Reducing managers’ incentives to cannibalize: Managerial stock options when shareholders are diversified ☆

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1. Introduction

Much of the empirical and theoretical work in corporate finance employs the assumption that shareholders want to maximize the value of the firm’s equity and give managers incentives to do so. When investors are well-diversified but managers are relatively undiversified, however, the standard view of managerial compensation raises an important issue. Since investors hold diversified portfolios, they are concerned with firm value only through the value of the portfolio. Managers pursuing

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firm value maximization may not be acting optimally for investors if increases to some firm values are accompanied by decreases to the value of other firms in investors’ portfolios.\footnote{Since 1989 institutional investors (pension funds, mutual funds, insurance companies, bank trust, and foundation/endowments funds) hold the majority of corporate US equity (Brancato, 1991). It is hard to know what is the exact percentage holding today, but there is evidence that the percentage has only increased since then (e.g., Poterba, 1998; Gompers and Metrick, 2001). For our purposes, it is also important to understand that most institutional investors hold shares in firms that affect each other (i.e., in the same industry).}

In this paper, we examine how shareholders’ diversification\footnote{Throughout the paper, if shareholders are diversified, we assume that they are perfectly diversified, and hold an equity stake in the market portfolio. This is done for simplicity and tractability and suits our objective, which is to highlight a contrast with the typical corporate capital budgeting rule that assumes that shareholders are concerned with the incremental cashflow of a single firm. Our assumption is also consistent with asset pricing models such as the CAPM. However, having heterogeneous investors with different portfolio holdings does not alter the qualitative nature of our results. Maximization of firm value is not a common objective of heterogeneous, but at least partially diversified, investors. There is no reason to believe that the diversified shareholders of a specific firm care more (or less) about its value than the value of the firm’s competitors.} affects the choice of managerial compensation when managers select the mix of projects that a company pursues, and when a company’s cashflow is affected by other companies’ actions. Our framework captures the idea that managers have discretion over project selection, and affect both the risk characteristics of the firm, and the ability of the firm to create (or destroy) value for shareholders. We show that the relation between riskiness of project and value creation/destruction for shareholders is central for the understanding of the complex relation between shareholders and managers.

The kind of situation we have in mind can be described by the following example: Consider a pharmaceutical firm whose managers are faced with a choice between two projects that are mutually exclusive due to capital rationing or some other exogenous condition. One project involves developing a generic drug for a disease that is already treatable by a drug of a competitor company, whose patent life has expired. The other project involves research for a cure to an untreated disease. The first project will generate cashflow to the firm by reducing the cashflow of the competitor firm. The second project will increase the opportunity set of the economy, by generating cashflow that is incremental to the economy after considering the cashflows of other firms. In general, one might expect the second project to be riskier (i.e., a higher probability of failure, yet a high return in case of success).\footnote{Having risk-averse managers would not change the qualitative nature of the results. This is discussed later.} This means that diversified shareholders who hold many pharmaceutical firms in their portfolio should compensate managers in a way that promotes the second type of project because these are the projects that increase the value of their portfolio.

In our model there are two firms and two non-diversified risk-neutral managers\footnote{See “Pharmaceutical Innovation Under Attack”, Pharmaceutical Executive, September 2002, p. 22.} who decide on the projects to be selected in their respective firms. Each of the managers has a two-dimensional problem in choosing a mix of projects: the manager exerts cannibalistic effort and economy-increasing effort. The cannibalistic effort involves imposing a negative externality on the other firm. This would typically involve taking market share from the competitor firm in a mature market. In contrast, economy-increasing effort involves investing in new markets that enhance the opportunity set of shareholders after accounting for the effects on the competitor firm.\footnote{In general, most real investment opportunities combine cannibalistic and economy-increasing aspects in different proportions.} We also make the critical assumption that economy-increasing projects have greater total risk than cannibalistic projects. We do not want to be dogmatic about this assumption as there could be circumstances in which the reverse is true. However, we do perceive that in general there is more theoretical reasoning and empirical evidence that economy-increasing projects are the riskier type of projects. There is more uncertainty about the success/failure of the development of new products and markets. Typically these projects involve high research and development expenses and there is evidence that these are the riskiest sort of expenditures.\footnote{For example, Bange and DeBondt (1998), Ryan and Wiggins (2002), and Coles et al. (2006).}

Our theoretical analysis concerns how commonly used compensation tools, namely stock and option grants; affect the value of a shareholder’s portfolio in a moral hazard setting. We do so by solving for the competitive Nash-equilibrium where shareholders set the compensation package in each firm...
independently; however, they do so realizing that their objective is to maximize their portfolio value and not the firm value. We show that when the firms in the economy are held by non-diversified shareholders (i.e., shareholders hold shares in only one of the two firms), the moral hazard problem of the shareholders can be solved by providing stock incentives. Under such circumstances, option compensation does not provide any benefits compared to stock incentives. Contrary to that, when the firm is held by diversified shareholders (i.e., shareholders hold shares in both firms) and the manager is provided stock incentives, the manager tends to exert a relatively large amount of cannibalistic effort even though diversified shareholders prefer that the manager would not engage in these types of projects. We show that option grant compensation results in a relatively greater loss in the manager's payoff from cannibalistic effort than in the manager's payoff from economy-increasing effort. This helps achieve the objective of diversified shareholders to shift the manager's choice of effort towards relatively more economy-increasing effort and less cannibalistic effort. While Jensen and Meckling (1976) show that risk-shifting is a form of agency cost, in our model risk-shifting helps induce managers to engage in less cannibalistic projects.

Our theoretical framework provides us with four testable hypotheses.

H1: Insiders', who typically hold non-diversified portfolios, would be reluctant to provide executives with option compensation as they can solve the moral hazard completely with stock incentives. We therefore hypothesize that a higher percentage of insiders' holdings would lead to a lower use of option compensation to executives.

H2: Institutional investors, who typically hold diversified portfolios, are better off by providing option grants to executives as it increases the relative effort exerted in economy-increasing projects and reduces cannibalistic activity between firms. We hypothesize that a higher percentage of institutional holdings would lead to higher use of option compensation.

H3: Firms with high leverage are reluctant to use option compensation as leverage may result in an added conflict with debtholders. Even if some debtholders are the same individuals as the shareholders (i.e., diversified shareholders hold the market portfolio of debt and equity), debt would provide the risk-shifting incentive. Therefore, we hypothesize that higher leverage would lead to lower use of option compensation.

H4: Relative performance evaluation leads to greater cannibalistic activity in the economy. Diversified shareholders would prefer that these types of compensations were not used and we hypothesize that they will not be observed in firms with a high percentage of institutional ownership.

Since there is ample evidence that relative performance measures are rare (e.g., Gibbons and Murphy, 1992), we test for hypotheses H1–H3. We find strong evidence that insiders' holdings leads to executives being compensated with less options, while institutional holdings leads to a higher use of option compensation to executives. We also find that leverage leads to lower use of option compensation. We consider the case of persistency in compensation and perform analysis with lag compensation variables for robustness.

The idea that options may increase risk taking behavior of managers is not new and is viewed as unambiguous.7 As a direct implementation of this observation, Smith and Stulz (1985) make the argument that the main advantage of using options is to induce managers to act as though they are less risk-averse. However, the literature has also shown that there are costs involved in providing options to a risk-averse manager: The value of options to a risk-averse manager is less than the value of the options to diversified investors (e.g., Meulbroek, 2001; Ingersoll, 2006). This raises the question of whether options provide any real benefit if the sole problem is the risk-aversion of the manager.

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7 There are a few studies that show that while option value increases with volatility, it does not mean that a risk-averse manager would always desire more volatility if he is granted options (e.g., Chevalier and Ellison, 1997; DeTemple and Sundaresan, 1999; Carpenter, 2000; Ross, 2004). However, a manager compensated with options will reduce risk only when the options are already far in the money and the options are close to maturity.
In our model, managerial risk-aversion is not a crucial ingredient for the understanding of the conflict between undiversified managers and diversified shareholders. Risk-aversion of managers would add another layer of trade-off to our model.\(^8\) Also, the main point is not whether shareholders want the manager to take on more or less risk.\(^9\) The important intuition delivered in our framework is the desire of shareholders to reduce the amount of cannibalistic projects. Therefore, to simplify and to contrast our results to the traditional agency problem, we assume managers are risk-neutral.

We recognize two important aspects of financial markets: (a) Firms interact in imperfectly competitive markets and affect each other; (b) the diversified shareholder’s objective is to maximize the value of a portfolio. While there are papers that show how capital structure and compensation choices affect product market interaction (Brander and Lewis, 1986; Maksimovic, 1988; Rotemberg and Scharfstein, 1990; Bolton and Scharfstein, 1990; Aggarwal and Samwick, 1999; Raith, 2003), none of them considers the fact that many shareholders are diversified. There are a few empirical studies that investigate the relationship between ownership structure and executive compensation (e.g., Mehran, 1995; Hartzell and Starks, 2003). Different in our analysis is the focus on option compensation rather than the other forms of compensation that affect pay-for-performance sensitivity.

To the best of our knowledge, there are two papers that share different parts of the intuition that is delivered in this paper. Reitman (1993) shows that stock options can be used to commit managers to behaving less aggressively in product markets, thereby raising shareholder’s profits. Two key differences are that Reitman’s paper relies on a particular case of a Cournot-based oligopoly and he does not consider the issue of shareholders’ diversification. Hansen and Lott (1996) address explicitly the fact that if companies impose externalities on each other, then diversified shareholders do not want to maximize firm value. However, they do not consider the agency problem we address, and they do not relate the concept of portfolio maximization to issues of compensation, which is our focus.

The remainder of the paper proceeds as follows. In Section 2 we develop our model. In Section 3 we test our hypotheses regarding the relation between option compensation, ownership structure and leverage. Section 4 concludes. Appendix A contains all proofs.

2. The model

The analysis is performed in a symmetric economy with two identical firms, \(i = 1, 2\). Also, if firm \(i\) is 1, then firm \(-i\) is 2, and vice versa. With no loss of generality, we assume that each of these firms has cash-in-place of \(w\), which is the minimum wage required in order to employ a manager. We assume a competitive labor market of risk-neutral managers, where each manager’s total compensation is set such that he receives the sum of \(w\) and the cost of his efforts. The manager of firm \(i\) decides on two types of effort: cannibalistic effort, \(E_{ci}\), and economy-increasing effort, \(E_{si}\). The manager can exert effort \(E_{ci}, E_{si} \in [0, \infty)\) at a cost of \(\frac{1}{2}E_{ci}^2, \frac{1}{2}E_{si}^2\), respectively.\(^{10}\) The two-dimensional effort choice gives the manager control over project selection. The manager can either exert cannibalistic effort that reduces the cashflow of the other firm, or invest in economy-increasing effort that does not affect the other firm. Holmstrom and Milgrom (1991) emphasize that a key restriction of the standard agency model is that the manager has no discretion over project selection, or, equivalently, that the shareholders specify which project the manager chooses. Addressing this problem, in our model the manager has two types of projects and decides on the mix of projects. The effort mix choice affects both the expected value and risk properties of the firm. More specifically, the cashflow generated by cannibalistic effort is \(cE_{ci}\) \((c > 0)\), while economy-increasing effort payoff follows a binomial distribution such that the payoff may be either \(s_iE_{si}\) in the

\(^8\) On the one hand, the advantage of options is even greater for risk-averse managers, as these managers tend to engage more in the safer cannibalistic projects. On the other hand, given a fixed amount of managerial reservation wage, there is a cost of providing options (as opposed to equity) to managers as they value options less than their expected cashflow payoff. From an empirical perspective, since managerial risk-aversion is hard to measure, there is no real benefit in incorporating it in the model.

\(^9\) Even if the manager was risk-averse and would have reduced risk (economy-increasing projects) when granted options, he would have reduced cannibalistic projects by more.

\(^{10}\) Having risk-neutral managers with a convex cost function allows us to present our model in a framework that puts a limit on output without precluding giving the firm to the manager due to risk-aversion (this is discussed in Section 2.1). We use a separable convex cost function as opposed to \(\frac{1}{2}(E_{ci} + E_{si})^2\) for tractability and because it is consistent with the idea that the manager has the ability to completely separate between cannibalistic and economy-increasing projects.
high state or $s_i E_{si}$ in the low state with probability $(1 - b)$ and $b$, respectively ($s_h > s_l > 0$). We can represent the expected cashflow of firm $i$ by,

$$
\mu_i = (s_i (1 - b) + s_l b) E_{si} + c E_{ci} - c E_{ci-} = s E_{si} + c E_{ci} - c E_{ci-}
$$

where $s$ is the expected cashflow generated by a unit of economy-increasing effort and $c$ is the cashflow generated by a unit of cannibalistic effort.

The crucial aspect of the above representation is that manager $i$'s choice of effort does not only affect firm $i$'s cashflow, but also affects the cashflow of firm $-i$, its rival. An increase in firm $i$'s cashflow due to cannibalistic effort comes at the expense of a reduction in cashflow of firm $-i$ by $E_{ci}$. Cannibalistic effort is a negative externality imposed by a firm on its competitor, while economy-increasing effort does not impose any externality on other firms in the market.\(^{11}\) Note that only the economy-increasing effort $E_{si}$ is risky. Assuming the cashflow from cannibalistic effort is riskless is an oversimplification for convenience; the critical point is that the risks from the two kinds of effort are different. This reflects two main ideas. First, we perceive economy-increasing projects as mostly research and development type of projects, whose purpose is to develop new products and markets. Second, from a theoretical point of view, economy-increasing effort is exerted in new markets with very little information about future prospects, while cannibalistic effort is exerted in mature markets with more predictability. In the limit, cannibalistic projects cashflow of a mature market are completely deterministic, while cashflow of economy-increasing projects are uncertain because there are no prior observations (Box and Tiao, 1973). We also assume that the risk involved in economy-increasing effort is non-systematic and therefore completely diversifiable.\(^{12,13}\)

Following, we study the role of ownership structure, leverage and compensation in this framework.

2.1. Non-diversified shareholders

As a first step we make the assumption that effort is observable. This essentially means that shareholders decide on the mix of projects. Under such conditions, the shareholders of firm $i$ maximize their wealth $V_i$ according to the following program,

$$
V_i = \max_{E_{ci}, E_{si}} \mu_i + \bar{w} - w_{0i}
$$

s.t.

$$
w_{0i} \geq \bar{w} + \frac{1}{2} (E_{ci}^2 + E_{si}^2)
$$

\(^{11}\) Note that while cannibalization is a zero sum game in generating cashflow in the economy, it destroys value for shareholders. This is because the manager’s wage depends on both cannibalistic and economy-increasing effort exertion, i.e., $s E_{si} + c E_{ci}$. A more structured model would allow for positive externalities (i.e., $E_{ci}$ having a positive effect on firm $-i$). This would make the mathematical representation more complex, but would not change the qualitative nature of our results. The important thing is that shareholders benefit from one type of effort more than the other.

\(^{12}\) However, note that in equilibrium the production function in the economy is altered because all firms in the economy take on more economy-increasing projects. Hence the pricing kernel and state prices will be affected. For tractability reasons, we ignore this effect even though it may mitigate (or enhance) our results. In that respect, we assume that the production change in the economy is the first-order effect, while the reaction of the pricing to the increase in wealth in the economy is second order. Note that in any capital budgeting decision, firms take the discount rate as exogenous and assume that the discount rate in the economy does not change whether the firm takes on the project or not. Our framework captures the idea that shareholders can quantify the cashflow effect of a firm’s decision on its competitors but find it rather hard to quantify the effect of the project on the interest rate and price of risk in the economy.

\(^{13}\) We note that our analysis is one that preserves competition between firms, so we assume that shareholders cannot base manager’s $i$ compensation on $-i$ results. One may argue that an incentive scheme that relies partly on other firms in the industry might reduce harmful cannibalistic activity. In fact providing compensation based on both firms’ cashflows or, equivalently, merging the two firms will ensure that no cannibalistic projects are taken on. However, there are difficulties with such an approach. First, a one-firm solution to the economy eliminates competition in the product market. One would think that there are potential social inefficiencies to a non-competitive economy (note also that anti-trust laws would oppose a one-firm solution). Second, as a firm gets larger, the costs of organizing additional transactions within the firm may lead to different distortions such as inefficiencies in placing the factors of production in the uses where their value is greatest. These types of inefficiencies correspond to the condition known as “diminishing returns to management” (see Coase, 1937, pp. 394–395).
where \( w_0 \) is manager’s fixed wage. Substituting for \( \mu_i \) and binding the managers to their reservation wage, we get that both firms will engage in the same amount of economy-increasing and cannibalistic effort, i.e., \( E_{ci} = s \) and \( E_{si} = c \). The value of the firms is \( V_i = V_{-i} = \frac{1}{2}(s^2 - c^2) \).

It is important to understand that in this framework where the firms maximize their value, the fact that effort is observable is not important. Even if there was a moral hazard problem and effort was not observable, shareholders could compensate the manager with stock and derive the same result as in the observable case. We analyze the decision making process of firm \( i \). Shareholders of firm \( i \) would set a fixed wage \( w_{0i} \) and an optimal share of the firm \( \alpha_i > 0 \) as compensation for the manager.

The shareholders would choose the manager’s share according to the following program,

\[
V_i = \max_{\alpha_i} (1 - \alpha_i)\mu_i + w - w_{0i} \\
\text{s.t.} \\
w_{0i} \geq \bar{w} + \frac{1}{2}(E_{ci}^2 + E_{si}^2) - \alpha_i\mu_i
\]

\[
E_{ci}, E_{si} \in \arg \max \left[ \alpha_i\mu_i - \frac{1}{2}(E_{ci}^2 + E_{si}^2) \right]
\]

The shareholders know that the manager chooses the mix of projects according to the compensation scheme outlined in Eq. (6). This means that cannibalistic effort and economy-increasing effort are \( E_{ci} = \alpha_ic \) and \( E_{si} = \alpha_is \), respectively. We next derive the optimal incentive \( \alpha_i \).

**Proposition 1.** When shareholders hold non-diversified portfolios the moral hazard problem can be solved by providing stock incentives of \( \alpha_i = 1 \) and retaining a bond which equals the total cashflow of the firm minus the reservation wage of the manager.

The intuition of this is straightforward. Traditional agency theory tells us that we have to give the manager incentives that align him with the objectives of shareholders. When the manager is risk-neutral, there is no trade-off in the traditional sense and the manager is not made worse off by adding incentives that increase his risk. The solution for shareholders under such circumstances is to give the firm to the manager (i.e., \( \alpha_i = 1 \)) and retain a bond promising a payment, whose present value is \( V_i \) (i.e., the total cashflow of the firm minus the reservation wage of the manager).

### 2.2. Diversified shareholders

When effort is observable and shareholders are homogeneous and perfectly diversified the problem of shareholders is equivalent to a social planner problem. Shareholders choose the efforts according to the following program.

\[
V_p = \max_{\epsilon_{i}, l_{di}; i = 1, 2} \mu_1 + \mu_2 + 2\bar{w} - w_{01} - w_{02} \\
\text{s.t.} \\
w_{0i} \geq \bar{w} + \frac{1}{2}(E_{ci}^2 + E_{si}^2), \quad i = 1, 2
\]

where \( V_p \) is shareholder portfolio value, and \( w_{0i} \) is manager’s fixed wage. Substituting for \( \mu_1 \) and \( \mu_2 \) and binding both managers to their reservation wage, we get

\[
V_p = \max_{\epsilon_{i}, l_{di}; i = 1, 2} s(E_{c1} + E_{c2}) - \frac{1}{2}(E_{c1}^2 + E_{c2}^2) - \frac{1}{2}(E_{c1}^2 + E_{c2}^2)
\]

Solving for the optimal effort choices, we find that diversified shareholders choose economy-increasing effort \( E_{ci} = s \), and no cannibalistic effort \( E_{si} = 0 \). This results in a portfolio value \( V_p = s^2 \).

When there is no moral hazard problem, shareholders do not choose any cannibalistic projects. The value of each firm is higher in this case compared to the case of non-diversified shareholders, because firms do not end up in a prisoner dilemma situation in which cannibalistic projects are pursued.
2.2.1. Stock compensation

When effort is not observable, shareholders choose the compensation package for the manager in each firm separately. They do not act as a central planner but choose compensation in a competitive environment assuming they have no control on the decision making process in the rival firm. When the manager of firm $i$ is compensated by a stock share of $x_i$, the shareholders’ problem is the following:

$$V_e = \max_{x_i} (1 - x_i)\mu_1 + (1 - x_2)\mu_2 + 2w - w_{01} - w_{02}$$

s.t.

$$w_{0i} \geq w + \frac{1}{2} (E_{c1}^2 + E_{s1}^2) - x_i\mu_1, \quad i = 1, 2$$

$$E_{c1}, E_{s1} \in \arg\max \left[ x_i\mu_1 - \frac{1}{2} (E_{c1}^2 + E_{s1}^2) \right], \quad i = 1, 2$$

where $V_e$ is the value of the shareholder’s portfolio when the compensation of the manager is done by an equity share. Solving for the optimal effort choice according to Eq. (12) we get

$$E_{c1} = x_c, \quad E_{s1} = x_s.$$

Since the manager is not diversified, he is not affected by the negative externalities that cannibalistic effort imposes on the other firms in the economy. We derive the optimal incentive $x_i$ and the shareholder’s portfolio value $V_e$.

**Proposition 2.** In equilibrium, the optimal stock grant of the manager $x_i$ is less than the case of non-diversified shareholders.

The incentive $x_i$ and portfolio value $V_e$ are

$$x_i = \frac{s^2}{(c^2 + s^2)}$$

$$V_e = -\frac{s^4}{(c^2 + s^2)}$$

When shareholders are diversified and effort is not observable the manager receives as compensation only part of the firm, i.e., $x_i < 1$. This is because an owner–manager solution to the incentive problem results in aggressive cannibalistic behavior. Diversified shareholders pay the cost of cannibalistic effort through the manager’s wage; however they do not benefit from it because they hold both firms. The intuition behind Proposition 2 is straightforward. Shareholders want the manager to engage only in economy-increasing effort. However, they have no way to force this because the manager is concerned only with the cashflow of the firm. Only when $c = 0$, is there no conflict between the shareholders and the manager and the model is reduced to the case where firms generate independent cashflows. Under such circumstances maximization of firm value is the same as maximizing shareholder’s portfolio value and $x_i = 1$. Thus, in this reduced framework of $c = 0$, the optimal incentive scheme is to give the manager the firm, similar to the case of a moral hazard problem when shareholders are not diversified and maximize firm value. In fact, this model provides an alternative theory to the traditional trade-off theory of risk and incentives. It shows that one can derive an internal solution of compensating the manager with a fraction of the firm’s equity which is less than 1, even if the manager is risk-neutral. This happens when one considers that the objective of shareholders is to maximize portfolio value rather than firm value.

2.2.2. Option compensation

In the last two decades it has become common to compensate managers with stock option grants. We analyze how this type of compensation may affect the portfolio value of diversified shareholders.

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14 Note that other forces, not captured in the model, would lead to an even stronger tendency of the manager to engage in the safe (cannibalistic) projects. (1) If the manager is risk-averse, the safer cannibalistic projects are preferred. (2) The fact that a manager desires to remain on the job provides a reason for taking on the safe projects in the mature market. If the manager takes on the risky project there is a possibility that a new market will be formed. Thus, there are chances that new expertise will be needed, and the manager may become expendable in the future. (3) In general, risky projects may drive firms to bankruptcy. Under such circumstances, the manager tends to suffer a high personal cost.
Under the option compensation scenario, shareholders of firm \(i\) issue stock option grants with an exercise price \(K_i\), where \(s_iE_{hi} + cE_{ci} - cE_{ci} \leq K_i < s_iE_{hi} + cE_{ci} - cE_{ci}\). Thus, the exercise price is chosen so that the option is in the money in the high payoff state only, i.e., when the economy-increasing project is successful. Shareholders also set the option grant incentive, which is the percentage of cashflow \(\beta_i\) above the exercise price \(K_i\) that the manager receives if the high state payoff is realized. In solving this problem, shareholders first choose \(\beta_i\) as it directly affects managerial effort and then choose \(K_i\) and \(w_{oi}\) in a way that binds the manager to his reservation wage.\(^{15}\) We define \(\mu_{hi}\) and \(\mu_{li}\) to be firm’s cashflow in the high and low state, respectively. The shareholders’ problem is as follows:

\[
V_{op} = \max_{\beta_i, \ i=1,2} \sum_{i=1}^{2} \left[ (1 - b)(\mu_{hi} - \beta_i(\mu_{hi} - K_i)) + b\mu_{li} + w - w_{oi} \right] 
\]

\[\text{s.t.} \]

\[
w_{oi} \geq w + \frac{1}{2}(E_{ci}^h + E_{ci}^l) - \beta_i(1 - b)(\mu_{hi} - K_i), \quad i = 1, 2
\]

\[
E_{ci}, E_{hi} \in \arg\max \left[ \beta_i(1 - b)(\mu_{hi} - K_i) - \frac{1}{2}(E_{ci}^2 + E_{hi}^2) \right], \quad i = 1, 2
\]

where \(V_{op}\) is the value of the shareholder’s portfolio when the manager is compensated by option grants. Solving for the optimal effort according to Eq. (17) we get \(E_{ci} = \beta_i c(1 - b), E_{hi} = \beta_i s_i(1 - b)\). Note that compared to the case of stock compensation, economy-increasing effort now depends on \(s_i\) rather than on \(s\), while cannibalistic effort still depends on \(c\). Options lead to a relative reduction in cannibalistic effort compared to economy-increasing effort. This is because in the low state cannibalistic effort payoff is the same as in the high state and equals \(cE_{ci}\), while economy-increasing effort payoff is lower in the low state relative to the high state, i.e., \(s_iE_{hi} < s_iE_{ci}\). The fact that the manager cares only about the outcome of the high state makes economy-increasing effort more valuable to him compared to cannibalistic effort.

Basically, the model shows that risk-shifting may create value for shareholders. While the literature starting with Jensen and Meckling (1976) regards risk-shifting as a form of agency cost between shareholders and debtholders, we show that risk-shifting can serve as a way to mitigate the conflict of interest between the undiversified manager and the diversified shareholders.

Jensen and Meckling (1976) recognize the incentive of the owner–manager to engage in riskier investments once he receives no payoff in the low states. However, they do not consider that this may create value for shareholders. In broad terms, the ability to risk shift creates value by switching the managerial choice of projects and comparatively reducing cannibalistic projects. Diversified shareholders are not concerned with the expected cashflow of firm \(i\) only, but rather are concerned with the total cashflow generated by both firms. They may grant stock options to the manager in order to align him with this objective. While the cost of capital is calculated under the assumption that shareholders are diversified, the expected cashflow in a typical NPV analysis is only that of the firm. Under such circumstances, taking on positive NPV projects does not necessarily create value for shareholders because the calculation ignores the cashflow effects to other firms in the economy.

**Proposition 3.** In equilibrium, the optimal stock option grant incentive \(\beta_i\) and portfolio value \(V_{op}\) are

\[
\beta_1 = \beta_2 = \frac{s_i s_h}{(1 - b)(s_i^2 + c^2)}
\]

\[
V_{op} = \frac{(s_i s_h)^2}{(s_i^2 + c^2)}
\]

---

\(^{15}\) There is a continuum of combinations \((K_i, w_{oi})\) that would satisfy the reservation wage condition. To some extent this framework shows the irrelevancy of the strike price as long as it satisfies the condition of being between the cashflows of the two states.
2.2.3. Option grants compared to stock compensation

We know that options compared to stock compensation have the advantage of comparatively reducing cannibalistic effort. However, allowing for the existence of a state in which the manager receives no compensation, has a negative effect on both types of effort, which is captured by the factor \( \frac{1}{C_0} b \) in the effort choice. This problem is similar to Myers (1977) debt overhang (under-investment). Since the manager knows that in the low state payoff he receives nothing, he tends to exert less effort of both kinds.\(^{16}\) It turns out that the overall effect of using options creates value for diversified shareholders because they provide a higher level of option compensation compared to stock compensation \( (b_i > a_i) \). In other words, with option grants economy-increasing effort always increases compared to stock grants. However, cannibalistic effort may increase or decrease with option grants. Increases in cannibalistic effort are possible if they correspond to a relatively large increase in economy-increasing effort.

Proposition 4. Options compared to stock grants contribute a higher portfolio value to diversified shareholders as long as the firms have some cannibalistic ability. That is, as long as \( c > 0 \) we have \( V_{op} > V_e \).

We wish to signify the role of options in our framework compared to common intuition. A common theoretical prescription to mitigate the effects of managerial risk-aversion is the inclusion of stock options in managers’ compensation. Smith and Stulz (1985) claimed that the linear payoff structure of stock holdings may create a potential incentive for a risk-averse manager to take actions that reduce firm risk and to reject risky projects that yield a positive net present value. Contrary to this traditional view, our remedy of using options always has value as it shifts managerial effort decision towards comparatively more economy-increasing projects and less cannibalistic projects. In our setting, if we had a sufficiently risk-averse manager, it might be that economy-increasing effort would decrease. However, cannibalistic projects would decrease comparatively more with options and that would enhance value for diversified shareholders. The fact that the cashflow variance of the firm would decrease with option compensation would not necessarily mean that option compensation does not dominate stock compensation. This is because the value of options is reduced cannibalism activity, and not the fact that they increase risk (which may not occur in a risk-averse manager setting). Thus, the fact that in a risk-neutral setting options increase risk is not the main property of our model.

2.2.4. Relative performance evaluation

Some economists argue for the benefits in relative performance evaluation as it avoids the common practice of rewarding managers for doing nothing more than riding the wave of a strong wave (Abowd and Kaplan, 1999; Core et al., 2003). It is straightforward to show that under our framework, relative performance measures lead to aggressive cannibalistic behavior.

Proposition 5. When the managers are given incentives in the form of a relative performance measure evaluation (RPE), they engage in comparatively more cannibalistic effort and less economy-increasing effort.

The manager’s incentive to take on cannibalistic projects is increased because he gains not only from the increased cashflow to his firm, but also from the reduced cashflow of the firm’s rival. Note that relative performance evaluation reduces value for shareholders no matter what we assume about the relation between types of projects and risk. Thus, our theory presents a plausible rationale for the observed absence of relative performance measures.

2.3. Leverage

In the previous subsection we saw that diversified shareholders have an incentive to shift managerial effort. However, risk-shifting is not only possible with options but also by having debt-in-place and then providing the manager with either stock compensation or option compensation. Thus, we

\(^{16}\) Note that in Myers (1977) projects are not taken on because no one is willing to finance them. Somewhat similarly, in our framework, the manager takes on fewer projects because in a low state realization, he receives no payoff for his effort.
would expect that diversified shareholders incentives to provide stock or option compensation may change when the firm is levered.

As a first point, it should be clear that if diversified shareholders are also the debt claimants, i.e., hold the market portfolio not only of equity but also debt, then using debt and stock compensation is the same as having no leverage and using an option grant as compensation for the manager. In both cases the manager earns a payoff only in the high payoff state, while the residual claimants after the payment to the manager are the shareholders. Under such circumstances, whether shareholders use leverage (i.e., repurchase equity and replace it with debt) plus stock compensation or whether shareholders simply use stock option grants results in the same portfolio value.

Another possibility to consider is that the debt market and the equity market are segmented so that shareholders and debtholders are different claimants. In this scenario, having debt-in-place can potentially achieve the same risk-shifting of effort as in the case of option grants, however; it comes at a cost because of the added conflict with debtholders, who price the debt according to its expected value. Thus, using any type of incentive (either stock or option) once debt is in place leads to the added conflict between the debtholders and the shareholders.

While the two scenarios for debt are quite different, they both show that the benefits of option grants are reduced when the firm is levered. If shareholders are also the debt claimants, their need to resort to option grants to promote risk-shifting is reduced once debt is in place. When the debt and equity market are segmented, the benefit of promoting economy-increasing projects are reduced because of the extra-cost involved with debtholders.

3. Empirical analysis

3.1. Hypotheses and sample selection

The previous section showed how managerial compensation differs depending on whether the firm is held by diversified or non-diversified shareholders. In reality, firms may have both diversified and non-diversified shareholders, which leads to ambiguity on the appropriate managerial compensation. In this section we test for three hypotheses implied by the propositions above.

As shown in Proposition 1, for non-diversified shareholders stock compensation results in a solution which is equivalent to the no moral hazard case. As a result there is no incentive for non-diversified shareholders to provide option compensation to managers. On the other hand, Proposition 4 states that diversified shareholders are better off by providing executives options rather than stock compensation. These two propositions lead us to hypothesize that option compensation tends to decrease with non-diversified shareholders’ ownership and increase with diversified shareholders’ ownership. A third hypothesis concerns the consideration of leverage, which implies that levered firms are expected to use less option incentives than unlevered firms.

To test these hypotheses we aggregated data from several sources. From Standard & Poor’s CompuStat and Execucomp we gathered data on firm characteristic and executive compensation, respectively, and from Vickers’ we gathered information on insider and institutional holdings. Because our ownership data covers the 2000 largest firms by asset value as of 31.12.1998 and follows them through time, we could include only Execucomp firms that meet this criterion. After excluding financial firms, utilities and regulated phone companies (standard classification code 4813), and firms with more than one type of stock, we were left with 947 different firms during the years 1999–2003.

17 See Abowd and Kaplan (1999), Gibbons and Murphy (1992), and Core et al. (2003) for discussions on the rarity of relative performance evaluation.

18 Note that the empirical hypotheses concerning ownership structure and leverage would remain the same in a setting of risk-averse managers. Assuming that all managers in the economy are equally risk-averse, option grants would still provide more benefits for firms with diversified shareholders compared to firms with non-diversified shareholders as they make the manager shift towards more economy-increasing projects.
3.2. Variables

3.2.1. Compensation variables

We consider two major variables in order to form our dependent variables. The first variable is ‘option portion’ which is the option value granted to the executive (Execucomp item BLK_VALU) divided by the executive’s total direct compensation (Execucomp item TDC1).\(^\text{19}\) The second variable that we initially considered is ‘stock portion’ which is the value of the restricted stock granted to the executive (Execucomp item RSTKGRNT) divided by the executive’s total direct compensation. The problem of using the stock portion variable in the analysis is that most firms do not use restricted stock as compensation for executives. In our sample 72.3% of the observation have a zero value for stock portion. Perhaps even more important, as can also be seen from Table 1, the portion of restricted stock in the compensation package for those firms that do provide restricted stock is relatively small (an average of 7% out of total direct compensation).\(^\text{20}\) As can be seen from Fig. 1, the option portion is predominantly a non-zero variable; we therefore perform our analysis on the option portion rather than the stock portion.

To avoid the clustering of correlated observations within a given firm, our main dependent variable is ‘option portion of mean executive’ which is the mean option portion of an executive employed by the firm during that year. In total the sample has 3942 firm-year observations for which we have an option portion of mean executive value. For robustness, we also employ in some of the analysis the dependent variable ‘option portion of CEO’, which equals the value of option compensation granted to the CEO (Execucomp item BLK_VALU) divided by the CEO’s total direct compensation (Execucomp item TDC1).

3.2.2. Main explanatory variables

Our measure for non-diversified shareholders is insiders’ holdings as reported in SEC insider reporting Form 3 or Form 4 from Vickers’. By law, all non-institutional insiders must report any transaction made on these forms within 2 business days. Insiders would include all executive, officers and beneficial owners who hold directly more than 10% of the firm’s share. Vickers’ aggregated for us all insiders’ holdings based on the last Form 3 or Form 4 filed by the insider where the amount owned is directly held. To find the most recent amount owned, Vickers looks at filings where the transaction date was within 3 years prior to the ending year date. Note that occasionally some filers report a transaction, but do not report the amount owned on that specific filing (the amount owned would be null); in this case Vickers would go the prior filing that had an amount owned that was not null. There are advantages and disadvantages of using Forms 3 and 4 as opposed to proxy statements. For our purposes the main advantage of looking at Forms 3 and 4 rather than proxy statements is that institutional shareholders do not submit these forms but do tend to appear on proxy statements if they hold more than 5% of the shares.\(^\text{21}\) Since we want to partition the ownership pie into two distinct groups of non-diversified and diversified shareholders, we use Forms 3 and 4 to separate insiders and institutions as much as possible.

Our measure for diversified shareholders holdings is institutional holdings, which is the combined holdings of all financial institutions that report an SEC 13F schedules. As most institutions hold diversified portfolios this measure captures the diversified shareholders’ importance in the ownership

\(^\text{19}\) Our measure for option portion depends on the annual option compensation rather than the overall amount of options (i.e., does not include non-exercised options from previous years). There are two main reasons for this: (1) Some executives have been employed in the firm more years than others, which may lead them to have accumulated more options than other executives who have been employed less years. Given that data on the overall accumulated wealth of the executive from the firm is not available, we would have a bias measure of the actual risk incentive given to the executive. (2) While all companies grant options with an exercise price that equals the share price, options from previous years may be very deep in the money and be more like restricted stock than options. This again will bias the actual risk incentive given to the manager.

\(^\text{20}\) Note that these facts are consistent with the idea that large public firms (which are generally held by diversified shareholders) should provide option incentives as opposed to stock.

\(^\text{21}\) According to rule 16(a)-1 of the Exchange Act of 1934, an institutional investor that holds more than 10% of the shares in a company is not considered an insider and does not need to submit Forms 3 and 4 if the shares are held for the benefit of third parties in the ordinary course of business and are not acquired by such institutions for the purpose of influencing control over the company.
structure. Our measure for debt is book value of long term debt (Compustat item A9) divided by market value of common stock (Execucomp item MKTVAL).

Table 1 provides sample distribution properties of most of the variables. The median insiders’ holdings is only about 1% reflecting the fact that most firms in the sample are widely held. Only 5.5% of the

---

**Table 1**

Sample distribution of managerial compensation and firm characteristics.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>Standard deviation</th>
<th>Percentile</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Compensation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CEO compensation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total direct compensation ($000)</td>
<td>6965</td>
<td>15,587</td>
<td>309</td>
</tr>
<tr>
<td>Option portion</td>
<td>0.38</td>
<td>0.29</td>
<td>0.00</td>
</tr>
<tr>
<td>Stock portion</td>
<td>0.07</td>
<td>0.15</td>
<td>0.00</td>
</tr>
<tr>
<td>Other executives</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total direct compensation ($000)</td>
<td>2455</td>
<td>6612</td>
<td>187</td>
</tr>
<tr>
<td>Option portion</td>
<td>0.33</td>
<td>0.26</td>
<td>0.00</td>
</tr>
<tr>
<td>Stock portion</td>
<td>0.06</td>
<td>0.13</td>
<td>0.00</td>
</tr>
<tr>
<td>Mean executive</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Option portion</td>
<td>0.34</td>
<td>0.22</td>
<td>0.00</td>
</tr>
<tr>
<td>B. Main explanatory variables</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Insiders' holdings (%)</td>
<td>5.18</td>
<td>11.24</td>
<td>0.01</td>
</tr>
<tr>
<td>Institutional holdings (%)</td>
<td>64.90</td>
<td>18.32</td>
<td>18.16</td>
</tr>
<tr>
<td>Leverage</td>
<td>0.635</td>
<td>1.265</td>
<td>0.00</td>
</tr>
<tr>
<td>C. Other explanatory variables</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dividend payout ratio</td>
<td>0.017</td>
<td>0.064</td>
<td>0.00</td>
</tr>
<tr>
<td>Market value ($000,000)</td>
<td>11,060</td>
<td>32,540</td>
<td>134</td>
</tr>
<tr>
<td>Return volatility</td>
<td>0.406</td>
<td>0.165</td>
<td>0.182</td>
</tr>
<tr>
<td>Tobin Q</td>
<td>1.383</td>
<td>1.956</td>
<td>0.110</td>
</tr>
</tbody>
</table>

The sample has 947 firms in the top 2000 firms by asset value as of 31.12.1998. Financial firms, utilities and regulated phone companies (standard classification code 4813) are excluded. Option portion is option value granted to the CEO (other executive) (Execucomp item BLK VALU) divided by the CEO (other executive) total direct compensation (Execucomp item TDC1). Option portion for the mean executive refers to the average option portion of an executive (including CEO) in a given firm-year. Stock portion is the value of the restricted stock granted to the CEO (other executive) (Execucomp item RSTKGRNT) divided by the CEO (other executive) total direct compensation. Insiders’ holdings is the combined holdings of all insiders as aggregated from Forms 3 and 4. Institutional holdings is the combined holdings of all financial institutions that report 13F schedules. Leverage is book value of long term debt (Compustat item A9) divided by market value of common stock (Execucomp item MKTVAL). Dividend payout ratio is regular cash dividends (Compustat item A21) divided by market value of common stock. Return volatility is the stock price volatility calculated based on the previous 60 monthly returns. Tobin Q is the combined value of market value of common stock and book value of long term debt divided by the book value of assets (Compustat item A6).
sample has firms that have insiders’ holding of more than 25%. Institutional holdings median is 67%, again reflecting the fact that most firms in the sample are widely held. The median leverage is 0.3 but it is worth noting that 17.9% of the firms have a long term debt value which is higher than the market value of equity.

3.2.3. Other firm characteristics

There are a few possible other explanations for the use of option compensation for executives. Smith and Watts (1992) argue that firms with many available growth opportunities could rely more heavily on options to provide management with the proper incentives when their investment decisions are difficult to monitor. These firms may also favor non-cash compensation to conserve cash. These authors argue that such firms would be expected to pay lower dividends. Indeed, Fenn and Liang (2001) find a strong negative relationship between dividends and option incentives. Our proxy for growth opportunities, Tobin Q, is the combined value of market value of common stock (Execucomp item MKTVAL) and book value of long term debt (Compustat item A9) divided by the book value of assets (Compustat item A6). Our measure for dividend payout ratio measure is regular cash dividends (Compustat item A21) divided by market value of common stock.

Another issue that we consider is the monitoring ability of shareholders. In general, shareholders could monitor managers (e.g., Admati et al., 1994) and reduce the need for incentives because incentives are costly when managers are risk-averse. This raises some ambiguity concerning the negative correlation that we hypothesize between insider ownership and option compensation. Recent literature suggests that monitoring and information asymmetries between shareholders are mostly associated with ownership concentration rather than ownership level (Helfin and Shaw, 2000; Hartzell and Starks, 2003). We therefore construct a measure of insiders’ concentration similar to what Hartzell and Starks (2003) do for institutions. The monitoring ability of insiders’ is defined as the percentage holding of the top 5 insiders holders divided by total insider holdings. The intuition behind this measure is that if insiders are in a position to monitor, the probability that a particular insider will monitor and

![Fig. 1. Distribution of the firm’s mean executive option portion out of total direct compensation. The sample has 947 firms in the top 2000 firms by asset value as of 31.12.1998. Firms are followed during 1999–2003. Option portion is option value granted to the executive (Execucomp item BLK_VALU) divided by the executive’s total direct compensation (Execucomp item TDC1).]
incurred the costs to do so is higher if he has a comparatively large ownership share compared to other insiders.\(^{23}\)

As we wish to distinguish our results from the traditional principal-agent problem, we also control for idiosyncratic risk. Jin (2002) claims that CEOs might be able to trade the market portfolio to adjust their exposure to systematic risk, however, for incentive reasons CEOs are required to maintain their exposure to firm specific risk. Because exposure to risk is costly in the traditional principal-agent problem, incentives should decrease with higher idiosyncratic risk, but they should not be affected due to systematic risk (as the CEO can short the market).\(^{24}\) Similar to Jin (2002), we construct an idiosyncratic risk measure which equals the mean-squared error derived from a market model regression using the previous 60 months returns.

Also as control variables we use return volatility based on the previous 60 monthly stock returns. Almost by definition this variable should be related to the dependent option portion of mean executive variable as the value of any option depends on the stock volatility. However, volatility may also capture other firm specific characteristics. Option compensation may also be dependent on the degree of vested options that managers have in their portfolio from previous years. We therefore include as control the value of unexercised vested options (Execucomp item UNEX_EXER_EST_VAL) divided by total direct compensation (Execucomp item TDC1). Other controls include the 1 and 3 year shareholder return (Execucomp items TRS1YR and TRS3YR, respectively), market value of common stock, and 2-digit SIC code indicators.

3.3. Univariate analysis

Table 2 presents difference of means tests between firms that provide options as incentives and those that do not. Firms that do not provide any option grants to executive represent 10.1% of our sample. The table provides the \(t\)-statistics and the Industry adjusted \(t\)-statistics, where each observation is adjusted by subtracting the 2-digit SIC code industry mean of the relevant variable. This provides a test of the significance of the variable once industry effects are accounted for.

We find that firms that provide option grants to executives have an insiders’ ownership level which is lower by 2.55% than that of firms that do not provide option incentives. There is also a distinct difference in the other direction in the holdings of institutions. Institutional holdings is higher by 5.98% in option giving firms compared to firms that do not provide options. Also, consistent with our hypothesis, leverage is lower in firms that provide options compared to those that do not provide them. The results that concern the option compensation to the CEO are similar. Note that Tobin Q and dividend payout ratio are not significant once we adjust for industry mean.

3.4. Multivariate analysis

3.4.1. Main results

We investigate the relation between option portion, ownership variables, and leverage. The model that we test is the following:

\[
\text{Option portion}_t = \gamma_0 + \gamma_1 (\text{Insider holdings}_{t-1}) + \gamma_2 (\text{Institutional holdings}_{t-1}) + \gamma_3 (\text{leverage}) + \gamma_{4-13} (\text{Control variables}) + \gamma_{11-74} (\text{Two-digit SIC code}) + \varepsilon
\]

Note that our hypotheses concerning the relationship between insiders’ holding, institutional holdings and option compensation could be associated with the monitoring ability of insiders’ and institutions, respectively. However, in our framework the monitoring hypotheses should yield different signs depending on whether the monitoring is done by institutions or insiders, respectively.

Note that Jin (2002) does not relate incentives to ownership structure. The cost in his model comes from the risk-aversion of the manager, and whether shareholders are diversified or not does not play a role. Important, the intuition from his paper is somewhat contrary to our model. In our model, option compensation are granted because we perceive economy-increasing effort to be mostly associated with firm specific risk (and not market risk); while in Jin (2002), with high idiosyncratic risk, there will be less pay-for-performance sensitivity because it is costly to provide stock and options to managers.
Because 10.1% of the dependent variable observations equal zero and because option portion cannot be less than zero, there is no way to distinguish among non-paying option firms even though they may differ in their attitude towards option compensation. We therefore employ random-effects tobit models. However, for robustness we also use OLS regression in some of the mean executive specifications.

The main results are presented in Table 3. The most striking result in our analysis is that we confirm our hypotheses. Insiders’ holdings is negative and significant and the institutional ownership variable is positive and significant. These two variables are almost always significant at the 1% level. As for leverage, it is negative in all specifications and significant in four out of the five specifications. In the mean executive regressions our predictions are strongly confirmed, as insiders’ holdings, institutional holdings, and leverage are almost always significant at the 1% level. In the CEO regression, the results are similar in nature; however, leverage is not significant in specification (4). As previously found, we also confirm that firms that pay low dividends and have a high Tobin Q tend to use option compensation more. Other relations are not very robust, except to the inherent relation between return volatility and option portion value.

25 We do not use firm fixed-effect for two reasons. First, our 5 year panel data is much more suitable to provide results for the cross-section than for the time-series. Changes in ownership structure over a year period are small (in our data, insiders’ holding change an average of 0.3% in a given year, and changes in institutional holdings are an average of 3.2% per year). We would fill uncomfortable to suggest that these small changes in holdings should immediately translate to changes in option compensation policy. Using fixed-effect would simply eliminate most of the cross-section variation that we wish to explain (and in particular the variation between option paying and non-option paying firms). Second, there is no sufficient statistic allowing the fixed-effects to be conditioned out of the likelihood and the unconditional fixed-effects estimates in tobit model are biased. Also, please note the analysis in Section 3.4.3 that takes into account the persistency in compensation policy.

Table 2
Difference of means tests between firms that provide and do not provide options as incentives for executives.

<table>
<thead>
<tr>
<th></th>
<th>Mean executive</th>
<th></th>
<th></th>
<th></th>
<th>Industry adjusted</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>No options</td>
<td>Options</td>
<td>t-statistics</td>
<td>t-statistic</td>
</tr>
<tr>
<td>Number of observations</td>
<td>3942</td>
<td>398</td>
<td>3544</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Explanatory variables</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Insiders’ holdings</td>
<td>3942</td>
<td>7.42</td>
<td>4.88</td>
<td>-4.31**</td>
<td>4.10**</td>
</tr>
<tr>
<td>Institutional holdings</td>
<td>3942</td>
<td>59.57</td>
<td>65.55</td>
<td>-6.22**</td>
<td>-5.18**</td>
</tr>
<tr>
<td>Leverage</td>
<td>3909</td>
<td>1.00</td>
<td>0.59</td>
<td>6.24**</td>
<td>5.19**</td>
</tr>
<tr>
<td>Dividend payout ratio</td>
<td>3889</td>
<td>0.020</td>
<td>0.017</td>
<td>0.71</td>
<td>0.15</td>
</tr>
<tr>
<td>Market value</td>
<td>3914</td>
<td>6767</td>
<td>11,528</td>
<td>-2.76**</td>
<td>-2.63**</td>
</tr>
<tr>
<td>Tobin Q</td>
<td>3936</td>
<td>1.15</td>
<td>1.41</td>
<td>-2.52**</td>
<td>-0.82</td>
</tr>
<tr>
<td>CEO</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of observations</td>
<td>3979</td>
<td>851</td>
<td>3128</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Explanatory variables</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Insiders’ holdings</td>
<td>3979</td>
<td>7.57</td>
<td>4.38</td>
<td>7.70**</td>
<td>6.36**</td>
</tr>
<tr>
<td>Institutional holdings</td>
<td>3979</td>
<td>61.94</td>
<td>65.90</td>
<td>-5.70**</td>
<td>-6.05**</td>
</tr>
<tr>
<td>Leverage</td>
<td>3942</td>
<td>0.74</td>
<td>0.59</td>
<td>3.19**</td>
<td>3.30**</td>
</tr>
<tr>
<td>Dividend payout ratio</td>
<td>3925</td>
<td>0.016</td>
<td>0.017</td>
<td>-0.41</td>
<td>-0.09</td>
</tr>
<tr>
<td>Market value</td>
<td>3949</td>
<td>11,217</td>
<td>11,685</td>
<td>-0.35</td>
<td>-0.50</td>
</tr>
<tr>
<td>Tobin Q</td>
<td>3971</td>
<td>1.33</td>
<td>1.41</td>
<td>-1.10</td>
<td>-0.61</td>
</tr>
</tbody>
</table>

The full sample has 947 firms in the top 2000 firms by asset value as of 31.12.1998. Financial firms, utilities and regulated phone companies (standard classification code 4813) are excluded. The No options column in the Mean executive part of the table represents cases where no options were granted to the any executive in the firm, while the Options column represents cases where the option amount to the mean executive is greater than zero. Similar is the case with regard to the CEO section of the table. Insiders’ holdings is the combined holdings of all insiders as aggregated from Forms 3 and 4. Institutional holdings is the combined holdings of all financial institutions that report 13F schedules. Leverage is book value of long term debt (Compustat item A9) divided by market value of common stock (Execucomp item MKTVAL). Dividend payout ratio is regular cash dividends (Compustat item A21) divided by market value of common stock. Tobin Q is the combined value of market value of common stock and book value of long term debt divided by the book value of assets (Compustat item A6). The table provides the t-statistics and the Industry adjusted t-statistic, where each observation is reduced by the 2-digit SIC code industry mean. The table provides significance at the 1% (**) level.
Table 3
The relation between executive option portion compensation, shareholders' diversification and leverage.

<table>
<thead>
<tr>
<th>Dependent at ( t )</th>
<th>(1) Option portion of mean executive (tobit)</th>
<th>(2) Option portion of mean executive (tobit)</th>
<th>(3) Option portion of mean executive (OLS)</th>
<th>(4) Option portion of CEO (tobit)</th>
<th>(5) Option portion of CEO (tobit)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Insiders' holdings at ( t - 1 )</td>
<td>(-0.00143) ( (-3.48^{***}) )</td>
<td>(-0.00142) ( (-3.40^{***}) )</td>
<td>(-0.00157) ( (-3.67^{***}) )</td>
<td>(-0.00223) ( (-2.92^{***}) )</td>
<td>(-0.00159) ( (-2.43^{**}) )</td>
</tr>
<tr>
<td>Institutional holdings at ( t - 1 )</td>
<td>(0.0011729) ( (4.11^{**}) )</td>
<td>(0.00129) ( (4.73^{***}) )</td>
<td>(0.00130) ( (3.98^{**}) )</td>
<td>(0.00156) ( (3.10^{**}) )</td>
<td>(0.00142) ( (3.45^{**}) )</td>
</tr>
<tr>
<td>Leverage at ( t - 1 )</td>
<td>(-0.014107) ( (-3.96^{**}) )</td>
<td>(-0.01899) ( (-5.30^{***}) )</td>
<td>(-0.01363) ( (-3.46^{**}) )</td>
<td>(-0.00738) ( (-1.16) )</td>
<td>(-0.01633) ( (-2.99^{**}) )</td>
</tr>
</tbody>
</table>

Other control variables

| 1 year return | \(-0.00029\) \( (-3.95^{**}) \) | \(-0.00028\) \( (-3.82^{**}) \) | \(-0.00036\) \( (-3.76^{**}) \) | \(-0.00013\) \( (-1.03) \) | \(-0.00012\) \( (-1.04) \) |
| 3 year return | \(0.00055\) \( (3.10^{**}) \) | \(0.00044\) \( (2.44^{*}) \) | \(8.97E-6\) \( (0.04) \) | \(0.00031\) \( (1.04) \) | \(0.00008\) \( (0.30) \) |
| Return volatility | \(0.29191\) \( (6.11^{***}) \) | \(0.35921\) \( (3.06^{**}) \) | \(0.29538\) \( (3.47^{**}) \) | \(0.34021\) \( (4.80^{*}) \) | \(0.39804\) |
| Dividend payout ratio at \( t - 1 \) | \(-0.50909\) \( (-2.62^{**}) \) | \(-0.72653\) \( (-3.86^{**}) \) | \(-0.73620\) \( (-1.65) \) | \(-0.36536\) \( (-1.12) \) | \(-0.65525\) \( (-2.33^{*}) \) |
| Market value at \( t - 1 \) | \(5.49E-7\) \( (4.21^{*}) \) | \(6.09E-7\) \( (3.15^{*}) \) | \(5.45E-7\) \( (1.13) \) | \(2.68E-7\) \( (1.90^{*}) \) | \(3.82E-7\) |
| Tobin Q at \( t - 1 \) | \(0.00761\) \( (4.49^{**}) \) | \(0.00936\) \( (5.51^{***}) \) | \(0.01292\) \( (2.62^{*}) \) | \(0.01000\) \( (3.26^{*}) \) | \(0.01268\) \( (4.73^{*}) \) |
| Insiders' concentration at \( t - 1 \) | \(0.02220\) \( (0.77) \) | \(0.01969\) \( (0.38) \) | \(0.02408\) \( (0.73) \) | \(0.01727\) \( (0.35) \) | \(0.00661\) |
| Vested options at \( t - 1 \) | \(0.00425\) \( (0.93) \) | \(0.00690\) \( (1.48) \) | \(0.02894\) \( (4.63^{**}) \) | \(-0.01163\) \( (-2.27^{**}) \) | \(-0.00797\) \( (-1.76^{*}) \) |
| Idiosyncratic risk at \( t - 1 \) | \(-0.32633\) \( (-1.56) \) | \(-0.39232\) \( (-1.79^{*}) \) | \(-0.13892\) \( (-0.43) \) | \(-0.82275\) \( (-2.35^{**}) \) | \(-0.80600\) \( (-2.57^{*}) \) |
| Industry dummy | Yes | No | Yes | Yes | No |
| \( N \) | 2612 | 2612 | 2612 | 2349 | 2349 |
| Log likelihood/R\(^2\) | 1185.26 | 1124.04 | 0.3500 | 108.48 |

The sample has 947 firms in the top 2000 firms by asset value as of 31.12.1998. Financial firms, utilities and regulated phone companies (standard classification code 4813) are excluded. Specifications (1), (2), (4), and (5) are random-effects tobit models; specification (3) is an OLS regression. Option portion of mean executive is the mean option portion of an executive employed by the firm during that year, where option portion of a specific executive is the option compensation value granted to the executive (Execucomp item BLK_VALU) divided by the executive’s total direct compensation (Execucomp item TDC1). Option portion of CEO is the option compensation value granted to the CEO (Execucomp item BLK_VALU) divided by the CEO’s total direct compensation (Execucomp item TDC1). Insiders’ holdings is the combined holdings of all insiders as aggregated from Forms 3 and 4. Institutional holdings is the combined holdings of all financial institutions that report 13F schedules. Vested options is the value of vested options (Execucomp item UNEX_EXER_EST_VAL) divided by total direct compensation (Execucomp item TDC1). Idiosyncratic risk is the mean-squared error derived from a market model regression using the last 60 months. All specifications include year indicators. The table provides z-statistics for the tobit regression, t-statistics calculated with firm clustered errors for the OLS regression, and significance at the one (**), five (*), and 10 (*) percent level.

3.4.2. Robustness

While we do employ year indicators in our analysis, one could still argue that over time both Institutional holdings’ and option compensation have become more common. This trend might lead to a spurious relation between these two variables. To preclude this, we rerun the tobit regression of Table 3 for each sample year separately. All the signs of the main explanatory variables coefficients...
remain the same, while only three out of the 12 coefficients are not significant. We conclude that our results are not driven by the time trend that may exist in the data.

We next conduct an analysis to verify that our results about the relation between option portion, ownership and leverage hold in different partitioning of the sample. We partition the sample according the two most important aspects of option grants that have been previously recognized in the literature, Tobin Q and dividend payout (see Table 4) (Smith and Watts, 1992).

Specifications (1) and (2) of Table 5 provide regression results for low (less than sample median) and high Tobin Q firms, respectively. Specifications (3) and (4) partition the firms by payout policy. Low payout may signal that a firm is limited in its cash resources and must resort to non-cash type

Table 4
Year sub-sample tobit regressions.

<table>
<thead>
<tr>
<th>Dependent at t</th>
<th>(1) Option portion of mean executive (year 2000)</th>
<th>(2) Option portion of mean executive (year 2001)</th>
<th>(3) Option portion of mean executive (year 2002)</th>
<th>(4) Option portion of mean executive (year 2003)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Insiders' holdings at t – 1</td>
<td>–0.00147 (−2.24)</td>
<td>–0.00243 (−3.67)</td>
<td>−0.00104 (−1.39)</td>
<td>−0.00074 (−1.00)</td>
</tr>
<tr>
<td>Institutional holdings at t – 1</td>
<td>0.00100 (2.05)</td>
<td>0.00174 (3.79)</td>
<td>0.00124 (2.73)</td>
<td>0.00095 (2.13)</td>
</tr>
<tr>
<td>Leverage at t – 1</td>
<td>−0.01456 (−1.96)</td>
<td>−0.01600 (−2.23)</td>
<td>−0.00633 (−0.76)</td>
<td>−0.00950 (−2.09)</td>
</tr>
<tr>
<td>Other control variables</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 year return</td>
<td>−0.00037 (−2.05)</td>
<td>−0.00050 (−2.59)</td>
<td>−0.00009 (−0.30)</td>
<td>−0.00018 (−1.06)</td>
</tr>
<tr>
<td>3 year return</td>
<td>0.00133 (3.00)</td>
<td>0.00009 (0.20)</td>
<td>−0.00089 (−1.77)</td>
<td>−0.00141 (−3.83)</td>
</tr>
<tr>
<td>Return volatility</td>
<td>0.23345 (2.22)</td>
<td>0.27335 (2.57)</td>
<td>0.16406 (1.82)</td>
<td>0.43010 (5.28)</td>
</tr>
<tr>
<td>Dividend payout ratio at t – 1</td>
<td>−0.12113 (−4.3)</td>
<td>−1.77909 (−3.54)</td>
<td>−1.39066 (−2.33)</td>
<td>−1.07895 (−2.51)</td>
</tr>
<tr>
<td>Market value at t – 1</td>
<td>4.69E–7 (2.28)</td>
<td>4.81E–7 (2.63)</td>
<td>5.25E–7 (1.93)</td>
<td>4.04E–7 (1.38)</td>
</tr>
<tr>
<td>Tobin Q at t – 1</td>
<td>0.00667 (2.98)</td>
<td>0.02047 (4.09)</td>
<td>0.02789 (3.87)</td>
<td>0.04727 (4.99)</td>
</tr>
<tr>
<td>Insiders’ concentration t – 1</td>
<td>−0.01674 (−0.32)</td>
<td>−0.04311 (−0.89)</td>
<td>0.00639 (0.14)</td>
<td>0.10384 (2.38)</td>
</tr>
<tr>
<td>Vested options t – 1</td>
<td>0.02447 (3.09)</td>
<td>0.00951 (1.21)</td>
<td>0.03199 (3.38)</td>
<td>0.03683 (5.37)</td>
</tr>
<tr>
<td>Idiosyncratic risk</td>
<td>0.59462 (1.38)</td>
<td>0.17893 (0.47)</td>
<td>−0.16220 (−0.48)</td>
<td>−1.03780 (−3.26)</td>
</tr>
<tr>
<td>N</td>
<td>671</td>
<td>676</td>
<td>665</td>
<td>600</td>
</tr>
<tr>
<td>Log likelihood</td>
<td>231.88</td>
<td>263.15</td>
<td>289.99</td>
<td>319.39</td>
</tr>
</tbody>
</table>

The sample has 947 firms in the top 2000 firms by asset value as of 31.12.1998. Financial firms, utilities and regulated phone companies (standard classification code 4813) are excluded. These are random-effects tobit models conducted for years 2000–2003, respectively. Option portion of mean executive is the mean option portion of an executive employed by the firm during that year, where option portion of a specific executive is the mean option compensation value granted to the executive (Execucomp item BLK_VALU) divided by the executive’s total direct compensation (Execucomp item TDC1). Insiders’ holdings is the combined holdings of all insiders as aggregated from Forms 3 and 4. Institutional holdings is the combined holdings of all financial institutions that report 13F schedules. Leverage is book value of long term debt (Compustat item A9) divided by market value of common stock (Execucomp item MKTVAL). The 1 year return (3 year return) is the 1 year (3 year) total return to shareholders, including the monthly reinvestment of dividends. Return volatility is the stock price volatility calculated based on the previous 60 monthly stock returns. Dividend payout ratio is regular cash dividends (Compustat item A21) divided by market value of common stock. Tobin Q is the combined value of market value of common stock and book value of long term debt divided by the book value of assets (Compustat item A6). Insiders’ concentration is the top 5 insiders holders divided by total insider holdings. Vested options is the value of vested options (Execucomp item UNEX_EXER_EST_VAL) divided by total direct compensation (Execucomp item TDC1). Idiosyncratic risk is the mean-squared error derived from a market model regression using the last 60 months. All specifications include 2-digit SIC code. The table provides z-statistics and significance at the one (***)-, five (**)-, and 10 (*)-percent level.
of compensation such as option grants. If that is truly the dominating factor, ownership structure should not play a role in option compensation when dividend payments are high. What we find is that ownership structure is very significant in all sub-samples. With regard to leverage, we find that it is negative and highly significant for high Tobin Q and low dividend payout firms, but it is only marginally significant for the other two sub-samples (specifications (1) and (4)). This is actually consistent with our hypothesis as we would expect that the potential conflict with debtholders in high dividend payout firms is small. Basically, firms pay dividends only after serving their debt obligations, so high dividends mean that a firm is not in the region of financial distress. As such, option grants can achieve risk-shifting without the added conflict with debtholders.

Table 5
Tobin Q and payout partitioning tobit regressions.

<table>
<thead>
<tr>
<th>Dependent variable at t</th>
<th>(1) Option portion of mean executive (low Tobin Q)</th>
<th>(2) Option portion of mean executive (high Tobin Q)</th>
<th>(3) Option portion of mean executive (low payout)</th>
<th>(4) Option portion of mean executive (high payout)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Insiders’ holdings</td>
<td>-0.00098</td>
<td>-0.01074</td>
<td>-0.00121</td>
<td>-0.00197</td>
</tr>
<tr>
<td>t - 1</td>
<td>(-1.2)</td>
<td>(-2.85**)</td>
<td>(-2.28**)</td>
<td>(-3.03**)</td>
</tr>
<tr>
<td>Institutional holdings</td>
<td>0.00113</td>
<td>0.00097</td>
<td>0.00117</td>
<td>0.00120</td>
</tr>
<tr>
<td>t - 1</td>
<td>(3.05**)</td>
<td>(2.36)</td>
<td>(2.80**)</td>
<td>(3.01**)</td>
</tr>
<tr>
<td>Leverage at t - 1</td>
<td>-0.00584</td>
<td>-0.02740</td>
<td>-0.01357</td>
<td>-0.01452</td>
</tr>
<tr>
<td></td>
<td>(-1.57)</td>
<td>(-3.11**)</td>
<td>(-2.92**)</td>
<td>(-1.79)</td>
</tr>
<tr>
<td>Other control variables</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 year return</td>
<td>-0.00919</td>
<td>-0.0028</td>
<td>-0.0025</td>
<td>-0.0022</td>
</tr>
<tr>
<td></td>
<td>(-1.81)</td>
<td>(-2.68)</td>
<td>(-2.61)</td>
<td>(-1.48)</td>
</tr>
<tr>
<td>3 year return</td>
<td>0.00009</td>
<td>0.0027</td>
<td>0.00051</td>
<td>0.00024</td>
</tr>
<tr>
<td></td>
<td>(0.32)</td>
<td>(1.13)</td>
<td>(2.23)</td>
<td>(0.66)</td>
</tr>
<tr>
<td>Return volatility</td>
<td>0.10367</td>
<td>0.52269</td>
<td>0.30591</td>
<td>0.30400</td>
</tr>
<tr>
<td></td>
<td>(1.64)</td>
<td>(5.15**)</td>
<td>(4.29)</td>
<td>(2.34)</td>
</tr>
<tr>
<td>Dividend payout ratio at t - 1</td>
<td>-0.41558</td>
<td>-2.21944</td>
<td>-0.13410</td>
<td>-1.18759</td>
</tr>
<tr>
<td></td>
<td>(-1.90)</td>
<td>(-3.82)</td>
<td>(-0.52)</td>
<td>(-2.89)</td>
</tr>
<tr>
<td>Market value at t - 1</td>
<td>1.15E-6</td>
<td>4.45E-7</td>
<td>3.86E-7</td>
<td>6.03E-7</td>
</tr>
<tr>
<td></td>
<td>(2.88**)</td>
<td>(2.94**)</td>
<td>(2.00)</td>
<td>(3.08**)</td>
</tr>
<tr>
<td>Tobin Q at t - 1</td>
<td>0.12577</td>
<td>0.00737</td>
<td>-0.00363</td>
<td>0.0234</td>
</tr>
<tr>
<td></td>
<td>(7.06**)</td>
<td>(4.06)</td>
<td>(-0.58)</td>
<td>(3.07**)</td>
</tr>
<tr>
<td>Insiders’ concentration at t - 1</td>
<td>-0.07853</td>
<td>0.06466</td>
<td>0.08618</td>
<td>-0.04156</td>
</tr>
<tr>
<td></td>
<td>(-2.18)</td>
<td>(1.53)</td>
<td>(1.83)</td>
<td>(-1.22)</td>
</tr>
<tr>
<td>N</td>
<td>1272</td>
<td>1340</td>
<td>1268</td>
<td>1328</td>
</tr>
<tr>
<td>Log likelihood</td>
<td>676.80</td>
<td>576.55</td>
<td>469.18</td>
<td>464</td>
</tr>
</tbody>
</table>

The sample has 947 firms in the top 2000 firms by asset value as of 31.12.1998. Financial firms, utilities and regulated phone companies (standard classification code 4813) are excluded. These are random-effects tobit models. Specifications (1) and (2) are conducted on firms that have a smaller and larger Tobin Q than the median Tobin Q of the sample, respectively. Specifications (3) and (4) are conducted on firms that pay a lower and higher dividend than the median dividend payout ratio in the sample, respectively. Option portion of mean executive is the mean option portion of an executive employed by the firm during that year, where option portion of a specific executive is the option compensation value granted to the executive (Execucomp item BLK_VALU) divided by the executive’s total direct compensation (Execucomp item TDC1). Insiders’ holdings is the combined holdings of all insiders as aggregated from Forms 3 and 4. Institutional holdings is the combined holdings of all financial institutions that report 13F schedules. Leverage is book value of long term debt (Compustat item A9) divided by market value of common stock (Execucomp item MKTVAL). The 1 year return (3 year return) is the 1 year (3 year) total return to shareholders, including the monthly reinvestment of dividends. Return volatility is the stock price volatility calculated based on the previous 60 monthly stock returns. Dividend payout ratio is regular cash dividends (Compustat item A21) divided by market value of common stock. Tobin Q is the combined value of market value of common stock and book value of long term debt divided by the book value of assets (Compustat item A6). Insiders’ concentration is the top 5 insiders holders divided by total insider holdings. Vested options is the value of vested options (Execucomp item UNEX_EXER_EST_VAL) divided by total direct compensation (Execucomp item TDC1). Idiosyncratic risk is the mean-squared error derived from a market model regression using the last 60 months. All specifications include 2-digit SIC code and year indicators. The table provides z-statistics and significance at the one (***), five (**), and 10 (*) percent level.
3.4.3. Persistency in compensation

One could argue that compensation policy is persistent in a given firm. Because we do not control for firm fixed-effect (but rather use the random-effects model), we should be cautious about our

<table>
<thead>
<tr>
<th>Table 6</th>
<th>Persistency in compensation.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dependent at (t)</td>
<td>(1)</td>
</tr>
<tr>
<td>Option portion of mean executive (Tobit)</td>
<td>0.29401</td>
</tr>
<tr>
<td>Insiders’ holdings at (t - 1)</td>
<td>(10.56**)</td>
</tr>
<tr>
<td>Institutional holdings at (t - 1)</td>
<td>(-2.62**)</td>
</tr>
<tr>
<td>Leverage at (t - 1)</td>
<td>0.00088</td>
</tr>
<tr>
<td>Other control variables</td>
<td></td>
</tr>
<tr>
<td>1 year return</td>
<td>-0.00029</td>
</tr>
<tr>
<td>3 year return</td>
<td>(3.81*)</td>
</tr>
<tr>
<td>Return volatility</td>
<td>0.00072</td>
</tr>
<tr>
<td>Dividend payout ratio at (t - 1)</td>
<td>0.22881</td>
</tr>
<tr>
<td>Market value at (t - 1)</td>
<td>0.22881</td>
</tr>
<tr>
<td>Tobin Q at (t - 1)</td>
<td>0.00877</td>
</tr>
<tr>
<td>Insiders’ concentration at (t - 1)</td>
<td>0.01399</td>
</tr>
<tr>
<td>Vested options at (t - 1)</td>
<td>0.00504</td>
</tr>
<tr>
<td>Idiosyncratic risk at (t - 1)</td>
<td>-0.22476</td>
</tr>
<tr>
<td>Industry dummy</td>
<td>Yes</td>
</tr>
<tr>
<td>(N)</td>
<td>2606</td>
</tr>
<tr>
<td>Log likelihood/(R^2)</td>
<td>1249.03</td>
</tr>
</tbody>
</table>

The sample has 947 firms in the top 2000 firms by asset value as of 31.12.1998. Financial firms, utilities and regulated phone companies (standard classification code 4813) are excluded. Specifications (1), (2), (4), and (5) are random-effects tobit models; specification (3) is an OLS regression. Option portion of mean executive is the mean option portion of an executive employed by the firm during that year, where option portion of a specific executive is the option compensation value granted to the executive (Execucomp item BLK_VALU) divided by the executive’s total direct compensation (Execucomp item TDC1). Option portion of CEO is the option compensation value granted to the CEO (Execucomp item BLK_VALU) divided by the CEO’s total direct compensation (Execucomp item TDC1). Insiders’ holdings is the combined holdings of all insiders as aggregated from Forms 3 and 4. Institutional holdings is the combined holdings of all financial institutions that report 13F schedules. Leverage is book value of long term debt (Compustat item A9) divided by market value of common stock (Execucomp item MKTVAL). The 1 year return (3 year return) is the 1 year (3 year) total return to shareholders, including the monthly reinvestment of dividends. Return volatility is the stock price volatility calculated based on the previous 60 monthly stock returns. Dividend payout ratio is regular cash dividends (Compustat item A21) divided by market value of common stock. Tobin Q is the combined value of market value of common stock and book value of long term debt divided by the book value of assets (Compustat item A6). Insiders’ concentration is the top 5 insiders holders divided by total insider holdings. Vested options is the value of vested options (Execucomp item UNEX_EXER_EST_VAL) divided by total direct compensation (Execucomp item TDC1). Idiosyncratic risk is the mean-squared error derived from a market model regression using the last 60 months. All specifications include year indicators. The table provides z-statistics for the tobit regression, t-statistics calculated with firm clustered errors for the OLS regression, and significance at the one (***) five (**) and 10 (*) percent level.
results. If compensation is truly persistent and the lagged ownership and leverage variable are spurious, then the lagged compensation variable should pick-up all of the explanation. Specifications (1)–(5) of Table 6 incorporate Optionportion \( t, t-1 \) in the regression. One can see that indeed compensation is highly persistent and that it accounts for 30–40% of the current executive compensation explanation. However, ownership and leverage structure continue to be very significant and with the same sign as before. This is especially true with regard to institutional holdings.

4. Conclusion

Studies that focus on firm value maximization have as an underlying assumption that shareholders are not diversified and care about the value of one specific company. In this paper, we show that if shareholders are diversified, providing managers with incentives to maximize firm value may not be optimal for diversified shareholders.

In our framework managers have discretion on project selections and affect the portfolio value of shareholders. We argue that in many instances the safer projects are those that destroy value for diversified shareholders. This means that compensating managers with options shifts managerial effort towards more of the projects that increase shareholder’s portfolio value and less of the projects that reduce portfolio value.

Our model provides a plausible rationale for the inappropriateness of relative performance evaluation as it encourages zero-sum competition. It provides three other hypotheses concerning the relation between executive option compensation, ownership structure, and leverage. Non-diversified shareholders would be reluctant to provide executives with option compensation, while diversified shareholders would prefer it. Leverage should reduce the use of option compensation. The three hypotheses are confirmed in the empirical part of the paper. We find that insiders’ holding and leverage are negatively and significantly related to executive option compensation, while institutional holdings is positively and significantly related to option compensation.

Appendix A

Proof of Proposition 1. Binding the manager to the participation constraint and substituting for the effort choice \( E_{ci} = \alpha_i c \) and \( E_{si} = \alpha_i s \) we derive firm \( i \) value:

\[
V_i = \max_{\alpha_i} \left[ \alpha_i(c^2 + s^2) - \frac{1}{2}(E_{ci}^2 + E_{si}^2) \right]
\]

Solving for the optimal compensation scheme we get \( \alpha_i = 1 \), and \( V_i = \frac{s^2 c^2}{2} \). Due to the symmetry of the firms, we get the same values for \( \alpha_{-i} \) and \( V_{-i} \), respectively. □

Proof of Proposition 2. Substituting the binding constraint of Eq. (11) into the maximization problem in Eq. (10) the following portfolio value is derived.

\[
Ve = \max_{\alpha_1, \alpha_2} \mu_1 + \mu_2 - \frac{1}{2}(E_{c1}^2 + E_{s1}^2 + E_{c2}^2 + E_{s2}^2)
\]

(A1)

Substituting for the expected cashflow of both firms (Eq. (1)) and the effort choices \( E_{ci} = \alpha_i c_i \) and \( E_{si} = \alpha_i s_i \), we solve for the stock compensation:

\[
\alpha_1 = \alpha_2 = \frac{s^2}{c^2 + s^2}
\]

Clearly, this first-order condition defines a unique maximum, as \( \frac{\partial Ve}{\partial \alpha_i} < 0 \).

Plugging \( \alpha_i \) in the effort choices and then into Eq. (A1), results in the following portfolio value,

\[
Ve = \frac{s^4}{(c^2 + s^2)}
\]

□
Proof of Proposition 3. Substituting the binding fixed wage derived from Eq. (16) into the maximization problem of Eq. (15), we derive the following maximization problem

\[ V_{op} = \max_{\beta_l, i=1,2} \sum_{i=1}^{2} \left[ \beta_i - \frac{1}{2}(E_{ci} + E_{si}) \right] \]  

(A2)

Substituting the effort choice derived from Eq. (17) and differentiating with respect to \(\beta_i\), we derive the option grant compensation,

\[ \beta_1 = \beta_2 = \frac{ss_h}{(1 - b)(s_{sh}^2 + c^2)} \]

Clearly, this first-order condition defines a unique maximum, as \(\frac{\partial^2 V_{op}}{\partial \beta_i^2} < 0\).

Substituting this back into the effort choices and then into Eq. (A2), the portfolio value is obtained.

\[ V_{op} = \frac{(ss_h)^2}{(s_{sh}^2 + c^2)} \]

Proof of Proposition 4. Note that in order to prove that \(V_{op} \geq V_e\), we must show that

\[ \frac{s_{sh}^2}{(c^2 + s_{sh}^2)} \geq \frac{s^2}{(c^2 + s^2)} \]

Divide the numerator and denominator of the RHS by \(s^2\), and divide the numerator and denominator of the LHS by \(s_{sh}^2\).

\[ \frac{1}{1 + \frac{c^2}{s_{sh}^2}} \geq \frac{1}{1 + \frac{c^2}{s^2}} \]

Note that by definition \(s_{sh} \geq s\) meaning that \(\frac{c^2}{s_{sh}^2} \leq \frac{c^2}{s^2}\). Thus option grants contribute more value to shareholder’s portfolio if an only if \(c > 0\).

Proof of Proposition 5. We define the relative performance evaluation of firm \(i\):

\[ r_i = sE_{si} + cE_{ci} - cE_{c-i} - (sE_{s-i} + cE_{c-i}) = s(E_{si} - E_{s-i}) + 2c(E_{ci} - E_{c-i}) \]

Manager of firm \(i\) is given stock incentive \(x_i\) and solves

\[ \max_{E_{ci}, E_{si}} \left[ x_i r_i - \frac{1}{2}(E_{ci}^2 + E_{si}^2) \right] \]

Under such circumstances, the amount of economy-increasing and cannibalistic effort is \(E_{si} = x_i s, E_{ci} = 2 x_i c\). The manager exerts comparatively more cannibalistic and comparatively less economy-increasing effort. Thus cannibalistic effort doubles compared to regular stock incentives. Note that this always holds not matter what we assume about the relation between riskiness and economy-increasing projects.

References