



Paper: "CEO Compensation and Corporate Risk-Taking: Evidence From a Natural Experiment"

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How an Increase in Business Risk Affects the Design of Managerial Compensation and Its Managers' Actions

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In the last 30 years, use of option-based compensation for corporate executives has drastically increased. In response to the global financial crisis and deep economic recession that followed, managers were often accused of taking excessive risks. Researchers from Washington University in St. Louis's Olin Business School, University of Pennsylvania's Wharton School and Northwestern University's Kellogg School of Management explored the relationship between CEO compensation and corporate risk.

John Markoff and David Leonhardt, writers for the *New York Times*, assert that critics say “the popularity of options gave executives an incentive to push up their stock prices by any means at their disposal, including questionable ones.” Corroborating this, the US government-sponsored Financial Crisis Inquiry Commission (FCIC) reported in 2011 that options “had the unintended consequence of creating incentives to increase both risk and leverage, which could lead to larger jumps in a company's stock price, [motivating] financial firms to take more risk and use more leverage.”

Does option-based compensation encourage managers to take unnecessary risk?

On the one hand, option-based compensation incentivizes risk taking because managers share

directly in the gains, but not symmetrically in all the losses. A stock option is used by the holder for a future purchase of stock at a fixed price. So when the stock price increases, managers gain the spread between the actual stock price and the fixed-option cost. But when the share price becomes lower than the fixed-option price, they gain nothing and lose only the value of the option. On the other hand, options have the ability to increase a manager's exposure to his firm's risk, decreasing the manager's wish to take risks.

In order to examine this relationship, the researchers found a unique way to deal with the identification problem. They explored changes in business environment that increase risk. Every firm is exposed to risks in its business environment, and those risks take many

What comes first, the chicken or the egg? Does the firms' risk environment affect managers' contracts? Or does the use of stock options encourage manager risk taking?

different forms such as technological irrelevance, adverse regulatory changes, asset expropriation, and so on. The researchers examined a risk that is exogenous and unanticipated, which allowed them to assess how managers' compensation would change and how these incentives affect managers' risk-taking choices.

Focusing on a specific risk scenario

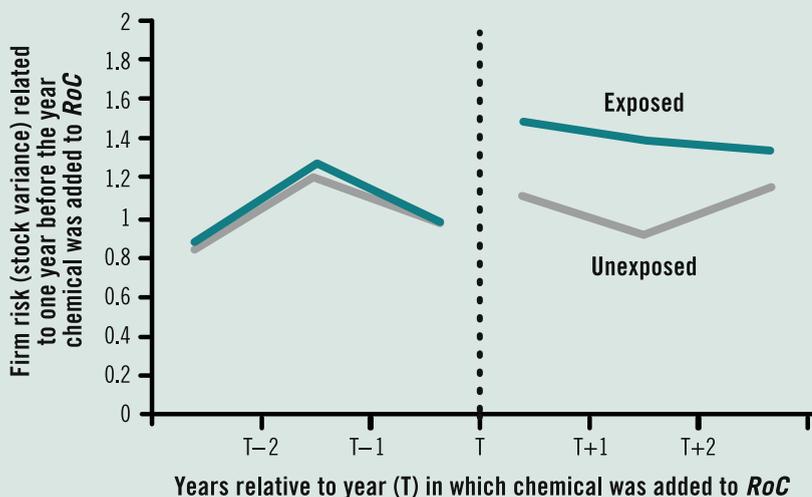
Milbourn and his colleagues focused on an increase in risk that occurred after a firm's workers were exposed to a chemical identified as a carcinogen. This risk ensnares the firm in a variety of concerns that require it to spend large amounts of money on legal fees, damage payments, and insurance premiums, which increases the cost of doing business. An increase in carcinogen risk reduces the profitability of new investments for the firm for a number of reasons. The risk reduces expected proceeds from new investments that use the chemical as an input because new regulation costs will swallow much of the profits. Additionally, any future lawsuits or adverse regulatory changes further consume cash returned from new investments that may or may not use the carcinogen input. Because shareholders may prefer the firm to pay out existing cash holdings to hedge against lawsuits, they are less willing to fund new investment. A predecessor study conducted by two of the authors of this paper (Todd Gormley and David Matsa) in 2011 found that the total legal liability faced by exposed firms tends to be around 5% of their assets and the new carcinogen listing could increase costs translating to a thirtyfold increase in the probability of financial distress.

Using the same empirical setting of this changing risk environment, the researchers here examined in what way boards change the structure of CEO compensation and whether managers' compensation structure is ultimately related to managerial risk taking. After all, the riskiness of firms' investment opportunities is widely thought to be an important determinant of managers' compensation. They kept two important questions in mind: 1) How do boards of directors adjust compensation in response to changes in their firm's business risk (increases in carcinogens, for example)? and 2) How do these incentives affect managers' risk taking?

Researchers sought the answers to two important questions: 1) How do boards of directors adjust compensation in response to changes in their firm's business risk (increases in carcinogens, for example)? and 2) How do these incentives affect managers' risk taking?

Identifying and comparing firms at risk vs. firms with no exposure

Before answering these questions, the researchers identified firms that were affected and unaffected by carcinogens. To identify the dangerous carcinogens, they consulted the Report on Carcinogens (RoC). Published by the U.S. Department of Health and Human Services every two years, the RoC lists chemicals that are presumed to be cancerous. To identify the exposed firms, the researchers consulted the National Occupational Exposure Survey. For each carcinogen, the group gathered a list of exposed companies and as a parallel group of companies in the same industry that were not exposed. Before the carcinogen was discovered, the researchers found that exposed and unexposed companies were similar in features such as average stock variance, size, market-to-book, profitability, annual compensation, and equity-based incentives. After the discovery of the carcinogen in the affected group, there was a stock variance divergence of 60%, as illustrated in the figure below. This divergence mirrors the increase in business risk for the affected firms.

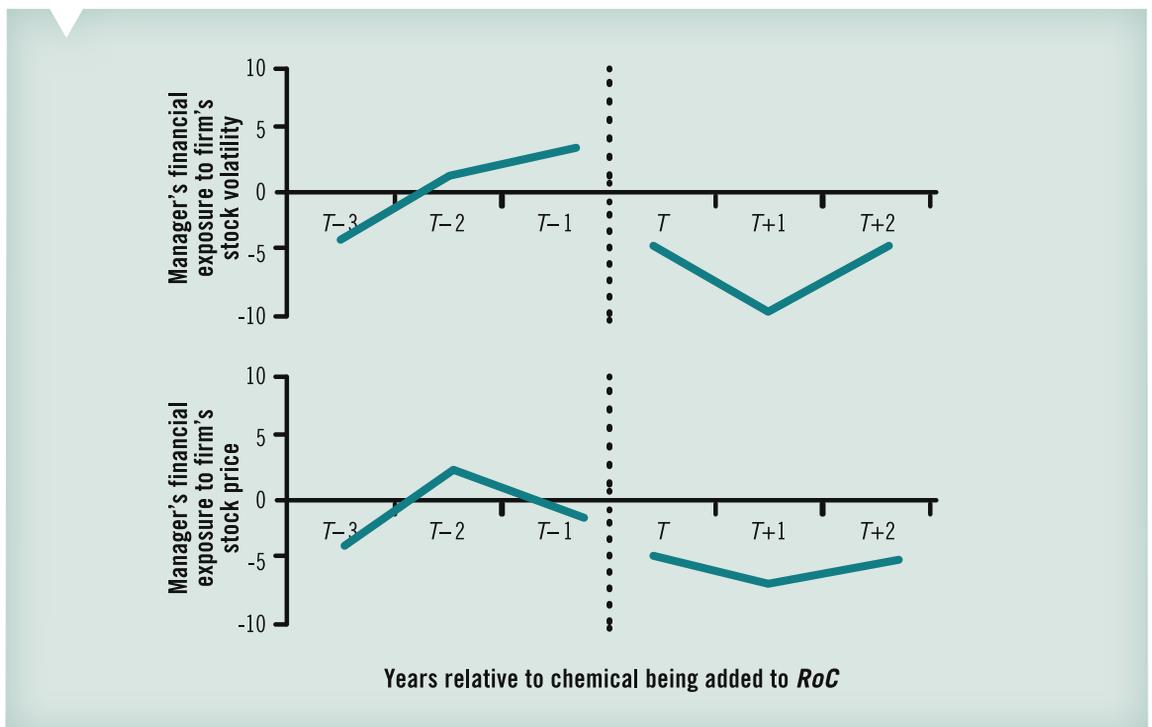


How business risk affects the structure of managerial compensation

To find out how compensation is adjusted in response to business risk, researchers examined companies that were affected and unaffected by the discovery of carcinogens. Then they analyzed the impact of the increase in risk on annual manager compensation. They found that boards of directors modify the composition of a manager's pay by altering stock and options in their compensation immediately after risk increases. Naturally, this alters the incentive structure as well, because the makeup of a manager's compensation determines that manager's incentive to take risks. Boards of directors alter how much of a manager's compensation package is affected by stock price movement and volatility in an attempt to insulate compensation from the decline in investment that shareholders wish to pursue after carcinogen discovery.

The figure below depicts relative changes in a manager's financial exposure to a firm's stock volatility ("vega") and price ("delta"), respectively. There is no indication of a decrease in financial exposure to firm stock price and volatility prior to carcinogen discovery. Beginning the year of discovery, however, exposed firms reduce their CEO's exposure to firm stock price and volatility. From this year onward, these reductions continue to stay lower.

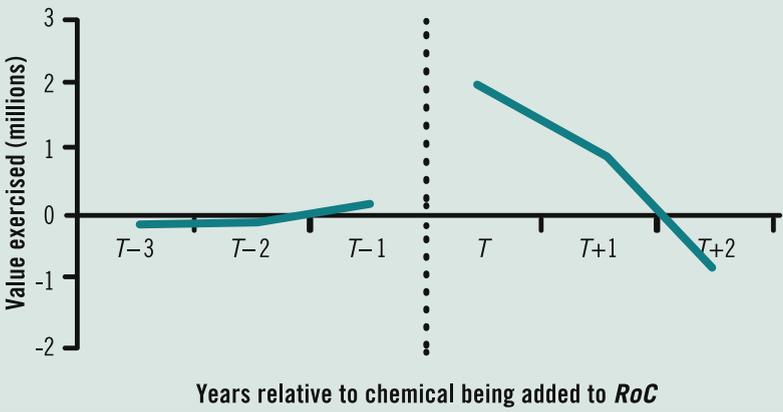
When a firm's business risk increases, executive compensation becomes less sensitive to the firm's stock price and its volatility. The executives exercise their vested options and sell restricted stock to reduce their exposure to business risk.



How do managers respond to the increase in their firm's risk?

Milbourn and his colleagues found that a manager will alter his or her financial exposure to the new risk by exercising vested options as well as by selling restricted stock in his or her company. After the increase in carcinogens, CEOs of exposed firms attempted to dilute overall risk exposure. They exercised an additional \$2 million in options in the year that risk increased and another \$1 million the following year relative to nonexposed firm managers. Also, qualitatively, there was a decrease in the number of company stock shares owned by managers of exposed firms, which suggests that managers sold shares to distance their portfolios from the increase in unanticipated risk.

The figure below plots options exercised by managers at exposed firms from three years before the risk increases, T-3, to three years after the risk increases. In the years prior to carcinogen discovery, the value exercised is nearly flat. Yet upon discovery, managers at exposed firms begin to exercise more options compared to those at unexposed firms.



Managers with reduced exposure to business risk are less likely to engage in diversifying acquisitions, reduce R&D expenses, and increase cash holdings in order to reduce their firm's risk.

How the structure of managerial compensation affects corporate risk

After exploring how the increase in an exogenous carcinogen risk affected manager's compensation portfolios, the researchers examined how incentives affect managerial risk taking. In response to the increase in risks, affected companies can take actions to decrease risk. For instance, they can increase cash holdings, decrease leverage and R&D expenditures and make diversifying acquisitions. In light of this, in 2011, Gormley and Matsa found that most firms respond by reducing leverage and diversifying through acquisitions of firms with relatively high-operating cash flows. Milbourn and his colleagues found that CEOs whose compensation is more sensitive to stock volatility are less likely to act in order to offset increases in exogenous risk. It is not as imperative for them to reduce risk, because that would lower the expected value of their payoff. Thus, they are less likely to engage in diversifying acquisitions, reducing leverage, cutting R&D expenditures, and increasing cash-to-asset ratios than their counterparts.