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Abandon Ship: Deferred Compensation and Risk-Taking Incentives in Bad Times

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Non-Technical Summary

Inside debt (namely, managerial deferred compensation and pension plans) is traditionally viewed as a tool to align the incentives of managers with those of shareholders and, thus, to decrease the risk of corporate default. Naturally, this result holds only if inside debt provides managers with a debt-like payoff. For this reason, the beneficial effect of inside debt hinges on the way managers' contributions are invested. If a large fraction of inside debt is invested in the company's stock, inside debt may provide equity-like payoffs that intensify, rather than diminish, managerial risk-taking incentives. We show that a large fraction of deferred compensation, an important component of inside debt, is highly correlated with company stocks suggesting that deferred compensation is actually invested in company stocks. Moreover, the investment strategy of deferred compensation is time-varying: Managers tend to divest deferred compensation from their own firm's equity in bad times and invest it in alternative assets. This strategy allows the manager to hedge his/her wealth against default risk and induces him/her to take on more risk. It is worth emphasizing that the investment strategy of deferred compensation increases managerial risk taking incentives in bad times, exactly when creditors would need more protection. We conclude that it would be improper to assume that deferred compensation unambiguously decreases managerial risk-taking incentives. Most importantly, it would be important to have information about the investment strategy of deferred compensation because this information can be used to build early warning indicators of distress. Unfortunately, the current regulation does not require companies to disclose information regarding the investment strategy of deferred compensation.

Abandon Ship: Deferred Compensation and Risk-Taking Incentives in Bad Times*

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Abstract

We develop a model that endogenizes the manager's choice of firm risk and of deferred compensation investment strategy. Our model delivers two predictions. First, managers have an incentive to reduce the correlation between deferred compensation and company stock in bad times. Second, managers that reduce such a correlation take on more risk in bad times. Using a sample of U.S. public firms, we provide evidence consistent with the model's predictions. Our results suggest that the weaker link between deferred compensation and company stock in bad times does not translate into a mitigation of debt-equity conflicts.

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1 Introduction

Top executives of U.S. public firms receive an important fraction of their compensation in the form of retirement benefits. Such benefits are akin to debt-like claims on the firm and are often called "inside debt". As pointed out by Jensen and Meckling (1976) and Edmans and Liu (2011), inside debt can align the incentives of managers and creditors, thus making the former more conservative.[1]

Yet, several studies suggest a more nuanced view of inside debt incentives. Inside debt is composed of pensions (rank-and-file plans and supplemental executive retirement plans) and deferred compensation. Anantharaman, Fang, and Gong (2014) show that the incentive alignment effect of inside debt is driven by supplemental executive retirement plans, i.e., the inside debt component most exposed to default risk. By contrast, rank-and-file plans are protected in bankruptcy, and deferred compensation plans, though often formally at risk in bankruptcy, allow some flexibility in the schedule of withdrawals, which can predate the retirement date (and the maturity date of outstanding debt).[2] Interestingly, deferred compensation plans also allow substantial flexibility in the investment strategy, which has the potential to affect managerial risk-taking incentives. However, this aspect has received little attention. An exception is Jackson and Honigsberg (2014), who show that a substantial fraction of deferred compensation is invested in the company's stock. Hence, deferred compensation may provide managers with equity-like payoff and intensify, rather than diminish, managerial risk-taking incentives in bad times, exactly when debt-related agency conflicts are most severe. Such a result would depend on how the manager's investment strategy of deferred compensation varies throughout time. However, the literature is silent as to the time-varying asset allocation of deferred compensation plans.

[1] Several studies provide evidence consistent with this view. See, e.g., Sundaram and Yermack (2007) and Cassel, Huang, Sanchez, and Stuart (2012).

[2] See references in Anantharaman, Fang, and Gong (2014).

We fill this gap in the literature. We start by developing a model that endogenizes the manager's risk choice and deferred compensation investment strategy. Our model provides two novel predictions. First, we expect CEOs to divest deferred compensation plans from their own firm's equity in bad times. Second, in bad times, CEOs with a smaller fraction of deferred compensation plans invested in their own firm's equity will take on more risk.

We test our model's predictions on a large sample of 1,740 U.S. public firms over the period 2006-2015 by analyzing CEOs' compensation packages. First, we substantiate the suggestive evidence of Jackson and Honigsberg (2014) and show that deferred compensation is indeed significantly linked to company stocks. Given that current disclosure rules do not require companies to reveal how deferred compensation contributions are invested, we measure the link between deferred compensation and company stocks by means of the correlation between deferred compensation returns and stock returns. We find that this correlation is indeed positive, large, and statistically significant. This suggests that deferred compensation is generally similar to equity-like compensation, such as restricted shares and stock options.

However, the high correlation between deferred compensation debt returns and stock returns is not necessarily incompatible with creditors' interests. In fact, debt-related agency conflicts (e.g., risk-shifting) are more prevalent in periods of financial distress. In other words, deferred compensation, to be effective, should mitigate agency problems especially during distress periods. Thus, as a second step, we analyze the time-varying relation between deferred compensation returns and stock returns. In line with our model's prediction, we find that this correlation is much lower during distress periods. This suggests that, in bad times, the interests of shareholders and managers are less aligned through deferred compensation, and deferred compensation may actually help reducing debt-related agency cost when it is needed the most.

To test the validity of the previous argument, we examine whether the decline in the correlation between deferred compensation and company stock is indeed the result of incentive realignment between managers and creditors or, instead, just reflects managers' desire to "abandon" the firm during bad times. To distinguish between these two possible causes of the decline in correlation, we explore patterns in firm risk. We find that asset risk is higher in distressed periods and especially so for firms characterized by a lower correlation between stock returns and deferred compensation returns. Indeed, as suggested by our model, the positive relation between asset risk and distress is significantly stronger for such firms. For those firms, bond yield spreads are also higher, which is inconsistent with a mitigation of debt-related agency conflicts.

Taken together, our results point to a novel channel through which deferred compensation may affect managerial risk-taking incentives. Deferred compensation plans are often proposed as a way to mitigate risk-shiting behavior because they are designed to give the manager low cash-flows in financial distress. The possibility to decide the investment strategy of these plans, however, provides the manager with an exchange option to allocate cash-flows exactly to distressed states of the world. This strategy increases the manager's expected compensation and induces risk-shifting behavior, which exposes creditors to increased risk.

Our paper contributes to the literature studying the risk-taking incentives of inside debt. A substantial body of work provides evidence compatible with the risk-reducing role of inside debt suggested by Jensen and Meckling (1976) and Edmans and Liu (2011). Sundaram and Yermack (2007) find a negative relation between the ratio of inside debt to inside equity and default risk. Wei and Yermack (2011) show that, after firms' initial disclosure of top executive retirement plans, bond prices rise while stock prices decrease. Liu, Mauer, and Zhang (2014) illustrate that inside debt helps protect creditors by favoring cash hoarding behavior. Srivastav, Armitage, and Hagendorff (2014) focus on the banking sector and document that inside debt limits managerial risk-shifting through a reduction of incentives to divert cash to shareholders. Cassel, Huang, Sanchez, and Stuart (2012) report evidence of a negative relation between executives' inside debt holdings and the volatility of stock returns. Anantharaman, Fang, and Gong (2014), however, show that inside debt is effective at reducing the cost of private loans only when it is effectively exposed to default risk. Colonnello, Curatola, and Hoang (2016) extend this result to public debt and illustrate that low-seniority debt can interact with equity incentives in making CEOs less conservative. Such an unintended increase in managerial risk-taking is concentrated in bad times (Inderst and Pfeil, 2013). Jackson and Honigsberg (2014) show that executives invest inside debt in their own firm's equity. We complement this literature by focusing on the risk-taking incentives of one component of inside debt, i.e., deferred compensation. To this end, we develop and test a model of managerial risk-taking that takes into account the manager's time-varying deferred compensation investment strategy.

Our paper also speaks to the literature on the hedging behavior of executives on their company equity holdings. Gao (2010) documents that optimal pay-performance sensitivity is decreasing in the hedging costs faced by the CEO. Bettis, Bizjak, and Lemmon (2001) find that managers use derivative instruments such as zero-cost collars and equity swaps to hedge their positions. Anderson and Puleo (2016) show that managers that hedge themselves by pledging their equity awards to borrow funds take on more risk. We illustrate that deferred compensation plans may allow executives more discretion over their exposure to the firm's idiosyncratic risk.

2 Model

To study the relation between the investment strategy of deferred compensation and risk-taking incentives, we build on the model of Bolton, Mehran, and Shapiro (2015) to account for deferred compensation. We consider a company characterized by separation between ownership and control. The risk-neutral manager, hired by shareholders, takes operating decisions under a compensation package consisting of a fixed component (i.e., salary), a share of equity, and deferred compensation. We consider a benchmark contract that does not allow the manager to modify the composition of deferred compensation and we compare the results with those of a contract that does allow the manager to decide the investment strategy of deferred compensation.

2.1 Investment technology and managerial compensation

The manager can invest an amount I at $t = 0$ and obtain a random payoff $\tilde{x}$ at $t = 1$ that can take three values:

- A high payoff $x + (1 + \mu)\Delta$ with probability q;
- A medium payoff x with probability $(1 - 2q)$;
- A low payoff $x - \delta$ with probability q.

Given that there are three possible states of the world, the probability $q < \frac{1}{2}$ represents tail risk and is the choice variable for the manager. In other words, the manager controls the riskiness of the company by choosing the variance of the investment technology of the firm. $\mu \in (0, 1)$ represents the firm's profitability: The higher is μ the higher is the expected payoff of the investment. The manager can change q at the cost $c(q) = \frac{1}{2}aq^2$.

To finance investments, the firm raises external funds at the rate R under the constraint that risk-neutral external creditors obtain a total return $1+R$ at least equal to the risk-free return, which is assumed to be 1 for simplicity. Under the additional assumption that the firm defaults only when the investment payoff is low, the payoff promised to creditors has to satisfy

$$(1 - q)(1 + R) + q(x - \delta) \geq 1. \tag{1}$$

R is chosen so that the previous constraint holds with equality, which implies that

$$1 + R = \frac{1 - q(x - \delta)}{(1 - q)}, \tag{2}$$

with the additional assumptions $x < 1 + \delta$ and $x > 1 + \frac{1}{2}\delta$. These assumptions, in conjunction with the fact that R is strictly increasing in q, ensure that default only occurs when the payoff is low.

The investment technology and borrowing conditions above are similar to those described by Bolton, Mehran, and Shapiro (2015). Our extension is related to the manager's compensation package. The manager total pay W is given by

$$W = \bar{w} + S_E P_E + S_D D, \tag{3}$$

where $\bar{w}$ represents the fixed salary, S_E the share of equity, P_E the price of equity, S_D the loading on deferred compensation, and D the expected value of deferred compensation.[3] The equity component and deferred compensation are paid at $t = 1$, whereas salary is paid at $t = 0$ and thus not subject to default risk. The price of equity is given by the present value of cash flows net of operational costs:

$$P_E = q(x + (1 + \mu)\Delta) + (1 - 2q)x - (1 - q)(1 + R) - \frac{1}{2}aq^2. \tag{4}$$

Deferred compensation can be interpreted as salary (or other forms of compensation) kept inside the firm for one period, which makes it exposed to the investment project's payoff. We consider two types of deferred compensation management. The first is a scheme where deferred compensation is represented by a fixed amount of money that the

[3] More precisely, Bolton, Mehran, and Shapiro (2015) assume that the compensation package of the manager depends on salary, equity, and the company's credit spread. Thus, the first two components of our compensation package are the same as those in Bolton, Mehran, and Shapiro (2015). The novelty of our approach relies on the third component.

manager obtains only if the company is solvent, that is with probability $1-q$. Under this scheme, the expected value of deferred compensation is given by $D = (1-q)\bar{D}$, where $\bar{D}$ is some positive constant decided at the time the contract is signed. We call this contract "non-discretionary" compensation scheme.

The second scheme, instead, allows for managerial discretion in deciding the deferred compensation investment strategy. We conjecture that, depending on the company's expected profitability, the manager may modify the exposure of his/her investment strategy to company stock in such a a way to increase his/her expected compensation when the company expected profitability is low. Hence, we consider an additional deferred compensation contract whose payoff is given by

$$D = \beta P_E + (1-\beta)q\bar{C}, \tag{5}$$

where $\bar{C}$ represents the cash-flow of the alternative assets. These assets payoff with probability q, that is the probability of extreme company cash-flows. As a result, such assets may be used by the manager to increase cash-flows in states where cash-flows from other assets (equity and deferred compensation) are low, namely when the firm's expected profitability is low. The manager can modify the composition of the deferred compensation by changing β at the cost $c(\beta) = \frac{1}{2}b\beta^2$. We assume that the manager cannot short-sell his/her own company stocks, i.e., we impose $\beta \geq 0$. In summary, under the "non-discretionary" contract, the manager only selects the risk of investment and thus solves the problem

$$\begin{aligned} &\max_q \bar{w} + S_E P_E + S_D D \qquad (6)\\ &\text{s.t.} \quad 0 \leq q \leq \frac{1}{2}, \end{aligned}$$

where

$$P_E = q(x + (1+\mu)\Delta) + (1-2q)x - (1-q)(1+R) - \frac{1}{2}aq^2, \tag{7}$$

$$D = (1-q)\bar{D}. \tag{8}$$

Under the "discretionary" contract, the manager can also choose the composition of his/her deferred compensation and thus solves

$$\begin{aligned} &\max_{q,\beta} \bar{w} + S_E P_E + S_D D - \frac{1}{2}b\beta^2 \\ &\text{s.t.} \quad 0 \leq q \leq \frac{1}{2}, \quad \beta \geq 0, \end{aligned} \tag{9}$$

where

$$P_E = q(x + (1+\mu)\Delta) + (1-2q)x - (1-q)(1+R) - \frac{1}{2}aq^2, \tag{10}$$

$$D = \beta P_E + (1-\beta)q\bar{C}. \tag{11}$$

Note that, when defining the discretionary contract, we assume that the cost of changing the composition of the deferred compensation is sustained by the manager. One could also assume that the cost is borne by shareholders. In this case, the quantity $\frac{1}{2}aq^2$ should be subtracted from the stock price P_E. These two alternatives produce qualitatively identical results. However, if one subtracts the cost $\frac{1}{2}aq^2$ from the stock price P_E, the maximization problem (9) becomes non-concave and no closed form solution is available.[4]

The proposition below reports the manager's optimal choice under the non-discretionary contract.

[4] More precisely, it is easy to see that in this case the equation for D, which includes the term βP_E, would contain the quantity $-\frac{1}{2}b\beta^3$ which, in turn, would make the objective function non-concave.

Proposition 1. *Let*

$$\tilde{q}_1 = \frac{1}{a}\left[(1+\mu)\Delta - \delta - \frac{S_D}{S_E}\bar{D}\right]$$

be the unconstrained risk-taking policy under the non-discretionary deferred compensation contract. The optimal constrained policy $\hat{q}_{NDIS}$ *is given by*

$$\hat{q}_{NDIS} = \begin{cases} 0, & \text{if } \tilde{q}_1 < 0; \\ \tilde{q}_1, & \text{if } 0 < \tilde{q} < \frac{1}{2}; \\ \frac{1}{2}, & \text{if } \tilde{q}_1 \geq \frac{1}{2}. \end{cases} \tag{12}$$

Proof. Appendix A. □

According to Proposition 1 the manager takes on more risk when the firm's profitability, as measured by μ, is high. This result hinges on the usual limited liability assumption which leaves creditors to bear the cost of default and gives the manager the gains of successful investments. The effect of firm's profitability is counterbalanced by the deferred compensation: The manager has the incentive to reduce firm's risk to increase the probability to receive the deferred compensation and, as a result, increase his/her expected compensation. Therefore, the higher is the amount of deferred compensation the lower is the amount of risk that the manager decides to take. The previous result holds as long as the manager's deferred compensation is lost in bankruptcy. If, instead, the manager has the possibility to preserve his/her deferred compensation in bankruptcy, the previous result may no longer be valid.

Proposition 2. *Let* β^* *be implicitly defined by*

$$\beta^* = \frac{S_D}{b}\left[\pi_F\left(\hat{q}_{DIS}\left(\beta^*\right)\right) - \hat{q}_{DIS}(\beta)\bar{C} - \frac{1}{2}a\hat{q}_{DIS}(\beta^*)^2\right],$$

where $\pi_F(q) = q\left[(1+\mu)\Delta - \delta\right] + (1-q)x - 1$ *represents the firm's expected payoff.* $\hat{q}_{DIS}$

is the optimal discretionary risky choice and is given by

$$\hat{q}_{DIS}(\beta) = \begin{cases} 0, & \text{if } \tilde{q}_2(\beta) < 0; \\ \tilde{q}_2(\beta), & \text{if } 0 < \tilde{q}_2(\beta) < \frac{1}{2}; \\ \frac{1}{2} & \text{if } \tilde{q}_2 \geq \frac{1}{2}; \end{cases} \tag{13}$$

where

$$\tilde{q}_2(\beta) = \frac{1}{a}\left[(1+\mu)\Delta - \delta + \frac{S_D(1-\hat{\beta})}{S_E + \hat{\beta}S_D}\bar{C}\right].$$

is the unconstrained risk-taking policy under the discretionary deferred compensation contract. The associated investment strategy of the deferred compensation plan is

$$\hat{\beta} = \begin{cases} 0, & \text{if } \pi(\tilde{q}_2(0)) - \tilde{q}_2(0)\bar{C} - \frac{1}{2}aq(0)^2 < 0; \\ \beta^*, & \text{if } \pi(\tilde{q}_2(0)) - \tilde{q}_2\bar{C} - \frac{1}{2}a\tilde{q}_2^2 \geq 0. \end{cases} \tag{14}$$

Finally, for any $\hat{\beta} \in [0,1]$, $\hat{q}_{DIS} \geq \hat{q}_{NDIS}$ *and the difference* $\hat{q}_{DIS} - \hat{q}_{NDIS}$ *decreases with* $\hat{\beta}$.

Proof. Appendix A. □

Several implications follow from Proposition 2. First, the investment strategy of deferred compensation depends on the expected payoff of the firm's investment relative to the expected payoff of the alternative investment available to the manager. The higher the expected payoff of the firm's investment compared to the payoff of the alternative investment opportunity, the higher the fraction of deferred compensation the manager desires to invest in the firm's stocks is. On the contrary, when the alternative investment opportunity is expected to deliver higher payoffs than the firm's stock, the manager has an incentive to short the firm's stock. As a result, the short selling constraint binds and the optimal $\hat{\beta}$ is equal to zero. Moreover, if we restrict our attention to the case $\hat{\beta} \in [0, 1]$, as seems natural, we see that in this case the discretionary investment policy increases managerial risk-taking incentives. The incremental risk induced by the discretionary policy decreases with the fraction of wealth tied to company stock ($\hat{\beta}$): The lower the fraction of wealth tied to company stock, the higher the incremental risk induced by the discretionary policy is. This result has to be interpreted in conjunction with the fact that the fraction of wealth tied to the firm's stock increases with the expected payoff of the firm's investment. This means that, when the payoff of the investment is expected to be low, the manager desires to decrease the fraction of deferred compensation tied to company stock and, at the same time, finds it optimal to take on more risk. When the firm's expected payoff is sufficiently larger than the expected payoff of alternative investments, the manager might find it optimal to overweight company stock, namely to select $\hat{\beta} > 1$, short sell the alternative assets, and invest the proceeds in the company stock. This would mean that the manager borrows against his/her deferred compensation to buy additional shares of the company stock.[5] In this case, the risk-shifting problem is less severe and creditors are not damaged. In other words, the discretionary contract is akin to an option that allows the manager to exchange the standard non-discretionary contract with a contract that delivers a positive payoff when the firm is in default. To keep the standard deferred compensation contract, the manager selects $\beta > 1$. In this case, $A \equiv \frac{S_D(1-\hat{\beta})}{S_E+\hat{\beta}S_D} < 0$, and, therefore, the optimal risk choice of the manager can be written as

$$\tilde{q}_2(\beta) = \frac{1}{a}\left[(1+\mu)\Delta - \delta - \mid A \mid \bar{C}\right],$$

[5]Note that we could exclude this case by adding one additional constraint to the maximization problem. We prefer not to do it for two reasons. First, the additional constraint would complicate the exposition of the optimal policy. Second, it is interesting to study the conditions under which the manager desires to overweight company stock.

which is in fact similar to the risk choice under the standard non-discretionary contract. In particular, we observe that in this case the deferred cash-flows $\bar{C}$ has a negative effect on the risk choice of the manager, similarly to the deferred compensation $\bar{D}$ in Proposition 2. When the firm's expected profitability is low, the manager exercises the exchange option by choosing $\beta < 1$. In this case, $A \equiv \frac{S_D(1-\hat{\beta})}{S_E+\hat{\beta}S_D} > 0$ and the deferred cash-flow $\bar{C}$ has a positive effect on managerial risk incentive because it allows the manager to increases the expected payoff of his/her deferred compensation.

A final remark is in order. Although the case $\beta > 1$ is theoretically possible, we argue that it is de facto of limited importance. First, employees cannot take loans out of nonqualified deferred compensation plans, which are widespread among managers.[6] Second, while in the past it was common practice for firms to extend loans to their executives to buy company stock with the goal of increasing managerial ownership, the Sarbanes-Oxley Act of 2002 forbade this type of loans (Kahle and Shastri, 2004) and our empirical analysis below focuses on the post-2006 period.

In conclusion, the model delivers two testable hypotheses.

Hypothesis 1:

The positive link between deferred compensation and company stock is weaker when the firm's profitability is expected to be low (bad times).

Hypothesis 2:

When the firm's profitability is expected to be low (bad times), CEOs choose a weaker link between deferred compensation and company stock, and take on more risk.

[6] See, e.g., https://www.fidelity.com/viewpoints/retirement/nqdc.

3 Empirical approach and data

3.1 Empirical approach

Our empirical approach, rather than establishing causality, goes in the direction of capturing endogenous patterns between the investment strategy of deferred compensation and managerial risk-taking that are consistent with the model (see, e.g., Danis, Rettl, and Whited, 2014). These variables are endogenous in our model, so the tests below are concerned with the relation among equilibrium quantities.

Our empirical analysis needs to deal with one important difficulty, namely, that we do not observe how CEOs invest their deferred compensation. As a consequence, we use the approach suggested by Jackson and Honigsberg (2014) and look at the correlation between returns on deferred compensation and stock returns. This is an admittedly indirect way to infer the actual CEO investment strategy, but it still provides insights about CEO time-varying incentives from deferred compensation.

To test Hypothesis 1, we analyze the relation between returns of deferred compensation and stock returns in normal and distressed times by estimating the following specification:

$$\begin{aligned} Def.\ comp\ return_{i,t} =& \beta_1 \cdot Distress_{i,t} \cdot Stock\ return_{i,t} \\ & + \beta_2 \cdot Distress_{i,t} + \beta_3 \cdot Stock\ return_{i,t} \\ & + \theta \cdot Control\ variables_{i,t} + \upsilon_i + \nu_t + \epsilon_{i,t}. \end{aligned} \tag{15}$$

The subscripts i and t indicate firm and year, respectively. $Def.\ comp.\ return_{i,t}$ is the CEO annual return on deferred compensation over the fiscal year. $Distress_{i,t}$ is an indicator variable for financial distress. $Stock\ return_{i,t}$ is the annual stock return over the fiscal year. We always first estimate regressions without control variables to limit concerns about "bad controls", namely about selection bias due to the inclusion of control variables that are outcome variable themselves (Angrist and Pischke, 2009). For the same reason, we choose a parsimonious set of control variables. $Control\ variables_{i,t}$ include CEO characteristics (age, tenure, and the relative debt-to-equity ratio) and firm size. Given that our hypotheses relate to the time-varying risk-taking incentives of deferred compensation, we focus on the time-series variation by including firm fixed effects, υ_i. To control for changing aggregate economic conditions, we include fiscal year fixed effects, ν_t. Standard errors are clustered at the firm-level.

Hypothesis 1 concerns the relation between returns of deferred compensation and stock returns in distress, so the parameter of interest in equation (15) is β_1. We expect it to be negative.

To shed light on how the link between deferred compensation and stock returns relates to debt agency conflicts, we investigate firm riskiness. Rather than directly examining risk-shifting, we verify whether patterns in firm risk are consistent with this phenomenon. We analyze firm risk by estimating this specification:

$$\begin{aligned} y_{i,t} =& \beta_1 \cdot Distress_{i,t} \cdot Low\ correlation_{i,t} + \beta_2 \cdot Distress_{i,t} + \beta_3 \cdot Low\ correlation_{i,t} \\ &+ \theta \cdot Control\ variables_{i,t} + \upsilon_i + \nu_t + \epsilon_{i,t}. \end{aligned} \tag{16}$$

$y_{i,t}$ is the outcome variable of interest (asset risk, yield spread). $Distress_{i,t}$ is defined as above. $Low\ correlation_{i,t}$ is an indicator variable equal to one if the absolute value of the residual from regressing $Def.\ comp.\ return_{i,t}$ on $Stock\ return_{i,t}$ alone (i.e., without control variables) is in the top quartile for a given firm-year. Such a measure captures weakened correlation between deferred compensation and stock returns and is consistent with our specification (15). $Low\ correlation_{i,t}$ thus proxies for periods in which deferred compensation is divested from the firm's own equity. $Control\ variables_{i,t}$ include the variables listed for equation (15).

The parameter of interest in equation (16) is β_1. Based on Hypothesis 2, we expect it to be positive.

3.2 Data and summary statistics

We consider a sample of U.S. public firms from 2006 through 2015 that have available executive compensation information in the Standard and Poor's Execucomp database. We start our analysis in 2006, because the U.S. Securities and Exchange Commission (SEC) enhanced disclosure requirements about executive pensions and deferred compensation were enforced starting in 2006. We obtain accounting data and daily stock return data from the CRSP-Compustat merged database. We require each firm to have traded ordinary shares (CRSP share code 10 or 11). We obtain corporate bond yield data from the Financial Industry Regulatory Authority's Trade Reporting and Compliance Engine (TRACE), and Treasury yield data from Federal Reserve Economic Data (FRED), St. Louis Federal Reserve Bank. We exclude financial institutions, utilities, subsidiaries and firm-years with negative assets or sales. We also exclude firm-years with missing assets, sales, number of outstanding shares, and stock price at fiscal year-end. Throughout our analysis, we focus on CEOs.

Using these data sources, we compute the following variables.

Returns. For our empirical analysis, we need to compute returns both on the firm's stock and on deferred compensation. The case of stock returns poses no difficulties. We measure them as the total market return on the firm's stock over the fiscal year.

The measurement of deferred compensation returns is more challenging. As pointed out by Wei and Yermack (2011), at p. 3817: "Deferred compensation may often be invested either at a fixed rate of return, or in the company's stock, or in a menu of stock or bond mutual funds chosen by the firm. Many companies allow managers to make frequent changes in how their deferred compensation is invested". The returns on deferred compensation plans can thus be computed by using information on each CEO's annual earnings from investing defined contributions. We use two different measures of deferred compensation returns. The first measure relies on the earnings a CEO receives on his/her plans relative to the beginning-of-year balance. The beginning-of-year balance is obtained from subtracting CEO's and firm's contributions and CEO's annual earnings from the end-of-year balance (Jackson and Honigsberg, 2014). The second measure is aimed at capturing the capital gain component as well, thus proxying for total return on deferred compensation. To this end, we divide the end-of-year balance (net of CEO's and firm's contributions) by the previous year's end-of-year balance.[7] In other words, we rely on the firm's assumptions to capture changes in market valuations of deferred compensation plans. While this second measure is more consistent with the measure of stock returns, we observe the changes in the market value of deferred compensation plan only noisily. Hence, we use the first return measure for our baseline analysis.

Deferred compensation plans (defined contribution plans), together with pension plans constitute inside debt. However, whereas it would also be interesting to analyze how pension plans are invested, only the returns on deferred compensation plans are likely to reflect CEOs' investment choices. Indeed, CEOs usually have little power to decide how to invest pension plans, which "usually accrue to managers under company-wide formulas established by each firm" (Wei and Yermack, 2011, p. 3817). The value of pension plans depends on many factors, such as years of service, cash compensation, and the firm's cost of debt (Sundaram and Yermack, 2007).[8] Hence, we neglect pension plans. We use the first measure of deferred compensation returns described above for our baseline tests.

[7] By using the previous year's end-of-year balance, we lose one year of observations in this case.

[8] The measurement of changes in the value of pension plans, indeed, is generally viewed as problematic. For instance, Wei and Yermack (2011), to compute their relative incentive ratio measure, proxy for the change in CEO deferred compensation relative to firm debt, $\Delta D_{CEO}/\Delta D_{FIRM}$, by means of the CEO inside debt to firm debt ratio (D_{CEO}/D_{FIRM}).

Finally, we compute *Low correlation*, an indicator variable equal to one if the absolute value of the residual from a firm fixed effect regression of deferred compensation returns on stock returns (without control variables) is in the top quartile for a given firm-year. We compute residuals both including the estimated firm fixed effect and excluding it. *Low correlation* is aimed at capturing periods of weakened correlation between deferred compensation and stock returns.

Distress. We proxy for default risk by using the Altman's Z-score. In our main analysis, we classify a firm-year as distressed if it belongs to the top quartile of the Altman's Z-score. We compute Altman's Z-score quartiles over the Compustat universe. It should be stressed that by using such a broad definition of distress we do not only capture highly distressed firms but also firms that experience a deterioration in their performance. We believe that this way of defining distress is particularly suitable to study the problem at hand, because it allows us to examine the whole period before potential default in which a CEO may divest his/her deferred compensation from the firm's stock.

Firm risk. We use the naïve asset volatility measure by Bharath and Shumway (2008) as a proxy for asset risk. As an alternative measure of firm risk, we use yield spreads on senior unsecured straight bonds whose trades are reported in TRACE. For each bond, we compute the yield spread as the difference between the yield and the yield on the Treasury security with closest residual maturity at the end of the year similarly to Badoer, Demiroglu, and James (2016). We also construct a firm-level measure of yield spread by computing the mean yield spread across a firm's different bond issues at each date.

Other variables. The variables for which we control in our regressions include CEO age and tenure, the CEO relative debt-to-equity ratio (Edmans and Liu, 2011), and size (logarithm of total assets). We also compute an indicator variable equal to one if the CEO withdraws a non-zero amount from his/her deferred compensation balance in a given year.

Table 1 presents summary statistics for the variables used in our tests. The final sample includes 1,740 unique firms. Stock returns are higher and more volatile than deferred compensation returns. The fraction of distressed firm-years in our sample is 11.9%.

All variables are winsorized at the 1% and 99% levels. Only deferred compensation returns are winsorized at the 2.5% and 97.5% levels, as their distribution is more prone to outliers (arguably because of measurement error). All dollar amounts are expressed in 2010 dollars.

4 Results

4.1 Deferred compensation returns and stock returns

Figure 1 shows the correlation between stock returns and our two measures of deferred compensation returns. Looking at our baseline measure (left graph), we observe that for a large fraction of CEOs (i.e., 189 out of 779), returns on deferred compensation and stock returns correlate almost perfectly (i.e the correlation between the two is larger than 0.9). This correlation pattern is even more pronounced for our alternative measure of deferred compensation returns (right panel). This suggests that these CEOs invest nearly all of their deferred compensation plans in company stock as pointed out by Jackson and Honigsberg (2014). As explained above, managers' have indeed discretion over the investment strategy of deferred compensation plans.

We now study the dynamics of these correlations over different states of the world. We aim to understand whether the incentives to invest the deferred compensation in company stock change with the firm's financial conditions. Hypothesis 1 suggests that if the manager is able to decide the investment strategy of deferred compensation, he/she would prefer to dampen the link between deferred compensation and company stock in bad times. Therefore, we expect to observe a lower correlation between deferred compensation and company stock returns when the firm approaches distress. Figure 2 confirms the model's intuition. We plot the linear relation between deferred compensation returns and stock returns distinguishing between distressed and non-distressed firm-years. In distressed periods, this relation is indeed weaker.

In Table 2, we confirm this prima facie evidence. In Panel A, we regress our two measures of returns on deferred compensation plans on stock returns (columns 1 and 4). Again, we find a positive and significant (at 1% level) relation. This result is robust to the inclusion of selected control variables (columns 2 and 5). One may be concerned that the observed positive relation is driven by firms whose stocks have a high correlation with the market. In other words, our result may be due to CEOs investing their plans in index funds tracking the market (or the industry) rather than in their own company's stock. To address this issue, in columns 3 and 6, we distinguish between idiosyncratic stock return and market-adjusted industry stock return (see, e.g., Peters and Wagner, 2014). We find that, while market-adjusted industry returns enter significantly only for the baseline measure of deferred compensation returns, the idiosyncratic component of stock returns is positively and significantly associated with both return measures. Hence, CEOs appear to be indeed investing deferred compensation plans in their own firm's stock.

In Panel B, we distinguish between distressed and non-distressed firm-years. In distressed periods, the correlation between stock returns and deferred compensation returns is significantly lower than in non-distressed periods as indicated by the negative and significant estimated coefficient of *Distress* × *Stock return* (columns 1 and 4). Again, this result is robust to the inclusion of control variables (columns 2 and 5) and to using the idiosyncratic component of stock return (columns 3 and 6). Figure 3 plots the estimated density of the absolute value of the residuals from estimating a regression of deferred compensation returns (baseline measure) on stock returns. The distribution outside of distress is more peaked around zero than in distress. These results support Hypothesis 1 and suggest that indeed CEOs divest deferred compensation from company stock in bad times.

In Panel C, we conduct the same tests but including also the lagged distress indicator and its interaction with contemporaneous stock returns among the explanatory variables. For our baseline measure of deferred compensation returns, we find that only the interaction with the contemporaneous distress indicator is statistically significant (columns 1 and 2). This result suggests that CEOs timely unwind their equity positions as soon as the firm enters distress. By contrast, when using the alternative measure of deferred compensation returns (which is a total return measure), the interaction with the lagged distress indicator seems to play a more important role (columns 3 and 4). Such a finding, however, may reflect firms' sluggishness in adjusting the reported value of deferred compensation plans to actual changes in market valuation.

Besides changing the investment strategy of their deferred compensation plans, a CEO may also make a withdrawal to modify his/her exposure to firm risk. In Table 3, we analyze the role of CEO withdrawals from deferred compensation balances. In columns 1 and 2, we re-examine the relation returns of deferred compensation plans and stock returns including an indicator variable (*Withdrawal*) equal to one in firm-years in which CEO withdrawals from deferred compensation plans are non-zero. Our main results remain unchanged. The decrease in correlation between deferred compensation and stock returns in bad times does not appear to be driven by CEO withdrawals. In other words, the decreased correlation is likely to reflect a change in the CEOs' investment strategy of their deferred compensation balances away from company stock. In columns 3 and 4, we adopt a different perspective and look at how CEO withdrawals correlate with stock returns, also conditioning on financial distress. To this end, we estimate probit regressions of *Withdrawal*, including industry fixed effects. We observe that withdrawals do not vary significantly with stock returns and financial distress, and exhibit a positive and statistically significant relation only with CEO tenure. Hence, CEOs do not seem to reduce their exposure to firm risk by cashing out their deferred compensation during distress. A possible explanation is that withdrawals in times of distress may be perceived negatively by investors. By contrast, reshuffling the investment strategy of deferred compensation away from company stock may allow CEOs to reduce their exposure to the firm and possibly go unnoticed.

What are the implications of these results for the conflict of interest between shareholders, creditors, and managers? In normal times, deferred compensation tends to be invested in company stock and therefore provides managers with equity-like incentives, rather than debt-like incentives. However, the observed decreased correlation between deferred compensation returns and stock returns in distressed periods may point toward a re-alignment of interests between managers and creditors that happens exactly when creditors would benefit the most from enhanced managerial alignment. A natural question then is whether the decreased correlation between deferred compensation returns and stock returns in distressed periods is associated with lower debt-related agency conflicts. Below, we address this question.

4.2 Debt-related agency conflicts

The decline in the correlation between deferred compensation and company stock in bad times can have different consequences. On the one hand, a lower correlation may signal a re-alignment of interests between creditors and managers. On the other hand, the decline in correlation may reflect the managers' desire to "abandon" the firm in distressed periods, i.e., managers may invest the deferred compensation in alternative assets in an effort to protect their balances. The latter is not necessary a good signal for creditors and may actually lead to an increase in debt-related agency conflicts.

We estimate different specifications of equation (16) using asset risk and yield spreads as dependent variables. Our goal is to verify whether patterns in the firm risk and investment policy in low-correlation distressed firm-years are consistent with debt-related agency conflicts, such as the risk-shifting problem (Jensen and Meckling, 1976).

Table 4 focuses on asset risk. CEOs can modify the composition of their deferred compensation to hedge their wealth against default risk (Wei and Yermack, 2011). We test Hypothesis 2, that, in bad times, when the payoff of the investment is expected to be low, CEOs desire to decrease the fraction of deferred compensation tied to company stock, and thus find it optimal to take on more risk. To this end, we use three different proxies for low correlation: i) An indicator variable equal to one if the absolute value of the residual from regressing deferred compensation returns (baseline measure) on stock returns is in the top quartile for a given firm-year (columns 1 and 2), ii) the absolute value of the residual as a continuous variable (column 3), and iii) the same as measure i) but removing the firm fixed effect from the residual (column 4). In each case, we observe that asset risk is significantly higher in distress and especially so for low-correlation firm-years, consistent with our Hypothesis 2.

We now examine yield spreads. Yield spreads not only provide us with an alternative proxy for firm risk, but they allow us to gain insights on debt value. Therefore, while asset risk mainly speaks to the risk-shifting problem, debt valuations reflect all types of debt-related agency conflicts that may negatively affect creditors, such as the underinvestment problem (Myers, 1977). In Table 5, we conduct tests similar to those on asset risk using yield spreads as dependent variable. Panel A studies yield spreads at the firm level. Panel B studies yield spreads at the bond level, which allows us to control also for coupon rate, residual maturity, and bond fixed effects.[9] All specifications, besides year fixed effects, include issuer rating fixed effects. Consistent with the results above, we find that yield spreads are generally significantly higher for distressed firm-years characterized by low correlation between deferred compensation and stock returns.

These results cast doubts on the traditional view that deferred compensation, which is usually considered part of inside debt, serves as a tool to discipline managerial risk-taking behavior especially during distress. We complement the analysis of Lee, Murphy, Oh, and Vance (2016), who find that risky investments are positively related to inside debt for financially constrained firms and that such a positive relation is stronger in distress. Taken together, these findings suggest that the negative effect of inside debt on risk-taking found in other studies (see references in Lee, Murphy, Oh, and Vance, 2016) may actually hinge on inside debt characteristics: The investment strategy (as suggested in this paper), seniority (Anantharaman, Fang, and Gong, 2014; Colonnello, Curatola, and Hoang, 2016), and financial constraints (Lee, Murphy, Oh, and Vance, 2016). Such a negative effect may also hinge on managers' characteristics, as we show below.

4.3 The role of CEO age

The evidence reported in the previous sections indicates that in distressed periods the correlation between returns on deferred compensation and stock returns decreases. We now check whether the incentive to decrease the correlation between deferred compensation and stock returns is influenced by the personal characteristics of the CEO. Given that payments of deferred compensation are received upon retirement, the CEO's age is expected to play an important role in shaping managerial incentives to change the link between deferred compensation and stock returns.

To shed more light on the effect of CEO's age on the time-varying correlation between

[9] Bond fixed effects absorb coupon rate in Panel B.

deferred compensation and stock returns, we regress deferred compensation returns (baseline measure) on stock returns and their interactions with CEO age groups (unreported but available upon request). In Figure 4, we report the average marginal effect of stock returns on deferred compensation returns as a function of CEO age (upper graph) and the conditional effect of CEO age differentiating between normal periods and distressed periods (lower graph). In the upper graph, we observe that the correlation between deferred compensation returns and stock returns tends to decline as CEO age increases but the changes are not statistically significant. The lower graph shows that the correlation between deferred compensation returns and stock returns across CEO age groups follows a similar pattern in distressed and non-distressed firm-years. The difference in correlation between distressed and non-distressed firm-years is negative across all CEO age groups, but statistically significant only for CEOs that are particularly likely to retire (aged between 60 and 64). These CEOs also exhibit the largest difference. Intuitively, CEOs close to retirement may be particularly interested in protecting their deferred compensation plans and shy away from investing them in their own company stock when in distress. Interestingly, the difference is economically large, though statistically insignificant, also for young CEOs (below 50 years of age).

5 Conclusion

The recent literature on executive compensation suggests that inside debt induces managers to behave more conservatively and, in this way, helps protect creditors from the risk of default. However, to serve this purpose, inside debt has to provide managers with debt-like payoffs and expose managers and creditors to the same default risk. But what happens if managers can invest the inside debt with the goal of protecting their expected compensation against the possibility of default?

We focus on the component of inside debt that allows such a behavior, i.e., deferred compensation plans. The theory and the empirical evidence provided in our paper suggests that in this case inside debt may be used strategically by the manager to increase his/her expected compensation in states in which deferred compensation contracts are supposed to deliver a low payoff, namely in default. As a result, deferred compensation will increase, rather than decrease, risk-taking incentives. The incentive to change the investment strategy of deferred compensation is most important in distress periods and, thus, induces managers to increase risk-taking exactly in those periods in which creditors would require a more prudent behavior.

These results have implications for the ongoing policy debate. First of all, it would be inadequate to assume that inside debt (and bonus deferral) would unambiguously successfully decrease risk-taking incentives. Second, it would be important to have information not only about the investment strategy of the deferred compensation, but also about its development and changes over time. Those changes may be useful early warning indicators of distress.

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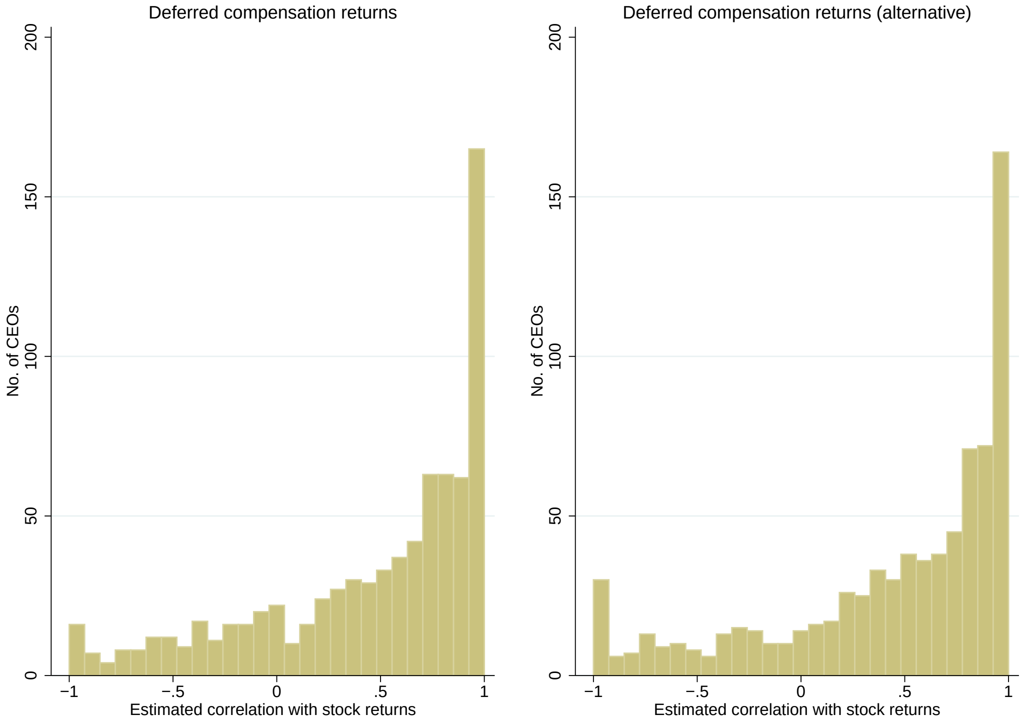

Figure 1: Correlation between stock returns and deferred compensation returns
This figure shows the distribution of correlation between deferred compensation returns and stock returns across CEOs. Correlation is computed for CEOs with at least four observation available. The same correlation is computed for two different measures of deferred compensation returns. Left panel shows the correlation between stock returns and the return measure based on earnings relative to beginning-of-year balance of deferred compensation plans. Right panel shows the correlation between stock returns and the total return measure relative to previous year's end-of-year balance of deferred compensation plans.

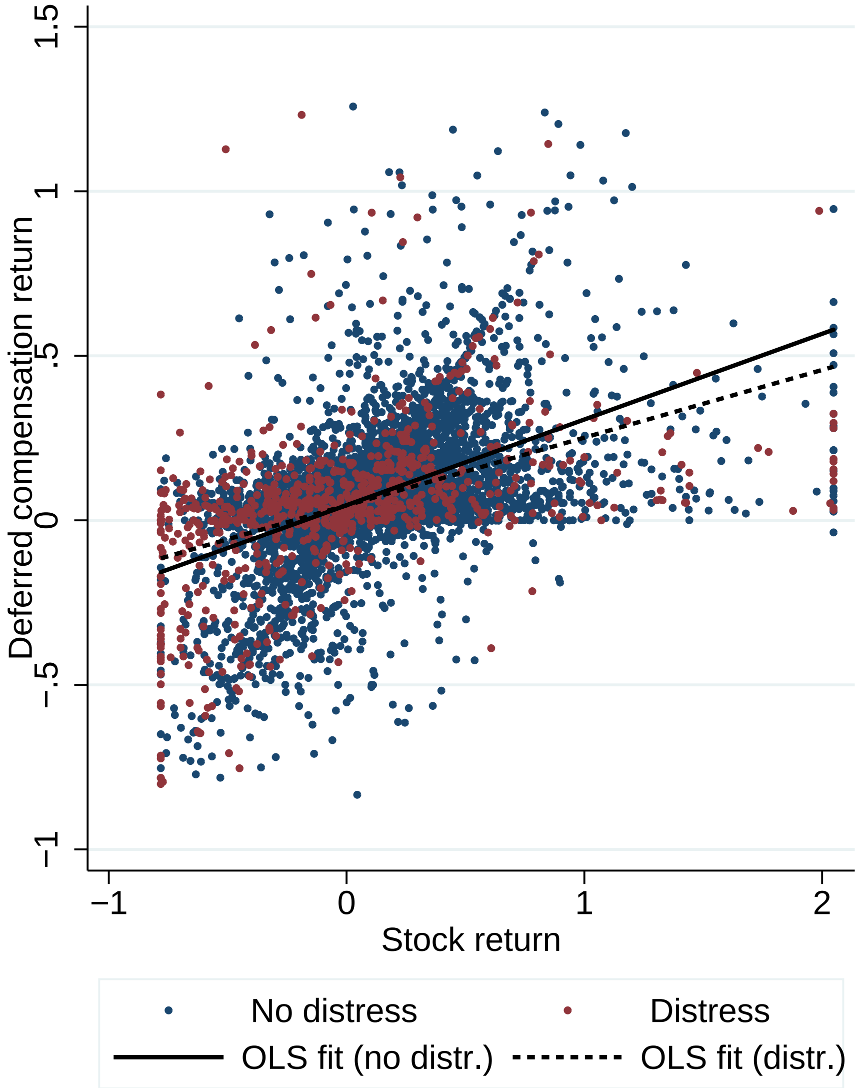

Figure 2: Relation between stock returns and deferred compensation returns
This figure shows CEO deferred compensation returns (baseline measure) and stock returns. The fitted lines are estimated using an OLS regression of deferred compensation returns on stock returns distinguishing between non-distressed and distressed firm-years. Outliers are omitted.

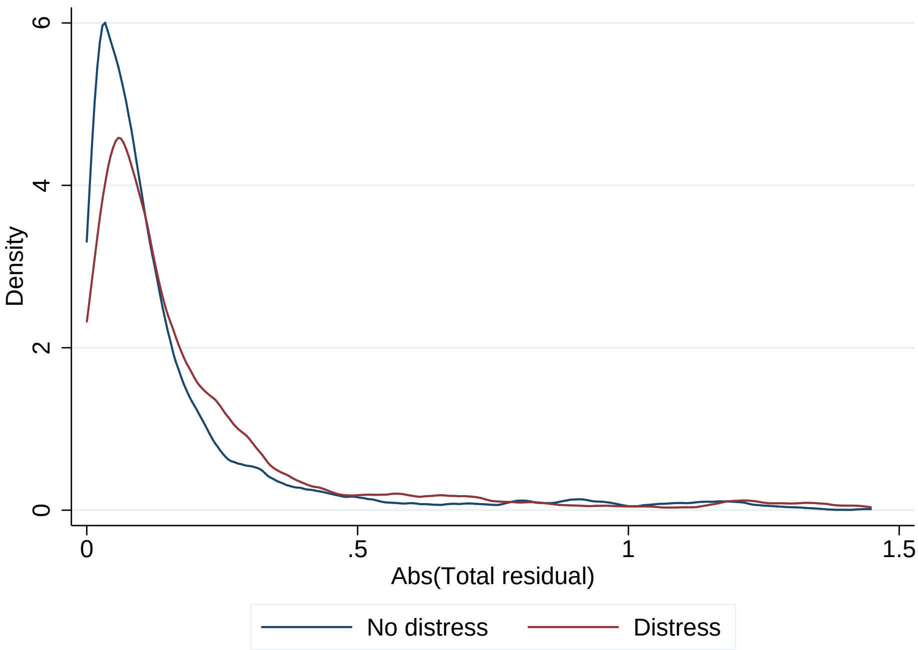

Figure 3: Distribution of residuals
This figure plots the density of the absolute value of residuals (inclusive of firm fixed effects) from estimating a regression of deferred compensation returns (baseline measure) on stock returns distinguishing between non-distressed and distressed firm-years (Epanechnikov kernel function).

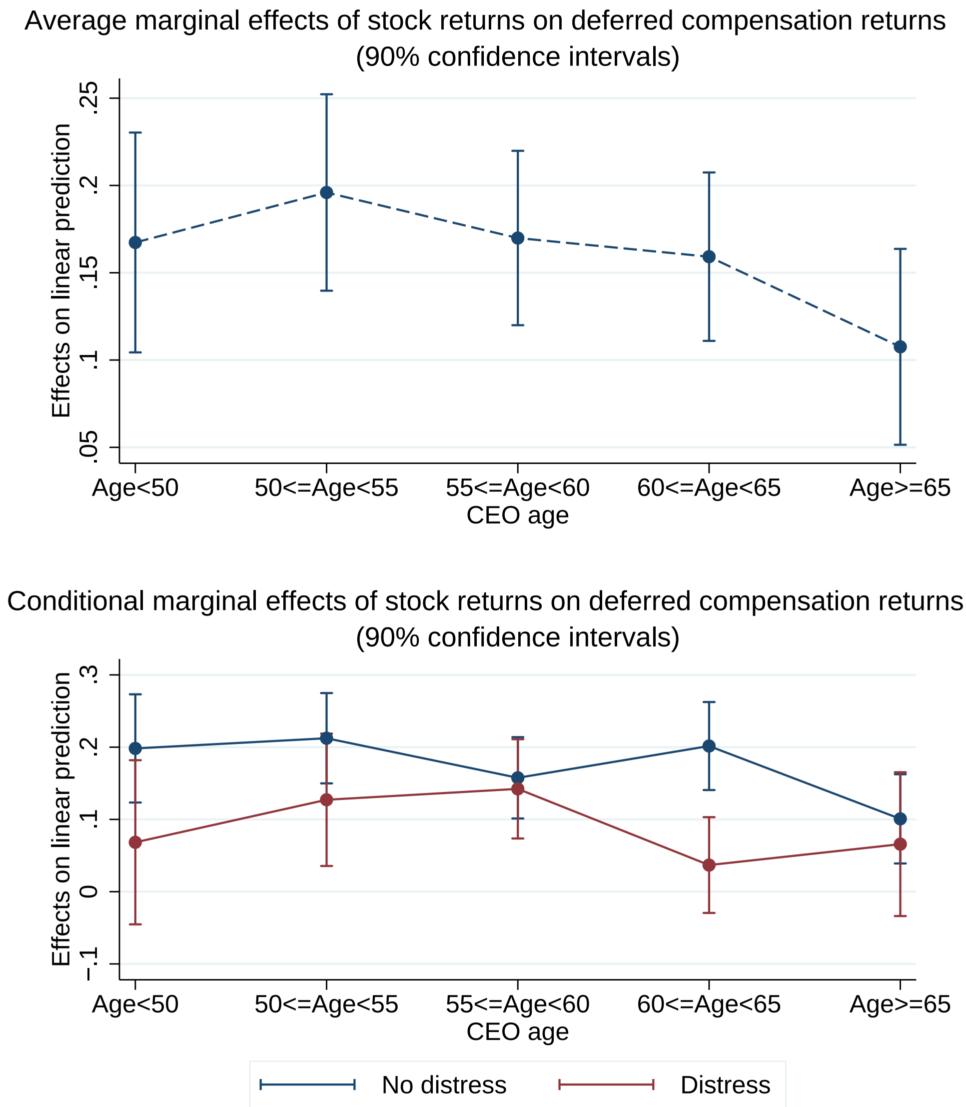

Figure 4: Average of managerial effect of stock returns on deferred compensation
This figure plots the average marginal effect of stock returns on deferred compensation returns (baseline measure) conditioning on the CEO age quintile. In the upper graph, the average marginal effects are estimated by using a regression of deferred compensation returns on stock returns and their interactions with CEO age groups, controlling for *Size*, *CEO relative D/E ratio*, *CEO tenure*, firm fixed effects, and year fixed effects. In the lower graph, the average marginal effects are computed by estimating the same specification separately over the non-distressed subsample and the distressed subsample.

Table 1: Summary statistics

This table reports summary statistics of all variables employed in the paper. The sample includes 1,740 U.S. firms over the period 2006-2015. We obtain executive compensation data from Execucomp, accounting and stock market data from the CRSP-Compustat merged database, and bond market data from TRACE. All dollar amounts are in 2010 constant dollars.

	Mean	Std.Dev.	Q1	Med.	Q3	Obs.
Returns						
Deferred compensation return	0.082	0.312	0.000	0.065	0.160	6097
Deferred compensation return (alt.)	0.028	0.275	-0.036	0.052	0.149	4975
Stock return	0.117	0.415	-0.127	0.095	0.312	6042
Idiosyncratic stock return	0.000	0.350	-0.185	-0.005	0.183	6012
Market-adj. industry stock return	0.027	0.172	-0.065	0.007	0.102	6010
Distress measures						
Z-score	-3.761	2.882	-4.770	-3.291	-2.159	5947
Distress	0.119	0.324	0.000	0.000	0.000	5947
Risk measures						
Asset risk	0.342	0.157	0.231	0.305	0.413	6097
Firm-level yield spread	0.028	0.037	0.011	0.018	0.033	2522
CEO characteristics						
CEO age	56.280	6.491	52.000	56.000	60.000	6097
CEO tenure	6.694	6.506	2.000	5.000	9.000	6097
CEO relative D/E ratio	3.598	12.580	0.149	0.530	1.687	5670
Withdrawal	0.112	0.315	0.000	0.000	0.000	6097
Firm characteristics						
Size	8.093	1.431	7.013	7.970	9.074	6097
Tobin's q	1.806	0.895	1.223	1.561	2.105	6097
Cash flow	0.650	1.508	0.215	0.445	0.890	6028
Rated	0.579	0.494	0.000	1.000	1.000	6097
Investment grade	0.347	0.476	0.000	0.000	1.000	6097

Table 2: Deferred compensation returns and stock returns
This table reports panel regressions of CEO deferred compensation returns on stock returns over the period 2006-2015. Panel A analyzes the relation between deferred compensation returns and stock returns. Panel B interacts stock returns with a distress indicator equal to one if a firm-year belongs to the top quartile of the Altman's Z-score. In both Panel A and Panel B, the same specifications are estimated for two different measures of deferred compensation returns. Columns 1 through 3 use the return measure based on earnings relative to beginning-of-year balance of deferred compensation plans. Columns 4 through 6 use the total return measure relative to previous year's end-of-year balance of deferred compensation plans. Columns 1 and 4 estimate the baseline specification. Columns 2 and 5 control also for size, CEO age, CEO tenure, and the CEO relative D/E ratio. Columns 3 and 6 distinguish between idiosyncratic stock returns and market-adjusted industry stock returns. Panel C estimates the same specifications of colums 1-2 and 4-5 of Panel B but including also the lagged distress indicators and its interaction with contemporaneous stock returns. All specifications include firm fixed effects and year fixed effects. The t-statistics are calculated with robust standard errors clustered by firm. Significance at the 10%, 5%, and 1% levels are indicated by *, **, ***, respectively.

Panel A: Baseline relation

	Deferred comp.			Deferred comp. (alt.)		
	(1)	(2)	(3)	(4)	(5)	(6)
Stock return	0.166***	0.169***		0.171***	0.173***	
	(9.43)	(9.25)		(10.07)	(9.91)	
Idio. stock return			0.133***			0.122***
			(6.90)			(6.54)
Market-adj. ind. stock return			0.171***			0.223***
			(5.30)			(6.66)
Size		-0.003	-0.005		-0.008	-0.010
		(-0.16)	(-0.28)		(-0.37)	(-0.49)
CEO age		0.002	0.002		-0.001	-0.001
		(1.59)	(1.42)		(-0.62)	(-0.65)
CEO tenure		-0.003**	-0.004**		-0.002	-0.002
		(-2.34)	(-2.39)		(-0.93)	(-0.94)
CEO relative D/E ratio		0.000	0.001		0.002***	0.001***
		(0.92)	(1.55)		(2.83)	(2.86)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	6042	5618	5541	5092	4764	4696
Adjusted R^2	0.20	0.20	0.18	0.24	0.24	0.23

Panel B: Distressed vs. non-distressed firms

	Deferred comp.			Deferred comp. (alt.)		
	(1)	(2)	(3)	(4)	(5)	(6)
Distress × Stock return	-0.096***	-0.086***		-0.099**	-0.116***	
	(-3.14)	(-2.84)		(-2.45)	(-3.90)	
Stock return	0.180***	0.181***		0.178***	0.192***	
	(9.05)	(8.61)		(9.86)	(9.90)	
Distress × Idio. stock return			-0.103***			-0.081**
			(-2.76)			(-2.01)
Idio. stock return			0.145***			0.129***
			(6.52)			(6.22)
Distress × Market-adj. ind. stock return			-0.180***			-0.113
			(-2.68)			(-1.54)
Market-adj. ind. stock return			0.195***			0.232***
			(5.39)			(6.23)
Distress	-0.003	-0.013	-0.031	0.020	-0.049**	-0.060***
	(-0.11)	(-0.56)	(-1.26)	(0.61)	(-2.09)	(-2.59)
Size		-0.001	-0.003	-0.002	-0.000	-0.003
		(-0.04)	(-0.15)	(-0.09)	(-0.02)	(-0.16)
CEO age		0.003	0.002	-0.001	-0.001	-0.001
		(1.60)	(1.44)	(-0.66)	(-0.63)	(-0.67)
CEO tenure		-0.003**	-0.004**	-0.002	-0.002	-0.002
		(-2.29)	(-2.32)	(-0.88)	(-1.00)	(-0.96)
CEO relative D/E ratio		0.000	0.001	0.002***	0.002***	0.002***
		(0.91)	(1.55)	(2.89)	(2.83)	(2.91)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	5893	5471	5396	4639	4639	4573
Adjusted R^2	0.19	0.19	0.18	0.24	0.24	0.22

Panel C: Distressed vs. non-distressed firms (lagged explanatory variables)				
	Deferred comp.		Deferred comp. (alt.)	
	(1)	(2)	(3)	(4)
Distress × Stock return	-0.099**	-0.095**	-0.037	-0.040
	(-2.38)	(-2.27)	(-0.97)	(-1.01)
Distress	-0.020	-0.020	-0.042*	-0.042*
	(-0.80)	(-0.78)	(-1.72)	(-1.70)
Distress (lagged) × Stock return	0.008	0.021	-0.113***	-0.111***
	(0.20)	(0.50)	(-2.90)	(-2.75)
Distress (lagged)	0.009	0.009	-0.003	-0.002
	(0.31)	(0.30)	(-0.10)	(-0.10)
Stock return	0.184***	0.179***	0.202***	0.207***
	(8.67)	(7.99)	(10.50)	(10.38)
Size		-0.005		-0.002
		(-0.25)		(-0.07)
CEO age		0.002		-0.001
		(1.30)		(-0.63)
CEO tenure		-0.003**		-0.002
		(-2.11)		(-1.00)
CEO relative D/E ratio		0.001		0.002***
		(1.26)		(2.83)
Firm FE	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes
Observations	5140	4791	4963	4636
Adjusted R^2	0.21	0.21	0.24	0.24

Table 3: The role of CEO withdrawals from deferred compensation plans

This table analyzes the role CEO withdrawals from deferred compensation plans over the period 2006-2015. Withdrawals are measured by means of the indicator variable *Withdrawal*, which is equal to one if the CEO withdraws a non-zero amound from his/her deferred compensation balance in a given year. Columns 1 and 2 report linear regressions of CEO deferred compensation returns on stock returns, including *Withdrawal* as a control variable. Deferred compensation returns are computed from earnings relative to beginning-of-year balance of deferred compensation plans. Columns 3 and 4 report probit regressions of *Withdrawal* on stock returns. Odd-numbered columns analyze the relation between the dependent variable and stock returns. Even-numbered columns analyze the relation between the dependent variable and stock returns conditional on the firm's financial distress, as measured equal to one if a firm-year belongs to the top quartile of the Altman's Z-score. Columns 1 and 2 include firm fixed effects. Columns 3 and 4 include industry (Fama-French 48) fixed effects. All specifications include year fixed effects and control variables (size, CEO age, CEO tenure, and the CEO relative D/E ratio). The t-statistics are calculated with robust standard errors clustered by firm. Significance at the 10%, 5%, and 1% levels are indicated by *, **, ***, respectively.

	Deferred comp.		Withdrawal	
	(1)	(2)	(3)	(4)
Distress × Stock return		-0.086***		-0.144
		(-2.84)		(-1.03)
Distress		-0.013		0.081
		(-0.54)		(0.81)
Stock return	0.169***	0.181***	-0.037	0.041
	(9.25)	(8.61)	(-0.63)	(0.63)
Distress × Withdrawal		-0.002		
		(-0.03)		
Withdrawal	0.008	0.007		
	(0.35)	(0.31)		
Size	-0.003	-0.001	0.004	0.004
	(-0.16)	(-0.04)	(0.11)	(0.11)
CEO age	0.002	0.003	-0.001	-0.002
	(1.58)	(1.59)	(-0.17)	(-0.26)
CEO tenure	-0.003**	-0.003**	0.012**	0.012**
	(-2.36)	(-2.31)	(2.08)	(2.17)
CEO relative D/E ratio	0.000	0.000	0.002	0.003
	(0.90)	(0.90)	(1.07)	(1.29)
Time FE	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	No	No
Industry FE	No	No	Yes	Yes
Observations	5618	5471	5482	5352
Adjusted R^2	0.20	0.19		
Pseudo R^2			0.04	0.04

Table 4: Asset risk and correlation between deferred compensation returns and stock returns in distress
This table reports panel regressions of asset risk over the period 2006-2015. The dependent variable is the naïve asset volatility measure by Bharath and Shumway (2008). Column 1 estimates a regression of asset volatility on the interaction of *Distress* and *Low correlation (total resid.)*. *Distress* is an indicator equal to one if a firm-year belongs to the top quartile of the Altman's Z-score. *Low correlation (total resid.)* is an indicator variable equal to one if the absolute value of the residual from regressing deferred compensation returns on stock returns alone (i.e., without control variables) is in the top quartile for a given firm-year. We use the deferred compensation returns based on earnings relative to beginning-of-year plan balance. Column 2 controls also for size, CEO age, CEO tenure, and the CEO relative D/E ratio. Column 3 interacts *Distress* with the absolute value of the total residual. Column 4 interacts *Distress* with *Low correlation (resid. w/o firm FE)*, an indicator defined in the same way as *Low correlation (total resid.)* but removing the firm fixed effect from the residual. All specifications include firm fixed effects and year fixed effects. The t-statistics are calculated with robust standard errors clustered by firm. Significance at the 10%, 5%, and 1% levels are indicated by *, **, ***, respectively.

	Asset risk			
	(1)	(2)	(3)	(4)
Distress × Low correlation (total resid.)	0.027*	0.024*		
	(1.95)	(1.85)		
Low correlation (total resid.)	0.012***	0.012***		
	(2.83)	(2.82)		
Distress × Low correlation (total resid.)			0.041*	
			(1.76)	
Total resid.			0.016*	
			(1.69)	
Distress × Low correlation (resid. w/o firm FE)				0.024*
				(1.79)
Low correlation (resid. w/o firm FE)				0.009**
				(2.30)
Distress	0.018**	0.020***	0.020**	0.019**
	(2.30)	(2.70)	(2.48)	(2.58)
Size		-0.057***	-0.056***	-0.057***
		(-8.58)	(-8.55)	(-8.61)
CEO age		0.000	0.000	0.000
		(0.91)	(0.93)	(0.85)
CEO tenure		-0.000	-0.000	-0.000
		(-0.48)	(-0.50)	(-0.55)
CEO relative D/E ratio		-0.000	-0.000	-0.000
		(-0.20)	(-0.16)	(-0.16)
Firm FE	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes
Observations	5893	5471	5471	5471
Adjusted R^2	0.58	0.59	0.58	0.58

Table 5: Yield spreads and correlation between inside debt returns and stock returns in distress
This table reports panel regressions of yield spreads over the period 2006-2015. The dependent variable is the yield spread on senior unsecured straight bonds. The yield spread is computed as the difference between the bond yield and the yield on the Treasury security with closest residual maturity. Panel A reports firm-level regressions of yield spreads. Column 1 estimates a regression of yield spreads on the interaction of *Distress* and *Low correlation (total resid.)*. *Distress* is an indicator equal to one if a firm-year belongs to the top quartile of the Altman's Z-score. *Low correlation (total resid.)* is an indicator variable equal to one if the absolute value of the residual from regressing deferred compensation returns on stock returns alone (i.e., without control variables) is in the top quartile for a given firm-year. We use the deferred compensation returns based on earnings relative to beginning-of-year plan balance. Column 2 controls also for size, CEO age, CEO tenure, and the CEO relative D/E ratio. Column 3 interacts *Distress* with the absolute value of the total residual. Column 4 interacts *Distress* with *Low correlation (resid. w/o firm FE)*, an indicator defined in the same way as *Low correlation (total resid.)* but removing the firm fixed effect from the residual. All specifications in Panel A include firm fixed effects. Panel B reports bond-level regressions of yield spreads. Columns 1 and 2 control for coupon rate, residual maturity, and firm fixed effects. Columns 3 through 5 control for residual maturity and bond fixed effects. Column 1 estimates a regression of yield spreads on the interaction of *Distress* and *Low correlation (total resid.)*. Columns 2 and 3 control also for size, CEO age, CEO tenure, and the CEO relative D/E ratio. Column 4 interacts *Distress* with the absolute value of the total residual. Column 5 interacts *Distress* with *Low correlation (resid. w/o firm FE)*. All specifications include issuer rating fixed effects and year fixed effects. The t-statistics are calculated with robust standard errors clustered by firm. Significance at the 10%, 5%, and 1% levels are indicated by *, **, ***, respectively.

Panel A: Firm-level analysis

	Yield spread			
	(1)	(2)	(3)	(4)
Distress × Low correlation (total resid.)	0.017**	0.017**		
	(2.16)	(2.17)		
Low correlation (total resid.)	-0.003**	-0.003**		
	(-1.99)	(-2.00)		
Distress × Low correlation (total resid.)			0.016	
			(1.37)	
Total resid.			-0.003	
			(-1.02)	
Distress × Low correlation (resid. w/o firm FE)				0.015*
				(1.86)
Low correlation (resid. w/o firm FE)				-0.002
				(-1.42)
Distress	0.012***	0.012***	0.014***	0.013***
	(2.88)	(2.83)	(2.74)	(2.94)
Size		0.003	0.003	0.003
		(1.20)	(1.13)	(1.15)
CEO age		0.000	0.000	0.000
		(0.15)	(0.18)	(0.17)
CEO tenure		0.000	0.000	0.000
		(0.25)	(0.30)	(0.32)
CEO relative D/E ratio		0.000	0.000	0.000
		(1.16)	(1.12)	(1.11)
Firm FE	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes
Rating FE	Yes	Yes	Yes	Yes
Observations	2092	2087	2087	2087
Adjusted R^2	0.39	0.39	0.38	0.39

Panel B: Bond-level analysis					
	Yield spread				
	(1)	(2)	(3)	(4)	(5)
Distress × Low correlation (total resid.)	0.016*	0.016*	0.017*		
	(1.70)	(1.72)	(1.72)		
Low correlation (total resid.)	-0.003**	-0.003**	-0.003***		
	(-2.27)	(-2.31)	(-2.66)		
Distress × Low correlation (total resid.)				0.025*	
				(1.92)	
Total resid.				-0.002	
				(-0.78)	
Distress × Low correlation (resid. w/o firm FE)					0.019*
					(1.94)
Low correlation (resid. w/o firm FE)					-0.001
					(-1.31)
Distress	0.011**	0.011**	0.011**	0.012*	0.010**
	(2.12)	(2.15)	(2.12)	(1.82)	(2.07)
Maturity	-0.000	-0.000	-0.000	-0.000	-0.000
	(-1.17)	(-1.08)	(-1.35)	(-1.54)	(-1.45)
Coupon rate	0.002***	0.002***			
	(6.42)	(6.48)			
Size		0.003	0.001	0.001	0.001
		(0.86)	(0.17)	(0.19)	(0.22)
CEO age		0.000	0.001	0.001	0.001
		(1.02)	(1.07)	(1.07)	(1.08)
CEO tenure		-0.000	-0.000	-0.000	-0.000
		(-0.77)	(-0.64)	(-0.61)	(-0.60)
CEO relative D/E ratio		0.000	0.000	0.000	0.000
		(0.23)	(0.47)	(0.52)	(0.56)
Firm FE	Yes	Yes	No	No	No
Time FE	Yes	Yes	Yes	Yes	Yes
Rating FE	Yes	Yes	Yes	Yes	Yes
Bond FE	No	No	Yes	Yes	Yes
Observations	7972	7955	7955	7955	7955
Adjusted R^2	0.60	0.61	0.33	0.33	0.34

Appendix for

"Abandon Ship: Deferred Compensation and Risk-Taking Incentives in Bad Times"

A Optimal policies

Under the non-discretionary contract the manager solves

$$\max_q \bar{w} + S_E P_E + S_D D + \lambda_0 q - \lambda_{\frac{1}{2}} q,$$

where

$$P_E = q(x + (1+\mu)\Delta) + (1-2q)x - (1-q)(1+R) - \frac{1}{2}aq^2$$
$$D = (1-q)\bar{D}$$
$$1 + R = \frac{1 - q(x-\delta)}{1-q}.$$

λ_0 is the multiplier attached to the constraint $q \geq 0$ and $\lambda_{\frac{1}{2}}$ is the multiplier attached to the constraint $q \leq \frac{1}{2}$. Replacing P_E, D and R into the optimization problem, we obtain

$$\max_q \bar{w} + S_E\{q\,[x + (1+\mu)\Delta] + (1-2q)x - 1 + q(x-\delta) - \frac{1}{2}aq^2 + S_D(1-q)\bar{D}\} + \lambda_0 q - \lambda_{\frac{1}{2}} q.$$

The first order condition (FOC) with respect to q gives

$$S_E\,[(1+\mu)\Delta - \delta - aq] - S_D\bar{D} + \lambda_0 - \lambda_{\frac{1}{2}} = 0.$$

Let

$$\tilde{q}_1 = \frac{1}{a}\left[(1+\mu)\Delta - \frac{S_D}{S_E}\bar{D}\right]$$

be the unconstrained optimal policy. The optimal constrained policy $\hat{q}_{NDIS}$ follows from an application of the Kuhn-Tucker theorem and is given by

$$\hat{q}_{NDIS} = \begin{cases} 0, & \text{if } \tilde{q}_1 < 0; \\ \tilde{q}_1, & \text{if } 0 < \tilde{q} < \frac{1}{2}; \\ \frac{1}{2}, & \text{if } \tilde{q}_1 \geq \frac{1}{2}. \end{cases} \tag{A.1}$$

Under the discretionary contract, the manager solves

$$\max_{q,\beta} \bar{w} + S_E P_E + S_D D - \frac{1}{2} b\beta^2 + \lambda_0 q - \lambda_{\frac{1}{2}} q + \nu_0 \beta, \tag{A.2}$$

where

$$P_E = q(x + (1+\mu)\Delta) + (1-2q)x - (1-q)(1+R) - \frac{1}{2} a q^2 \tag{A.3}$$

$$D = \beta P_E + (1-\beta) q \bar{C} \tag{A.4}$$

$$1 + R = \frac{1 - q(x-\delta)}{1-q} \tag{A.5}$$

and ν_0 is the multiplier attached to the constraint $\beta \geq 0$. Replacing P_E, D and R into the optimization problem, we obtain

$$\max_{q,\beta} \bar{w} + (S_E + \beta S_D) \left\{ q \left[x + (1+\mu)\Delta \right] + (1-2q)x - 1 + q(x-\delta) - \frac{1}{2} a q^2 \right\} + S_D (1-\beta) q \bar{C}$$
$$- \frac{1}{2} b \beta^2 + \lambda_0 q - \lambda_{\frac{1}{2}} q + \nu_0 \beta.$$

Thus

$$\text{FOC}_q: \quad (S_E + \beta S_D) \left[(1+\mu)\Delta - \delta - aq \right] + S_D (1-\beta) \bar{C} + \lambda_0 - \lambda_{\frac{1}{2}} = 0$$

$$\text{FOC}_\beta: \quad S_D \left[q \left((1+\mu)\Delta - \delta \right) + (1-q)x - 1 - \frac{1}{2} a q^2 \right] - S_D q \bar{C} - b\beta + \nu_0 = 0.$$

The unconstrained risk choice is given by

$$\tilde{q}_2(\beta) = \frac{1}{a} \left[(1+\mu)\Delta - \delta + \frac{S_D (1-\hat{\beta})}{S_E + \hat{\beta} S_D} \bar{C} \right]$$

and therefore the optimal constrained risk choice is

$$\hat{q}_{DIS} = \begin{cases} 0, & \text{if } \tilde{q}_2 < 0; \\ \tilde{q}_2, & \text{if } 0 < \tilde{q} < \frac{1}{2}; \\ \frac{1}{2}, & \text{if } \tilde{q}_2 \geq \frac{1}{2}. \end{cases} \tag{A.6}$$

Let now $\pi_F(q)$ be the payoff of the firm's assets expressed as a function of the probability chosen by the manager

$$\begin{aligned}\pi_F(q) &= q(x+(1+\mu)\Delta)+(1-2q)x-(1-q)(1+R)\\ &= q(x+(1+\mu)\Delta)+(1-2q)x-(1-q)\frac{1-q(x-\delta)}{1-q}\\ &= q(x+(1+\mu)\Delta)+(1-2q)x-1+q(x-\delta)\\ &= q(1+\mu)\Delta)+(1-q)x-1-q\delta\\ &= q(1+\mu)\Delta-\delta)+(1-q)x-1.\end{aligned}$$

Using $\pi_F(q)$, we can express the unconstrained investment strategy of the deferred compensation as

$$\begin{aligned}\tilde{\beta} &= \frac{S_D}{b}\left[\tilde{q}_2(\beta)\left((1+\mu)\Delta-\delta\right)+(1-\tilde{q}_2(\beta))x-1-\tilde{q}_2(\beta)\bar{C}-\frac{1}{2}a\tilde{q}_2(\beta)^2\right]\\ &= \frac{S_D}{b}\left[\pi_F(q)-\tilde{q}_2(\beta)\bar{C}-\frac{1}{2}a\tilde{q}_2(\beta)^2\right]. \qquad \text{(A.7)}\end{aligned}$$

Note that $\tilde{\beta}$ is only implicitly defined by equation (A.7). The reason is that the right-hand side of equation (A.7) depends on $\tilde{\beta}$ through the optimal risky choice $\tilde{q}$. Assume for the moment that a solution to the fixed point problem (A.7) exists and let this solution be β^*. The Kuhn-Tucker theorem implies that the constrained investment strategy $(\hat{\beta})$ is given by

$$\hat{\beta} = \begin{cases} 0, & \text{if } \pi\left(\tilde{q}_2(0)\right)-\tilde{q}_2(0)\bar{C}-\frac{1}{2}a\tilde{q}_2(0)^2<0;\\ \beta^*, & \text{if } \pi\left(\tilde{q}_2(0)\right)-\tilde{q}_2\bar{C}-\frac{1}{2}a\tilde{q}_2^2\geq 0.\end{cases} \qquad \text{(A.8)}$$

Concerning the existence and uniqueness of β^*, note that the Brouwer's fixed-point theorem guarantees that there must exist at least one $\beta^* \in [0,1]$ such that equation (A.7) holds. For any optimal $\hat{\beta} \in [0,1]$, we have that

$$\tilde{q}_2-\tilde{q}_1 = \frac{1}{a}\left[\frac{S_D(1-\hat{\beta})}{S_E+S_D\hat{\beta}}+\frac{S_D}{S_E}\bar{D}\right]>0 \qquad \text{(A.9)}$$

and therefore we conclude that $\hat{q}_{DIS} \geq \hat{q}_{NDIS}$. The difference between $\hat{q}_{DIS}$ and $\hat{q}_{NDIS}$ is given by

$$\hat{q}_{DIS}-\hat{q}_{NDIS} = \begin{cases} 0, & \text{if } \tilde{q}_1<\tilde{q}_2<0;\\ \frac{1}{a}\left[(1+\mu)\Delta-\delta+\frac{S_D(1-\hat{\beta})}{S_E+\hat{\beta}S_D}\bar{C}\right]=\tilde{q}_2, & \text{if } \tilde{q}_1<0<\tilde{q}_2<\frac{1}{2};\\ \frac{1}{a}\left[\frac{S_D(1-\hat{\beta})\bar{C}}{S_E+S_D\hat{\beta}}+\frac{S_D}{S_E}\bar{D}\right]=\tilde{q}_2-\tilde{q}_1, & \text{if } 0<\tilde{q}_1<\tilde{q}_2<\frac{1}{2};\\ \frac{1}{2}-\frac{1}{a}\left[(1+\mu)\Delta-\frac{S_D}{S_E}\bar{D}\right]=\frac{1}{2}-\tilde{q}_1, & \text{if } 0<\tilde{q}_1<\frac{1}{2}<\tilde{q}_2;\\ 0, & \text{if } 0<\frac{1}{2}<\tilde{q}_1<\tilde{q}_2.\end{cases} \qquad \text{(A.10)}$$

Therefore

$$\frac{\partial(\hat{q}_{DIS}-\hat{q}_{NDIS})}{\partial\hat{\beta}} = \begin{cases} 0, & \text{if } \tilde{q}_1 < \tilde{q}_2 < 0; \\ -\frac{\bar{C}}{a}\frac{S_D S_E + S_D^2}{\left(S_E+\hat{\beta}S_D\right)^2} < 0, & \text{if } \tilde{q}_1 < 0 < \tilde{q}_2 < \frac{1}{2}; \\ -\frac{\bar{C}}{a}\frac{S_D S_E + S_D^2}{\left(S_E+\hat{\beta}S_D\right)^2} < 0, & \text{if } 0 < \tilde{q}_1 < \tilde{q}_2 < \frac{1}{2}; \\ 0, & \text{if } 0 < \tilde{q}_1 < \frac{1}{2} < \tilde{q}_2; \\ 0, & \text{if } 0 < \frac{1}{2} < \tilde{q}_1 < \tilde{q}_2. \end{cases} \tag{A.11}$$

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