheses because the state-level changes in UI benefits can significantly alter workers' perception over unemployment concern without affecting the risk appetite of the CEO.

Specifically, we conduct a firm-level multivariate regression in which we regress the level of risk-taking incentive in the current year (CEO flow vega) on the logarithm of state-level maximum UI benefits measured in the previous year while controlling for a comprehensive array of firm-, CEO-, and state-specific variables. The firm-panel regression we estimate is specified as follows:

$$Incentive_{i,j,s,t} = \alpha_1 Log\ max\ total\ benefit_{s,t-1} + X_{i,j,s,t}\beta + Y_{s,t}\gamma + u_i + v_{jt} + w_s + \varepsilon_{i,j,s,t}$$

where $Incentive_{i,j,s,t}$ represents the level of risk-taking incentive embedded in a CEO's annual compensation package at firm *i* from industry *j* in state *s* and year *t* (i.e., CEO flow vega). $Log\ max\ total\ benefit_{s,t-1}$ denotes the logarithm of maximum UI benefits in state *s* in the previous year. We also follow the previous literature on the design of CEO incentive-based compensation (Guay, 1999; Hayes et al., 2012; Gormley et al., 2013) and control for a series of contemporaneous firm- and CEO-level characteristics ($X_{i,j,s,t}$) that may affect CEO vega. The firm-level characteristics we control for include firm size (measured by the logarithm transformation of the book value of total assets), leverage, market-to-book ratio, return on assets (ROA), tangibility (measured by PPE scaled by book value of total assets), and firm risk (measured by logarithm transformation of stock return volatility). The CEO characteristics that we control for include CEO tenure,

an indicator for whether the CEO is also chairman of the board, and cash compensation as a portion of the CEO's total annual compensation.

In addition to firm and CEO characteristics, we also control for contemporaneous state-level economic factors ($Y_{s,t}$) such as state GDP growth rate and unemployment rate. Changes in unemployment insurance benefits could be a response to changes in state economic conditions and at the same time these local economic conditions may affect companies' investment opportunities and further influence managers' incentive compensation.

Finally, we include several fixed effects to account for different unobservables that may drive the relationship between unemployment insurance and CEO's convex payoffs. First, we include firm fixed effects (u_i) to account for firm-specific but time-invariant attributes and year fixed effects to capture any time-trend of CEO compensation. Second, to account for time-varying differences across industries, we replace year fixed effects with industry-year fixed effects (v_{jt}). Third, it is also possible that state-level variables, beyond the observables we use in the control set, may also drive the basic relationship of interest. To account for these unobserved characteristics we further control for headquarters state fixed effects (w_s). Finally, we replace firm fixed effects with CEO fixed effects to account for CEO unobserved characteristics, such as ability, that may influence the compensation structure. We also account for the double-matching dimension of compensation (Graham, Li, and Qiu, 2012) by including CEO-firm fixed effects. Table 2 reports the results from these regressions.

[Insert Table 2 here]

In column (1) we only include our key independent variable, *Log max total benefit*$_{t-1}$, and firm fixed effects as well as year fixed effects. The coefficient estimate of *Log max total benefit*$_{t-1}$ is positive and statistically significant at the 5% level, suggesting that CEO flow vega increases following an increase in the generosity of state UI benefits. In column (2) we add all the firm-, CEO-, and state-level control variables, while keeping the firm-level and year fixed effects, and continue to find a positive and significant coefficient estimate of *Log max total benefit*$_{t-1}$.

In column (3), we replace the year-fixed effects with industry-by-year fixed effects to control for unobserved and time-varying differences across different industries but keep the firm fixed effects. To further control for unobserved state-level factors, we add state-fixed effects in column (4). The coefficient estimates of *Log max total benefit*$_{t-1}$ continue to be positive and statistically significant after we control for these higher-order fixed effects in these two separate specifications. This means that the result that boards change the convexity payoff following UI benefit changes cannot be explained by any unobserved firm-level, state-level or time-varying industry-level characteristic that is not captured by the set of control variables we use. The effect of the increase in state UI benefits on CEO flow vega also appears to be economically significant. Specifically, using the coefficient estimate in column (4), we find that a one-standard-deviation increase in the logarithm of maximum UI benefits is associated with a 12.8% increase in CEO flow vega. These results echo the findings from the univariate analysis and support the hypothesis that boards of directors reshape the risk environment of the firm by providing managers with more risk-taking incentives when states increase UI benefits and thus workers are less exposed to the costs associated with unemployment risk.

Finally, in columns (5), we replace firm fixed effects with CEO fixed effects, since Graham, Li, and Qiu (2012) show that CEO compensation varies with managers' attributes and styles and managerial fixed effects can explain a significant variation of CEO compensation. We also saturate the model by including the industry-year and state fixed effects. We find that the coefficient of *Log max total benefit*$_{t-1}$ is still positive and significant and its magnitude is similar to that reported in column (4). In column (6), we further control for CEO-by-firm fixed effects to take into account the potential endogeneity from the matching between firms and CEOs while keeping the industry-year and state fixed effects. The maintained hypothesis survives even this very demanding specification: importantly, anything intrinsic to the CEO-firm match, (time-varying) industry or state characteristics cannot explain the boards' quick behavior in adjusting current convexity payoff decisions following UI benefit changes.

C. Compensation structure

The change in the CEO's flow vega following UI benefits changes shown in Table 2 can result from an adjustment of either stock or stock options, with the latter source providing a much more powerful channel to change the managers' risk-taking incentives, at least in firms that are not close to bankruptcy (Kadan and Swinkels 2008). In this section, we further investigate the change in the compensation structure components to better understand the boards' actions when targeting the CEO flow vega following an increase in state UI benefits.

We expect that boards of directors shift from stocks towards stock options when designing CEO equity-based pay following a decrease in costs associated with workers' unemployment risk. To test this conjecture, we conduct multivariate regressions where the dependent variable is the ratio of newly granted option value (number) to the total value (number) of CEO equity-based pay during a fiscal year. The independent variables are the same as in Table 2, along with the different sets of fixed effects we used before. Table 3 presents the regression results.

[Insert Table 3 here]

The dependent variable in columns (1) to (5) is the *value* of newly granted options during a fiscal year divided by the value of all equity-based compensation in that year, while the dependent variable in columns (6) to (10) is the *number* of options divided by the number of stock and option awards to the CEO. The coefficient estimates of the generosity of UI benefits are positive and significant in all specifications (some at the 1% level), suggesting that boards tilt the balance towards the granting of more stock options in the CEO equity-based pay component following an increase in the state UI benefits.[9]

The results on CEO's equity-based compensation structure reinforce the baseline findings we have documented in Table 2 and provide additional insights that we are not just capturing some mechanical or spurious relationship between UI benefits and CEO flow vega. By shifting the balance away from stock and towards stock options the board of directors takes on a more aggressive stance of increasing the risk-

[9] The number of observations in Table 3 reduces to 26,049 compared with 32,561 in Table 2 because we restrict those firm-years with positive equity grants (the denominator of the dependent variable). In unreported results, we find that the results from the baseline regressions in Table 2 continue to hold if we only include firm-years with positive equity grants.

taking activities very quickly and this explains the significant increase in the CEO's flow vega observed in Table 2.

D. Sensitivity analysis

In this section, we conduct a battery of sensitivity tests to establish the robustness of our findings. To save space, we only present results based on two specifications: (i) controlling for firm and year fixed effects; and (ii) controlling for firm, industry-year, and state fixed effects.

Our first set of robustness tests are related to different sampling strategies. First, we exclude firm-years with CEO turnovers since the new CEO and her predecessor may have very different compensation contracts, making the comparison very hard to interpret. Second, we drop firms in the financial and utility industries since firms in these industries are regulated. Third, we exclude firms from industries characterized with geographically-dispersed workforce such as retail, wholesale, and transport to alleviate the concern for the potential mismeasurement of eligible UI benefits when a firm has operations outside its headquartering state. This is an important first step in our effort to tie more strictly the state-level changes in UI to subsequent changes in the compensation structure and we shall return to this issue later on in our analysis. Finally, we drop the recent financial crisis period (2008-2009) from our investigation since supplemental and extended programs of UI benefits were frequently adopted during the crisis period (Hsu, Matsa, and Melzer, 2014) and can thus be argued to bias in favor of finding results in line with our maintained hypothesis. Results of these robustness checks are reported in Table 4.

[Insert Table 4 here]

We find that the positive effect of UI benefits on CEO flow vega continues to hold when we (i) exclude CEO turnover years (columns (1) and (2)), (ii) exclude the financial and utility industries (columns (3) and (4)), (iii) exclude firms in geographically dispersed industries (columns (5) and (6)), and (iv) exclude the financial crisis periods (2008-2009) (columns (7) and (8)). In addition, both the statistical significance and economic magnitude of the coefficient estimate of *Log max total benefi*$_{t-1}$ are similar to those reported in Table 2.

Our second set of robustness tests investigates whether results so far survive when controlling for the flow delta and when using alternative measures of managerial risk-taking incentive. The results are shown in Table 5.

[Insert Table 5 here]

Following Lambert et al. (1991) we know that options, particularly those that are deep-in-the-money, will make the CEO's wealth more sensitive to stock price movements which should make the CEO more risk averse. This increase in the delta of the payoff structure may reduce risk-taking incentives, something that should prompt the board to wanting to overcome this effect by increasing further the payoff convexity. We show the results obtained from two different specifications shown in Table 2 (the first one using firm and year fixed effects and, the second one using firm, industry-year and state fixed effects) for (a) flow vega, (b) the value of options over the entire value of equity grants, and (c) the number of options over the total number of equity grants in columns (1) to (6). Besides finding that the impact of the UI benefit change on the CEO flow vega is unchanged after controlling for flow delta, we also find that higher flow vega is positively associated with higher delta implying that boards have to provide a larger convexity payoff increase to overcome the risk-reduction incentives induced by higher equity granted to the CEO.

In the second half of Table 5 we investigate the robustness of our results by using different measures of risk-taking incenvites: (i) CEO flow vega scaled by CEO flow delta, since delta may have different implications for managerial risk attitudes (Lambert et al., 1991; Guay, 1999) in columns (7) and (8); (ii) the logarithmic transformation of CEO flow vega as in Low (2009) in columns (9) and (10) ; and (iii) the flow vega for the top management team as in Armstrong, Larcker, Ormazabal, and Taylor (2013) in columns (11) and (12). The regression results presented in Table 5 show that the finding that CEO flow vega increases following an increase in UI benefits is robust to using these different measures of risk-taking incentives. The result in columns (11) and (12), where we use the flow vega for the top management team, is particularly important because it shows that any re-calibration that the board does to the compensation structure following the change in UI benefits is not limited to the CEO package but rather targets the top executives. To the extent that financial leverage is not decided exclusively by the CEO, but rather is a

shared decision with other executives (such as the CFO), this result suggests that board targets the flow vega of the top management team in its strategy to provide the appropriate incentive to increase risk taking.

As an alternative measure of UI generosity, we follow Hsu, Matsa, and Melzer (2014) and use the wage-replacement rate, defined as the state maximum UI benefits divided by the mean or median semi-annual wages earned by workers in a particular industry. Industry wage information is obtained from the Occupational Employment Statistics (OES) Survey conducted by Bureau of Labor Statistics[10]. The regression results based on this alternative measure of UI generosity are reported in Table 6 using two different specifications with different fixed effects to control for unobserved heterogeneities at the firm, year levels (columns (1) and (3)) and at the firm, industry-year and state levels (in columns (2) and (4)). The coefficient estimates of the wage-replacement rates are positive and significant, indicating that our results are robust to using this alternative measure of UI generosity.

[Insert Table 6 here]

We also revisit the issue about the geographic dispersion of the firms' operations. Firms may have geographically-dispersed workforce and therefore using the UI benefits of the headquartering state likely causes measurement errors that should be addressed. We have partially addressed this concern by excluding firms from industries with geographically-dispersed operations (see our preliminary results shown in columns (5) and (6) in Table 4) but it could be argued that this approach is too coarse to really address comprehensively this concern. To further address this issue, here we directly correct the potential mismeasurement of eligible UI benefits using the information obtained from the LexisNexis Corporate Affiliations Database which provides the number of employees a firm has in each state where it has operations. After matching our sample firms with the universe of the LexisNexis Corporate Affiliations Database, we are left with 25,984 firm-year observations. Several analyses are conducted based on this sample. First, we find that employees located in a firm's headquarters state, on average, account for 86% of its total workforce. This suggests that any bias caused by measurement errors in our baseline regressions

[10] http://www.bls.gov/oes/

is likely to be small. Notwithstanding this, we investigate the maintained hypothesis in this sample by using two modified definitions of our main independent variable. First, we use UI benefits of the state where the majority number of workers are located (*Log max total benefit*$_{t-1}$, *majority-worker state*) and, second, the UI benefits obtained from a weighted average of all the UI benefits in states where the firm's operations are located (*Log max total benefit*$_{t-1}$, *weighted average*). The latter is constructed as the weighted average UI benefits for each firm, where the weights are based on a firm's employee distribution across states. Results are shown in Table 7.

[Insert Table 7 here]

Our results continue to hold when we use UI benefits in the state where the majority of a firm's workforce is located, as evidenced by the positive and significant coefficient estimates in columns (1) and (2) of Table 7. Results presented in columns (3) and (4) of Table 7 also suggest that the positive effect of UI generosity on CEO flow vega continues to hold when we use the weighted average UI benefits. Put together, the results in Table 7 provides further comfort to our baseline results shown in Table 2 even when using a more precise definition of the exact exposure of unemployment cost faced by a firm's workforce.

E. Falsification tests

So far we have used several fixed effects to control for different dimensions of the unobserved heterogeneity that may drive the relationship of interest. While the concern over endogeneity or the omitted variable problem is attenuated due to the systematic saturation of the model for firm, CEO, year, industry-year and state fixed effects, some additional concerns may remain. For example, it is possible that some time-varying factors, particularly those related to local investment opportunities or regional economic conditions, cause changes in both state UI benefits and the structure of CEO pay. We have several ways to address this concern. First, we have controlled for state-level GDP growth rates and unemployment rates in all regressions. Our state fixed effects, while they absorb the time-invariant heterogeneity dimension, will leave unaddressed any time-varying changes in unobserved characteristics.

To address this concern, we conduct two falsification tests in which we use the different timing of UI benefit change and the change of UI benefits in the bordering states as the "false identifications". Specifically, if the adjustment of compensation vega is *caused* by the change of workers' exposure to unemployment risk, then boards would only respond to change of UI benefits in the past, not the contemporaneous change or change of UI benefits in the future. Furthermore, if the results are simply caused by local economic conditions, we would expect the change of UI benefits in the bordering state to have significant effects on CEO vega as the bordering states share similar economic environment. The results are shown in Table 8.

[Insert Table 8 here]

In columns (1) and (2), we regress CEO vega in year *t* on UI benefits in year *t-1*, year *t*, and year *t+1*. We find that only UI benefits in year *t-1* have a significantly positive impact on CEO vega, while UI benefits in year *t* and *t+1* have no such effect. In columns (3) and (4), we control for the UI benefits of a firm's bordering states and find that they have no significant impact on CEO vega. The coefficient estimates of the boarding states' UI benefits continue to be insignificant in columns (5) and (6) when we remove the UI benefits of the firm's headquarters state. Since geographically-proximate states tend to have similar economic conditions, these findings help rule out the alternative explanation that some omitted local economic factors are responsible for the change in both UI benefits and the design of CEO compensation.

F. Difference-in-Differences approach: Local economic conditions

To further establish the causal interpretation of our findings, in this section we take advantage of the geographical richness of our data and exploit the fact that economic conditions tend to be similar and persistent for state-pairs (or county-pairs that locate on either side of the state border) but state UI policy can only apply within the state. We conduct a difference-in-differences (DID) analysis, where our treatment firms are defined as those that are headquartered in states (counties) that experience a large increase in UI benefits and control firms are those in a bordering state (contiguous counties located in a neighboring state) with no such increase in UI benefits.

To have a meaningful event, we focus on state-years with at least a 10% increase in UI benefits.[11] In order to explore this effect in as clear way as possible, we also require that the state does not experience a large increase in the UI benefits in the prior year and following year. To account for local economic conditions that potentially affect the adjustment in state UI provisions, each event state-year is matched to at least one bordering state that does not experience a large increase in UI benefits in the previous, current, and following year. Firms headquartered in the event state are treatment firms while those in the matched bordering states are the control firms. A three-year window centered on the event year is selected for the DID analysis. In the DID regression, we create two indicator variables. The first indicator, *After*, is equal to one for the period after the increase in maximum UI benefits and zero otherwise. The second indicator, *Treat*, is equal to one for firms located in the event states and zero otherwise. Note that we continue using the two different sets of fixed effects as before to control for any unobserved heterogeneity of interest. The results from the DID regressions are presented in Table 9.

[Insert Table 9 here]

In columns (1) and (2), we include all the firms located in the event states and their matched bordering states. The insignificant coefficient of *Treat* suggests that there are no significant differences in the pre-event annual incentives granted to the CEO between the treatment and control firms. Also, the control firms do not appear to react in any way to the event as evidenced by the insignificant coefficient of the dummy variable *After*. Most interestingly for our argument, the significantly positive coefficient of the interaction term *After*Treat* clearly indicates that treatment firms significantly increase the flow vega after the large increase in state maximum UI benefits relative to the control firms. To the extent that regional economic conditions are similar across geographically-proximate states, the different adjustment in CEO compensation design between the two groups of companies around the event can be attributed to the reduced exposure to unemployment concern faced by workers of the treatment firms engendered by the change of UI benefits in the headquarters state.

[11] We thank Carola Frydman (AFA discussant) for this suggestion.

To address the concern that the treatment and control firms might be located at the far-away ends of two large states and thus might not share similar economic conditions, we follow Heider and Ljungqvist (2015) and further require that the treatment and control firms be located in contiguous counties on either side of the state border and re-run the DID specification.[12] While this approach provides us with a cleaner identification strategy to further pin down the mechanism, as expected the sample that we use is smaller than the one we used for the specifications shown in columns (1) and (2). The results reported in columns (3)-(5) of Table 9 show clearly that our findings continue to hold in this smaller sample in which the treatment and control firms likely share very similar local economic conditions. In all specifications we include state-level control variables and in column (3) we include firm and year fixed effects. In columns (4) and (5) we further saturate the model with other fixed effects to tease out the effect that UI benefits changes have on executive compensation: in column (4) we use firm, industry-year and county-pair fixed effects, and in column (5) we use firm, industry-year and county-pair-year fixed effects. When using the county-pair fixed effects, especially when using the county pair-year effects we effectively control for any unobserved local economic conditions, even the time-varying type over and above what we use as observables, that surround the county pairs and spill across the state borders. We find consistent results that the treatment firms raise the risk-taking incentive in CEO pay following a large increase in state UI benefits relative to the control firms. Overall, the results from these additional analyses built on the DID framework support the causal interpretation of the positive effect of UI benefits on CEO vega and provides us with a more precise estimate of the effects by ruling out several other alternative hypotheses.

[12] We obtain a firm's historical zip code from the WRDS SEC Analytics Suite database and corporate filings. Based on the historical zip code, we identify a firm's county information using the bridge provided by the Centers for Disease Control and Prevention (http://wonder.cdc.gov/wonder/sci_data/codes/fips/type_txt/cntyxref.asp). We further identify contiguous counties at bordering states using the County Adjacency File provided by the U.S. Census Bureau (https://www.census.gov/geo/reference/county-adjacency.html).

G. Controlling for possible confounding state-level changes

In addition to local economic conditions, other changes at the state-level may also potentially coincide with the change in state UI benefits. To address this concern, we construct potential confounding state-level changes and add them as additional control variables in our vega regressions. First, we consider the state-level political cycle and specifically the gubernatorial elections in each state. As UI policies are likely altered during gubernatorial elections, we control for the indicator of whether the state has a gubernatorial election in year *t-1*. Second, since changes in UI policies may be confounded by concurrent changes in state-level taxes, we follow Heider and Ljungqvist (2015) and control for two indicators for state corporate tax increase and state corporate tax cut. We also control for state personal income taxes and capital gains taxes. Results from this additional set of analysis are shown in Table 10.

[Insert Table 10 here]

In columns (1) and (2), we control for the indicator for gubernatorial elections and explore whether any previous year's gubernatorial election, which may change the political and economic climate in the state, impacts the changes in the payoff convexity made by the board. We continue finding the strong effect of UI benefit changes and find no evidence that gubernatorial elections influence the board's compensation decision. In columns (3) and (4), we further control for the indicators for state corporate tax changes.[13] In columns (5) and (6), we include all these potential confounding changes. We find that most of these state-level changes do not significantly impact the vega in CEO annual pay package, except (weakly) for a corporate tax cut. The coefficient estimate of state corporate tax cut is positive and significant, at the 10% confidence level, in two specifications. Since a state is likely to cut corporate tax rate to encourage more corporate investments, firms in the state may respond to the corporate tax cut by providing managers more incentives to take risks. More importantly, the positive and significant effect of UI benefits on CEO vega continues to hold after we control for these potential confounding state-level changes.

[13] The information on state corporate income tax changes is obtained from Heider and Ljungqvist (2015). Specifically, *state corporate tax increase (cut)*$_{t-1}$ is a dummy indicator which equals one if the state increased (cut) its top marginal corporate income tax rate in year t-1.

H. Cross-sectional variation

In this section, we explore whether the positive effect of UI benefits on CEO vega varies with the importance of labor as a production input factor, labor's bargaining power as embodied by labor union representation, and the degree of CEO risk aversion. Results from these cross-sectional analyses will shed further light into the channels through which UI benefits affect CEO incentive compensation. The results are shown in Table 11.

[Insert Table 11 here]

First, we investigate whether the positive impact of UI generosity on CEO vega is more pronounced in industries where labor is more important as a production input factor. We use the labor intensity measure constructed in section A to proxy for the importance of labor in firms' production technologies and split the sample based on whether an industry's labor intensity is above or below sample median. Panel A of Table 11 presents the regression results. We find that the effect of UI generosity on CEO flow vega continues to be positive and significant in the subsample of firms from industries with a higher level of labor intensity but turns insignificant in the subsample of firms from low labor intensity industries.

Second, we examine how labor's collective bargaining power affects the relation between CEO vega and UI generosity. Unionized workers can significantly improve their bargaining power over employers and hence have a crucial impact on major corporate decisions, such as leverage (Matsa, 2010), cash holdings (Klasa, Maxwell, and Ortiz-Molina, 2009), and earning management (Bova, 2013). AFL-CIO's comment letter to the SEC also suggests that labor unions tend to oppose the use of stock options as a form of managerial equity-based compensation, largely because stock options increase managers' incentives to take risk which may jeopardize worker's job security. Accordingly, we hypothesize that unionized workers represented by collective bargaining agreements could mitigate the board's ability to make prompt and significant adjustment in CEO vega following an increase in UI generosity. To test this conjecture, we collect the industry-level unionization rates from the Union Membership and Coverage Database and split the sample based on whether the industry unionization rate is above or below sample median. The unionization rate is defined as the percentage of employed workers in an industry covered by

unions in collective bargaining and is available at the level of Census Industry Classification (CIC). The results presented in Panel B of Table 11 indicate that the positive effect of UI generosity on CEO flow vega is only significant in low unionized industries. This evidence is consistent with our hypothesis and suggests that unionized workers can potentially voice their opinions over CEO compensation policy and constrain boards' ability to increase CEO vega following an increase in UI generosity.

Finally, we investigate whether boards of directors are more responsive to changes in UI generosity when CEOs are more risk-averse and hence need a higher level of risk-taking incentive. Undiversified CEOs who invest most of their human capital in their employers tend to pass up risky positive-NPV projects. Knopf, Nam, and Thornton (2002) show that a CEO's risk aversion is exacerbated when her wealth is more sensitive to the stock prices (i.e. a high CEO *delta*). Therefore, we expect that the adjustment in CEO incentive compensation after the increase in UI benefits to be more pronounced when CEO delta is higher. To test our prediction, we split our sample based on whether CEO portfolio delta is above or below sample median, where CEO portfolio delta is defined as the dollar change in CEO wealth for a 1% increase in the firm's stock price based on the complete equity portfolios held by the CEO. The results from this split-sample analysis are presented in Panel C of Table 11. Consistent with our conjecture, the positive effect of UI benefits on CEO flow vega is only significant when the CEO has a higher portfolio delta. These findings suggest that following an increase in UI benefits, boards use more option-based compensation to incentivize managers to take risk, particularly when CEOs are risk-averse and therefore the benefits of doing so are higher.

I. Impact on risk-taking behavior and operating performance

Two interesting questions immediately arise from our findings of the positive effect of UI benefits on CEO vega. The first is whether firms that increase CEO vega undertake more risky investment and financing decisions subsequent to the adjustment in their convexity payoff structure. Answering this question will speak to the effectiveness of the board's decision in the first place. The second question is

whether any change in the risk-taking activities engaged by management help the firm to deliver superior operating performance and reach its final objective for shareholders.

To address the first question, we examine the relationship between subsequent corporate risk-taking activities and the generosity of state UI benefits. Following Coles, Daniel, and Naveen (2006), we construct several proxies for the riskiness of a firm's investment and financial policies. Specifically, we obtain from Compustat a firm's R&D, capital expenditure, cash holdings, and book value of total debt, all of which are scaled by the book value of total assets and measured at the end of year $t+1$. We also create an indicator variable that is equal to one if a firm makes a diversifying acquisition in year $t+1$ and zero otherwise using the M&A transaction data from SDC. Finally, we construct a firm's stock return volatility during year $t+1$ as a measure of its overall risk. We then split the sample based on whether the *change* in the CEO flow vega in year t is above sample median or below sample median and in each of the subsample regress the investment and financial outcome variables in year $t+1$ on UI generosity measured at year $t-1$. Naturally we should expect to find the largest impact on firms' risk-taking activities in the case of CEOs who experienced the largest increase in their convexity payoff structure.

The regression results are presented in Table 12, where panel A reports the results based on the subsample in which the change in the CEO flow vega is above sample median and panel B reports the results based on the subsample in which the change in the CEO flow vega is below sample median. Note that all specifications control for firm and year fixed effects and thus our results should reflect the within-firm adjustments in the risk-taking behavior following a change in the state-level UI benefits.

[Insert Table 12 here]

We find that firms increase their risk-taking activities following the increase in state UI benefits and such increase is only statistically significant when the change in the CEO flow vega is relatively high, confirming that the largest increases in the convexity payoff structure of the CEO's annual compensation package have the biggest impact. Specifically, results in Panel A show that following an increase in UI generosity, conditional on the CEO experiencing a large increase in the flow vega, a firm significantly increases its R&D investment and leverage ratio, reduces capital expenditure and cash holding, and is less

likely to make diversifying acquisitions. These corporate decisions are associated with a surge in the firm's total risk as evidenced by the significantly positive effect of lagged UI benefits on stock return volatility measured in *t+1*.

We find no significant correlation between firms' risk-taking activities and UI generosity when the change in CEO flow vega is relatively low (shown in Panel B). One reason that the impact is concentrated in the case of the largest increase in convexity payoff may be due to the drag that a modest increase in option granting can have on the CEO's risk-taking incentives. As argued above, options also affect the CEO's delta and a larger increase in the convexity payoff is needed to offset the resulting risk-reducing influence. These findings suggest that increases in UI benefits generate real economic and financial impacts by inducing boards of directors to increase vega embedded in CEO compensation. In other words, the boards' strategy of increasing the payoff convexity of top management following a reduction of the costs associated with unemployment risk produces the desired outcome: more risk-taking activities and higher overall firm risk.

Finally, we examine whether more risk-taking activities following the increase in UI generosity translate into better operating performance for firms that improve managerial risk-taking incentives. This is the ultimate goal of shareholders and we have argued that boards, acting on behalf of shareholders, adjust the CEO's pay structure precisely to reach this objective. Empirically, we regress a firm's operating performance in year *t+1*, measured by its Return on Assets (ROA), on UI benefits in year *t-1*. Continuing from our results in Table 12, we should expect that the operating performance improves the most when CEOs experience a relatively larger adjustment in their convexity payoff because they are more likely to change the firms' activities. We present the results in Table 13.

[Insert Table 13 here]

Columns (1) and (2) of Table 13 present the regression results based on the subsample in which the change of the CEO flow vega of year *t* is above sample median, while columns (3) and (4) show the regression results based on the subsample in which the change of the CEO flow vega of year *t* is below

sample median.[14] We find that increases in UI benefits have a significant and positive effect on firm's operating performance only when CEOs experience the largest increases in their flow vega which induce them to make the most significant changes in the firms' risk-taking activities. Interestingly, these results imply that the higher risk exposure is value enhancing. This finding, combined with the results on firms' risk-taking activities, provides suggestive evidence that by increasing managerial risk-taking incentive in response to a negative shock to workers' exposure to unemployment risk, boards of directors can encourage managers to take more risk and improve the overall firm performance.

IV. Conclusions

In this paper, we uncover the important impact of a salient feature of labor market frictions, i.e. labor's concern over unemployment risk, on the design of CEO incentive compensation, specifically the convexity payoff structure. Through its impact on risk-taking activities, option-based compensation is likely to also influence rank-and-file workers' unemployment risk. Unlike diversified shareholders, managers are risk-averse because they not only have a large portion of their personal wealth closely tied to their companies' performance, at the same time they also invest heavily their human capital in their respective companies. When costs associated with unemployment decrease, boards acting in the interests of shareholders will want to take on more risks. The question that we address is how managers can be incentivized to overcome their risk aversion and career concerns and increase the use of leverage following decreases in the unemployment costs borne by rank-and-file employees.

Using state-level changes in unemployment insurance benefits as a source of variation in the unemployment costs faced by workers, we show that boards adjust CEO compensation structure and provide managers with more risk-taking incentives following increases in UI benefits. The positive effect of UI benefits on managerial risk-taking incentive is more pronounced in labor-intensive industries, but is significantly attenuated when strong labor unions are present. The results are also stronger for CEOs whose

[14] In columns (2) and (4), we include the set of industry-year fixed effects to industry-adjust the variables each year (Gormley and Matsa, 2014).

wealth is more closely tied to firm performance. Finally, we show that the increase in managerial risk-taking incentive largely comes from more option grants to managers following an increase in UI generosity. These option-based pay encourages managers to undertake more risk-taking investment and financial decisions that lead to improved operating performance after increases in UI benefits. Our findings contribute to the literature by showing the importance of workers' exposure to unemployment risk in the design of managerial compensation.

References

Abowd, J.M., Ashenfelter, O.C., 1981. Anticipated unemployment, temporary layoffs, and compensating wage differentials. In: Studies in labor markets. University of Chicago Press, pp. 141-186.

Agrawal, A.K., Matsa, D.A., 2013. Labor unemployment risk and corporate financing decisions. Journal of Financial Economics 108, 449-470.

Amihud, Y., Lev, B., 1981. Risk reduction as a managerial motive for conglomerate mergers. The Bell Journal of Economics, 605-617.

Armstrong, C.S., Larcker, D.F., Ormazabal, G., Taylor, D.J., 2013. The relation between equity incentives and misreporting: the role of risk-taking incentives. Journal of Financial Economics 109, 327-350.

Bae, K.-H., Kang, J.-K., Wang, J., 2011. Employee treatment and firm leverage: A test of the stakeholder theory of capital structure. Journal of Financial Economics 100, 130-153.

Berk, J.B., Stanton, R., Zechner, J., 2010. Human capital, bankruptcy, and capital structure. The Journal of Finance 65, 891-926.

Bova, F., 2013. Labor Unions and Management's Incentive to Signal a Negative Outlook. Contemporary Accounting Research 30, 14-41.

Brown, J., Matsa, D.A., 2016. Boarding a Sinking Ship? An Investigation of Job Applications to Distressed Firms. The Journal of Finance 71, 507-550.

Chemmanur, T.J., Cheng, Y., Zhang, T., 2013. Human capital, capital structure, and employee pay: An empirical analysis. Journal of Financial Economics 110, 478-502.

Cohen, D.A., Dey, A., Lys, T.z., 2013. Corporate Governance Reform and Executive Incentives: Implications for Investments and Risk Taking. Contemporary Accounting Research 30, 1296-1332.

Coles, J.L., Daniel, N.D., Naveen, L., 2006. Managerial incentives and risk-taking. Journal of Financial Economics 79, 431-468.

Core, J., Guay, W., 2002. Estimating the value of employee stock option portfolios and their sensitivities to price and volatility. Journal of Accounting Research 40, 613-630.

De Angelis, D., Grullon, G., Michenaud, S., 2015. The effects of short-selling threats on incentive contracts: Evidence from a natural experiment. Unpublished working paper. Rice University.

Farber, H.S., 2005. What do we know about job loss in the United States? evidence from the displaced workers survey, 1984-2004. Economic Perspectives, 13-28.

Gormley, T.A., Matsa, D.A., 2014. Common errors: How to (and not to) control for unobserved heterogeneity. Review of Financial Studies 27, 617-661.

Gormley, T.A., Matsa, D.A., 2016. Playing it safe? Managerial preferences, risk, and agency conflicts. Journal of Financial Economics. (forthcoming).

Gormley, T.A., Matsa, D.A., Milbourn, T., 2013. CEO compensation and corporate risk: Evidence from a

natural experiment. Journal of Accounting and Economics 56, 79-101.

Graham, J.R., Li, S., Qiu, J., 2012. Managerial attributes and executive compensation. Review of Financial Studies 25, 144-186.

Gruber, J., 1997. The Consumption Smoothing Benefits of Unemployment Insurance. The American Economic Review, 192-205.

Guay, W.R., 1999. The sensitivity of CEO wealth to equity risk: an analysis of the magnitude and determinants. Journal of Financial Economics 53, 43-71.

Hayes, R.M., Lemmon, M., Qiu, M., 2012. Stock options and managerial incentives for risk taking: Evidence from FAS 123R. Journal of Financial Economics 105, 174-190.

Heider, F., Ljungqvist, A., 2015. As certain as debt and taxes: Estimating the tax sensitivity of leverage from state tax changes. Journal of Financial Economics 118, 684-712.

Heron, R.A., Lie, E., 2016. Do Stock Options Overcome Managerial Risk Aversion? Evidence from Exercises of Executive Stock Options. Management Science. (forthcoming).

Holmström, B., 1999. Managerial incentive problems: A dynamic perspective. The Review of Economic Studies 66, 169-182.

Hsu, J.W., Matsa, D.A., Melzer, B.T., 2014. Positive externalities of social insurance: Unemployment insurance and consumer credit. NBER Working Paper No. 20353.

Jensen, M.C., Meckling, W.H., 1976. Theory of the firm: Managerial behavior, agency costs and ownership structure. Journal of Financial Economics 3, 305-360.

Kadan, O., Swinkels, J.M., 2008. Stocks or options? Moral hazard, firm viability, and the design of compensation contracts. Review of Financial Studies 21, 451-482.

Kalil, A., Ziol-Guest, K., 2008. Parental job loss and children's academic progress in two-parent families. Social Science Research 37, 500-515.

Katz, L.F., Meyer, B.D., 1990. The impact of the potential duration of unemployment benefits on the duration of unemployment. Journal of Public Economics 41, 45-72.

Klasa, S., Maxwell, W.F., Ortiz-Molina, H., 2009. The strategic use of corporate cash holdings in collective bargaining with labor unions. Journal of Financial Economics 92, 421-442.

Knopf, J.D., Nam, J., Thornton Jr, J.H., 2002. The volatility and price sensitivities of managerial stock option portfolios and corporate hedging. The Journal of Finance 57, 801-813.

Lambert, R.A., Larcker, D.F., Verrecchia, R.E., 1991. Portfolio considerations in valuing executive compensation. Journal of Accounting Research, 129-149.

Low, A., 2009. Managerial risk-taking behavior and equity-based compensation. Journal of Financial Economics 92, 470-490.

Matsa, D.A., 2010. Capital structure as a strategic variable: Evidence from collective bargaining. The

Journal of Finance 65, 1197-1232.

Meyer, B.D., 1990. Unemployment Insurance and Unemployment Spells. Econometrica 58, 757-782.

Meyer, B.D., 1995. Lessons from the US unemployment insurance experiments. Journal of Economic Literature, 91-131.

Petersen, M.A., 2009. Estimating standard errors in finance panel data sets: Comparing approaches. Review of financial studies 22, 435-480.

Smith, C.W., Stulz, R.M., 1985. The determinants of firms' hedging policies. Journal of Financial and Quantitative Analysis 20, 391-405.

Smith Jr, C.W., Watts, R.L., 1992. The investment opportunity set and corporate financing, dividend, and compensation policies. Journal of Financial Economics 32, 263-292.

Titman, S., 1984. The effect of capital structure on a firm's liquidation decision. Journal of Financial Economics 13, 137-151.

Topel, R.H., 1984. Equilibrium earnings, turnover, and unemployment: New evidence. Journal of Labor Economics, 500-522.

White, H., 1980. A Heteroskedasticity-Consistent Covariance Matrix Estimator and a Direct Test for Heteroskedasticity. Econometrica 48, 817-838.

Zingales, L., 2000. In search of new foundations. The Journal of Finance 55, 1623-1653.

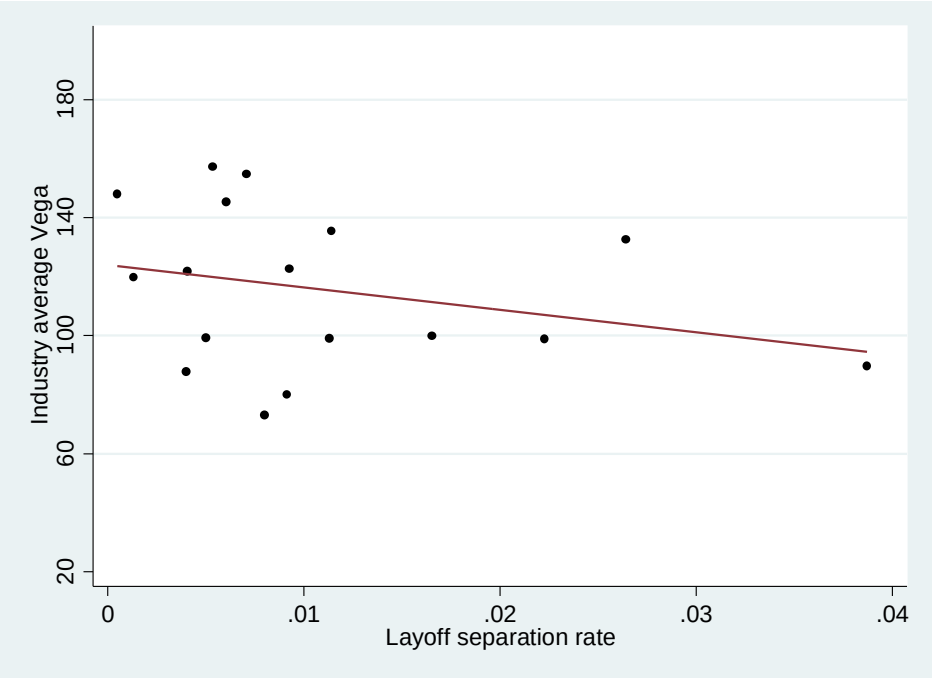

Figure 1. Industry average CEO vega and layoff separation rate

This figure plots the cross-sectional correlation between industry average CEO vega and long-run layoff separation rate at the two-digit NAICS level in 2002. Vega is calculated as the CEO's dollar change in wealth for a 0.01 increase in the annualized standard deviation of firm's stock returns based on the CEO's complete equity portfolios. Layoff separation rate is the ratio of workers affected by a mass layoff to total industry employment following Agrawal and Matsa (2013).

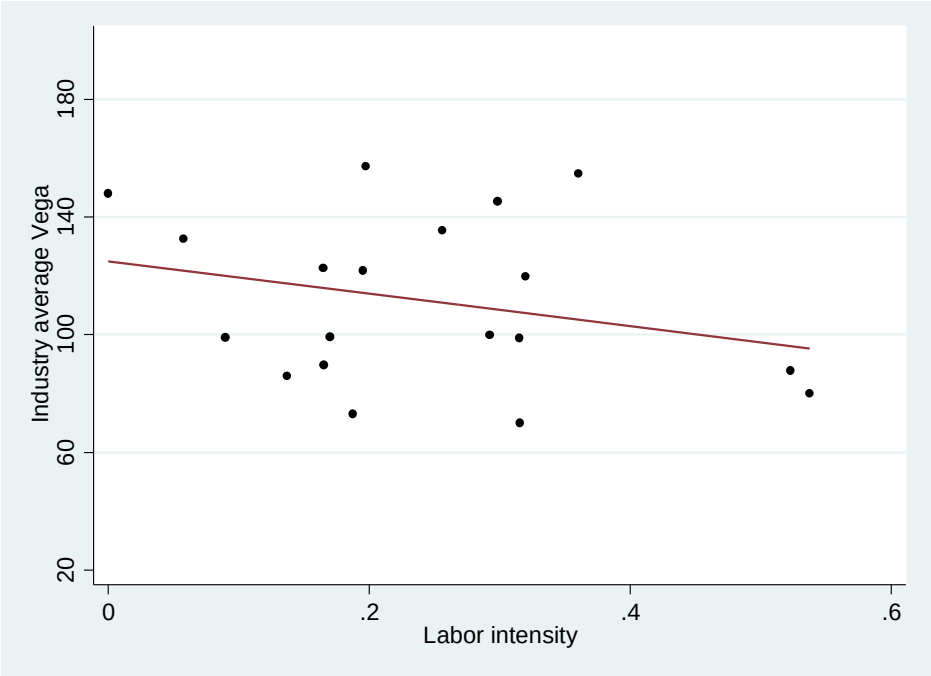

Figure 2. Industry average CEO vega and labor intensity

This figure plots the cross-sectional correlation between industry average CEO vega and long-run labor intensity at the two-digit NAICS level in 2002. Vega is calculated as the CEO's dollar change in wealth for a 0.01 increase in the annualized standard deviation of firm's stock returns based on the CEO's complete equity portfolios. Labor intensity is measured as the median ratio of total labor expenses (XLR) to sales (SALE) for all COMPUSTAT firms in each two-digit NAICS industry.

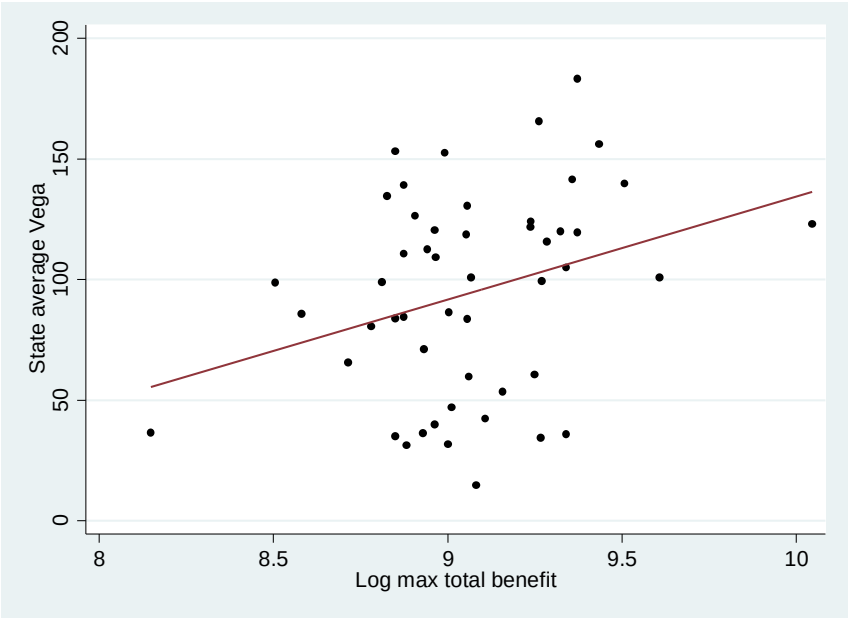

Figure 3A. State average CEO vega and maximum UI benefits

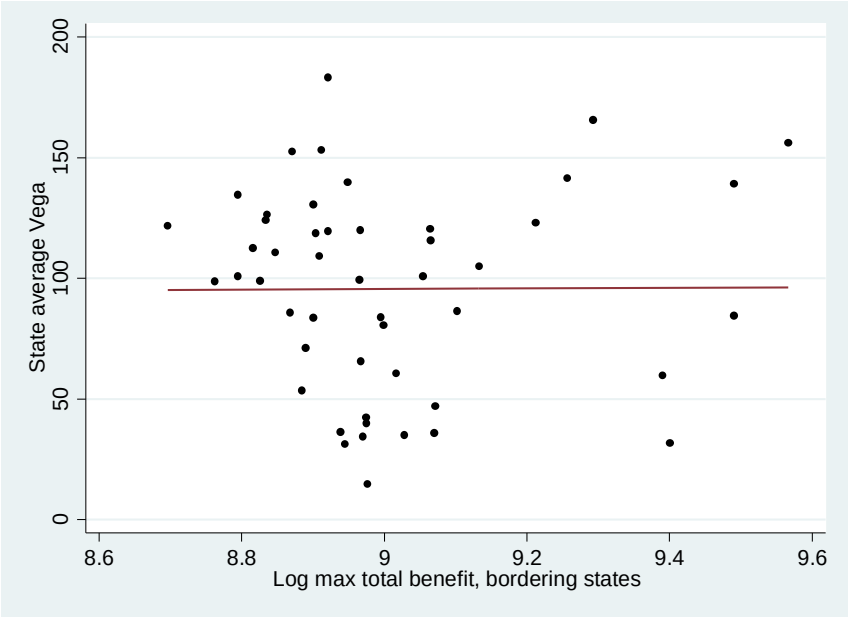

Figure 3B. State average CEO vega and maximum UI benefits: placebo

This figure plots the cross-sectional correlation between state average CEO vega and the logarithm of state maximum UI benefits in 2002. Figure 3A and 3B plots the state average CEO vega against the UI policy in the headquarter state and its bordering states, respectively. Vega is calculated as the CEO's dollar change in wealth for a 0.01 increase in the annualized standard deviation of firm's stock returns based on the CEO's complete equity portfolios. Log max total benefit is the natural logarithm of the maximum total unemployment insurance benefit under the state's unemployment insurance system.

Table 1. Summary statistics

The table presents the summary statistics for variables used in the paper. The sample consists of 32,561 firm-year observations covered by the COMPUSTAT ExecuComp database from 1992 to 2013. Panel A, B, and C presents the summary statistics for the CEO compensation variables, firm-, and state-level characteristics, respectively. Variable definitions are in Appendix A.

Panel A: CEO compensation

	N	Mean	Std	Q1	Median	Q3
Flow vega (in thousands of $)	32561	26.172	50.827	0.000	6.864	27.223
Options/Equity (value)	26049	0.702	0.390	0.404	1.000	1.000
Options/Equity (number)	26049	0.755	0.368	0.651	1.000	1.000
Cash compensation	32561	0.445	0.297	0.193	0.379	0.662

Panel B: Firm-level characteristics

	N	Mean	Std	Q1	Median	Q3
Assets (in $mil)	32561	10420	55460	461	1418	5020
Firm size	32561	7.396	1.750	6.134	7.257	8.521
Leverage	32561	0.220	0.181	0.058	0.202	0.336
MB ratio	32561	1.933	1.316	1.138	1.478	2.166
ROA	32561	0.036	0.101	0.012	0.043	0.082
Tangibility	32561	0.273	0.238	0.078	0.202	0.415
Stock volatility	32561	0.430	0.198	0.278	0.382	0.538
Tenure	32561	7.525	7.295	2.000	5.000	10.000
CEO chairman	32561	0.563	0.496	0.000	1.000	1.000
$R\&D_{t+1}$	29937	0.028	0.053	0.000	0.000	0.031
$CAPEX_{t+1}$	28685	0.054	0.053	0.019	0.039	0.071
$Cash_{t+1}$	29924	0.141	0.167	0.022	0.070	0.201
Diversifying $acquisitions_{t+1}$	10269	0.742	0.438	0.000	1.000	1.000

Panel C: State-level characteristics

	N	Mean	Std	Q1	Median	Q3
Max weekly benefit (in $)	32561	359	103	289	346	412
Max duration (in weeks)	32561	26	0.961	26	26	26
Max total benefit (in $)	32561	9470	3132	7503	9002	10726
Log max total benefit	32561	9.112	0.286	8.923	9.105	9.280
Replacement rate, mean (%)	32359	50.524	22.052	35.879	45.187	58.588
Replacement rate, median (%)	32359	61.813	28.102	43.056	54.738	72.875
State GDP growth rate (%)	32561	2.287	2.673	0.962	2.325	4.005
State unemployment rate (%)	32561	6.022	2.001	4.600	5.400	6.900

Table 2. Labor unemployment risk and CEO vega: Baseline regressions

The table presents the results from regressions of CEO risk-taking incentives on the natural log of the maximum UI benefits in the previous year. The dependent variable is the flow vega defined as the CEO's dollar change in wealth for a 0.01 increase in the annualized standard deviation of the firm's stock returns based on the CEO's equity grants in the current fiscal year. Other variable definitions are in Appendix A. In parentheses are heteroscedasticity-consistent standard errors (White, 1980) clustered at the state level (Petersen, 2009). ***, **, and * stand for statistical significance based on two-sided tests at the 1%, 5%, and 10% level, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent variables	Flow Vega	Flow Vega	Flow Vega	Flow Vega	Flow Vega	Flow Vega
Log max total benefit$_{t-1}$	5.830**	10.788***	10.375***	11.715**	11.465**	11.598**
	(2.391)	(3.966)	(3.340)	(4.728)	(4.812)	(5.254)
Firm size		10.668***	10.332***	10.345***	10.952***	11.029***
		(0.972)	(0.862)	(0.877)	(1.124)	(1.181)
Leverage		-7.090**	-10.230***	-10.154***	-11.399***	-11.200***
		(3.095)	(3.358)	(3.336)	(3.598)	(3.696)
MB ratio		4.943***	5.036***	5.081***	5.010***	4.924***
		(0.475)	(0.552)	(0.545)	(0.557)	(0.523)
ROA		-0.604	-5.171*	-4.916*	-6.453**	-6.037*
		(2.642)	(2.793)	(2.742)	(2.923)	(3.407)
Tangibility		-11.730**	-10.894**	-11.206**	-3.279	-4.806
		(4.708)	(5.327)	(5.544)	(5.568)	(5.197)
Log(Stock volatility)		-1.063	-1.832	-1.596	0.058	0.765
		(1.523)	(1.328)	(1.314)	(1.452)	(1.405)
Tenure		0.087	0.107	0.113	0.370	0.984**
		(0.059)	(0.069)	(0.070)	(0.291)	(0.430)
CEO chairman		0.222	0.208	0.248	-1.654	-1.483
		(0.709)	(0.715)	(0.714)	(1.039)	(1.274)
Cash compensation		-60.750***	-60.757***	-60.823***	-63.319***	-63.292***
		(3.058)	(2.973)	(2.983)	(3.345)	(3.374)
State GDP growth rate		0.330***	0.335**	0.329**	0.316**	0.284**
		(0.122)	(0.139)	(0.132)	(0.138)	(0.138)
State unemployment rate		0.256	0.246	0.099	0.159	0.067
		(0.358)	(0.471)	(0.485)	(0.591)	(0.603)
Firm fixed effects	X	X	X	X		
CEO fixed effects					X	
CEO-firm fixed effects						X
Year fixed effects	X	X				
Industry-Year fixed effects			X	X	X	X
State fixed effects				X	X	X
Observations	32,561	32,561	32,561	32,561	32,561	32,561
Adjusted R-squared	0.396	0.491	0.504	0.504	0.564	0.573

Table 3. Labor unemployment risk and CEO compensation structure

The table presents the results from regressions of CEO equity-based compensation structure on the natural log of the maximum UI benefits in the previous year. Only firm-years with positive equity grants are included. The dependent variable in columns (1) to (5) is the value of stock options granted to the CEO scaled by the total value of equity grants in the current fiscal year. The dependent variable in columns (6) to (10) is the number of stock options granted to the CEO scaled by the total number of equity grants in the current fiscal year. Other variable definitions are in Appendix A. In parentheses are heteroscedasticity-consistent standard errors (White, 1980) clustered at the state level (Petersen, 2009). ***, **, and * stand for statistical significance based on two-sided tests at the 1%, 5%, and 10% level, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Dependent variables	Options/Equity (value)					Options/Equity (number)				
Log max total benefit$_{t-1}$	0.084***	0.064**	0.101***	0.074**	0.062**	0.067***	0.045**	0.076**	0.069**	0.060**
	(0.024)	(0.024)	(0.032)	(0.032)	(0.028)	(0.021)	(0.022)	(0.031)	(0.027)	(0.027)
Firm size	0.006	0.009	0.009	-0.000	0.004	0.007	0.011	0.010	0.003	0.005
	(0.007)	(0.008)	(0.008)	(0.007)	(0.006)	(0.007)	(0.008)	(0.008)	(0.007)	(0.006)
Leverage	0.026	0.005	0.009	-0.030	-0.030	0.039	0.008	0.013	-0.025	-0.021
	(0.027)	(0.026)	(0.026)	(0.029)	(0.023)	(0.027)	(0.027)	(0.027)	(0.028)	(0.022)
MB ratio	0.014***	0.016***	0.016***	0.009**	0.009***	0.006	0.009**	0.009**	0.002	0.002
	(0.004)	(0.005)	(0.005)	(0.004)	(0.003)	(0.004)	(0.004)	(0.004)	(0.003)	(0.003)
ROA	0.001	0.015	0.017	-0.015	-0.007	0.012	0.015	0.018	-0.013	-0.006
	(0.033)	(0.033)	(0.033)	(0.035)	(0.028)	(0.034)	(0.034)	(0.034)	(0.033)	(0.026)
Tangibility	0.008	0.054	0.057	-0.016	0.042	-0.039	0.023	0.027	-0.022	0.030
	(0.054)	(0.052)	(0.054)	(0.053)	(0.040)	(0.061)	(0.054)	(0.056)	(0.055)	(0.039)
Log(Stock volatility)	0.028**	0.040***	0.042***	0.019*	0.016	0.008	0.019	0.022*	0.011	0.009
	(0.011)	(0.011)	(0.011)	(0.011)	(0.010)	(0.012)	(0.013)	(0.013)	(0.011)	(0.010)
Tenure	0.000	0.001	0.001	0.003	0.004*	-0.000	-0.000	-0.000	0.003*	0.007***
	(0.001)	(0.001)	(0.001)	(0.002)	(0.003)	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)
CEO chairman	-0.001	0.000	0.001	0.001	-0.001	-0.000	0.001	0.002	0.002	0.001
	(0.006)	(0.007)	(0.007)	(0.009)	(0.006)	(0.007)	(0.007)	(0.007)	(0.008)	(0.006)
Cash compensation	-0.005	-0.004	-0.004	-0.031	-0.028**	-0.060***	-0.063***	-0.063***	-0.090***	-0.087***
	(0.017)	(0.017)	(0.017)	(0.025)	(0.013)	(0.016)	(0.015)	(0.015)	(0.023)	(0.012)
State GDP growth rate	0.001	0.002**	0.002*	0.001	0.001	0.001	0.002	0.002	0.000	0.000
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
State unemployment rate	-0.001	-0.001	-0.002	-0.005	-0.004	0.000	-0.001	-0.002	-0.005	-0.004
	(0.005)	(0.006)	(0.006)	(0.007)	(0.003)	(0.005)	(0.006)	(0.006)	(0.006)	(0.003)
Firm fixed effects	X	X	X			X	X	X		
CEO fixed effects				X					X	
CEO-firm fixed effects					X					X
Year fixed effects	X					X				
Industry-Year fixed effects		X	X	X	X		X	X	X	X
State fixed effects			X	X	X			X	X	X
Observations	26,049	26,049	26,049	26,049	26,049	26,049	26,049	26,049	26,049	26,049
Adjusted R-squared	0.537	0.545	0.546	0.610	0.613	0.513	0.524	0.526	0.600	0.604

Table 4. Labor unemployment risk and CEO vega: Alternative sampling methods

The table presents the results from robustness checks using alternative sampling methods. CEO turnover years are defined as firm-years when a CEO turnover is observed. Financial firms are those with one-digit SIC code of 6. Utility firms are those with two-digit SIC code of 49. Dispersed industries are those in which the workforce is likely to be geographically dispersed, namely retail, wholesale, and transport. Other variable definitions are in Appendix A. In parentheses are heteroscedasticity-consistent standard errors (White, 1980) clustered at the state level (Petersen, 2009). ***, **, and * stand for statistical significance based on two-sided tests at the 1%, 5%, and 10% level, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Sample	Exclude CEO turnover years		Exclude financial and utility		Exclude dispersed industries		Exclude financial crisis periods (2008-2009)	
Dependent variables	Flow Vega	Flow Vega	Flow Vega	Flow Vega	Flow Vega	Flow Vega	Flow Vega	Flow Vega
Log max total benefit$_{t-1}$	9.287**	12.088***	11.949***	12.560**	12.361**	11.268**	11.568**	10.919**
	(3.759)	(4.379)	(4.161)	(5.281)	(5.225)	(4.928)	(4.469)	(4.538)
Firm size	10.804***	10.274***	11.076***	10.919***	10.491***	10.306***	11.133***	10.423***
	(1.016)	(0.940)	(1.145)	(1.044)	(0.827)	(0.948)	(0.976)	(0.951)
Leverage	-5.948*	-9.595**	-8.566***	-10.904***	-6.947**	-10.002***	-6.372*	-9.672***
	(3.148)	(3.792)	(3.046)	(3.549)	(3.182)	(3.072)	(3.202)	(3.159)
MB ratio	5.387***	5.309***	5.101***	5.213***	5.164***	5.105***	5.086***	5.031***
	(0.576)	(0.708)	(0.525)	(0.579)	(0.510)	(0.550)	(0.498)	(0.525)
ROA	-1.692	-5.705*	-2.580	-4.900*	-4.709*	-7.571**	-0.741	-4.425
	(3.243)	(2.952)	(2.362)	(2.666)	(2.670)	(3.029)	(3.083)	(3.583)
Tangibility	-9.651	-5.591	-12.689***	-9.872*	-15.950***	-14.337**	-12.366**	-9.734*
	(6.092)	(6.270)	(4.353)	(5.252)	(5.313)	(6.041)	(4.694)	(5.416)
Log(Stock volatility)	-3.083**	-2.088	-0.763	-0.975	-3.420**	-1.399	-0.592	0.340
	(1.470)	(1.535)	(1.893)	(1.628)	(1.487)	(1.333)	(1.716)	(1.364)
Tenure	0.179***	0.195***	0.029	0.039	0.094	0.112	0.105**	0.118
	(0.062)	(0.066)	(0.059)	(0.071)	(0.058)	(0.080)	(0.051)	(0.074)
CEO chairman	1.633**	1.509**	0.102	0.318	0.280	0.535	0.100	0.278
	(0.736)	(0.749)	(0.771)	(0.708)	(0.774)	(0.823)	(0.751)	(0.793)
Cash compensation	-61.439***	-61.543***	-59.764***	-59.811***	-59.647***	-60.055***	-62.173***	-62.799***
	(3.011)	(3.350)	(3.028)	(2.926)	(3.098)	(2.046)	(2.978)	(1.948)
State GDP growth rate	0.319**	0.313**	0.354**	0.304**	0.440**	0.313**	0.423**	0.322**
	(0.127)	(0.146)	(0.152)	(0.150)	(0.178)	(0.147)	(0.181)	(0.160)
State unemployment rate	0.597	0.370	0.396	-0.074	0.540	0.020	0.669	0.326
	(0.478)	(0.587)	(0.514)	(0.647)	(0.580)	(0.609)	(0.565)	(0.577)
Firm fixed effects	X	X	X	X	X	X	X	X
Year fixed effects	X		X		X		X	
Industry-Year fixed effects		X		X		X		X
State fixed effects		X		X		X		X
Observations	26,149	26,149	26,275	26,275	27,254	27,254	29,299	29,299
Adjusted R-squared	0.518	0.530	0.494	0.504	0.495	0.505	0.493	0.504

Table 5. Labor unemployment risk and CEO vega: Further robustness checks

The table presents the results from further robustness checks. In columns (1) to (6), we additionally control for the CEO's flow delta in the regressions. In columns (7) and (8), the dependent variable is the CEO flow vega scaled by flow delta. In columns (9) and (10), the dependent variable is the logarithmic transformation of one plus CEO flow vega. In columns (11) and (12), the dependent variable is the flow vega of top management team measured. Other variable definitions are in Appendix A. In parentheses are heteroscedasticity-consistent standard errors (White, 1980) clustered at the state level (Petersen, 2009). ***, **, and * stand for statistical significance based on two-sided tests at the 1%, 5%, and 10% level, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Dependent variables	Flow Vega		Options/Equity (value)		Options/Equity (number)		Flow Vega/Flow Delta		Log(1+Flow Vega)		Flow Vega of Top Management Team	
Log max total benefit$_{t-1}$	11.128***	10.734***	0.085***	0.101***	0.067***	0.076**	0.120***	0.101**	0.310***	0.283**	4.778**	5.908**
	(2.000)	(2.451)	(0.024)	(0.033)	(0.022)	(0.032)	(0.036)	(0.044)	(0.072)	(0.118)	(1.838)	(2.874)
Firm size	2.125***	2.179***	-0.004	0.000	-0.002	0.002	0.074***	0.077***	0.255***	0.254***	5.477***	5.024***
	(0.657)	(0.563)	(0.006)	(0.008)	(0.007)	(0.008)	(0.013)	(0.015)	(0.026)	(0.026)	(0.349)	(0.306)
Leverage	2.968**	0.252	0.037	0.020	0.049*	0.024	0.109***	0.033	-0.061	-0.191	-4.044***	-5.086***
	(1.198)	(1.527)	(0.026)	(0.026)	(0.027)	(0.027)	(0.032)	(0.040)	(0.108)	(0.114)	(1.316)	(1.654)
MB ratio	-2.107***	-1.945***	0.007	0.009*	-0.001	0.002	-0.035***	-0.029***	0.033***	0.046***	2.750***	2.584***
	(0.365)	(0.367)	(0.004)	(0.005)	(0.004)	(0.004)	(0.006)	(0.005)	(0.012)	(0.012)	(0.246)	(0.256)
ROA	7.472***	4.661**	0.008	0.026	0.019	0.026	0.015	0.005	0.258**	0.184	-0.649	-0.884
	(1.749)	(2.074)	(0.033)	(0.033)	(0.034)	(0.034)	(0.067)	(0.067)	(0.116)	(0.113)	(1.317)	(1.179)
Tangibility	-1.627	1.650	0.013	0.064	-0.034	0.033	-0.011	0.120	-0.312	-0.031	-3.790*	-3.014
	(3.331)	(3.414)	(0.054)	(0.054)	(0.060)	(0.056)	(0.091)	(0.080)	(0.207)	(0.180)	(2.219)	(1.864)
Log(Stock volatility)	-1.747*	-2.159**	0.029**	0.042***	0.008	0.022*	-0.065***	-0.065***	-0.242***	-0.173***	-0.370	0.466
	(0.897)	(0.892)	(0.011)	(0.011)	(0.012)	(0.013)	(0.020)	(0.021)	(0.044)	(0.053)	(0.671)	(0.674)
Tenure	-0.009	-0.006	0.000	0.000	-0.000	-0.000	-0.002**	-0.002**	-0.004	-0.003	0.095***	0.103***
	(0.043)	(0.042)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)	(0.023)	(0.022)
CEO chairman	-0.175	-0.074	-0.002	0.001	-0.001	0.001	0.008	0.010	-0.008	0.001	-0.190	-0.130
	(0.382)	(0.344)	(0.006)	(0.007)	(0.007)	(0.007)	(0.012)	(0.012)	(0.023)	(0.022)	(0.262)	(0.227)
Cash compensation	2.746**	2.634**	0.059***	0.057**	0.002	-0.005	0.596***	0.549***	-3.453***	-3.494***	-19.103***	-19.459***
	(1.251)	(1.219)	(0.021)	(0.023)	(0.017)	(0.018)	(0.034)	(0.031)	(0.062)	(0.066)	(0.821)	(0.889)
State GDP growth rate	0.031	0.031	0.001	0.002*	0.001	0.002	-0.001	-0.000	0.006	0.006	0.149**	0.113*
	(0.052)	(0.059)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)	(0.004)	(0.004)	(0.066)	(0.057)
State unemployment rate	0.047	-0.125	-0.001	-0.002	-0.000	-0.002	-0.002	-0.012*	0.001	-0.009	0.419	0.112
	(0.249)	(0.353)	(0.005)	(0.006)	(0.005)	(0.006)	(0.007)	(0.007)	(0.012)	(0.013)	(0.257)	(0.167)
Flow Delta	0.604***	0.601***	0.000***	0.000***	0.000***	0.000***						
	(0.019)	(0.019)	(0.000)	(0.000)	(0.000)	(0.000)						
Firm fixed effects	X	X	X	X	X	X	X	X	X	X	X	X
Year fixed effects	X		X		X		X		X		X	
Industry-Year fixed effects		X		X		X		X		X		X
State fixed effects		X		X		X		X		X		X
Observations	32,561	32,561	26,049	26,049	26,049	26,049	26,049	26,049	32,561	32,561	32,561	32,561
Adjusted R-squared	0.806	0.811	0.541	0.550	0.516	0.529	0.331	0.373	0.653	0.665	0.541	0.555

Table 6. Labor unemployment risk and CEO vega: Alternative measures of UI generosity

The table presents the results from additional analyses using alternative measures of UI benefits generosity. "Replacement rate$_{t-1}$, mean (median)" is defined as the state maximum total unemployment insurance benefit scaled by industry average (median) semi-annual wages. Other variable definitions are in Appendix A. In parentheses are heteroscedasticity-consistent standard errors (White, 1980) clustered at the state level (Petersen, 2009). ***, **, and * stand for statistical significance based on two-sided tests at the 1%, 5%, and 10% level, respectively.

	(1)	(2)	(3)	(4)
Dependent variable	Flow Vega	Flow Vega	Flow Vega	Flow Vega
Replacement rate$_{t-1}$, mean	0.116***	0.133**		
	(0.033)	(0.055)		
Replacement rate$_{t-1}$, median			0.091***	0.110**
			(0.025)	(0.045)
Firm size	10.761***	10.511***	10.730***	10.496***
	(0.953)	(0.849)	(0.948)	(0.846)
Leverage	-6.680**	-9.936***	-6.632**	-9.932***
	(3.034)	(3.416)	(3.021)	(3.410)
MB ratio	4.898***	5.077***	4.875***	5.073***
	(0.461)	(0.533)	(0.462)	(0.533)
ROA	-1.222	-4.472*	-1.166	-4.484*
	(2.616)	(2.597)	(2.618)	(2.593)
Tangibility	-12.057**	-11.150**	-12.138**	-11.170**
	(4.927)	(5.547)	(4.931)	(5.536)
Log(Stock volatility)	-2.199	-1.832	-2.247	-1.829
	(1.380)	(1.234)	(1.373)	(1.227)
Tenure	0.079	0.101	0.080	0.101
	(0.058)	(0.070)	(0.059)	(0.070)
CEO chairman	0.174	0.167	0.171	0.165
	(0.697)	(0.716)	(0.701)	(0.717)
Cash compensation	-60.126***	-60.643***	-60.133***	-60.649***
	(3.020)	(3.002)	(3.020)	(3.003)
State GDP growth rate	0.361**	0.311**	0.359**	0.312**
	(0.147)	(0.134)	(0.147)	(0.133)
State unemployment rate	0.580	0.161	0.580	0.161
	(0.423)	(0.514)	(0.423)	(0.513)
Firm fixed effects	X	X	X	X
Year fixed effects	X		X	
Industry-Year fixed effects		X		X
State fixed effects		X		X
Observations	32,359	32,359	32,359	32,359
Adjusted R-squared	0.491	0.504	0.491	0.504

Table 7. Labor unemployment risk and CEO vega: Accounting for the geographic distribution of a firm's employees

The table presents the results for a sample matched with the Lexis Nexis Corporate Affiliations Database. "Log max total benefit$_{t-1}$, majority-worker state" is the natural log of the maximum UI benefits in the state where the majority of workers are located. "Log max total benefit$_{t-1}$, weighted average" is the natural log of the weighted-average measure of UI benefits with the proportion of workers in each state as the weight. Other variable definitions are in Appendix A. In parentheses are heteroscedasticity-consistent standard errors (White, 1980) clustered at the state level (Petersen, 2009). ***, **, and * stand for statistical significance based on two-sided tests at the 1%, 5%, and 10% level, respectively.

	(1)	(2)	(3)	(4)
Dependent variable	Flow Vega	Flow Vega	Flow Vega	Flow Vega
Log max total benefit$_{t-1}$, majority-worker state	11.250**	10.855**		
	(4.229)	(4.685)		
Log max total benefit$_{t-1}$, weighted average			9.409***	9.647***
			(2.903)	(3.447)
Firm size	9.434***	9.447***	9.863***	9.891***
	(0.768)	(0.931)	(0.654)	(1.037)
Leverage	-7.681**	-7.658**	-4.710*	-4.596*
	(3.360)	(3.154)	(2.477)	(2.534)
MB ratio	4.607***	4.649***	4.532***	4.562***
	(0.440)	(0.560)	(0.381)	(0.563)
ROA	-4.072	-3.776	-0.294	0.072
	(3.486)	(3.197)	(3.073)	(2.797)
Tangibility	-11.467**	-11.799**	-10.854***	-10.904**
	(5.176)	(5.170)	(3.759)	(4.287)
Log(Stock volatility)	-3.153**	-3.107**	-3.914***	-3.786**
	(1.190)	(1.347)	(1.032)	(1.422)
Tenure	0.096	0.092	0.067	0.069
	(0.079)	(0.082)	(0.051)	(0.069)
CEO chairman	0.193	0.179	0.366	0.366
	(0.754)	(0.827)	(0.663)	(0.705)
Cash compensation	-57.190***	-57.207***	-58.451***	-58.519***
	(3.238)	(2.061)	(1.236)	(3.135)
State GDP growth rate	0.333**	0.349***	0.286**	0.290*
	(0.152)	(0.132)	(0.136)	(0.155)
State unemployment rate	0.066	-0.043	0.372	0.275
	(0.642)	(0.535)	(0.341)	(0.506)
Firm fixed effects	X	X	X	X
Year fixed effects	X		X	
Industry-Year fixed effects		X		X
State fixed effects		X		X
Observations	25,984	25,984	25,984	25,984
Adjusted R-squared	0.502	0.556	0.488	0.537

Table 8. Labor unemployment risk and CEO vega: Falsification tests

The table presents the results from falsification tests. Columns (1) and (2) present the results from regressions of CEO's risk-taking incentives in year t on the natural log of the maximum UI benefits measured in year t-1, t, and t+1. Columns (3) to (6) present results from regressions of CEO's risk-taking incentives in year t on the natural log of the maximum UI benefits of the bordering states. Other variable definitions are in Appendix A. In parentheses are heteroscedasticity-consistent standard errors (White, 1980) clustered at the state level (Petersen, 2009). ***, **, and * stand for statistical significance based on two-sided tests at the 1%, 5%, and 10% level, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent variable	Flow Vega	Flow Vega	Flow Vega	Flow Vega	Flow Vega	Flow Vega
Log max total benefit$_{t-1}$	11.612**	13.483**	12.473***	15.102**		
	(4.938)	(5.765)	(4.302)	(6.208)		
Log max total benefit$_{t}$	-3.350	-3.533				
	(6.732)	(6.537)				
Log max total benefit$_{t+1}$	4.524	6.452				
	(6.385)	(7.368)				
Log max total benefit$_{t-1}$, bordering states average			-3.376	-3.685	0.071	-1.408
			(6.810)	(7.961)	(6.881)	(7.442)
Firm size	11.090***	11.114***	10.669***	10.702***	10.613***	10.673***
	(0.967)	(0.962)	(0.968)	(0.960)	(0.962)	(0.974)
Leverage	-8.292**	-8.104**	-7.283**	-7.147**	-6.879**	-6.780**
	(3.230)	(3.199)	(3.047)	(3.016)	(3.008)	(2.979)
MB ratio	4.962***	5.005***	4.961***	4.997***	4.892***	4.933***
	(0.428)	(0.426)	(0.482)	(0.477)	(0.462)	(0.456)
ROA	-2.215	-1.872	-2.212	-1.991	-2.189	-1.945
	(2.568)	(2.558)	(2.723)	(2.709)	(2.673)	(2.645)
Tangibility	-10.830**	-11.179**	-11.405**	-11.806**	-11.594**	-11.899**
	(4.665)	(4.783)	(4.784)	(4.932)	(4.729)	(4.896)
Log(Stock volatility)	-2.232	-2.115	-2.299	-2.184	-2.731*	-2.651*
	(1.517)	(1.567)	(1.531)	(1.582)	(1.442)	(1.471)
Tenure	0.078	0.085	0.086	0.092	0.082	0.087
	(0.064)	(0.064)	(0.060)	(0.060)	(0.060)	(0.060)
CEO chairman	-0.040	-0.053	0.108	0.094	0.143	0.095
	(0.701)	(0.699)	(0.707)	(0.707)	(0.707)	(0.709)
Cash compensation	-60.767***	-60.892***	-60.072***	-60.213***	-59.985***	-60.076***
	(3.108)	(3.143)	(2.997)	(3.041)	(2.967)	(3.008)
State GDP growth rate	0.393**	0.407***	0.413***	0.426***	0.356**	0.364**
	(0.151)	(0.142)	(0.152)	(0.141)	(0.150)	(0.143)
State unemployment rate	0.634	0.498	0.678	0.506	0.641	0.482
	(0.488)	(0.479)	(0.474)	(0.453)	(0.525)	(0.520)
Firm fixed effects	X	X	X	X	X	X
Year fixed effects	X		X		X	
Industry-Year fixed effects		X		X		X
State fixed effects		X		X		X
Observations	31,441	31,441	32,561	32,561	32,561	32,561
Adjusted R-squared	0.495	0.544	0.490	0.540	0.490	0.539

Table 9. Labor unemployment risk and CEO vega: DID analysis

The table presents the results from difference-in-differences (DID) specifications. State-years with a large increase in maximum UI benefits (at least 10%) but without a large increase in the previous and next year are identified as the event-years. For each event-year, the state with a large increase in UI is matched to at least one bordering state that does not experience a large increase in UI in the previous, current, and next year. Three-year event window [-1, 1] centered on the event-year is selected. In columns (1) and (2), all the firms located in the event state and its matched bordering states are included. Columns (3) to (5) further require that the treatment and control firms be located in contiguous counties on either side of the state border. "After" is a dummy variable which equals one for the period after the large increase in maximum UI benefits and zero otherwise. "Treat" is a dummy variable which equals one for firms located in the event states and zero otherwise. Other variable definitions are in Appendix A. In parentheses are heteroscedasticity-consistent standard errors (White, 1980) clustered at the state level (Petersen, 2009). ***, **, and * stand for statistical significance based on two-sided tests at the 1%, 5%, and 10% level, respectively.

	(1)	(2)	(3)	(4)	(5)
Sample	Bordering states		Contiguous border counties		
Dependent variables	Flow Vega	Flow Vega	Flow Vega	Flow Vega	Flow Vega
After	-1.425	-0.210	-4.496	-2.477	-2.452
	(1.067)	(0.770)	(4.641)	(3.510)	(6.137)
After*Treat	6.051***	5.589***	11.343**	13.564***	20.381***
	(2.331)	(2.051)	(4.134)	(4.332)	(7.238)
Treat	-2.324	0.889	0.209	7.620	3.772
	(2.195)	(2.049)	(7.667)	(11.584)	(13.288)
Firm size	10.653***	5.621***	22.742***	23.212***	23.297***
	(1.922)	(1.585)	(3.334)	(6.095)	(7.010)
Leverage	-10.147	-7.449	-13.675	-4.441	1.404
	(6.251)	(5.805)	(10.037)	(16.612)	(19.725)
MB ratio	3.223***	3.076***	5.238	2.577	0.964
	(0.951)	(0.866)	(4.481)	(2.564)	(2.920)
ROA	0.017	2.967	-5.490***	-3.879	-3.853
	(6.691)	(6.171)	(1.733)	(2.531)	(2.961)
Tangibility	-1.902	5.853	25.869**	53.667**	43.968*
	(9.276)	(8.698)	(10.761)	(21.119)	(25.835)
Log(Stock volatility)	-3.114	-2.728	-3.301	10.180	12.851
	(2.717)	(1.937)	(4.322)	(6.692)	(8.648)
Tenure	0.252*	0.214*	0.239	0.208	0.092
	(0.131)	(0.123)	(0.326)	(0.383)	(0.470)
CEO chairman	0.300	1.337	0.045	11.007***	15.420***
	(1.634)	(1.545)	(2.240)	(3.344)	(4.426)
Cash compensation	-58.346***	-53.734***	-85.735***	-93.827***	-96.649***
	(3.603)	(3.214)	(7.511)	(6.914)	(8.405)
State GDP growth rate	0.536***	0.322**	1.648	1.640**	-0.151
	(0.189)	(0.127)	(1.345)	(0.697)	(1.203)
State unemployment rate	0.660	-2.197***	-3.870	-2.378	-2.872
	(0.897)	(0.343)	(2.433)	(2.300)	(4.051)

Firm fixed effects	X	X	X	X	X
Year fixed effects	X		X		
Industry-Year fixed effects		X		X	X
State fixed effects		X			
County Pair fixed effects				X	
County Pair-Year fixed effects					X
Observations	9,316	9,316	3,139	3,139	3,139
Adjusted R-squared	0.615	0.684	0.610	0.660	0.701

Table 10. Labor unemployment risk and CEO vega: Controlling for possible confounding events

The table presents the results from regressions controlling for potential state-level confounding events. "Gubernatorial election$_{t-1}$" is equal to 1 if the state experiences a gubernatorial election in the previous year and 0 otherwise. "State corporate tax increase (cut)$_{t-1}$ " is equal to 1 if the state increases (cuts) its top marginal corporate income tax rate in the previous year and 0 otherwise (Heider and Ljungqvist, 2015). "State personal income (capital gains) tax$_{t-1}$" is the maximum state tax rate on wage income (long-term capital gains) in the previous year. Other variable definitions are in Appendix A. In parentheses are heteroscedasticity-consistent standard errors (White, 1980) clustered at the state level (Petersen, 2009). ***, **, and * stand for statistical significance based on two-sided tests at the 1%, 5%, and 10% level, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent variables	Flow Vega	Flow Vega	Flow Vega	Flow Vega	Flow Vega	Flow Vega
Log max total benefit$_{t-1}$	12.193***	11.714**	11.981***	11.547**	11.958***	11.660***
	(4.052)	(4.725)	(3.710)	(4.360)	(3.773)	(4.141)
Firm size	10.661***	10.345***	10.671***	10.365***	10.672***	10.369***
	(0.969)	(0.877)	(0.974)	(0.878)	(0.973)	(0.878)
Leverage	-7.286**	-10.156***	-7.295**	-10.177***	-7.278**	-10.204***
	(3.050)	(3.337)	(3.053)	(3.339)	(3.037)	(3.346)
MB ratio	4.960***	5.081***	4.951***	5.076***	4.954***	5.077***
	(0.482)	(0.545)	(0.477)	(0.542)	(0.475)	(0.540)
ROA	-2.195	-4.916*	-2.235	-4.948*	-2.213	-4.967*
	(2.739)	(2.743)	(2.723)	(2.733)	(2.681)	(2.724)
Tangibility	-11.447**	-11.201**	-11.438**	-11.131*	-11.425**	-11.209**
	(4.743)	(5.543)	(4.755)	(5.564)	(4.748)	(5.559)
Log(Stock volatility)	-2.300	-1.594	-2.313	-1.602	-2.313	-1.611
	(1.533)	(1.314)	(1.525)	(1.312)	(1.525)	(1.308)
Tenure	0.086	0.113	0.085	0.112	0.085	0.111
	(0.060)	(0.070)	(0.060)	(0.069)	(0.060)	(0.069)
CEO chairman	0.112	0.248	0.137	0.269	0.139	0.267
	(0.705)	(0.713)	(0.706)	(0.714)	(0.705)	(0.714)
Cash compensation	-60.088***	-60.824***	-60.093***	-60.823***	-60.094***	-60.803***
	(3.011)	(2.983)	(3.001)	(2.975)	(3.001)	(2.974)
State GDP growth rate	0.417***	0.329**	0.449***	0.356**	0.452***	0.342**
	(0.150)	(0.132)	(0.152)	(0.136)	(0.152)	(0.139)
State unemployment rate	0.711	0.100	0.796	0.176	0.781	0.215
	(0.491)	(0.484)	(0.535)	(0.523)	(0.545)	(0.511)
Gubernatorial election$_{t-1}$	-0.497	-0.205	-0.354	-0.082	-0.357	-0.061
	(0.857)	(0.787)	(0.948)	(0.845)	(0.944)	(0.858)
State corporate tax increase$_{t-1}$			0.350	0.327	0.334	0.373
			(1.165)	(1.198)	(1.160)	(1.256)
State corporate tax cut$_{t-1}$			2.268	1.920*	2.289*	1.767
			(1.358)	(1.085)	(1.320)	(1.062)
State tax on personal income$_{t-1}$					0.075	0.037
					(0.564)	(0.610)

State tax on capital gains$_{t-1}$					0.017	-0.563
					(0.423)	(0.467)
Firm fixed effects	X	X	X	X	X	X
Year fixed effects	X		X		X	
Industry-Year fixed effects		X		X		X
State fixed effects		X		X		X
Observations	32,561	32,561	32,561	32,561	32,561	32,561
Adjusted R-squared	0.490	0.504	0.491	0.504	0.490	0.504

Table 11. Labor unemployment risk and CEO vega: Cross-sectional variations

The table presents cross-sectional variations in the effect of labor unemployment risk on CEO flow vega. Each panel presents an excerpt of the results from subsample regressions of CEO risk-taking incentives on the natural log of the maximum UI benefits based on whether the split variable is above or below the sample median. Labor intensity is measured as the median ratio of total labor expenses (XLR) to sales (SALE) for COMPUSTAT firms based on three-digit NAICS industries. Industry unionization is calculated as the percentage of total workers in a 3-digit Census Industry Classification (CIC) industry that are represented by unions in collective bargaining agreements. CEO portfolio delta is measured as the dollar change in the CEO' wealth for a 1% increase in the firm's stock price following Core and Guay (2002). Other variable definitions are in Appendix A. In parentheses are heteroscedasticity-consistent standard errors (White, 1980) clustered at the state level (Petersen, 2009). ***, **, and * stand for statistical significance based on two-sided tests at the 1%, 5%, and 10% level, respectively. We control for the same set of control variables as in column (4) of Table (2) in all regressions, whose coefficient estimates are suppressed.

Panel A: Partition based on industry labor intensity

	(1)	(2)	(3)	(4)
Sample	High labor intensity		Low labor intensity	
Dependent variables	Flow Vega	Flow Vega	Flow Vega	Flow Vega
Log max total benefit$_{t-1}$	19.570***	23.613***	1.974	0.764
	(6.257)	(5.837)	(5.238)	(7.301)
Control variables	X	X	X	X
Firm fixed effects	X	X	X	X
Year fixed effects	X		X	
Industry-Year fixed effects		X		X
State fixed effects		X		X

Panel B: Partition based on industry unionization

	(1)	(2)	(3)	(4)
Sample	Low union representation		High union representation	
Dependent variables	Flow Vega	Flow Vega	Flow Vega	Flow Vega
Log max total benefit$_{t-1}$	15.186**	13.208**	8.593	7.805
	(6.192)	(6.190)	(5.535)	(4.743)
Control variables	X	X	X	X
Firm fixed effects	X	X	X	X
Year fixed effects	X		X	
Industry-Year fixed effects		X		X
State fixed effects		X		X

Panel C: Partition based on CEO portfolio delta

	(1)	(2)	(3)	(4)
Sample	High portfolio delta		Low portfolio delta	
Dependent variables	Flow Vega	Flow Vega	Flow Vega	Flow Vega
Log max total benefit$_{t-1}$	22.059**	20.795***	2.351	0.628
	(9.082)	(7.592)	(2.385)	(3.038)
Control variables	X	X	X	X
Firm fixed effects	X	X	X	X
Year fixed effects	X		X	
Industry-Year fixed effects		X		X
State fixed effects		X		X

Table 12. Labor unemployment risk, CEO vega and firms' risk taking

The table presents results from regressions of several risk-taking measures on the natural log of the maximum UI benefits. The dependent variables in columns (1) to (6) are R&D to assets ratio, capital expenditures to assets ratio, cash holdings to assets ratio, an indicator for diversifying acquisitions, the natural log of annualized stock return volatility, and leverage ratio, respectively. Panel A and B present regression results for subsamples based on whether the change in flow vega is above or below the sample median for each year, respectively. Other variable definitions are in Appendix A. In parentheses are heteroscedasticity-consistent standard errors (White, 1980) clustered at the state level (Petersen, 2009). ***, **, and * stand for statistical significance based on two-sided tests at the 1%, 5%, and 10% level, respectively. We control for firm and year fixed effects in all regressions, whose coefficient estimates are suppressed.

Panel A: $\Delta Flow\ Vega_t$ is above median

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent variables	$R\&D_{t+1}$	$CAPEX_{t+1}$	$Cash_{t+1}$	Diversifying acquisitions indicator	Log(Stock volatility)$_{t+1}$	$Leverage_{t+1}$
Log max total benefit$_{t-1}$	0.010**	-0.014***	-0.030**	-0.842**	0.109***	0.021***
	(0.005)	(0.004)	(0.015)	(0.372)	(0.035)	(0.006)
Firm size	-0.002***	-0.002	-0.026***	0.168***	-0.022***	-0.004
	(0.001)	(0.001)	(0.004)	(0.049)	(0.007)	(0.006)
Leverage	-0.029***	-0.030***	-0.052***	-0.589**	0.080*	0.727***
	(0.006)	(0.006)	(0.016)	(0.273)	(0.040)	(0.033)
MB ratio	0.006***	0.004***	0.007***	0.039**	0.025***	0.003
	(0.001)	(0.001)	(0.002)	(0.020)	(0.004)	(0.004)
ROA	-0.110***	0.044***	-0.085***	-0.436	-0.312***	-0.058*
	(0.010)	(0.007)	(0.025)	(0.327)	(0.086)	(0.033)
Tangibility	-0.017***	0.036***	-0.203***	0.994**	-0.080	0.012
	(0.005)	(0.011)	(0.025)	(0.449)	(0.052)	(0.050)
Log(Stock volatility)	0.011***	-0.000	0.006	0.246	0.448***	-0.004
	(0.002)	(0.002)	(0.005)	(0.201)	(0.014)	(0.005)
Tenure	0.000	0.000	-0.000	-0.008	0.001	-0.000
	(0.000)	(0.000)	(0.000)	(0.005)	(0.001)	(0.000)
CEO chairman	-0.002**	0.001	-0.003	-0.112*	0.001	0.012***
	(0.001)	(0.001)	(0.003)	(0.066)	(0.007)	(0.004)
Cash compensation	-0.008***	-0.008***	-0.008	0.245	-0.002	0.013
	(0.003)	(0.003)	(0.007)	(0.354)	(0.030)	(0.019)
State GDP growth rate	0.001***	0.000	0.001*	-0.027	0.011***	0.000
	(0.000)	(0.000)	(0.000)	(0.023)	(0.002)	(0.001)
State unemployment rate	0.004***	-0.001	-0.002	-0.036	-0.003	-0.001
	(0.001)	(0.001)	(0.002)	(0.036)	(0.006)	(0.001)
Firm fixed effects	X	X	X	X	X	X
Year fixed effects	X	X	X	X	X	X
Observations	11,365	10,795	11,360	4,078	11,372	11,365
Adjusted (Pseudo) R-squared	0.883	0.723	0.798	0.536	0.790	0.768

Panel B: $\Delta Flow\ Vega_t$ is below median

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent variables	$R\&D_{t+1}$	$CAPEX_{t+1}$	$Cash_{t+1}$	Diversifying acquisitions indicator	$Log(Stock\ volatility)_{t+1}$	$Leverage_{t+1}$
Log max total $benefit_{t-1}$	0.005	-0.009**	-0.019	0.072	-0.042	0.010
	(0.004)	(0.004)	(0.012)	(0.310)	(0.048)	(0.008)
Firm size	-0.002***	-0.001	-0.023***	0.012	-0.046***	0.001
	(0.000)	(0.001)	(0.004)	(0.110)	(0.014)	(0.003)
Leverage	-0.023***	-0.028***	-0.082***	-0.568	0.155**	0.721***
	(0.003)	(0.004)	(0.015)	(0.407)	(0.058)	(0.033)
MB ratio	0.007***	0.006***	0.006***	-0.076*	0.014***	0.007**
	(0.001)	(0.001)	(0.002)	(0.042)	(0.005)	(0.003)
ROA	-0.109***	0.033***	-0.043**	0.931**	-0.410***	-0.067***
	(0.008)	(0.005)	(0.019)	(0.417)	(0.052)	(0.022)
Tangibility	-0.011***	0.034***	-0.203***	-0.970*	-0.014	0.025
	(0.004)	(0.009)	(0.022)	(0.550)	(0.078)	(0.015)
Log(Stock volatility)	0.007***	0.001	0.010**	0.065	0.457***	-0.009*
	(0.002)	(0.001)	(0.005)	(0.153)	(0.019)	(0.005)
Tenure	-0.000	0.000	-0.000	0.003	-0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.011)	(0.001)	(0.000)
CEO chairman	-0.002	-0.000	0.000	0.153**	0.011	0.004
	(0.001)	(0.001)	(0.003)	(0.076)	(0.012)	(0.003)
Cash compensation	-0.012***	-0.003*	-0.001	-0.103	-0.024	0.004
	(0.002)	(0.002)	(0.004)	(0.129)	(0.019)	(0.004)
State GDP growth rate	0.001***	0.000	-0.000	0.046***	-0.001	-0.001
	(0.000)	(0.000)	(0.000)	(0.016)	(0.002)	(0.000)
State unemployment rate	0.003**	-0.001**	-0.001	0.045	-0.018***	-0.000
	(0.001)	(0.000)	(0.001)	(0.040)	(0.007)	(0.001)
Firm fixed effects	X	X	X	X	X	X
Year fixed effects	X	X	X	X	X	X
Observations	15,371	14,879	15,363	5,029	15,417	15,368
Adjusted (Pseudo) R-squared	0.892	0.704	0.796	0.579	0.801	0.823

Table 13. Labor unemployment risk, CEO vega and operating performance

The table presents results from regressions of operating performance on the natural log of the maximum UI benefits. The dependent variable is the return on assets (ROA) in t+1. The first (last) two columns present regression results for subsamples based on whether the change in flow vega is above (below) the sample median for each year, respectively. Other variable definitions are in Appendix A. In parentheses are heteroscedasticity-consistent standard errors (White, 1980) clustered at the state level (Petersen, 2009). ***, **, and * stand for statistical significance based on two-sided tests at the 1%, 5%, and 10% level, respectively.

	(1)	(2)	(3)	(4)
	ΔFlow Vega$_t$ is above median		ΔFlow Vega$_t$ is below median	
Dependent variables	ROA$_{t+1}$	ROA$_{t+1}$	ROA$_{t+1}$	ROA$_{t+1}$
Log max total benefit$_{t-1}$	0.023***	0.018***	0.006	0.001
	(0.009)	(0.007)	(0.010)	(0.008)
Firm size	-0.014***	-0.014***	-0.020***	-0.022***
	(0.003)	(0.002)	(0.003)	(0.002)
Leverage	0.025**	0.026***	0.014	0.015*
	(0.010)	(0.007)	(0.011)	(0.008)
MB ratio	0.013***	0.013***	0.018***	0.018***
	(0.001)	(0.001)	(0.001)	(0.001)
ROA	0.306***	0.304***	0.236***	0.230***
	(0.027)	(0.011)	(0.021)	(0.010)
Tangibility	0.006	0.010	-0.000	-0.003
	(0.016)	(0.012)	(0.015)	(0.013)
Log(Stock volatility)	-0.026***	-0.028***	-0.034***	-0.036***
	(0.003)	(0.003)	(0.003)	(0.003)
Tenure	0.000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)
CEO chairman	-0.001	-0.001	-0.006***	-0.006***
	(0.002)	(0.002)	(0.002)	(0.002)
Cash compensation	0.002	0.002	-0.007*	-0.007**
	(0.004)	(0.003)	(0.004)	(0.003)
State GDP growth rate	-0.000	-0.000	-0.001*	-0.001*
	(0.000)	(0.000)	(0.000)	(0.000)
State unemployment rate	0.001	0.001	0.000	0.001
	(0.001)	(0.001)	(0.001)	(0.001)
Firm fixed effects	X	X	X	X
Year fixed effects	X		X	
Industry-Year fixed effects		X		X
State fixed effects		X		X
Observations	11,364	11,364	15,370	15,370
Adjusted R-squared	0.484	0.493	0.538	0.545

Appendix A. Variable definitions

Variable	Definitions
CEO compensation	
Flow vega	CEO's dollar change in wealth for a 0.01 increase in the annualized standard deviation of firm's stock returns following Core and Guay (2002). Calculated using only CEO's equity grants in the current fiscal year.
Flow delta	CEO's dollar change in wealth for a 1% increase in the firm's stock price following Core and Guay (2002). Calculated using only CEO's equity grants in the current fiscal year.
Options/Equity (value)	The value of stock options granted to the CEO scaled by the total value of equity grants in the current fiscal year.
Options/Equity (number)	The number of stock options granted to the CEO scaled by the total number of equity grants in the current fiscal year.
Cash compensation	The sum of salary and bonus scaled by CEO's total compensation.
Firm-level characteristics	
Firm size	Natural logarithm of firm's total assets (at).
Leverage	The sum of long-term debt (dltt) and current liability (dlc) scaled by firm's total assets (at).
MB ratio	Market value of firm's assets (at – ceq + csho*prcc_f) scaled by book value of total assets (at).
ROA	Income before extraordinary items (ib) scaled by firm's total assets (at).
Tangibility	Net PPE (property, plant and equipment) (ppent) scaled by firm's total assets (at).
Log(Stock volatility)	The log of the annualized standard deviation of firm's daily stock returns.
Tenure	Number of years a manager has been CEO of the firm.
CEO chairman	A dummy variable: 1 if the CEO of the firm is also the board chairman, 0 otherwise.
R&D	Research and development expense (xrd) scaled by firm's total assets (at).
CAPEX	Capital expenditures (capx) scaled by firm's total assets (at).
Cash	Cash and short-term investments (che) scaled by firm's total assets (at).

Diversifying acquisitions	Dummy variable: 1 if the acquirer and target do not share a four-digit SIC industry, 0 otherwise.
State-level characteristics	
Log max total benefit	Natural logarithm of the maximum total unemployment insurance benefit under the state's unemployment insurance system. We measure the log max total benefit as the product of the maximum amount of weekly dollar benefit (measured in 2002 constant dollars), and the maximum benefit duration.
Replacement rate, mean (median)	Maximum total unemployment insurance benefit scaled by industry average (median) semi-annual wages.
State GDP growth rate	State-level growth rate of GDP.
State unemployment rate	State-level unemployment rate.