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ABSTRACT

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We study the implication of the standard principal-agent theory developed by Holmstrom and Milgrom (1987) on the endogenous matching of CEO and firm. We show that a CEO with low disutility of effort, low risk aversion, or both should manage a safer firm in the matching equilibrium, and that a CEO in a safer firm should receive a higher compensation than average. Nevertheless, these predictions are not supported by data; proxies for low disutility such as educational achievement and experience are either not related to firm risks or significantly related but in the direction opposite to that predicted by the theory. CEOs of safer firms are paid less than average, again contrary to the standard principal-agent theory.

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1 Introduction

The standard principal-agent theory based on risk-incentive tradeoffs plays a central role in economic research on managerial compensation.[1] In particular, the theory offers two simple intuitive predictions: First, the manager's pay should be based on relative performance instead of absolute performance (Holmstrom, 1982; Shavell, 1982), and second, pay-performance sensitivity should be negatively related to idiosyncratic risk of the firm (Holmstrom and Milgrom, 1987). Though these two predictions have been repeatedly tested in a variety of contexts, the evidence is mixed.[2] And therefore scholars have not yet reached agreement as to the validity and economic relevance of the standard principal-agent theory.

This paper brings a new perspective to this debate. Existing research studies the standard principal-agent theory's implications on managerial compensation, given the characteristics of the CEO-firm match. We go one step further and ask the following questions: which CEO should be matched with which firm if both CEO and firm anticipate that the managerial compensation will be set in the way that the standard principal-agent theory predicts? What firm characteristics are associated with superior CEOs? Do the CEO-firm match data support the predictions of the standard principal-agent theory? Our baseline model is Holmstrom and Milgrom, and, as in their model, we characterize firms by idiosyncratic risk (hereafter, simply risk) and CEOs by disutility of effort and risk aversion. In this character-

[1] By "the standard principal-agent theory," we mean the principal-agent theory that assumes risk-averse agents and no limited liability constraint. Central to the standard principal-agent theory is the risk-incentive tradeoff such that high pay-performance sensitivity exposes the agent to higher risks, whereas it strengthens the agent's incentive to exert effort. For instance, Prendergast (2002) is not "standard" according to our definition, because this risk-incentive tradeoff does not exist.

[2] Examples of papers testing one or both of these predictions include Demsetz and Lehn (1984), Garen (1994), Baker and Hall (2002), Aggarwal and Samwick (1999 and 2003), Core and Guay (2002), Garen (1994), Garvey and Milbourn (2003), and Jin (2002). Prendergast (2002) contains a summary of these papers' results as well as results from contexts other than managerial compensation.

ization, firms and CEOs are ranked as follows. A firm with higher risk is inferior to one with lower risk, in that the link between CEO effort and firm performance is weakened and therefore the CEO's incentive is undermined in such a firm. A CEO with higher disutility of effort is inferior to one with lower disutility, in that it is more costly to elicit effort from the former. A more risk averse CEO is inferior to a less risk averse CEO, in that it is inevitable to impose risk on the agent in the presence of moral hazard and it is more costly to impose such risk on the more risk averse CEO.

Within a framework of a typical assignment model, we solve for the equilibrium in which every CEO-firm match is stable. We find that the equilibrium is characterized by "positive sorting," meaning that a superior firm should match with a superior manager and an inferior firm should match with an inferior manager. A CEO with low disutility of effort should manage a safer firm in equilibrium for the following reasons. A low-disutility CEO is more responsive to high pay-performance sensitivity than a high-disutility CEO, meaning that the low-disutility CEO greatly increases his or her effort if pay-performance sensitivity increases. A safer firm can increase pay-performance sensitivity without making the CEO's income very volatile. As a consequence, when a low-disutility CEO manages a safer firm, the CEO's effort is efficiently induced, and therefore an effort-underprovision problem associated with moral hazard is reduced. We also find the counter-intuitive result that a less risk averse CEO should manage a safer firm when exogenous parameters of the model are restricted to a reasonable range.[3] Given that these two results suggest that superior managers (low-disutility, low-risk-aversion, or both) manage safer firms, we should observe that CEOs in safer firms are paid more than CEOs in riskier firms.

We then bring these predictions of the matching model to the data.

[3] As detailed in the following section, the parameter range that supports this claim is that the pay-performance sensitivity is less than 2/3. Nevertheless, this parameter condition is almost always met, at least for publicly traded companies, where most CEOs do not hold even 3/100 of their firms (Hall and Liebman, 1998).

To do so, we restrict our study to the points where the firm experienced a CEO turnover and we measure the characteristics of the CEO and the firm just before the turnover event. This restriction allows us to isolate the intrinsic firm characteristics from those influenced by strategies of the post-turnover CEO. Our sample is CEO turnovers in S&P 1500 firms between 1998 and 2002. We use two variables, CEO education and prior experience as executives of other firms, to proxy for disutility of effort. These two variables are presumably negatively related to disutility of effort, because educational achievement and executive appointment both suggest that these CEOs have been hardworking and effective leaders.

Our analysi of the data reveal quite different pictures from what the standard principal-agent theory suggests. Contrary to the theory's prediction, we find that more-experienced CEOs tend to work for riskier firms instead of safer firms. Educational achievement of CEOs is not significantly related to firm risk. We also examine the relation of CEO risk aversion and firm risk using CEOs' wealth as an inverse proxy for CEO risk aversion. Again, we find that wealthier CEOs tend to manage riskier firms, in opposition to the theory's prediction. Finally, we also find that individuals who became CEOs of safer firms were paid less than CEOs of riskier firms. These results are robust to including various control variables such as firm size, CEO age, industry, and time dummies and to various specifications of firm risk. As a sub-product of this exercise, we find that CEOs with MBA degrees tend to manage larger firms. This finding is consistent with the complementarity between managerial talent and firm size advocated by Rosen (1982).

Assignment models were studied in many different fields, including marriage (Becker, 1973), medical interns and hospitals as well as colleges and students (Roth and Sotomayor, 1992), workers and firms (Kremer and Maskin, 1996), farmer and crop types (Ackerberg and Botticini, 2002), teachers and schools (Boyd et al., 2003), banks and borrowers (Chen, 2005), issuers and underwriters (Fernando, Gatchev, and Spindt, 2005), and venture capitalists and portfolio firms (Sørensen, 2003). Nevertheless, only few papers exist in the field of CEO markets. An exception is Rosen, who argues that assigning persons of superior talent to top positions increases productivity by more than the increments of their abilities because greater talent filters through the entire firm by a recursive chain-of-command technology. As a result, persons of superior talent tend to manage larger firms and receive higher rewards than less talented persons. Whereas Rosen focused on firm size, our focus is firm risk.[4] Similar to this paper, Core and Guay (2002) and Prendergast (2002) offer skeptical views on the prediction of the standard principal-agent theory with regard to the relationship between pay-performance sensitivity and firm risk. Nevertheless, they did not study the matching issue of CEO and firm.

This paper is organized as follows. Section 2 studies the implications of the standard principal-agent model when CEO and firm are endogenously matched. Section 3 describes our empirical methods and results to test the predictions derived in Section 2. Section 4 concludes. Proofs of the propositions are gathered in the appendix.

2 The Principal-Agent Model

In this section, we study the endogenous matching between a firm and a manager (CEO) in the principal-agent model developed by Holmstrom and Milgrom (1987); hereafter referred to as the HM model. The HM model is one of the most celebrated works in the area of managerial compensation. The authors developed a principal-agent model when the agent with CARA utility continuously controls the return process that follows the Brownian motion. One of the HM model's results popular with empiricists is the

[4] Allgood and Farrell (2003) also studied the CEO-firm match issue. They suggested the possibility of CEO-firm mismatch by showing that CEO-firm matches tend to fall apart when the match is still new. Nevertheless, in contrast to our paper, Allgood and Farrell did not study the characteristics of CEOs and firms that govern the profitability of the match.

linearity of the optimal incentive scheme with the closed-form solution for the pay-performance sensitivity.[5]

We begin with sketching a reduced-form version of the HM model. The focus of this model is characterizing the optimal contract given the characteristics of the principal and the agent. We then proceed to study the market in which heterogeneous agents and heterogeneous principals are matched, given that, once the match is formed, the agent's compensation will be set according to the HM model. In what follows, we call the principal and the agent the firm and the manager, respectively. We address the principal as male and the agent as female.

2.1 Basic Setup

The manager's preference is the negative exponential utility defined on her pay, denoted by s minus disutility cost of providing the firm with effort e. The disutility cost c is a quadratic function of effort, $c = .5ke^2$, where k is a positive constant. A manager with a low k can provide a high managerial effort with low disutility cost, and therefore we call such a manager energetic. As we will see in what follows, effort e is effectively equal to managerial input. Hence, alternatively we can interpret k as an inverse measure of managerial productivity since, for given disutility cost c, lower k generates a higher level of managerial input according to the disutility cost function. Therefore, we call a low k manager both energetic and productive interchangeably.

Let ρ be the manager's coefficient of absolute risk aversion. Her utility function is then

$$\upsilon(s-c) = -\exp\left[-\rho(s-c)\right].$$

The production technology of the firm requires two inputs. One is managerial effort and the other is fixed resources of the firm, denoted by q. We

[5] Sung (1995) found a similar result to the original HM model when the agent is allowed to control not only mean but also variance.

assume that q is positive and that the *dollar return* to the firm is expressed by the following multiplicative form,

$$\widetilde{y} = eq + \tilde{\varepsilon},$$

where $\tilde{\varepsilon} \backsim N\left(0, \sigma^2\right)$ is a nonobservable stochastic factor.[6] We primarily interpret q as firm size. For instance, one may argue that the manager's effort is magnified geometrically, affecting the productivity of all who work below her in the organization (Lucas 1978, Rosen 1982), and therefore e and q are multiplicative in the production function.

The effort level e is privately known by the manager, whereas the realized return y is public information. The firm that the manager runs is held by a set of many investors, and their preference is therefore approximated by risk neutrality. We call this set of investors the firm. The firm rewards the manager based on y using the linear sharing rule $s = \alpha_0 + \alpha_1 y$, where α_0 is the fixed transfer from the principal to the manager, and α_1 is a positive constant and a measure of pay-performance sensitivity. In this setting, the certainty equivalent payoff of the manager is

$$CE = \alpha_0 + \alpha_1 eq - .5ke^2 - .5\rho\alpha_1^2\sigma^2. \tag{1}$$

If the manager chooses not to run the firm, she would get a reservation payoff u that is expressed in certainty equivalent and determined in equilibrium. The firm's payoff is

$$\begin{aligned} \widetilde{\pi} &= -\alpha_0 + (1 - \alpha_1)\,\widetilde{y} \\ &= -\alpha_0 + (1 - \alpha_1)\,(eq + \tilde{\varepsilon})\,. \end{aligned} \tag{2}$$

The firm chooses α_0, α_1, and e so as to maximize its expected return $E\tilde{\pi}$ subject to the incentive compatibility condition of the manager

$$\frac{dCE}{de} = \alpha_1 q - ke = 0,$$

[6] In the original HM model, q is set to unity.

and the participation constraint of the manager

$$CE \geqq u.$$

As is well known, the solution for this problem is

$$\widehat{\alpha_0} = u - .5\widehat{\alpha_1}^2 \left(\frac{q}{k} - \rho\sigma^2 \right), \tag{3}$$

$$\widehat{\alpha_1} = \frac{1}{1 + k\rho q^{-2}\sigma^2}, \tag{4}$$

and

$$\widehat{e} = \frac{q}{k}\widehat{\alpha_1}. \tag{5}$$

The impact of the manager's characteristics on pay-performance sensitivity, $\widehat{\alpha_1}$, and effort level, $\widehat{e}$, has a straightforward interpretation. The more productive the manager (lower k), the higher the pay-performance sensitivity ($\widehat{\alpha_1}$), and the higher the effort ($\widehat{e}$). If the manager is more productive, it is less costly to solicit her effort, and therefore it is optimal to do so by increasing the pay-performance sensitivity. The less risk averse the manager (lower ρ), the higher the pay-performance sensitivity ($\widehat{\alpha_1}$), and therefore the higher the effort ($\widehat{e}$).[7] This is because if the manager is less risk averse, it is less costly to expose her to risk by increasing the pay-performance sensitivity and thereby to solicit her effort.

It is important to stress that firm risk σ^2 is negatively related to pay-performance sensitivity and therefore to the manager's effort. This negative impact of firm risk arises from the trade-off between incentive and risk. Raising pay-performance sensitivity encourages the manager to make more effort but exposes her to more income risk. The latter effect is more acute if σ^2 is high. As a consequence, high-risk firms need to sacrifice incentives to protect the manager from income risk. Contrary to σ^2, q is positively related to pay-performance sensitivity and thereby effort.

[7] Bitler, Moskowitz, and Vissing-Jorgensen (2005) confirm these predictions of the agency theory in a sample of private firms.

The first-best of this model is achieved if effort is verifiable and we can drop the incentive compatibility condition (5) from the optimization problem. The first-best effort e^* maximizes the expected output and therefore $e^* = q/k$. According to equations (4) and (5), the second-best effort $\widehat{e}$ is always less than e^*.

Sticking $\widehat{\alpha_0}$, $\widehat{\alpha_1}$, and $\widehat{e}$ into equation (2) and taking the expectation gives the firm's expected profit

$$E\tilde{\pi} = \frac{.5q^2}{k\left(1 + k\rho q^{-2}\sigma^2\right)^2} - u. \tag{6}$$

This equation implies that the firm's expected profit is increasing in q and decreasing in σ^2. This equation also implies that, other things being equal, including u, a firm becomes better off if a more productive and/or less risk averse manager is hired. Thus, every firm is naturally willing to pay more for such a manager, and therefore in equilibrium the manager's outside option, u, should be positively related to her productivity and negatively related to her risk aversion.

We define expected managerial compensation $w = \alpha_0 + \alpha_1 eq$. Then, evaluating the endogenous variables at the optimum (i.e., setting $\alpha_0 = \widehat{\alpha}_0, \alpha_1 = \widehat{\alpha}_1$, and $e = \widehat{e}$), gives the expected output

$$Ey = \widehat{e}q = \frac{q^2}{k\left(1 + k\rho\sigma^2 q^{-2}\right)}$$

and the expected managerial compensation

$$\begin{aligned} w &= u + .5\left(k\widehat{e}^2 + \rho\widehat{\alpha}_1^2\sigma^2\right) \\ &= u + .5Ey. \end{aligned} \tag{7}$$

2.2 Endogenous Matching

We now describe the economy in which many managers and many firms are populated, and ask the question of which manager should run which firm in equilibrium. For simplicity, we assume that the number of managers and firms are both equal to N. The population of managers is expressed by $M = \{m_1, m_2, ..., m_N\}$ and the population of firms is expressed by $F = \{f_1, f_2, ..., f_N\}$. Manager i, m_i, is characterized by $\{k_i, \rho_i\}$ and firm j, f_j, is characterized by $\left\{q_j, \sigma_j^2\right\}$. Our equilibrium concept is the core. Specifically, an equilibrium consists of a matching correspondence $\mathfrak{M}^* : F \rightrightarrows M$ that specifies the type of manager to which each firm is matched, and a payoff allocation $u^* : M \to \mathbb{R}$ and $E\tilde{\pi}^* : F \to \mathbb{R}$ specifying the equilibrium utility achieved by each type. The key property it satisfies is a stability or no-blocking condition: if the set of $\mathfrak{M}$, u, and $E\tilde{\pi}$ is in equilibrium, then there should be no pair of manager and firm such that they are not matched, but both of them can achieve a higher payoff if they are matched.

To find an equilibrium, it is useful to understand what kind of matching is stable or unstable in a simple case. Consider the economy in which $N = 2$. Fix the expected payoff of the manager m_2 to u_2. Then, using equation (6), the firm j's payoff if it is matched with m_2 is

$$\frac{.5q_j^2}{k_2\left(1 + k_2\rho_2\sigma_j^2 q_j^{-2}\right)^2} - u_2 \quad j = 1, 2.$$

Suppose that the two firms are competing for manager m_1 rather than m_2. A firm will get manager m_1 if and only if the firm is willing to pay m_1 more than the other firm is willing to pay. Firm j's willingness to pay m_1 rather than m_2 is

$$\phi_j = \frac{.5q_j^2}{k_1\left(1 + k_1\rho_1\sigma_j^2 q_j^{-2}\right)^2} - \left(\frac{.5q_j^2}{k_2\left(1 + k_2\rho_2\sigma_j^2 q_j^{-2}\right)^2} - u_2\right) \quad j = 1, 2.$$

Suppose that $\phi_1 > \phi_2$. Then the case in which m_1 is matched with f_2 and m_2 is matched with f_1 is unstable because f_1 is willing to give up more to m_1 than f_2 is. Thus, the stability concept of the core implies that m_1 should be matched with f_1 and m_2 should be matched with f_2 if $\phi_1 > \phi_2$, and vice versa.

One convenient feature of the difference function ϕ_j here is that $\phi_1 - \phi_2$ does not depend on u_2. Thus, we can determine if a match is stable without referencing an endogenous variable u_2. This is a feature of cooperative games with transferable utility. Endogenous matching models with moral hazard is typically a case of nontransferable utility.[8] Nevertheless, our model resembles the case of the transferable utility due to the specialized functional forms; one can make a fixed transfer between the firm and the manager without distorting the manager's effort and therefore fixing the expected output. This is because effort cost and monetary benefit are separable in the manager's utility function.

We now study the case in which a manager and a firm are different in only one dimension for each. An interesting question here is whether manager and firm monotonically sort in equilibrium. For instance, suppose that all managers have the same ρ but differ in k and that all firms have the same q but differ in σ^2. Without loss of generality, we assume that $k_1 < k_2$ and $\sigma_1^2 < \sigma_2^2$. Applying the aforementioned argument, m_1 should be matched with f_1 and m_2 should be matched with f_2 in equilibrium; that is, a more productive manager should be matched with a safer project if

$$\begin{aligned}\phi_1 - \phi_2 &= \left(\frac{.5q^2}{k_1\left(1+k_1\rho\sigma_1^2 q^{-2}\right)^2} - \frac{.5q^2}{k_2\left(1+k_2\rho\sigma_1^2 q^{-2}\right)^2}\right) \\ &\quad - \left(\frac{.5q^2}{k_1\left(1+k_1\rho\sigma_2^2 q^{-2}\right)^2} - \frac{.5q^2}{k_2\left(1+k_2\rho\sigma_2^2 q^{-2}\right)^2}\right) \\ &> 0.\end{aligned} \tag{8}$$

Otherwise, m_1 should be matched with f_2 and m_2 should be matched with f_1 in equilibrium; that is, a more productive manager should be matched

[8] Matching with nontransferability is not well studied, but Legros and Newman (2003) derived sufficient conditions for monotone matching in equilibrium. They showed that if the payoff function satisfies generalized increasing difference, a party with a lower index should be matched with another with a lower index. If the payoff function satisfies generalized decreasing difference, a party with a lower index should be matched with another with a higher index.

with a riskier project. Condition (8) is equivalent to saying that the joint payoff function

$$\Phi \equiv E\tilde{\pi} + u = \frac{.5q^2}{k\left(1 + k\rho\sigma^2 q^{-2}\right)^2}$$

is supermodular with respect to k and σ^2.

Before proceeding to solve for the matching equilibrium, it is useful to characterize the joint payoff function. This function is increasing in q and decreasing in k, ρ, and σ^2. Therefore, in terms of contribution to joint output, a firm with high q and/or low σ^2 is superior to a firm with low q and/or high σ^2, and a manager with low k and/or low σ^2 is superior to a manager with high k and/or high ρ. Intuition behind these rankings is straightforward. When q is high, one unit of managerial effort is translated into a high output, and therefore such a firm is desirable. When σ^2 is low, the manager of such a firm is exposed to fewer uncontrollable risk and therefore such a firm is desirable. When k is low, the manager makes effort without incurring high cost, and therefore such a manager is desirable. When ρ is low, the firm can offer high pay-performance sensitivity without hurting the manager's expected utility too much, and therefore a less risk averse manager is desirable.

2.2.1 Relations between Firm Characteristics and Manager Characteristics

Rewriting condition (8) as a local condition gives us $\partial^2\Phi/\partial k\partial\left(\sigma^2\right) > 0$. Hence, a manger and a firm positively sort locally if $\partial^2\Phi/\partial k\partial\left(\sigma^2\right) > 0$ and negatively sort if $\partial^2\Phi/\partial k\partial\left(\sigma^2\right) < 0$. Using these observations, we can prove the following:

Proposition 1 *Other things being equal, a manager with lower k should be matched with a firm with lower σ^2 and higher q.*

Intuitions behind this proposition are as follows. A more productive manager (lower k) should be matched with a higher q firm because managerial effort e and q are complementary in the production function. It is cheaper to motivate a more productive manager and to elicit a higher effort, and therefore managerial productivity and q are effectively complementary through the negative relation between k and e. Putting it another way, a firm with high q can exploit the productivity of the manager better than a firm with low q. Thus, in equilibrium, a firm with high q wins a productive manager. Why should a more productive manager be matched with a safer firm? As equation (5) shows, a more productive manager is more responsive to high pay-performance sensitivity, meaning that she increases her effort by a large degree when pay-performance sensitivity is raised. This responsiveness is better exploited at a safer firm, in that a safer firm can offer high pay-performance sensitivity without raising the manager's risk exposure too much.

Proposition 2 *Other things being equal, a manager with lower ρ should be matched with a firm with higher q. A manager with lower ρ should be matched with a firm with lower σ^2 if $k\rho\sigma^2 q^{-2} > 0.5$ for any combination of firm and manager.*

The reason that a less risk averse manager (ρ) should be matched with a firm with high q is similar to why a more productive manager should be matched with a higher q firm. It is cheaper to motivate a less risk averse manager to provide a higher effort because she is willing to accept high pay-performance sensitivity. Effort and q are complementary, and thus a more productive manager should run a firm with high q.

The most interesting part of this proposition is the last part, which says that a less risk averse manager should run a safer firm if $k\rho\sigma^2 q^{-2} > 0.5$. This condition is equivalent to say that for any arbitrary firm-manager match the optimal pay-performance sensitivity is less than $2/3$. (Note that the optimal pay-performance sensitivity is equal to $\left(1 + k\rho\sigma^2 q^{-2}\right)^{-1}$.) In practice, the pay-performance sensitivity of a public firm is usually well below 5/100 and let alone 2/3 (Hall and Liebman, 1998). This fact does not immediately imply that any arbitrary combination of firm and manager gives pay-performance sensitivity less than 2/3, because observed match are systematic instead of random due to endogenous matching. Nevertheless, the fact that the observed pay-performance sensitivity is much less than the parameter threshold 2/3 is suggestive that the parameter conditions may extend to off-equilibrium and therefore unobservable combinations of firms and managers.

Intuitions behind this result are not as straightforward as for the other results. To understand the intuitions, it is convenient to divide the effect of increase in σ^2 on the joint payoff into two effects: the portfolio effect and the incentive effect. The portfolio effect is a direct effect on the manager's utility for a given pay-performance sensitivity. According to the last term of equation (1), the manager's utility decreases in σ^2 and this decrease increases in ρ, *ceteris paribus*. Therefore, according to the portfolio effect, a more risk averse manager should be willing to pay more to avoid high σ^2 than a less risk averse manager. Note that this portfolio effect is bigger when pay-performance sensitivity is greater. There is also an indirect effect; increase in σ^2 reduces pay-performance sensitivity and affects the manager's incentive (the incentive effect). According to equation (4), the impact of σ^2 on equilibrium pay-performance sensitivity depends on ρ in two ways. Differentiating $\widehat{\alpha}_1$ with respect to σ^2 gives

$$\frac{\partial \widehat{\alpha}_1}{\partial \sigma^2} = -\left(k\rho q^{-2} \times \widehat{\alpha}_1^2\right).$$

According to this derivative, first, high ρ *increases* the negative impact of σ^2 on incentives through the first term $k\rho q^{-2}$, and second, high ρ *decreases* the same negative impact through the second term $\widehat{\alpha}_1^2$ that is decreasing in ρ. Similar to the portfolio effect, not only does the first part increase the negative impact of σ^2 but also the magnitude of effect linearly increases in $\widehat{\alpha}_1$. Therefore, when $\widehat{\alpha}_1$ is small enough, both the portfolio effect and the first part of the incentive effect become small, and as a consequence the second part of the incentive effect outweighs - higher ρ weakens the negative impact of σ^2 on the incentives. Hence, a less risk averse manager should be willing to bid more to a safer firm than as a more risk averse manager.

These propositions have a straightforward empirical prediction. Other things being equal, the rank of relevant firm characteristics and the rank of CEO characteristics should be correlated. To be concrete, the rank of CEO productivity should be negatively related to the rank of firm risk if CEO risk aversion and q are controlled, and the rank of CEO risk aversion should be positively related to the rank of firm risk if CEO productivity and q are controlled. We will test these implications in the following section.

2.2.2 Which Firm Offers High Compensation?

What does the model imply regarding managerial compensation? Intuitively, managers of high q and/or low σ^2 firms should receive higher compensation than others, given that Propositions 1 and 2 imply that such managers are superior to others. This intuition is correct if managers differ in only one dimension, but it is not always correct otherwise. This is because when managers differ in two dimensions, firms' rankings of managers may differ. To see this point, we introduce an additional notation. Let $m(j)$ be the equilibrium matching function such that if $m(j) = i$, then the match f_j and m_i is in the equilibrium. Also, let

$$\Phi(i,j) \equiv \frac{.5q_j^2}{k_i\left(1 + k_i\rho_i\sigma_j^2 q_j^{-2}\right)^2} \ \ \forall i,j.$$

The stability condition implies that the sum of the equilibrium payoffs of any matched firm and manager should be not less than the joint payoff of the unmatched firm and manager. Therefore,

$$\Phi\left(m\left(j'\right), j'\right) - u^*_{m(j')} + u^*_{i'} \geq \Phi\left(i', j'\right), \ \ \forall i' \neq m\left(j'\right). \tag{9}$$

If we focus on two firms, $f_{j'}$ and $f_{j''}$, then we can combine equation (9) for these two firms as

$$\Phi\left(m\left(j''\right),j''\right)-\Phi\left(m\left(j'\right),j''\right) \geq u^*_{m(j'')}-u^*_{m(j')} \geq \Phi\left(m\left(j''\right),j'\right)-\Phi\left(m\left(j'\right),j'\right). \tag{10}$$

Therefore, the difference in the joint payoffs define the upper bound and lower bound of the difference in the managers' payoffs. This property allows us to characterize the distribution of managers' payoffs. For instance, if $\Phi\left(m\left(j''\right),j'\right) - \Phi\left(m\left(j'\right),j'\right)$ is positive, one can conclude that $u^*_{m(j'')} > u^*_{m(j')}$. Suppose that $q_{j''} \geq q_{j'}$ and $\sigma^2_{j'} \geq \sigma^2_{j''}$, that is, $f_{j''}$ is inferior to $f_{j'}$ in neither dimension. In this case, does $m\left(j''\right)$ receive higher payoff than $m\left(j'\right)$? The answer is yes if both firms prefer $m\left(j''\right)$ to $m\left(j'\right)$, meaning that $\Phi\left(m\left(j''\right),j''\right) > \Phi\left(m\left(j'\right),j''\right)$ and $\Phi\left(m\left(j''\right),j'\right) > \Phi\left(m\left(j'\right),j'\right)$. Under these conditions, equation (10) implies that $u^*_{m(j'')} > u^*_{m(j')}$. Nevertheless, for instance, if $f_{j'}$ prefers $m\left(j'\right)$ to $m\left(j''\right)$ (i.e., $\Phi\left[m\left(j''\right),j'\right] < \Phi\left[m\left(j'\right),j'\right]$), there is no guarantee that $u^*_{m(j'')} > u^*_{m(j')}$. To characterize the distribution of w instead of u, we also have to add the costs of effort and risk bearing to u^*, as in the equation (7).

As the earlier argument illustrates, whether a manager of a superior firm receives a higher payoff (and compensation) depends on if every firm has the same preference ordering. Further, if every firm has the same preference ordering depends on the distribution of firm and manager characteristics. Here, we supply one sufficient condition that guarantees the positive relation between compensation and firm characteristics. Imagine that managers differ in only one dimension, either k or ρ. Then, every firm agrees with the ranking of managers. Given the positive sorting results in Propositions 1 and 2, a manager of a superior firm is always better off than a manager of an inferior firm. We are now going to formalize this statement and also derive the distribution of managerial compensation. We begin with spelling out the assumptions.

Assumption 1: Either one of the following conditions holds: $\rho = \rho_i$, $\forall i$

or $k = k_i$, $\forall i$.

We also formalize the previously introduced assumption.

Assumption 2: $k\rho\sigma^2 q^{-2} > 0.5$, $\forall k, \rho, \sigma^2, q^{-2}$.

Then we can show the following proposition.

Proposition 3 *Suppose that Assumptions 1 and 2 hold. If* $q_{j'} \leq q_{j''}$ *and* $\sigma^2_{j'} \geq \sigma^2_{j''}$, *then* $u_{m(j')} \leq u_{m(j'')}$ *and also* $w_{m(j')} \leq w_{m(j'')}$.

Roughly speaking, this proposition claims that managers of high q and/or low σ^2 firms receive higher payoffs as well as higher expected compensation. We will also test this claim in the section that follows.

3 Testing the Presence of Endogenous Matching

In this section, we test the predictions of the model derived in the previous section. We first examine if CEOs of superior firms are receiving higher compensation than average. And then we examine if a manager and a firm are systematically matched as predicted in the model developed in the previous section. In particular, we regress proxies of CEO productivity and risk aversion to the characteristics of the firm he or she manages, controlling for other characteristics of the CEO. We gather most of the data from ExecComp and CRSP, as in Aggarwal and Samwick (1999, 2002), and Core and Guay (2001, 2002). We gather educational achievements of CEOs from various sources, including Forbes magazine, Forbes Person Tearsheet, S&P Registry of Coporate Directors, D&B Million Dollar Database, SEC proxy filings, and Google searches. We focus our analysis on the sample of firms at the point when their CEOs were replaced. We measure characteristics of both CEOs and firms using data from before the arrival of the CEOs so that we can treat these characteristics as exogenous variables when CEO and firm are matched. Because it is important to identify the timing of a new CEO arrival accurately, we did not use observations that did not record the date at which a given individual became CEO. Our sample years are 1998-2002, and all finance and utility firms are excluded.

3.1 Construction of Variables

In what follows, we will describe the measures we use to proxy for all parameters in the model.

3.1.1 Managerial Productivity

One CEO characteristic relevant for endogenous matching is productivity. We use the CEO's experience of serving as an executive in the past to proxy for the CEO's productivity. Using ExecComp, we constructed two different measures of executive experience: external CEO experience and external non-CEO experience. These external experience measures count only executive experiences in firms other than the current firm. External CEO experience is computed using a few different variables from ExecComp, such as the date a given individual became CEO, the date a given individual left as CEO, and the date a given individual left a company. When these data are missing, we count the number of years that an individual appears as a CEO in ExecComp. We computed external non-CEO experience by counting the number of years that an individual appears as a non-CEO executive. Both CEO and non-CEO executive experience measures are expressed in number of months and are adjusted so that no individual's experience is more than 12 months a year. We do not use internal experience as a proxy for managerial productivity, in that it is not clear if internal experience is positively related to managerial productivity. For instance, individuals with low productivity may have longer internal experience because their promotion to CEO was slow.

One caveat of our methodology is that CEOs in our sample may have served as executives in firms that are not recorded in ExecComp, and therefore our experience measures do not necessarily reflect the comprehensive experience of each CEO. However, both the experience variables are significantly and positively correlated with the current compensation of CEOs, and therefore they seem to work well as at least the market perception of CEO ability (see Table 2).[9] This finding is consistent with that of Murphy and Zábojník (2003, 2004), who argue for an increasing importance of "general skills" of CEOs instead of firm-specific skills.

Following Palia (2001), we use educational achievement of CEOs to proxy for their productivity. Palia refers to an individual as being from a top school if he or she is a graduate of either the top 13 undergraduate nonengineering colleges (Brown, Columbia, Cornell, Dartmouth, Duke, Georgetown, Harvard, Johns Hopkins, Northwestern, Pennsylvania, Princeton, Stanford, and Yale), the top six engineering schools (Berkeley, CalTech, Illinois, Michigan, MIT, and Stanford), the top 10 MBA schools (Carnegie, Chicago, Columbia, Harvard, Michigan, Northwestern, Sloan, Stanford, Tuck, and Wharton) or the top nine law schools (Berkeley, Chicago, Columbia, Harvard, Michigan, New York University, Pennsylvania, Stanford, and Yale).[10] We also identify whether a CEO has a MBA degree. We do not include CEOs whose educational information was not available in our empirical study. Due to this inability to find educational information, our sample was reduced by roughly 30%.

As presented in Table 1, 38% of the CEOs in our sample have MBA degrees and 27% graduated from one of the top schools. The latter number is consistent with the previous study by Palia, who found that 26% of CEOs graduated from top schools. As presented in Table 2, younger CEOs are more likely to hold MBA degrees than older CEOs. Both of the education variables are significantly and positively related to the CEOs' current

[9] Current compensation is the ExecComp variable tdc1 that includes both flow compensation such as salary and bonus and grants of restricted stocks and options.

[10] The top 13 undergraduate programs were compiled by Coleman (1973). The top engineering programs were compiled by Cartter (1966). The top MBA programs list is according to (MBA 1974), and the top law programs list is according to Useem and Karabel (1986).

compensation, suggesting that these education variables are correlated with perceived CEO productivity. Nevertheless, these correlations are smaller than those of the experience variables and current compensation.

3.1.2 Risk Aversion of Manager

The other characteristic of the manager that is relevant to endogenous matching is the coefficient of absolute risk aversion. Similar to Bitler, Moskowitz, and Vissing-Jørgensen (2005), we attempt to use CEO wealth as a proxy for risk aversion, in that a wealthier individual is considered to be less risk averse than a less wealthy individual. Nevertheless, wealth information of CEOs is difficult to obtain. Therefore, we resort to the past compensation information of CEOs. To be specific, we compute the CEO's accumulated compensation recorded in ExecComp before his or her arrival as a new CEO. The compensation is adjusted for inflation and expressed in 2003 dollars.

There are three caveats regarding our measure of risk aversion. First, strictly speaking, this measure is inconsistent with the theoretical assumption that agents have CARA utility, and therefore absolute risk aversion should not be related to agents' wealth. Nevertheless, if we see CARA utility as a local approximation of the agent's underlying CRRA preference, using wealth as a proxy for absolute risk aversion makes some sense. Second, one can criticize this measure on the basis that wealth may be endogenous to CEO risk aversion. For instance, individuals who are more risk averse are likely to work harder at a younger age and also have a higher amount of precautionary savings, and therefore there may be a positive relation between CEO risk aversion and wealth. Lastly, and most importantly, our measure of risk aversion may actually proxy managerial productivity, in that a more productive manager has naturally received higher compensation in the past than others have.

3.1.3 CEO Age

We use CEO age as a control variable in the analysis that follows, given that age may be related to both CEO productivity and risk aversion. For instance, Poterba (2001) presents evidence on age-dependent risk aversion.

Compared to the CEO sample in Palia, our CEOs are significantly younger (Table 1). The average age of our CEOs are 52.41 years old, whereas that in the Palia's sample is 57.35 years. Because our sample is more recent than the Palia's sample, this difference indicates a trend for younger CEOs.

3.1.4 Return Variance

Dollar return variance is one of the firm characteristics that influences matching. Theoretically, idiosyncratic risk instead of total risk should affect pay-performance sensitivity and thereby should be correlated with CEO characteristics through endogenous matching. Nevertheless, significant evidence suggests that relative performance compensation is rare, and CEOs tend to incur not only idiosyncratic risks but also market risks of the firm. (See Prendergast, 2002, for instance.) Therefore, we compute both idiosyncratic risk and total risk and see if these two variables are systematically related to CEO characteristics.

We use data from CRSP and Compustat to construct risk measures and follow the method to construct this risk variable as specified in Aggarwal and Samwick (1999, 2002), namely, we calculate variance of monthly dollar returns over the 60 months preceding the 3 months before the date an individual became a CEO. The monthly returns used here are all real returns after subtracting CPI growth and including dividends and other distributions. If we do not observe a minimum 12 months of return during the 60-month period, we do not include such turnover firms in our sample. To minimize the effect of IPO periods during which stock returns are highly volatile compared to non-IPO stocks, we do not use the first 12 records for each firm. To compute idiosyncratic risks, we first estimate the percentage idiosyncratic risk as the mean-squared error from a market model regression. We also use the Fama-French three-factor model to estimate the unpriced firm-specific risk. Results from these different specifications of percentage idiosyncratic risk are virtually similar. Therefore, we present only the results based on the Fama-French three-factor model. Then we compute dollar return idiosyncratic risk as the estimated percentage idiosyncratic risk multiplied by the squared market value at the month preceding three months before the CEO's arrival.

Core and Guay (2002) criticized this procedure of dollar return risk measures used by Aggarwal and Samwick (1999), in that they are highly correlated with firm size, and therefore the results by Aggarwal and Samwick may be driven by the firm size effect instead of the firm risk effect. To circumvent this problem, we also measure the total risk of the firm by the following two-step procedure. We first regress the total risk to various firm size proxies and then use the unexplained component as the total risk.

3.1.5 Other Firm Characteristics, q

Following Rosen (1982), we use firm size as a proxy for q. Technically, q is the marginal product of a manager's effort, and a manager's effort is presumably translated into a larger context in a bigger firm.[11] Firm size variables may deviate from the firm's typical values in the short run due to accounting manipulation, temporary fluctuation of sales or stock price, mergers and acquisitions, and sell-offs. Therefore, we measure firm size by averaging the last five years of observation instead of using only the last one year of observation. Following typical corporate finance literature, we measure firm size by sales, number of employees, assets, and market value of the firm.

Average sales, assets, market value, and number of employees are all right

[11] Schaefer (1998) claimed that q is negatively related to firm size. However, his results crucially depend on the assumption that dollar return variance is the same for all the firms.

skewed, as seen from the fact that the medians for these four variables are much smaller than their means (Table 1). Also, the minimum and maximum values of the four variables show the presence of outliers in the data. We can observe the same pattern for the four risk measures. Accordingly, if a simple OLS is used, these data characteristics hinder us from obtaining true natures of the relationship between variables. However, we will use the CDF regressions for the reasons specified later. Therefore, a difficulty associated with these data characteristics is avoided in our regressions.

3.2 Results: CEO and Firm Characteristics

To examine whether there is endogenous matching between firms and managers, we begin with converting each variable to CDF in each year. Note that if we use ranking in each year instead of CDF, the distribution of variables would differ across years because the number of observations differs across years. The reason that we use CDF is that firms and executives are matched with each other based on the relative ranking of their respective characteristics within their group in the job market of executives.

Note that the matching model we have developed generally predicts a positive sorting between firms and managers. A more productive manager (i.e., lower disutility of effort k) and/or a less risk averse manager (i.e., lower absolute risk aversion ρ) will be matched with a firm with higher returns to effort, q, and lower σ^2. According to our model, CEO experience variables should be positively related with firm size and negatively related with variance of dollar return, and a CEO risk aversion should be negatively related with firm size and positively related with variance of dollar returns.[12]

Table 2 presents the CDF correlation of both firm and CEO character-

[12] Lucas (1978) has a similar production technology to the current setting in which output is proportional to managerial input and the factor that multiplies the managerial input into output is positively related to firm size. Thus, naturally, Lucas also has an implication that firm size and managerial efficiency are positively related. Lucas does not model moral hazard problems.

istics. All the experience variables are more or less positively and significantly related to all the firm size proxies, suggesting a positive sorting of manager productivity and firm size. However, the experience variables are also positively related with dollar return variance, and this positive relation contradicts the standard principal-agent model. This is not really surprising because dollar return variance is strongly and positively related to firm size variables. Hence, without controlling for firm size variables, there is likely a positive correlation between experience variables and dollar return variance.

3.2.1 CEO Compensation and Firm Risk

The standard principal-agent model suggests that a safer firm wins a desirable CEO, that is, one who has lower risk aversion and higher productivity. Therefore, CEOs in a safer firm should receive higher compensation than average. To test this hypothesis, we regress the CEO's current compensation to firm risk measures and other control variables. These control variables are firm size measures, two-digit SIC code dummies, and year dummies. The results are presented in Table 3 for the three different risk measures. Across all specifications, the results are virtually the same. Firm risks are positively and significantly correlated with the current compensation of the CEO. A 1% increase in firm risk corresponds to a 0.27%–0.776% increase in current compensation. This finding does not support the prediction of the standard principal-agent model that CEOs in safer firms should be paid more. Consistent with Rosen (1982), current compensation is positively related to firm size proxies.

3.2.2 Relation between CEO and Firm Characteristics: Direct Test of Endogenous Matching

We will now examine if a systematic relation exists between CEO and firm characteristics as the endogenous matching model suggests. We test the relation of managerial productivity and firm risks using the following panel regressions:

$$
\begin{aligned}
& \frac{\log CDF\left(\text{Proxy of Managerial Productivity}_{it}\right)}{1-\log CDF\left(\text{Proxy of Managerial Productivity}_{it}\right)} \\
= \quad & \alpha_0+\alpha_1 CDF\left(\text{Risk}_{jt}\right)+\sum_{n=2}^{3}\alpha_n CDF\left(X_{nt}\right)+\sum_{n=1}^{4}\beta_n CDF\left(Z_{nt}\right)+\lambda_t+\varepsilon_{jit},
\end{aligned}
$$

where X_{it} are control variables for firm, that is, size and two-digit SIC industry; Z_{nt} are control variables for CEO except the dependent variable; and λ_t is year dummy. There are five attributes of CEO: experience, MBA degree, top school graduate, age, and accumulative compensation. For instance, when we use experience as the dependent variable, all four of the other variables are used as the control variables. We test the relation of managerial risk aversion and firm risk using the following panel regressions:

$$
\begin{aligned}
& \frac{\log CDF\left(\text{Accumulative Compensation}_{it}\right)}{1-\log CDF\left(\text{Accumulative Compensation}_{it}\right)} \\
= \quad & \alpha_0+\alpha_1 CDF\left(\text{Risk}_{jt}\right)+\sum_{n=2}^{3}\alpha_n CDF\left(X_{nt}\right)+\sum_{n=1}^{4}\beta_n CDF\left(Z_{nt}\right)+\lambda_t+\varepsilon_{jit}
\end{aligned}
$$

We run the regressions using three different productivity variables (experience, MBA, top school) and three different risk measures (total, idiosyncratic, and residual). The results are summarized in Tables 4, 5, 6, and 7. The dependent variable is CEO's educational achievements in Table 4. None of the independent variables are significantly related to whether the CEO has a degree from one of the top schools, suggesting that this characteristic is irrelevant for the pairing between CEO and firm. MBA degree is positively related to firm sales, market value, and employment, consistent with Rosen (1982).[13] The negative coefficient on age means that younger CEOs tend to hold MBA degrees relative to older CEOs. Nevertheless, similar to the top school dummy, MBA degree is not significantly related to total risk and therefore this result does not support the standard principal-agent theory.

[13] Bertrand and Schoar (2003) also found that managers with MBA degrees tend to run larger firms.

The top panels of Table 5, 6, and 7 present the results on CEO experience under three different specifications of firm risk. CEO experience is significantly and positively related to firm risk when sales, assets, or employment is controlled, contradicting the standard principal-agent theory that predicts a negative relation. The coefficients on the risk variables are not significant when market value instead of firm size proxies is controlled. This may be due to the endogeneity of market value relative to firm risk. As Pastor and Veronesi (2003) argue, market value may increase firm risk, especially for young firms. Hence, market value is likely to be endogenous to firm risk, and vice versa. This mutual dependence may create a difficulty in separating the two effects (firm risk and size) when the two effects are simultaneously included.

The bottom panels of Table 5, 6, and 7 present the results on accumulated compensation, again under three different specifications of firm risk. Accumulated compensation is also positively related to firm risk and firm assets, sales, and employment under any specifications. These results suggest that a more productive and/or less risk averse CEO tends to manage a riskier firm in that accumulated compensation is likely to measure both CEO productivity and risk aversion.[14]

Whether we use total risk or idiosyncratic risk does not affect our results. This result differs from the existing results on CEO compensation. The existing results often suggest that CEO compensations are more related to total risk than idiosyncratic risk. Finally, using residual risk does not alter the results (Table 7).

So far our sample includes not only CEOs from other firms but also internally promoted CEOs. Firms that internally promoted CEOs may choose

[14]Different results are obtained in another context. Ackerberg and Botticini (2002) found that poor farmers tended to cultivate vines and that wealthier farmers tended to cultivate cereals in the 14th-century Tuscany. Vines are considered to be riskier crops than cereals, and therefore this result suggests that a less risk averse agent is matched with a safe business, consistent with the standard principal-agent model.

CEOs for reasons other than the endogenous matching theory we presented, such as succession within a family and promotion incentives. Therefore, as an additional robustness check, we have run the CDF regressions without internally promoted CEOs, using idiosyncratic risk. The results are presented in Table 8. As the number of observations in the sample substantially drops (688 -> 236), the significance of the coefficients also drops in many cases. Nevertheless, we continue to see that CEO experience and accumulated compensation are both positively related to firm risk.

3.2.3 Related Evidence

Related to our evidence against the standard principal-agent theory, some authors also find counter evidence of the standart theory by studying pay-performance sensitivity. Demsetz and Lehn (1984) found that managerial ownership is positively related to firm risk, contradictory to equation (4). A significant number of papers also found a negative relation between pay-performance sensitivity and firm risk (e.g., Aggarwal and Samwick, 1999), consistent with the standard principal-agent theory. Nevertheless, Core and Guay (2002) questioned the validity of these results supporting the standard theory, arguing that firm risk measures used in Aggarwal and Samwick are proxies for firm size instead of firm risk.

3.3 Discussions

Two alternative theories may explain our empirical findings. First, a simple portfolio theory is consistent with our findings. A riskier firm needs to pay more to its CEO as a risk premium, and a less risk averse CEO is more willing to take a position with a riskier firm, because a less risk averse CEO is more tolerant of income risk. Nevertheless, this explanation assumes that becoming a CEO of a risky firm is equivalent to holding a risky portfolio. This link is not clear, in that a CEO may reduce his or her exposure to the risk of the firm he or she manages by receiving a fixed salary instead of performance pay. Second, a CEO's experience may enhance his or her ability to identify a better strategy among many alternatives. Such an ability is more valued in riskier circumstances. As a consequence, more experienced CEOs run riskier firms and get paid more (Takii, 2003).

4 Concluding Remarks

When firms and CEOs choose each other from the pool of heterogeneous CEOs and the pool of heterogeneous firms, respectively, the economics of endogenous matching suggests that a systematic relation should exist between firm characteristics and CEO characteristics. To explore endogenous matching in the market for CEOs, we study the standard principal-agent model and find that a less risk averse and/or more productive CEO should manage a safer firm, and CEOs of safer firms should be paid more than average. We bring these predictions to the data and find that the data are not consistent with the standard principal-agent theory. We find that a more experienced and/or less risk averse CEO tends to run a riskier firm, and CEOs of riskier firms are paid more. As we carefully measure the characteristics of both CEO and firm prior to their match, our results are not due to the CEO's influence on the firm characteristics.

CEOs are believed to play significant roles even in modern large corporations, where most corporate functions are decentralized and each division operates as an autonomous entity. Hall and Liebman (1998) documented that average CEOs received 23 times as much compensation as all workers in 1982, and this gap grew to 50 times in 1994. Much recent anecdotal evidence, including the collapse of Enron and WorldCom, suggests that CEOs can also do enormous harm to the corporations they manage by self-dealing and deliberately misleading investors. In light of this importance of CEOs, it is vital to understand the role of CEOs and use the appropriate model to study CEO incentives and compensation.

The standard principal-agent theory is one of the most frequently used theories of CEO compensation. Therefore, we feel concern with regard to the poor performance of the theory in this paper's exercise.

5 Appendix

Proof of Proposition 1: The proof of this proposition is done by taking cross derivatives of Φ. Observe that

$$\frac{\partial\Phi}{\partial k\partial q}=-\frac{1}{k^2}\frac{q+4k\rho\sigma^2q^{-1}+9k^2\rho^2\left(\sigma^2\right)^2q^{-3}}{\left(1+k\rho\sigma^2q^{-2}\right)^4}<0,$$

and

$$\frac{\partial^2\Phi}{\partial k\partial\left(\sigma^2\right)}=\frac{3\rho^2\sigma^2q^{-2}}{\left(1+k\rho\sigma^2q^{-2}\right)^4}>0.$$

This completes the proof. Q.E.D.

Proof of Proposition 2: Similar to the proof of Proposition 1, observe that

$$\frac{\partial\Phi}{\partial\rho\partial\left(\sigma^2\right)}=\frac{2k\rho\sigma^2q^{-2}-1}{\left(1+k\rho\sigma^2q^{-2}\right)^4}$$

and

$$\frac{\partial\Phi}{\partial\rho\partial q}=\frac{-6q^{-3}k\rho\left(\sigma^2\right)^2}{\left(1+k\rho\sigma^2q^{-2}\right)^4}<0.$$

This completes the proof. Q.E.D.

Proof of Proposition 3: Suppose that ρ is the same for all managers, and managers differ only in k. We will first show that $k_{m(j'')}\leq k_{m(j')}$. Then, $u_{m(j'')}\geq u_{m(j')}$ immediately follows. And then we proceed to prove that $w_{m(j'')}\geq w_{m(j')}$.

Differentiating the joint payoff Φ with respect to k gives

$$\frac{\partial\Phi}{\partial k}=-\frac{q^2\left(1+3k\rho\sigma^2q^{-2}\right)}{2k^2\left(1+k\rho\sigma^2q^{-2}\right)^3}.$$

If the absolute value of this derivative is bigger for $f_{j''}$ than for $f_{j'}$, $f_{j''}$ has a higher willingness to pay to hire a low k manager than $f_{j'}$. This is what we demonstrate now.

$$\begin{aligned}
\frac{q_{j''}^2\left(1+3k\rho\sigma_{j''}^2 q_{j''}^{-2}\right)}{\left(1+k\rho\sigma_{j''}^2 q_{j''}^{-2}\right)^3} &= \frac{\left(q_{j''}^2-q_{j'}^2\right)\left(1+3k\rho\sigma_{j''}^2 q_{j''}^{-2}\right)}{\left(1+k\rho\sigma_{j''}^2 q_{j''}^{-2}\right)^3}+\frac{q_{j'}^2\left(1+3k\rho\sigma_{j''}^2 q_{j''}^{-2}\right)}{\left(1+k\rho\sigma_{j''}^2 q_{j''}^{-2}\right)^3} \\
&\geq \frac{q_{j'}^2\left(1+3k\rho\sigma_{j'}^2 q_{j'}^{-2}\right)}{\left(1+k\rho\sigma_{j'}^2 q_{j'}^{-2}\right)^3}. \qquad (11)
\end{aligned}$$

The inequality in the second line follows because $q_{j''}^2 \geq q_{j'}^2$ and $\left(1+3k\rho\sigma^2 q^{-2}\right)/\left(1+k\rho\sigma^2 q^{-2}\right)^3$. Hence, $k_{m(j'')} \leq k_{m(j')}$. This, in turn, implies that

$$\Phi\left(m\left(j''\right), j'\right)-\Phi\left(m\left(j'\right), j'\right) \geq 0.$$

Combined with equation (10), $u_{m(j'')} \geq u_{m(j')}$.

We now show that not only payoff but also expected compensation of $m\left(j''\right)$ is not less than $m\left(j'\right)$, given that $f_{j''}$ is not only inferior to $f_{j'}$ in neither dimension but also possesses a manager that is at least as good as $f_{j'}$'s manager. Therefore, the expected output Ey is not less for $f_{j''}$ than $f_{j'}$, given that neither u nor Ey of $f_{j''}$ is less than those of $f_{j'}$, $w_{m(j'')} \geq w_{m(j')}$ by equation (7). In essentially the same way, one can prove the case in which mangers differ only in ρ. Q.E.D.

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Table 1. Summary Statistics

Assets, Sales, Market Value, and Number of Employees are average value over 5 years preceding the sample year. Total risk is estimated standard deviation of monthly percentage return multiplied by the market value at the time preceding the CEO switching date by one quarter. Idiosyncratic risk is the mean-squared error from Fama French three-factor regression multiplied by the the market value at the time preceding the CEO switching date by one quarter. Risk estimation period is 60 months preceding CEO turnover month by one quarter. Experience variables are constructed based on the length of the named CEO's previous managerial experience. MBA is a dummy variable that takes one if the executive has an MBA degree and takes zero otherwise. TOPSCH equals 1 if the executive holds a bachelor's or master's degree from top schools. Age variable indicates the age of the executive. Current compensation is the amount that the firm paid to the CEO during the year. Accumulated compensation is the amount that the CEO has accumulated over his or her career. Sample period is from 1998 to 2002. All monetary variables are restated to 2003 constant dollars using the end-of-fiscal-year consumer price index. There are 814 observations.

	Firm Characteristics					
	Assets ($000,000)	Sales ($000,000)	Market Value ($000,000)	Number of employees (000)	Total Risk ($000,000)	Idiosyncratic Risk ($000,000)
MIN	9.88	2.21	7.19	0.01	0.97	0.98
MAX	428,017.49	185,349.81	419,007.76	969.40	42,866.92	32,391.88
MEAN	4,958.11	4,433.79	7,433.28	20.31	802.66	672.67
MEDIAN	997.59	1,108.26	1,148.86	5.84	123.33	108.76
STD	22,084.69	13,168.96	26,256.68	53.61	3,028.46	2,364.79

	CEO Characteristics							
	External CEO Experience	External non-CEO Executive Experience	Total External Experience	MBA	TOPSCH	Age	Current Compensation ($000)	Accumulated Compensation ($000)
MIN	0	0	0	0	0	33	0	0
MAX	150	108	174	1	1	89	281,126.01	20,299,281.35
MEAN	3.12	7.49	10.61	0.37	0.27	52.37	6,904.60	56,333.86
MEDIAN	0	0	0	0	0	52	2,690.60	8,489.49
STD	14.67	18.67	26.57	0.48	0.44	7.91	16,690.63	722,066.29

Table 2. Simple Correlation Result for CDF Variables

Assets, Sales, Market Value, and Number of Employees are average value over 5 years preceding the sample year. Total risk is estimated standard deviation of monthly percentage return multiplied by the market value at the time preceding the CEO switching date by one quarter. Idiosyncratic risk is the mean-squared error from Fama French three-factor regression multiplied by the the market value at the time preceding the CEO switching date by one quarter. Risk estimation period is 60 months preceding CEO turnover month by one quarter. Experience variables are constructed based on the length of the named CEO's relevant previous managerial experience. MBA is a dummy variable that takes one if the executive has an MBA degree and takes zero otherwise. TOPSCH equals 1 if the executive holds a bachelor's or master's degree from top schools. Age variable indicates the age of the executive. Current compensation is the amount that the firm paid directly to the CEO during the year. Accumulated compensation is the amount that the CEO has accumulated over his or her career. Sample period is from 1998 to 2003. All monetary variables are restated to 2002 constant dollars using the end-of-fiscal-year consumer price index. Correlation is calculated using CDFs of all the corresponding variables within each year. P-value is included in parenthesis.

	Firm Characteristics						**CEO Characteristics**							
	Assets	Sales	Market Value	Number of employees	Total Risk	Idiosyncratic Risk	External CEO Experience	External non-CEO Executive Experience	Total External Experience	MBA	TOPSCH	Age	Current Comp.	Accumulated Comp.
Assets	1													
Sales	0.926	1												
	(0.000)													
Market Value	0.836	0.749	1											
	(0.000)	(0.000)												
Number of Employees	0.829	0.894	0.658	1										
	(0.000)	(0.000)	(0.000)											
Total Risk	0.695	0.602	0.920	0.509	1									
	(0.000)	(0.000)	(0.000)	(0.000)										
Idiosyncratic Risk	0.693	0.602	0.918	0.510	0.998	1								
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)									
External CEO Experience	0.145	0.109	0.143	0.118	0.132	0.131	1							
	(0.000)	(0.002)	(0.000)	(0.001)	(0.000)	(0.000)								
External non-CEO Executive Experience	0.078	0.054	0.056	0.063	0.047	0.046	0.522	1						
	(0.027)	(0.125)	(0.108)	(0.073)	(0.184)	(0.187)	(0.000)							
Total External Experience	0.093	0.067	0.070	0.075	0.059	0.058	0.611	0.988	1					
	(0.008)	(0.055)	(0.046)	(0.033)	(0.095)	(0.097)	(0.000)	(0.000)						
MBA	0.078	0.094	0.085	0.094	0.064	0.067	0.016	0.045	0.037	1				
	(0.037)	(0.012)	(0.023)	(0.012)	(0.086)	(0.075)	(0.676)	(0.231)	(0.323)					
TOPSCH	0.031	0.033	0.066	0.037	0.062	0.061	0.053	0.045	0.048	0.498	1			
	(0.415)	(0.380)	(0.079)	(0.329)	(0.098)	(0.103)	(0.162)	(0.237)	(0.200)	(0.000)				
Age	0.101	0.109	0.033	0.142	-0.027	-0.032	0.132	0.053	0.074	-0.065	-0.001	1		
	(0.004)	(0.002)	(0.348)	(0.000)	(0.454)	(0.366)	(0.000)	(0.138)	(0.038)	(0.086)	(0.980)			
Current Compensation	0.504	0.457	0.623	0.383	0.626	0.629	0.096	0.174	0.174	0.062	0.035	-0.092	1	
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.006)	(0.000)	(0.000)	(0.101)	(0.351)	(0.010)		
Accumulated Compensation	0.465	0.442	0.589	0.392	0.582	0.584	0.011	-0.099	-0.091	0.027	0.067	0.062	0.450	1
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.761)	(0.005)	(0.010)	(0.478)	(0.075)	(0.082)	(0.000)	

Table 3. Current Compensation

Dependent variables are logarithm of current compensation that are the amount that the firm paid to the CEO during the sample year. Assets, Sales, Market value, and Number of Employees are average value over 5 years preceding the sample year. Total risk is estimated standard deviation of monthly percentage return multiplied by the market value at the time preceding the CEO switching date by one quarter. Residual risk is part of total risk that is orthogonal to size measure. Risk estimation period is 60 months preceding CEO turnover month by one quarter. Logarithm is used for both size and risk variables. Sample consists of 688 observations from firms that did not belong to the finance and utility industries during the sample period from 1998 to 2002. All monetary variables are restated to 2003 constant dollars using the end-of-fiscal-year consumer price index. Year fixed effect, SIC 2-digit fixed effect, and constant are included in the model but not reported. Heteroskedasticity robust standard error is included in parentheses. Significance level of 10%, 5%, and 1% are indicated by *, **, and ***, respectively.

Panel A: Total Risk Is the Risk Measure				
Total Risk	0.449***	0.462***	0.270***	0.511***
	(0.052)	(0.049)	(0.095)	(0.050)
Assets	0.084			
	(0.057)			
Sales		0.071		
		(0.056)		
Market Value			0.261**	
			(0.104)	
Number of Employees				-0.007
				(0.073)
R-square	0.31	0.31	0.32	0.31
Panel B: Idiosyncratic Risk Is the Risk Measure				
Idiosyncratic Risk	0.460***	0.474***	0.294***	0.522***
	(0.052)	(0.050)	(0.096)	(0.050)
Assets	0.082			
	(0.058)			
Sales		0.067		
		(0.056)		
Market Value			0.242**	
			(0.104)	
Number of Employees				-0.010
				(0.073)
R-square	0.31	0.31	0.32	0.31
Panel C: Residual Risk Is the Risk Measure				
Residual Risk	0.668***	0.747***	0.581***	0.776***
	(0.087)	(0.087)	(0.116)	(0.092)
Assets	0.184***			
	(0.049)			
Sales		0.224***		
		(0.045)		
Market Value			0.337***	
			(0.058)	
Number of Employees				0.226***
				(0.060)
R-square	0.30	0.30	0.33	0.28

Table 4. CDF Regression for Education Variables with Total Risk

Assets, Sales, Market Value, and Number of Employees are average value over 5 years preceding the sample year. Total risk is estimated standard deviation of monthly percentage return multiplied by the market value at the time preceding the CEO switching date by one quarter. Idiosyncratic risk is the mean-squared error from Fama French three-factor regression multiplied by the market value at the time preceding the CEO switching date by one quarter. Risk estimation period is 60 months preceding CEO turnover month by one quarter. Experience variables are constructed based on the length of the named CEO's relevant previous managerial experience. MBA is a dummy variable that takes one if the executive has an MBA degree and takes zero otherwise. TOPSCH equals 1 if the executive holds a bachelor's or master's degree from top schools. Age variable indicates the age of the executive. Current compensation is the amount that the firm paid directly to the CEO during the year. Accumulated compensation is the amount that the CEO has accumulated over his or her career. CDFs are calculated by ranking the corresponding variable with in each year.

Sample consists of firms that did not belong to the finance and utility industries during the sample period from 1998 to 2002. All monetary variables are restated to 2003 constant dollars using the end-of-fiscal-year consumer price index. Year fixed effect and constant are included in the model but not reported. Standard error is included in parentheses. Significance level of 10%, 5%, and 1% are indicated by *, **, and ***, respectively.

Panel A: Dependent Variable: Top School Graduates				
Total Risk	0.170	0.127	0.077	0.087
	(0.188)	(0.171)	(0.299)	(0.162)
Assets	-0.056			
	(0.174)			
Sales		0.005		
		(0.158)		
Market value			0.060	
			(0.299)	
Number of Employees				0.081
				(0.152)
ccumulated Compensatio	0.169	0.167	0.163	0.161
	(0.140)	(0.140)	(0.141)	(0.140)
Age	-0.049	-0.054	-0.056	-0.063
	(0.110)	(0.110)	(0.110)	(0.110)
Total External Experience	0.220	0.219	0.219	0.219
	(0.165)	(0.165)	(0.165)	(0.165)
Observations	689	689	689	689
R-square	0.09	0.09	0.09	0.09

Panel B: Dependent Variable: MBA Degree				
Total Risk	-0.026	-0.053	-0.346	-0.060
	(0.204)	(0.185)	(0.326)	(0.175)
Assets	0.337*			
	(0.189)			
Sales		0.437**		
		(0.171)		
Market value			0.633*	
			(0.325)	
Number of Employees				0.519***
				(0.164)
ccumulated Compensatio	-0.004	-0.021	-0.029	-0.025
	(0.152)	(0.152)	(0.153)	(0.151)
Age	-0.279**	-0.291**	-0.277**	-0.316***
	(0.120)	(0.119)	(0.119)	(0.120)
Total External Experience	0.235	0.239	0.232	0.237
	(0.179)	(0.179)	(0.179)	(0.178)
Observations	693	693	693	693
R-square	0.10	0.11	0.10	0.11

Table 5. CDF Regression for Experience and Accumulated Compensation with Total Risk

Assets, Sales, Market value, and Number of Employees are average value over 5 years preceding the sample year. Total risk is estimated standard deviation of monthly percentage return multiplied by the market value at the time preceding the CEO switching date by one quarter. Idiosyncratic risk is the mean-squared error from Fama French three-factor regression multiplied by the market value at the time preceding the CEO switching date by one quarter. Risk estimation period is 60 months preceding CEO turnover month by one quarter. Experience variables are constructed based on the length of the named CEO's relevant previous managerial experience. MBA is a dummy variable that takes one if the executive has an MBA degree and takes zero otherwise. TOPSCH equals 1 if the executive holds a bachelor's or master's degree from top schools. Age variable indicates the age of the executive. Current compensation is the amount that the firm paid directly to the CEO during the year. Accumulated compensation is the amount that the CEO has accumulated over his or her career. CDFs are calculated by ranking the corresponding variable with in each year.
Sample consists of 688 observations from firms that did not belong to the finance and utility industries during the sample period from 1998 to 2002. All monetary variables are restated to 2003 constant dollars using the end-of-fiscal-year consumer price index. Year fixed effect and constant are included in the model but not reported. Standard error is included in parentheses. Significance level of 10%, 5%, and 1% are indicated by *, **, and ***, respectively.

Panel A: Dependent Variable: Total External Experience				
Total Risk	0.363**	0.409***	0.272	0.402***
	(0.165)	(0.150)	(0.264)	(0.142)
Assets	0.060			
	(0.154)			
Sales		-0.004		
		(0.141)		
Market Value			0.152	
			(0.264)	
Number of Employees				0.008
				(0.135)
Accumulated Compensation	-0.611***	-0.609***	-0.619***	-0.610***
	(0.121)	(0.122)	(0.122)	(0.121)
Age	0.204**	0.210**	0.203**	0.209**
	(0.097)	(0.097)	(0.097)	(0.098)
Top School Graduates	0.117	0.114	0.117	0.114
	(0.142)	(0.142)	(0.142)	(0.142)
MBA Degree	0.103	0.108	0.102	0.107
	(0.131)	(0.131)	(0.131)	(0.132)
R-square	0.13	0.13	0.13	0.13
Panel B: Dependent Variable: Accumulated Compensation				
Total Risk	2.322***	2.252***	1.291***	2.350***
	(0.233)	(0.209)	(0.399)	(0.194)
Assets	0.401*			
	(0.237)			
Sales		0.559***		
		(0.215)		
Market Value			1.440***	
			(0.400)	
Number of Employees				0.471**
				(0.207)
Total External Experience	-1.057***	-1.046***	-1.052***	-1.048***
	(0.220)	(0.219)	(0.218)	(0.219)
Age	0.250*	0.229	0.214	0.224
	(0.150)	(0.149)	(0.148)	(0.150)
Top School Graduates	0.304	0.314	0.305	0.308
	(0.218)	(0.218)	(0.216)	(0.218)
MBA Degree	-0.155	-0.186	-0.182	-0.189
	(0.201)	(0.201)	(0.200)	(0.202)
R-square	0.40	0.41	0.41	0.40

Table 6. CDF Regression for Experience and Accumulated Compensation with Idiosyncratic Risk

Assets, Sales, Market value, and Number of Employees are average value over 5 years preceding the sample year. Total risk is estimated standard deviation of monthly percentage return multiplied by the market value at the time preceding the CEO switching date by one quarter. Idiosyncratic risk is the mean-squared error from Fama-French three factor regression multiplied by the market value at the time preceding the CEO switching date by one quarter. Risk estimation period is 60 months preceding CEO turnover month by one quarter. Experience variables are constructed based on the length of the named CEO's relevant previous managerial experience. MBA is a dummy variable that takes one if the executive has an MBA degree and takes zero otherwise. TOPSCH equals 1 if the executive holds a bachelor's or master's degree from top schools. Age variable indicates the age of the executive. Current compensation is the amount that the firm paid directly to the CEO during the year. Accumulated compensation is the amount that the CEO has accumulated over his or her career. CDFs are calculated by ranking the corresponding variable with in each year.

Sample consists of 688 observations from firms that did not belong to the finance and utility industries during the sample period from 1998 to 2002. All monetary variables are restated to 2003 constant dollars using the end-of-fiscal-year consumer price index. Year fixed effect and constant are included in the model but not reported. Standard error is included in parentheses. Significance level of 10%, 5%, and 1% are indicated by *, **, and ***, respectively.

Panel A: Dependent Variable: Total External Experience				
Idiosyncratic Risk	0.360**	0.406***	0.261	0.400***
	(0.165)	(0.151)	(0.263)	(0.143)
Assets	0.064			
	(0.154)			
Sales		-0.002		
		(0.141)		
Market Value			0.163	
			(0.262)	
Number of Employees				0.010
				(0.135)
Accumulated Compensation	-0.611***	-0.609***	-0.619***	-0.610***
	(0.121)	(0.122)	(0.122)	(0.122)
Age	0.205**	0.212**	0.203**	0.210**
	(0.097)	(0.097)	(0.097)	(0.098)
Top School Graduates	0.119	0.116	0.118	0.116
	(0.142)	(0.142)	(0.142)	(0.142)
MBA Degree	0.102	0.107	0.100	0.105
	(0.131)	(0.131)	(0.131)	(0.132)
R-square	0.13	0.13	0.13	0.13
Panel B: Dependent Variable: Accumulated Compensation				
Idiosyncratic Risk	2.360***	2.287***	1.411***	2.381***
	(0.232)	(0.208)	(0.396)	(0.194)
Assets	0.379			
	(0.236)			
Sales		0.538**		
		(0.214)		
Market Value			1.333***	
			(0.396)	
Number of Employees				0.452**
				(0.207)
Total External Experience	-1.054***	-1.043***	-1.050***	-1.045***
	(0.219)	(0.218)	(0.218)	(0.219)
Age	0.261*	0.240	0.225	0.235
	(0.149)	(0.149)	(0.148)	(0.150)
Top School Graduates	0.313	0.322	0.309	0.316
	(0.218)	(0.217)	(0.216)	(0.217)
MBA Degree	-0.162	-0.192	-0.184	-0.195
	(0.201)	(0.201)	(0.199)	(0.202)
R-square	0.40	0.41	0.41	0.41

Table 7. CDF Regression for Experience and Accumulated Compensation with Residual Risk

Assets, Sales, Market value, and Number of Employees are average value over 5 years preceding the sample year. Total risk is estimated standard deviation of monthly percentage return multiplied by the market value at the time preceding the CEO switching date by one quarter. Residual risk is part of total risk that is orthogonal to size measure. Risk estimation period is 60 months preceding CEO turnover month by one quarter. Experience variables are constructed based on the length of the named CEO's relevant previous managerial experience. MBA is a dummy variable that takes one if the executive has an MBA degree and takes zero otherwise. TOPSCH equals 1 if the executive holds a bachelor's or master's degree from top schools. Age variable indicates the age of the executive. Current compensation is the amount that the firm paid directly to the CEO during the year. Accumulated compensation is the amount that the CEO has accumulated over his or her career. CDFs are calculated by ranking the corresponding variable with in each year.

Sample consists of 688 observations from firms that did not belong to the finance and utility industries during the sample period from 1998 to 2002. All monetary variables are restated to 2003 constant dollars using the end-of-fiscal-year consumer price index. Year fixed effect and constant are included in the model but not reported. Standard error is included in parentheses. Significance level of 10%, 5%, and 1% are indicated by *, **, and ***, respectively.

Panel A: Dependent Variable: Total External Experience				
Residual Risk	0.384**	0.373***	0.301	0.340***
	(0.159)	(0.134)	(0.185)	(0.131)
Assets	0.054			
	(0.150)			
Sales		0.050		
		(0.130)		
Market Value			0.140	
			(0.198)	
Number of Employees				0.077
				(0.127)
Accumulated Compensation	-0.617***	-0.597***	-0.613***	-0.586***
	(0.120)	(0.119)	(0.121)	(0.120)
Age	0.205**	0.206**	0.208**	0.201**
	(0.097)	(0.097)	(0.097)	(0.098)
Top School Graduates	0.120	0.125	0.128	0.122
	(0.142)	(0.142)	(0.142)	(0.142)
MBA Degree	0.105	0.107	0.103	0.104
	(0.131)	(0.131)	(0.131)	(0.132)
R-square	0.13	0.13	0.13	0.13
Panel B: Dependent Variable: Accumulated Compensation				
Residual Risk	2.186***	1.903***	0.533*	2.096***
	(0.227)	(0.192)	(0.283)	(0.183)
Assets	0.542**			
	(0.231)			
Sales		0.976***		
		(0.198)		
Market Value			2.174***	
			(0.290)	
Number of Employees				0.872***
				(0.193)
Total External Experience	-1.081***	-1.066***	-1.065***	-1.041***
	(0.221)	(0.222)	(0.219)	(0.222)
Age	0.233	0.197	0.186	0.188
	(0.150)	(0.151)	(0.149)	(0.151)
Top School Graduates	0.337	0.389*	0.346	0.359
	(0.219)	(0.220)	(0.217)	(0.220)
MBA Degree	-0.150	-0.207	-0.204	-0.209
	(0.202)	(0.204)	(0.201)	(0.204)
R-square	0.40	0.39	0.40	0.39

Table 8. CDF Regression for Experience and Accumulated Compensation with Idiosyncratic Risk Without Internally Promoted CEOs

Assets, Sales, Market value, and Number of Employees are average value over 5 years preceding the sample year. Total risk is estimated standard deviation of monthly percentage return multiplied by the market value at the time preceding the CEO switching date by one quarter. Idiosyncratic risk is the mean-squared error from Fama French three-factor regression multiplied by the market value at the time preceding the CEO switching date by one quarter. Risk estimation period is 60 months preceding CEO turnover month by one quarter. Experience variables are constructed based on the length of the named CEO's relevant previous managerial experience. MBA is a dummy variable that takes one if the executive has an MBA degree and takes zero otherwise. TOPSCH equals 1 if the executive holds a bachelor's or master's degree from top schools. Age variable indicates the age of the executive. Current compensation is the amount that the firm paid directly to the CEO during the year. Accumulated compensation is the amount that the CEO has accumulated over his or her career. CDFs are calculated by ranking the corresponding variable within each year. Internally promoted CEOs are excluded.

Sample consists of 236 observations from firms that did not belong to the finance and utility industries during the sample period from 1998 to 2002. All monetary variables are restated to 2003 constant dollars using the end-of-fiscal-year consumer price index. Year fixed effect and constant are included in the model but not reported. Standard error is included in parentheses. Significance level of 10%, 5%, and 1% are indicated by *, **, and ***, respectively.

Panel A: Dependent Variable: Total External Experience				
Idiosyncratic Risk	0.592	0.628*	0.695	0.575*
	(0.428)	(0.351)	(0.683)	(0.326)
Assets	0.183			
	(0.432)			
Sales		0.171		
		(0.361)		
Market value			0.038	
			(0.693)	
Number of Employees				0.305
				(0.339)
Accumulated Compensation	-0.116	-0.119	-0.097	-0.119
	(0.284)	(0.284)	(0.285)	(0.280)
Age	0.052	0.049	0.076	0.030
	(0.255)	(0.255)	(0.249)	(0.254)
Top School Graduates	0.537	0.528	0.518	0.520
	(0.389)	(0.387)	(0.387)	(0.386)
MBA Degree	0.149	0.137	0.154	0.115
	(0.334)	(0.336)	(0.334)	(0.336)
R-square	0.24	0.24	0.24	0.24
Panel B: Dependent Variable: Accumulated Compensation				
Idiosyncratic Risk	0.857	1.175***	0.269	1.584***
	(0.542)	(0.438)	(0.876)	(0.403)
Assets	1.367**			
	(0.539)			
Sales		1.195***		
		(0.450)		
Market value			1.799**	
			(0.868)	
Number of Employees				0.694
				(0.435)
Total External Experience	-0.177	-0.183	-0.149	-0.193
	(0.371)	(0.370)	(0.373)	(0.376)
Age	-0.276	-0.290	-0.111	-0.205
	(0.324)	(0.324)	(0.318)	(0.327)
Top School Graduates	0.937*	0.871*	0.783	0.827*
	(0.492)	(0.489)	(0.493)	(0.496)
MBA Degree	-0.069	-0.150	-0.062	-0.116
	(0.424)	(0.426)	(0.427)	(0.433)
R-square	0.35	0.36	0.34	0.34