Executive Compensation, Financial Constraint and Product Market Strategies

Jaideep Chowdhury*

January 17, 2012

Abstract

In this paper, we provide an additional factor that can explain a firm’s product market decisions. Managerial compensation can strategically affect a firm’s product market decisions. Higher variable compensation provides incentives for a manager to act more aggressively in the product market. We develop a theoretical model to examine how the product market, managerial compensation and financial constraints are interlinked in a Cournot duopoly setup. Empirically, we report that the firm’s behavior in the product market can be explained by the variable component of the managerial compensation structure. We also document that the financially constrained firms are more aggressive in the product market. Further, we report that the financially constrained firms offer higher variable compensation as performance incentives in the compensation package of their managers. This may be an explanation as to why financially constrained firms are more aggressive in the product market.

Keywords: Product Markets, Capital Markets, Financial Constraints, Executive Compensation

1 Introduction

What are the different factors which can affect the product market behavior of the firms? The question is important because strong performance
in the product market helps the firms not only in the stock market but also in the capital market. The literature on product market and financial market interaction is concentrated on how debt financing affects firm performance. In this paper, we introduce a new factor managerial compensation which affect firms’ performance in the product market. We also document that the financially constrained firms are more aggressive in the product markets. Further, we report that the financially constrained firms offer higher performance incentives in the compensation package of their managers which may be an explanation as to why financially constrained firms are more aggressive in the product market.

Brander and Lewis (1986), Maksimovic (1988) and Hendel (1996) argue that debt financing leads to more aggressive behavior in the product market because of ‘risk shifting’. The firm managers cater to the equity holders. They engage in riskier projects and act aggressively in the output markets. Glazer (1994) and Chevalier and Scharfstein (1996) believe that firms behave less aggressively due to debt financing. They argue that ex-ante, debt financing increases the probability of bankruptcy. If the firm faces high liquidation costs and high bankruptcy costs, then the firm should behave less aggressively in the output market, i.e., by avoiding risky output market strategies. We add to the literature by introducing a new factor managerial compensation which may affect the product market behavior of the firms. We develop a theoretical model and then test empirically to show that the variable component of the managerial compensation positively affect the industry adjusted sales growth of the firms.

We derive optimal compensation contracts for the managers of the two firms in a Cournot duopoly setup. The optimal compensation contract of a manager is positively dependent on the value of the firm which, in turn, depends on the equilibrium output of the firm. This compensation structure provides incentive to the manager to act more aggressively in the product market in order to secure higher equilibrium output. Following Aggarwal and Samwick (1999), we decompose CEO compensation into three components, flow compensation, change in the value of the stock holding and change in the value of stock options. We provide evidence that product market aggressiveness can be explained by the different components of managerial compensation after we control for endogenity problems. Industry adjusted sales growth is used as the proxy for aggressiveness in the product market following Campello (2003), Campello and Fluck (2004) and Opler and Titman (1994). Further, short run bonus, defined as ratio of bonus to total current compensation, explains industry adjusted sales growth which confirms our intuition that incentive based compensations like short run bonus provides incentives for the managers to be more aggressive in the product
We consider a Cournot duopoly setup. Both the firms raise capital from the external capital market. The degree of financial constraint of a firm is dependent on how high is the cost of external capital for the firm. Both the firms engage in risky and aggressive product market strategies like more spending in advertisement, more research and development for increasing the equilibrium output. But engaging in riskier projects involve higher probability of bankruptcy and liquidation. A firm weighs the costs of acting aggressively against the benefits of aggressive product market behavior. Without loss of generality, we assume that firm 2 is financially constrained, has higher cost of capital which results in higher marginal cost of production as compared to firm 1. Higher marginal cost of production leads to decrease in equilibrium output and profit for firm 2. When the degree of product differentiation is sufficiently high, the higher cost firm, firm 2, can act more aggressively and produce more in order to compensate for the higher cost of production it faces. The first (second) effect decreases (increases) the amount of output produced. Which effect dominates depends on the extent to which firm 2’s product is different from firm 1’s product. Theoretically we conclude that when the degree of product differentiation is sufficiently high, the more financially constrained firm acts more aggressively in the output markets. Further, we document empirically that more financially constrained firms are more aggressive in the output markets compared to the less financially constrained firms.

We report that the shares owned by the CEO, the change in the value of stock option of the CEO, the total compensation of the CEO and bonus as a percentage of total current compensation are higher for more financially constrained firms. Further, these are the same variables which are also the determinants of industry adjusted sales growth of a firm, our proxy for product market aggressiveness. This suggests that the difference in the product market aggressiveness between the more financially constrained firms and less financially constrained firms can be attributed to the differences in the components of managerial compensation.

It should be noted that the theoretical model is not tested per se. This is the first limitation of the paper. Most of the assumptions made in the theoretical model are too simple to be realistic. For example, the assumption of constant marginal cost of production and linear demand function are made for obtaining closed form solutions. But these assumptions are common in theoretical models. The theoretical model provides some justification for the empirical results we document in section 5. The theoretical model also serve to provide economic intuition to the empirical results. Another limitation of this paper is the use of industry adjusted sales growth of a firm as a measure of
product market aggressiveness of the firm. Ideally one should use production level data to measure aggressive product market behavior of a firm. The lack of reliable plant level production data forces us to use industry adjusted sales growth of a firm as a measure of product market aggressiveness of the firm. This measure of aggressiveness of the firm has been used in several recent papers such as Campello(2003) and Campello and Fluck(2004).

This paper contributes to three different strands of the literature. First, this paper contributes to the product market and financial market interaction literature. We provide an alternative explanation of product market aggressiveness based on managerial compensation. This paper is the first paper to our knowledge to test if the product market aggressiveness can be explained by the executive compensation structure. This paper shows empirically that short run bonus, managerial stock holding, change in the value of stock options, total compensation and change in the value of stock holdings can explain the product market behavior of the firms. Second, this paper contributes to the executive compensation literature. We document that the executive compensation structure is different for financially constrained firms. We document that more financially constrained firms’ managers have a higher percentage of bonus in total current compensation, higher stock ownership, higher change in stock options and higher total compensation. To my knowledge there is only one other paper which deals with executive compensation of the financially constrained firms. Wang (2005) shows that the CEO pay performance sensitivities are higher for financially constrained firms where performance is measured in terms of stock returns. She also reports that the total compensation packages of CEOs of financially constrained firms are higher as compared to less financially constrained firms. The third stand of literature where we add to the body of knowledge is the literature on financially constrained firms. Papers in this literature have suggested that financially constrained firms are more riskier firms because they undertake riskier projects. We document that the financially constrained firms are more aggressive in the product market. This is the first paper in our knowledge which investigates the product market strategies of the financially constrained firms. We conclude that the financially constrained firms are more aggressive in the product market because the compensation structure of these firms is more incentive oriented which encourages the managers to be more aggressive in the product market.

The paper is organized as follows. In section 2, I present a theoretical model. In section 3, I develop my hypothesis based on the model in section 2. In section 4, I describe my data and methodology. In section 5, I document my results. In section 6, I conclude the paper.
2 A Theoretical Model

In this section, we present a theoretical model linking the financial constraints with managerial compensation and product markets. Let us consider a Cournot duopoly setup. Without loss of generality, let us assume that firm 2 is more financially constrained than firm 1.

2.1 Definition of Financial Constraint

If a firm is financially unconstrained, the cost of internal capital and the cost of external capital should be the same. Any wedge between the cost of internal capital and the cost of external capital is a measure of the degree of financial constraint. The cost of capital of firm 1 is \( r \) whereas the cost of capital of firm 2 is \( r + d \), where \( d \) is the extra cost of capital the more financially constrained firm 2 faces. The higher is the degree of financial constraint, the higher is the value of parameter \( d \).

2.2 The Two Stage Game

In this section, the manager of a firm \( i \) treats the wage contract as exogenous. The wage contract is given by

\[
w_i = \alpha_i + \beta_i V_i^{1/3}, \quad i = 1, 2.
\]

(1)

\( \alpha_i \) and \( \beta_i \) are exogenous to the manager’s decision making process. \( V_i \) is the equity value of the firm.\(^1\)

2.2.1 The Set-Up

The two firms who engage in a Cournot duopoly game to maximize their values. The manager of each firm chooses her effort and firm output.

In the first stage, the manager chooses her effort. Effort is unobservable to the equity holders and debt holders. The equity holders design a contract to ensure that the interest of the manager is aligned with that of the equity holders. This is done in order to tackle the agency problem between the manager and the equity holders. The managerial wage is composed of two parts. The first component is \( \alpha_i \) which is the fixed component of managerial wage. The second component is \( \beta_i V_i^{1/3} \), which is the variable component of the compensation structure. This compensation structure is reasonable

\(^1\)The wage contract is dependent on \( V_i^{1/3} \) instead of \( V_i \) in order to obtain a closed form solution.
because in real world, manager’s compensation has a fixed component which consists of the salary and a variable component, which consists of bonus, perks and options granted.

The manager decides on two things: How much effort to put and how much output to produce. In the first stage, the manager maximizes her utility by choosing her effort. The managerial utility is given by

$$U_i = w_i - \frac{e_i^2}{2}, i = 1, 2.$$  \hspace{1cm} (2)

As manager’s variable wage depends on the value of the firm, the manager has the incentive to maximize the value of the firm by putting in more effort. But putting in more effort is a disutility for the manager which is represented by the second term of equation 2.

There is an inverse market demand of the affine-linear form

$$p_i = \theta + e_i + z_i - q_i - \lambda q_j$$  \hspace{1cm} (3)

where $\lambda$ is the degree of product differentiation, $\theta > c$ is a positive constant and $z$ is a random parameter, which represents the state of the nature. We further assume that $z$ is uniformly distributed on a non-degenerate interval $[\underline{z}, \overline{z}]$ with constant density

$$f(z) = \frac{1}{\overline{z} - \underline{z}}$$  \hspace{1cm} (4)

If the manager puts more effort, the price increases leading to an increase in revenue. If the state of the nature improves, the firm can charge a higher price and increase revenue. The equity holders, the debt holders and the rest of the world cannot distinguish if the increase in revenue occurred due to increase in manager’s effort or due to the improvement in the state of the nature, which is random. So the outside world cannot distinguish between $e_i$ and $z_i$. If there is a reduction in firm revenue, the outside world cannot know if the manager did not put in enough effort leading to a fall in demand or if the state of nature was bad. This creates an opportunity for the manager to act in her self-interest which is the reason for the existence of a principle agent problem between the manager and the equity holders of the firm. The compensation structure of the manager is aligned with the equity value of the firm in order to mitigate the agency problem between the equity holders and the manager.

In the second stage, the manager of the firm chooses output to maximize the equity value of the firm. The firm raises money from the debt holder to fund its project.
We assume absence of exogenous debt (for simplicity), zero fixed, set-up or sunk costs, and marginal cost of production $c \geq 0$. We further assume that the firm issues debt to finance its operating cost so that it will have debt equal to

$$D = cq$$

Thus there is an direct linkage between the financial decision and the output decision.

Switching state of nature, $\hat{z}$ is defined as that state of nature at which the revenue of a firm is just enough to pay off its debt and interest on debt. $r$ is the rate of interest on debt. For firm 1:

$$(1 + r)D = R_1(q_i, q_j, \hat{z}),$$

$$(1 + r)cq_1 = [\theta + e_1 + \hat{z}_1 - q_1 - \lambda q_2]q_1,$$

$$\hat{z}_1 = -[\theta + e_1 - (1 + r)c - q_1 - \lambda q_2].$$

(4a)

For firm 2,

$$\hat{z}_2 = -[\theta + e_2 - (1 + r + d)c - q_2 - \lambda q_1].$$

(4b)

This game is solved by backward induction. In the second stage, the manager of a firm engages in Cournot duopoly game with the other firm to maximize the value of her firm and obtain the optimal value of $q$ in terms of managerial effort. In the first stage, the managers of each firm choose their efforts simultaneously to maximize their utilities. Optimal efforts are obtained in terms of wage contract parameters $\alpha_i, \beta_i$.

### 2.2.2 The Second Stage

Then with limited liability, a firm’s manager maximizes

$$\int_{\hat{z}}^{\bar{z}} [R_i(z; q_i, q_{-i}) - D_i] f(z) dz,$$

For firm 1;

$$\max_{q_i} V_1 = \int_{\hat{z}_1}^{\bar{z}} [\theta + e_1 + \hat{z}_1 - q_1 - \lambda q_2]q_1 - (1 + r)cq_1] f(z) dz.$$

(5a)

For firm 2;

$$\max_{q_2} V_2 = \int_{\hat{z}_2}^{\bar{z}} [\theta + e_2 + \hat{z}_2 - q_2 - \lambda q_1]q_2 - (1 + r + d)cq_2] f(z) dz.$$

(5b)
It can be shown that the value of the firms are

\[ V_1^* = \frac{(q_1^*)^3}{\bar{x}} \]  
\[ V_2^* = \frac{(q_2^*)^3}{\bar{x}} \]

where

\[ q_1^* = \frac{\bar{x} + \theta + e_1 - (1 + r)c - \frac{\lambda}{3}[\bar{x} + \theta + e_2 - (1 + r + d)c]}{(3 - \frac{\lambda^2}{3})} \]  
\[ (7a) \]

and

\[ q_2^* = \frac{\bar{x} + \theta + e_2 - (1 + r + d)c - \frac{\lambda}{3}[\bar{x} + \theta + e_1 - (1 + r)c]}{(3 - \frac{\lambda^2}{3})}. \]  
\[ (7b) \]

### 2.2.3 The First Stage

In stage 1, the manager of each firm chooses her effort simultaneously with the manager of the other firm to maximize her own utility:

\[ \max_{e_i} U_i = w_i - \frac{e_i^2}{2}, i = 1, 2, \]

\[ \max_{e_i} U_i = \alpha_i + \beta_i(V_i^*)^\frac{3}{2} - \frac{e_i^2}{2}, i = 1, 2, \]  
\[ (8) \]

where \((V_i^*)^\frac{3}{2}\) is given by equation 6. Solving for \(e_i\), we get,

\[ e_i^* = \frac{\beta_i}{(\bar{x})^\frac{1}{2}(3 - \frac{\lambda^2}{3})}, i = 1, 2. \]  
\[ (8a) \]

We assume

\[ 3 - \frac{\lambda^2}{3} > 0. \]  
\[ (A1) \]

Justification for this assumption is that in reality, the pay performance sensitivity \(\beta_i\) is always positive. It does not make sense to have \(\beta_i\) as negative. If \(3 - \frac{\lambda^2}{3} < 0\), then \(\beta < 0\) for effort to be positive.

Individual rationality constraint suggests that the utility of an individual manager must be greater than or equal to the reservation utility prevailing in the market. So

\[ U_i \geq \bar{U}. \]
We assume that the labor market for managers is perfectly competitive which implies that a manager receives only the reservation utility. As a result,

\[ U = \alpha_i + \beta_i V_i^{1/3} - \frac{e_i^2}{2}, \quad i = 1, 2. \]

Putting value of \( \alpha_i \) in the wage equation, we get,

\[ w_i = U + \frac{e_i^2}{2}, \quad i = 1, 2. \]

Putting the value of \( e_i \) from equation (8a), the compensation contract of the manager is given by

\[ w_i = U + \frac{\beta_i^2}{2(\bar{z} + \theta + \beta_i z)} (3 - \frac{\lambda^2_2}{3})^2, \quad i = 1, 2. \]  (9)

The equilibrium outputs are given by

\[ q_1^* = \frac{\bar{z} + \theta + \frac{\beta_1}{(\bar{z} + \theta + \beta_1 z)} - (1 + r)c - \frac{\lambda}{3}[\bar{z} + \theta + \frac{\beta_2}{(\bar{z} + \theta + \beta_2 z)}] - (1 + r + d)c}{(3 - \frac{\lambda^2_2}{3})} \]  (10a)

and

\[ q_2^* = \frac{\bar{z} + \theta + \frac{\beta_2}{(\bar{z} + \theta + \beta_2 z)} - (1 + r + d)c - \frac{\lambda}{3}[\bar{z} + \theta + \frac{\beta_1}{(\bar{z} + \theta + \beta_1 z)}] - (1 + r)c}{(3 - \frac{\lambda^2_2}{3})}. \]  (10b)

\( \beta_i, i = 1, 2, \) are exogenous. Equilibrium outputs \( q_1^* \) and \( q_2^* \) depend on the values of the parameters \( \beta_i, i = 1, 2. \) \( \beta_i, i = 1, 2, \) can be interpreted as the percentage of short term variable compensation in total current compensation. \( \beta_i, i = 1, 2, \) can also be interpreted as the pay performance sensitivity of firm i.

2.2.4 Proposition 1

The more is the percentage of variable compensation in the total compensation of the manager of a firm, the more aggressive is the firm in the product market compared to its rival.

In Appendix A1, we show

\[ \frac{dq_2^*}{d\beta_2} - \frac{dq_1^*}{d\beta_2} > 0 \]
**Intuition:** The compensation contract of the manager of firm 2 is given by equation (1), \( w_i = \alpha_i + \beta_i V_i^{1/3} \). Equity value of a firm depends on its output as given by equation (6). An increase in the value of the parameter \( \beta_2 \) implies more incentive to the manager of firm 2 to increase the value of firm 2 and hence increase firm 2 outputs. As this set-up is a Cournot duopoly, the output of rival firm, firm 1, decreases when firm 2 increases its output.

This illustrates why the compensation contract should play an active role in the output market strategies. The variable portion of managerial compensation is linked with the value of the firm, which crucially depends on the output of the firm. So an increase in the pay performance sensitivity, captured by the parameter \( \beta \), (which can also be interpreted as the percentage of variable pay in total salary) provides incentive to the manager to act more aggressively in the output markets.

Up to now, we have assumed that the compensation contract is exogenously given and the manager cannot affect the compensation structure. Specifically, we have assumed that the manager’s decisions cannot affect the values of \( \alpha \) and \( \beta \). This is too simplistic an assumption. The manager decides what should be the output which, in turn, determines the equity value of the firm. The equity holder maximizes the net equity value of the firm by choosing values of \( \alpha \) and \( \beta \). Her maximization problem is given by

\[
\max_{\alpha_i, \beta_i} V_i^{\text{net}} = V_i - w_i
\]

If the manager is rational, she can figure out that her output decision determines what should be the values of \( \alpha \) and \( \beta \) and hence the compensation contract is not exogenously given. Rather, we should have a three stage game which is described and solved below.

### 2.3 The Three Stage Game

#### 2.3.1 The Set-Up

There are two firms who engage in a Cournot duopoly game to maximize their values. The manager of each firm chooses her effort and firm output. The equity holders choose optimal contracts for the manager. Let us explain the setup of the model in details.

There are three stages of this duopoly game. In the first stage, the equity holders choose the optimal contract \( \alpha_i, \beta_i \) in order to maximize the net value of their respective firms.

\[
\max_{\alpha_i, \beta_i} V_i^{\text{net}} = V_i - w_i.
\]
In the second stage, the manager of each firm chooses her effort to maximize her utility. The managerial utility is given by equation (2). Effort is unobservable to the equity holders and debt holders. The compensation contract is same as above and is given by equation (1).

In the third stage, the manager of each firm chooses output to maximize the equity value of her firm. The equity value of the firm is exactly the same as the two stage game.

This game is solved by backward induction. In the third stage, the manager of a firm engages in Cournot duopoly with the other firm to maximize the value of her firm and obtain the optimal value of $q$ in terms of managerial effort. In the second stage, the manager of the firm chooses her effort simultaneously with the manager of the other firm in Cournot game, to maximize her utility. Optimal efforts are obtained in terms of contract parameters $\alpha_i, \beta_i$. In the first stage, knowing the amount of effort of the manager in terms of the contract parameters, the equity holders of each firm choose the optimal managerial contracts to maximize the net value of the firms.

### 2.3.2 The Third Stage

This is same as stage 2 of the two stage game. Problem of the manager in stage 3 is to maximize the equity value of the firm. The maximization problem is same as equation 5.

The maximized value of the firms are

$$V_1^* = \frac{(q_1^*)^3}{z}$$

$$V_2^* = \frac{(q_2^*)^3}{z}$$

where

$$q_1^* = \frac{\pi + \theta + e_1 - (1 + r)c - \frac{\lambda_1}{3}[\pi + \theta + e_2 - (1 + r + d)c]}{(3 - \frac{\lambda_2}{3})}$$

and

$$q_2^* = \frac{\pi + \theta + e_2 - (1 + r + d)c - \frac{\lambda_2}{3}[\pi + \theta + e_1 - (1 + r)c]}{(3 - \frac{\lambda_1}{3})}.$$

### 2.3.3 The Second Stage

This is same as the stage 1 of the two stage game. In stage 2, the manager of a firm chooses effort simultaneously with the manager of the other firm
in order to maximize her own utility. The maximization problem is given by equation (8) and the maximized efforts are given by equation (8a). The compensation contract is given by equation (9).

2.3.4 The First Stage

Given the wage contract in terms of the contract parameters \(\alpha\) and \(\beta\), the equity holders of the company maximize the net value of the firm by choosing the optimal compensation contract. The equity holders choose the values of \(\alpha_i, \beta_i\) in order to maximize the net value of their respective firms.

\[
\max_{\alpha_i, \beta_i} V_{net}^i = V_i - w_i.
\]

For firm 1, the optimization problem of the equity holders is

\[
\max_{\alpha_1, \beta_1} V_{net}^1 = \frac{[\zeta + \theta + \frac{\beta_1}{(\zeta)^{\frac{1}{3}}(3 - \frac{\lambda_1}{3})} - (1 + r)c - \frac{\lambda}{3}[\zeta + \theta + \frac{\beta_2}{(\zeta)^{\frac{1}{3}}(3 - \frac{\lambda_2}{3})}] - (1 + r + d)c]^3}{\zeta(3 - \frac{\lambda_1}{3})^3} - \frac{\beta_1^2}{2(\zeta)^{\frac{1}{3}}(3 - \frac{\lambda_1}{3})^2} - \overline{U}.
\] (11a)

For firm 2, the optimization problem of the equity holders is

\[
\max_{\alpha_2, \beta_2} V_{net}^2 = \frac{[\zeta + \theta + \frac{\beta_2}{(\zeta)^{\frac{1}{3}}(3 - \frac{\lambda_2}{3})} - (1 + r + d)c - \frac{\lambda}{3}[\zeta + \theta + \frac{\beta_1}{(\zeta)^{\frac{1}{3}}(3 - \frac{\lambda_1}{3})}] - (1 + r)c]^3}{\zeta(3 - \frac{\lambda_2}{3})^3} - \frac{\beta_2^2}{2(\zeta)^{\frac{1}{3}}(3 - \frac{\lambda_2}{3})^2} - \overline{U}.
\] (11b)

The first order conditions with respect to \(\beta_1\) are

\[
3[\zeta + \theta + \frac{\beta_1}{(\zeta)^{\frac{1}{3}}(3 - \frac{\lambda_1}{3})} - (1 + r)c - \frac{\lambda}{3}[\zeta + \theta + \frac{\beta_2}{(\zeta)^{\frac{1}{3}}(3 - \frac{\lambda_2}{3})}] - (1 + r + d)c]^2 = (3 - \frac{\lambda_1^2}{3})^2 \zeta^{\frac{2}{3}} \beta_1.
\] (12a)

The first order conditions with respect to \(\beta_2\) are

\[
3[\zeta + \theta + \frac{\beta_2}{(\zeta)^{\frac{1}{3}}(3 - \frac{\lambda_2}{3})} - (1 + r + d)c] = (3 - \frac{\lambda_2^2}{3})^2 \zeta^{\frac{2}{3}} \beta_2.
\] (12b)
The equilibrium values of $\beta_1$ and $\beta_2$ satisfy equations (12a) and (12b) simultaneously. Our goal is to find out how an increase in the cost of capital of financially constrained firm, firm 2, affect the equilibrium values of $\beta_1$ and $\beta_2$. As defined before, financially constrained firm has a higher cost of capital. Firm 2 in our model is financially constrained as it has higher cost of capital compared to firm 1, where the difference in cost of capital is given by $d$. So $d$ can be regarded as the parameter capturing the degree of financial constraint. We do not attempt to solve for $\beta_1$ and $\beta_2$ but find the values of $\frac{d\beta_1}{dd}$ and $\frac{d\beta_2}{dd}$. Differentiating equations (10a) and (10b) with respect to $d$ and applying the first order conditions (10a) and (10b), we get,

\[
\frac{1}{2} \left( 1 - \frac{(3 - \frac{\lambda^2}{3})^2 \frac{3}{2}}{\beta_1^* \frac{1}{2}} \right) \frac{d\beta_1^*}{dd} - \frac{\lambda}{3} \frac{d\beta_2^*}{dd} = -\frac{\lambda}{3} \frac{c_1}{\beta_1^*} (3 - \frac{\lambda^2}{3}) \tag{13a}
\]

\[
-\frac{\lambda}{3} \frac{d\beta_1^*}{dd} + \left[ 1 - \frac{(3 - \frac{\lambda^2}{3})^2 \frac{3}{2}}{2\sqrt{3}\beta_2^* \frac{1}{2}} \right] \frac{d\beta_2^*}{dd} = \frac{c_2}{\beta_2^*} (3 - \frac{\lambda^2}{3}). \tag{13b}
\]

From (11a) and (11b), we solve for $\frac{d\beta_1^*}{dd}$ and $\frac{d\beta_2^*}{dd}$ which are given by

\[
\frac{d\beta_1^*}{dd} = \frac{\frac{\lambda}{3} \frac{c_1}{\beta_1^*} (3 - \frac{\lambda^2}{3})^3}{2\sqrt{3}\beta_1^* \frac{1}{2}} D \tag{14a}
\]

\[
\frac{d\beta_2^*}{dd} = \frac{\frac{c_2}{\beta_2^*} (3 - \frac{\lambda^2}{3}) \left[ 1 - \frac{(3 - \frac{\lambda^2}{3})^2 \frac{3}{2}}{2\sqrt{3}\beta_1^* \frac{1}{2}} \right] - \frac{\lambda^2}{9}}{D} \tag{14b}
\]

where

\[
D = \left[ 1 - \frac{(3 - \frac{\lambda^2}{3})^2 \frac{3}{2}}{2\sqrt{3}\beta_1^* \frac{1}{2}} \right] \left[ 1 - \frac{(3 - \frac{\lambda^2}{3})^2 \frac{3}{2}}{2\sqrt{3}\beta_2^* \frac{1}{2}} \right] - \frac{\lambda^2}{9}.
\]

### 2.3.5 Proposition 2

The variable component of the managerial compensation of a financially constrained firm increases with the degree of financial constraint. Further,
the difference between the variable component of the managerial compensation of a more financially constrained firm and less financially constrained firm increases with the degree of financial constraint.

Proof: This theorem is equivalent to showing that

\[
\frac{d\beta^*_2}{dd} > 0 \\
\frac{d\beta^*_2}{dd} - \frac{d\beta^*_1}{dd} > 0
\]

for sufficiently high values of \(\lambda\). Proof is in Appendix A2. We show in Appendix A2 that sufficient condition for \(\frac{d\beta^*_2}{dd} > 0\) and \(\frac{d\beta^*_2}{dd} - \frac{d\beta^*_1}{dd} > 0\) to hold is \(\frac{3}{2} < \lambda\).

Intuition behind this theorem is that a financially constrained firm is one with a higher cost of capital, leading to higher marginal cost of production. Higher marginal cost of production reduces firm output which in turn decreases firm value. The compensation structure of a financially constrained firm has to be designed in such a manner so as to induce the manager to put more effort in order to offset higher cost of production. Financially constrained firm has to provide higher incentive for the manager to increase the value of the firm in order to compensate for the higher cost of capital. As the degree of financial constraint increases, the pay performance sensitivity should increase in order to induce the manager to put in more effort and counter the effect of higher cost of capital. Hence, the pay performance sensitivity increases due to increase in the degree of financial constraint.

2.3.6 Proposition 3

Financially constrained firms are more aggressive in the product market

Proof: See Appendix A3.

When \(\frac{3}{2} < \lambda\),

\[
\frac{dq_2}{dd} > 0 \\
\frac{dq_1}{dd} < 0 \\
\frac{dq_2}{dd} - \frac{dq_1}{dd} > 0
\]
For the financially constrained firm, one unit increase in the degree of financial constraint has two opposing effects. The first effect is that the marginal cost of production increases by $c$, thereby reducing the output produced, $q_2$. The second effect is that the pay performance sensitivity $\beta_2$ also increases in order to induce the manager to put in more effort thereby increasing output $q_2$. The first effect reduces output $q_2$ whereas the second effect increases $q_2$. If the degree of product substitution is sufficiently high, a firm can act more aggressively by increasing output as the consumers cannot switch to rival’s product. The second effect of increase in output dominates the first effect of reduction in output.

3 Hypothesis Development

In this section, we develop three hypotheses corresponding to the three propositions. We are not testing the model per se. The theoretical model above provides some theoretical justification of the empirical results which follows. We argue that the empirical results documented below are at least theoretically conceivable from the theoretical model above.

3.1 Aggressiveness In the Product Markets

3.1.1 Hypothesis 1

_Financially constrained firms are more aggressive in the product market compared to the financially unconstrained firms._

This hypothesis follows directly from Proposition 3. When faced with an investment opportunity, a firm raises capital from the external market. If the firm is more financially constrained, the cost of raising external capital is higher. The financially constrained firms should behave more aggressively in the product market in order to make up for their higher cost of capital. This is the traditional argument as to why financially constrained firms should behave more aggressively.

What are the different reasons for aggressiveness in the product market? Our hypothesis is that managerial compensation is one of the causes for differences in the product market behavior.
3.2 Product Market Strategies and Managerial Compensation

In this section, we examine how various components of managerial compensation affect product market strategies.

3.2.1 Hypothesis 2

Aggressiveness of a firm in the output market depends positively on managerial compensation.

This hypothesis follows directly from Proposition 1. We examine how the different components of managerial compensation affect product market aggressiveness.

3.3 Managerial Compensation And Financial Constraints

3.3.1 Hypothesis 3

Variable component of managerial compensation of more financially constrained firms are higher than that of less financially constrained firms.

This hypothesis follows from Proposition 2. More financially constrained firms have to be more aggressive in the product market in order to compensate for their higher cost of capital and higher cost of production. In order to induce the managers to be more aggressive in the product market, these firms offer a compensation structure which has a higher variable component as compared to the less financially constrained firms.

4 Data and Methodology

In this section, we describe the data we use. The sample includes all US firms listed on NYSE, AMEX or NASDAQ that are present in CRSP and COMPUSTAT for the period 1993 to 2007. The firm characteristics data are from COMPUSTAT. The executive compensation data are from ExecuComp. We use CRSP to calculate firm’s return. The risk of the firm is calculated as the preceding sixty month variance of monthly return. We define industry by the NAICS industry code. We exclude financial companies (SIC 6000-6999) and utility companies (SIC 4900 to 4999) to avoid the possible effects of regulations prevalent in these type of industries. We also exclude any firm with assets less than 10 million dollars.
4.1 Data Definition

See Appendix A4.

4.2 Criteria For Financial Constraint

We use two measures of financial constraint as has been used by the literature.

4.2.1 Payout Ratio

Firms are classified based on Payout ratio in the seminal work of Fazzard, Hubbard and Peterson (1998) and subsequently by many others. The intuition is that firms who pay dividends are not financially constrained, whereas the cash constrained firms are less likely to pay dividends. The payout ratio is defined as the total dividends paid by the firm normalized by operating income (Compustat data items data 19 plus data 21 divided by data 178). Firms are classified in terms of the payout ratios. The top 30% of the firms are classified as financially unconstrained and the bottom 30% of the firms are considered financially constrained.

4.2.2 S&P Long Term Credit Rating

Data 280 of COMPSTAT provides the historical long term domestic issuer credit rating. Firms with credit rating of BBB- or better (data 280 less than or equal to 12) are termed as unconstrained and all other firms are termed as constrained (data 280 greater than or equal to 13). Whited (1992), Gilchrist and Himmelberg (1995) and Malmendier and Tate (2005) use this criteria to classify firms as constrained or unconstrained.

4.2.3 KZ Index

Lamont,Polk and Saa-Raquejo (2001) ranked the firms based on an index called K Z index. The top 30% of the firms are classified as financially constrained and the bottom 30% of the firms are considered financially unconstrained. This KZ index is based on Kaplan and Zingales (1997). It is computed as

\[
KZindex = -1.001909 \times CashFlow + 0.02826389 \times TobinQ + 3.139193 \times Leverage \\
- 39.3678 \times Dividends - 1.314759 \times Cashholdings
\]
4.3 Methodology

For testing Hypothesis 1, we split the sample of firms into financially constrained and financially unconstrained based on the above two criteria. We test for the difference in the means of sales growth and industry adjusted sales growth across financially unconstrained and financially constrained firms.

Following Opler and Titman(1994), Campello(2003), Campello and Fluck(2004), our baseline regression of industry adjusted sales growth is given by

\[
SalesGrowth_{i,t} = c + \beta_0 SalesGrowth_{i,t-1} + \beta_1 Size_{i,t} \\
+ \beta_2 Profitability_{i,t} + \beta_3 Profitability_{i,t-1} + \beta_4 Investment_{i,t} \\
+ \beta_5 Investment_{i,t-1} + \beta_6 Leverage_{i,t} + \beta_7 Leverage_{i,t-1} \\
+ \beta_8 Variance_{i,t} + \epsilon_{i,t}. \quad (R1)
\]

For testing Hypothesis 1, we use a dummy variable for financial constraint and control for all the other explanatory variables given by the baseline regression. The following regression is run.

\[
SalesGrowth_{i,t} = c + \beta_0 SalesGrowth_{i,t-1} + \beta_1 Size_{i,t} \\
+ \beta_2 Profitability_{i,t} + \beta_3 Profitability_{i,t-1} + \beta_4 Investment_{i,t} \\
+ \beta_5 Investment_{i,t-1} + \beta_6 Leverage_{i,t} + \beta_7 Leverage_{i,t-1} \\
+ \beta_8 Variance_{i,t} + \beta_8 fcDummy + \epsilon_{i,t}. \quad (R2)
\]

If industry adjusted sales growth is higher for financially constrained firms, i.e., if hypothesis 1 is true, the coefficient \(\beta_8\) on the financial constraint dummy should be positive and significant.

To test hypothesis 2, we use base line sales growth regression as defined by equation R1 and add components of managerial compensation into the regression.

\[
SalesGrowth_{i,t} = c + \beta_0 SalesGrowth_{i,t-1} + \beta_1 Size_{i,t} \\
+ \beta_2 Profitability_{i,t} + \beta_3 Profitability_{i,t-1} + \beta_4 Investment_{i,t} \\
+ \beta_5 Investment_{i,t-1} + \beta_6 Leverage_{i,t} + \beta_7 Leverage_{i,t-1} \\
+ \beta_8 Variance_{i,t} + \beta_9 ManagerialCompensation + \epsilon_{i,t}. \quad (R3)
\]

Managerial compensations include short run bonus, stocks owned by the CEO, total compensation, flow compensation, the change in the value of stock holding and the change in the value of stock options. If hypothesis 2 is correct, the coefficient \(\beta_9\) should be positive and significant.
4.3.1 Two Stage Least Square

One can argue that CEO compensation may be dependent on sales growth. To control for endogenity, two common methods are used. First we use a two stage least square method. Following Aggarwal and Samwick (1999), CEO compensation is estimated using the following equation.

\[
CEOCompensation_{i,t} = c + \beta_1 Ret_{i,t} + \beta_2 Ret_{i,t} * Tenure \\
+ \beta_3 * variance + \beta_4 * size + \epsilon_{i,t} \tag{R4}
\]

\(Ret\) is the total dollar return to the shareholder. Variance is the variance of the preceding 5 year stock return of the firm. Variance captures the risk of the stock. Tenure is proxy for CEO’s ability. Size is defined as log of assets, data6. Size captures the size effect, which is common in CEO compensation regression. Adding industry adjusted sales growth in the baseline regression, we have

We estimate a two stage least square regression equation with the CEO compensation being estimated in the first stage using equation R4. In the second stage, we estimate equation R3 using the estimated value of CEO compensation from the first stage.

4.3.2 Instrumental Variable Approach

We also estimate equation R3 using an instrumental variable approach. We use one year lagged value of CEO compensation as the instrument for CEO compensation. It is unlikely that CEO compensation last year will be dependent on industry adjusted sales growth this year.

For testing Hypothesis 3, different components of managerial compensation are regressed on the financial constraint dummy. The three components of CEO compensation: flow compensation, the change in the value of stock holding and the change in the value of stock options as well as total compensation, short run bonus and stock holding of the manager are regressed on the financial constraint dummy after controlling for all other explanatory variables given by the baseline regression R4.

\[
CEOCompensation_{i,t} = c + \beta_1 Ret_{i,t} + \beta_2 Ret_{i,t} * Tenure \\
+ \beta_3 * variance + \beta_4 * size \\
+ \beta_5 * fcDummy + \epsilon_{i,t} \tag{R6}
\]
fcDummy is a dummy variable for financial constraint. If hypothesis 3 is true, the coefficient on financial constraint dummy should be positive and significant.

The dataset is an unbalanced panel data of observations. The regressions are estimated with both firm fixed effect and time effect. To control for heteroskedasticity, we report heteroskedastic adjusted standard errors. To control for auto correlation, our dependent variable is not in levels. Sales growth is used as a dependent variable instead of sales. Further, lag sales growth is included as an explanatory variable to control for any remaining autocorrelation.

5 Results

We test our first hypothesis by dividing the firms into financially constrained and unconstrained firms. We estimate the standard t test to test if there is difference in the mean across the two groups of firms.

Table 1 reports the descriptive statistics mean sales growth and industry adjusted sales growth of the two groups of firms based on three criteria of financial constraint. Industry adjusted sales growth is the sales growth of the firm minus the median sales growth of the firms in the industry, where industry is defined by the three digit NAICS code. Every entry has three values. The first value is the value for the financially unconstrained firms and the second value is that of the financially constrained firm. The third value is the t statistic value to test if the mean of financially constrained firm is equal to that of financially unconstrained firm. For example, the first entry says that mean sales growth for financially unconstrained firms is 5.956 and mean sales growth for financially constrained firms is 21.269 where dividend payment is the financial constraint measure. The t statistic that tests the difference between the mean sales growth of unconstrained and constrained is -17.18 and it is significant at 1 percent significance level. We find that industry adjusted sales growth is higher for the financially constrained firms supporting hypothesis 1 that the financially constrained firms are more aggressive in the output markets.

We test for hypothesis 1 by estimating the regression equation given by R2. The results are reported in table 2.
The coefficient on the dummy variable is positive and statistically significant for all the three criteria of financial constraint thereby providing empirical evidence in favor hypothesis 1.

We estimate the regression equation R3 by the two stage least square method and report the results in table 3.

*Table3*

The first column of table 3 reports the baseline regression, given by equation R1. In column 2, we report that short run bonus is positive and statistically significant supporting hypothesis 2. In column 3, we document that the coefficient of total compensation is positive and significant in support of hypothesis 2. We break up the total CEO compensation into three components, flow compensation, change in the value of stock holding and the change in the value of stock options. Flow compensation coefficient is almost zero and statistically insignificant. Change in the value of stock holding coefficient is positive and statistically significant providing empirical evidence in favor of hypothesis 2. But the coefficient of the change in the value of stock options is positive but statistically insignificant.

As a robustness measure, we estimate regression equation R3 employing the instrumental variable approach. The results are documented in table 4.

*Table4*

The instrument for CEO compensation is lag values of CEO compensation. In column 3, the coefficient of total compensation is positive and significant supporting hypothesis 2. We break up the total CEO compensation into three components, flow compensation, change in the value of stock holding and the change in the value of stock options. Flow compensation coefficient is almost zero and statistically insignificant. Change in the value of stock holding and the change in the value of stock options both have positive and statistically significant coefficient.

Results from tables 3 and 4 suggest that the product market aggressiveness is explained by CEO total compensation, SR bonus and Change in the value of stock holding even though the results for change in the value of stock options is mixed. We do not expect the coefficient of the flow compensation to be statistically significant as the flow compensation mainly consists of fixed salary and long term payouts. The results from tables 3 and 4 are in support of hypothesis 2.

We test for hypothesis 3 by estimating the regression equation R6 and reporting the results in tables 5 and 6. The dependent variable in this regression estimation are the five compensation variables used in the estimation of equation R3 and reported in tables 3 and 4.
The coefficient of financial constraint dummy is positive and significant using both the measures of financial constraints providing empirical evidence for hypothesis 3. The results suggest that the financially constrained firms’ variable compensation are higher as compared to the firms which are financially unconstrained.

6 Conclusion

We provide an additional factor which can explain the product market decisions of the firms. We document that the product market aggression depends on the variable component of the managerial compensation structure. Further, we report that the financially constrained firms are more aggressive in the product market. We also provide empirical evidence that the variable compensation are higher for the financially constrained firms as compared to the financially unconstrained firms. These results suggest that the aggressive product market behavior of the financially constrained firms may be explained by the higher variable component of the managerial compensation of these firms.
7 Appendix

7.1 Appendix A1

Proof of Proposition 1

\[
q_1^* = \frac{\bar{z} + \theta + \frac{\beta_1}{(\pi)^4 (3 - \lambda^2/3)} - (1 + r)c - \frac{\lambda}{3}[\bar{z} + \theta + \frac{\beta_2}{(\pi)^4 (3 - \lambda^2/3)}] - (1 + r + d)c}{(3 - \lambda^2/3)} \tag{10a}
\]

and

\[
q_2^* = \frac{\bar{z} + \theta + \frac{\beta_2}{(\pi)^4 (3 - \lambda^2/3)} - (1 + r + d)c - \frac{\lambda}{3}[\bar{z} + \theta + \frac{\beta_1}{(\pi)^4 (3 - \lambda^2/3)}] - (1 + r)c}{(3 - \lambda^2/3)} \tag{10b}
\]

\[
\frac{d q_1^*}{d \beta_1} = -\lambda \frac{1}{3 \pi^4 (3 - \lambda^2/3)^2} > 0
\]

\[
\frac{d q_2^*}{d \beta_1} = \frac{\lambda}{3 \pi^4 (3 - \lambda^2/3)^2} > 0
\]

\[
\frac{d q_1^*}{d \beta_2} = \frac{\lambda}{3 \pi^4 (3 - \lambda^2/3)^2} > 0
\]

\[
\frac{d q_2^*}{d \beta_2} = \frac{1}{\pi^4 (3 - \lambda^2/3)^2} (1 + \frac{\lambda}{3}) > 0
\]

for all values of \(\lambda\) as long as assumption A1 holds \(3 - \lambda^2/3 > 0\)

7.2 Appendix A2

\[
\frac{d \beta_1^*}{d \delta} = \frac{\lambda c}{2 \sqrt{3} \beta_1^* D} \tag{14a}
\]

\[
\frac{d \beta_2^*}{d \delta} = \frac{c \pi^4 (3 - \lambda^2/3)}{2 \sqrt{3} \beta_1^* D} \tag{14b}
\]
where
\[
D = \left[1 - \frac{(3 - \lambda^2)^2 z^2}{2\sqrt{3}\beta_1^{\frac{3}{2}}} \right] \left[1 - \frac{(3 - \lambda^2)^2 z^2}{2\sqrt{3}\beta_2^{\frac{3}{2}}} \right] - \frac{\lambda^2}{9}
\]

Using the FOC equation 10a and 10b, the maximized value of \( V_i \) can be written as
\[
V_i^* = \left( \frac{\beta_i^*}{3^2} \right) \frac{3}{2}.
\]

Maximized net value of the firm is
\[
V_{i,\text{net}}^* = V_i^* - w_i
= \left( \frac{\beta_i^*}{3^2} \right) \frac{3}{2} - \frac{(\beta_i^*)^2}{2(\overline{z})^2 (3 - \frac{\lambda^2}{3})^2} - \overline{U}.
\]

\( \overline{U} \) is the reservation utility which is positive. This implies that
\[
\left( \frac{\beta_i^*}{3^2} \right) \frac{3}{2} > \frac{(\beta_i^*)^2}{2(\overline{z})^2 (3 - \frac{\lambda^2}{3})^2}
\]
leading to
\[
\frac{(3 - \lambda^2)^2 z^2}{2\sqrt{3}\beta_i^{\frac{3}{2}}} > \frac{3}{4}.
\]

\( V_{i,\text{net}}^* \) is the maximized net value of firm \( i \), maximized with respect to \( \beta_i \).

Hence,
\[
\frac{dV_{i,\text{net}}^*}{d\beta_i} < 0
\]
which leads to
\[
\frac{(3 - \lambda^2)^2 z^2}{2\sqrt{3}\beta_i^{\frac{3}{2}}} < 1.
\]

Hence we get the upper and lower limits
\[
\frac{3}{4} \leq \frac{(3 - \lambda^2)^2 z^2}{2\sqrt{3}\beta_i^{\frac{3}{2}}} < 1,
\]
\[
-\frac{\lambda^2}{9} \leq \left[1 - \frac{(3 - \lambda^2)^2 z^2}{2\sqrt{3}\beta_i^{\frac{3}{2}}} - \frac{\lambda^2}{9} \right] < 1 - \frac{3}{4} - \frac{\lambda^2}{9}.
\]
Sufficient condition for \( [1 - \frac{(3 - \frac{\lambda^2}{3})^\frac{1}{2} \pi^\frac{3}{2}}{2\sqrt{3}\beta_1^{\frac{1}{2}}} - \frac{\lambda^2}{9}] < 0 \) is \( \frac{3}{2} < \lambda \).

\[
-\frac{\lambda^2}{9} < D = \left[1 - \frac{(3 - \frac{\lambda^2}{3})^\frac{1}{2} \pi^\frac{3}{2}}{2\sqrt{3}\beta_1^{\frac{1}{2}}} \right]\left[1 - \frac{(3 - \frac{\lambda^2}{3})^\frac{1}{2} \pi^\frac{3}{2}}{2\sqrt{3}\beta_2^{\frac{1}{2}}} \right] - \frac{\lambda^2}{9} < \frac{1}{16} - \frac{\lambda^2}{9}
\]

Sufficient condition for D to be negative is \( \frac{3}{4} < \lambda \).

If \( \frac{3}{2} < \lambda \), \( \frac{d\beta_2}{dd} > 0 \).\(^2\)

So \( \frac{d\beta_2}{dd} > 0 \) when \( \frac{3}{2} < \lambda \). Further, when \( \frac{3}{2} < \lambda \), \( \frac{d\beta_1}{dd} < 0 \). So as long as \( \frac{3}{2} < \lambda \)

\[
\frac{d\beta_2}{dd} - \frac{d\beta_1}{dd} > 0
\]

Hence we show that as long as \( \frac{3}{2} < \lambda \),

\[
\frac{d\beta_2}{dd} > 0
\]

\[
\frac{d\beta_2}{dd} - \frac{d\beta_1}{dd} > 0.
\]

We note that \( \frac{3}{2} < \lambda \) is a sufficient condition for these to hold, not necessary conditions. There can be other ranges of \( \lambda \) when these two inequalities may hold.

### 7.3 Appendix A3

\[
\frac{de_2}{dd} = \frac{d\beta_2}{dd} \frac{de_2}{d\beta_2} = \frac{c\pi^\frac{3}{2}(3 - \frac{\lambda^2}{3})[1 - \frac{(3 - \frac{\lambda^2}{3})^\frac{1}{2} \pi^\frac{3}{2}}{2\sqrt{3}\beta_1^{\frac{1}{2}}} - \frac{\lambda^2}{9}]}{D}
\]

\[
= \frac{1}{\pi^\frac{3}{2}(3 - \frac{\lambda^2}{3})} \frac{c\left[1 - \frac{(3 - \frac{\lambda^2}{3})^\frac{1}{2} \pi^\frac{3}{2}}{2\sqrt{3}\beta_1^{\frac{1}{2}}} - \frac{\lambda^2}{9}\right]}{D}
\]

\( ^2 \)We only consider positive value of \( \lambda \)
\[
\frac{de_1}{dd} = \frac{\beta_1 de_1}{\beta_1} = \frac{1}{\beta_1} \frac{\frac{\lambda}{3} e \pi \frac{1}{4} (3 - \frac{\lambda^2}{3}) \pi \frac{1}{2}}{2 \sqrt{3} \beta_2^\frac{1}{2} D} = \frac{\frac{\lambda}{3} e \pi \frac{1}{4} (3 - \frac{\lambda^2}{3})^2}{2 \sqrt{3} \beta_2^\frac{1}{2} D}.
\]

where

\[
D = \left[1 - \frac{(3 - \frac{\lambda^2}{3})^2 \pi \frac{1}{2}}{2 \sqrt{3} \beta_1^\frac{1}{2}}\right]\left[1 - \frac{(3 - \frac{\lambda^2}{3})^2 \pi \frac{1}{2}}{2 \sqrt{3} \beta_2^\frac{1}{2}}\right] - \frac{\lambda^2}{9}.
\]

\[
\frac{dq_2}{dd} = \frac{\frac{\lambda}{3} c - \frac{\lambda}{3} \frac{de_2}{dd}}{(3 - \frac{\lambda^2}{3})} = \frac{c}{(3 - \frac{\lambda^2}{3}) D} \left[\frac{(3 - \frac{\lambda^2}{3})^2 \pi \frac{1}{2}}{2 \sqrt{3} \beta_2^\frac{1}{2}}\right]\left[1 - \frac{(3 - \frac{\lambda^2}{3})^2 \pi \frac{1}{2}}{2 \sqrt{3} \beta_2^\frac{1}{2}}\right] - \frac{\lambda^2}{9}.
\]

The sufficient condition for \( \frac{dq_2}{dd} > 0 \) is that \( \frac{3}{2} < \lambda \). We should also note that this is a sufficient condition for \( \frac{dq_2}{dd} > 0 \) but not a necessary condition.

Proceeding in the same way for \( q_1 \), we get,

\[
\frac{dq_1}{dd} = \frac{\frac{\lambda}{3} c - \frac{\lambda}{3} \frac{de_2}{dd}}{(3 - \frac{\lambda^2}{3})} = \frac{c \lambda}{(3 - \frac{\lambda^2}{3}) D} \frac{(3 - \frac{\lambda^2}{3})^2 \pi \frac{1}{4}}{12 \beta_1^\frac{1}{2} \beta_2^\frac{1}{2}}.
\]

The sufficient condition for \( \frac{dq_1}{dd} < 0 \) is that \( \frac{3}{2} < \lambda \). We should also note that this is a sufficient condition for \( \frac{dq_1}{dd} > 0 \) but not a necessary condition.

So when \( \frac{3}{2} < \lambda \),

\[
\frac{dq_2}{dd} > 0, \\
\frac{dq_2}{dd} < 0, \\
\frac{dq_2}{dd} - \frac{dq_1}{dd} > 0.
\]

QED.
7.4 Appendix A4

The various data definitions are as follows:

Sales is Data 12 from COMPUTSTAT. Sales Growth is defined as Sales in year \( t \) minus Sales in year \( t-1 \) divided by Sales at year \( t-1 \). **Proxy for firm aggressiveness is defined as Sales growth of a firm minus the median sales growth of that industry.** This is called industry adjusted sales growth. So if a firm is more aggressive in terms of sales than its peers in the industry, this proxy variable should be positive. If the firm is lagging behind others in the same industry, then this variable should come as negative. Industry is defined as the NAICS code. NAICS code better describes industry compared to SIC code. Profitability is defined as the sum of data18, Income before extraordinary items, and data14, Depreciation and Ammortization, divided by total assets, data6. All these data are from Compustat database. Investment is defined as the ratio of data172 by data6, total assets. data 172 is net income (loss). Size is log of assets, \( \log(\text{data6}) \). Leverage is defined as the ratio of data9, long term debt to total assets data6.

We get executive compensation data from ExecuComp. Short Run Bonus is defined as Bonus divided by total current compensation, TDC1 of ExecuComp. Percentage of shares owned by executives is defined as shown divided by shrsout divided by 10. shrsout is the common shares outstanding. shown is the shares owned by the executive. Following Aggarwal and Samwick (1999), CEO compensation is composed of three components: flow compensation, the change in the value of stock holding and the change in the value of stock options. Flow compensation is easily calculated as TDC1, which is available from ExecuComp. TDC1 is composed of salary, bonus, total value of stock options, long term incentive payouts, other annual compensation and all other, as is defined in ExecuComp manual. The change in the value of stock holding is defined as the percentage of stocks held by the CEO at the beginning of the fiscal year multiplied by shareholder dollar return. Total return to shareholders are reported in ExecuComp in percentages. The dollar return is defined as the percentage total return multiplied by the market value of the firm at the beginning of the fiscal year. Once we have the dollar return to shareholder, we can calculate the change in the value of stock holding. The change in the value of stock options is a bit difficult to calculate. We calculate the value of old options as the sum of INMONEX and INMONUN. INMONEX is the value of the unexercised exercisable options. INMONUN is the value of unexercised unexercisable options. The new options are defined as BLK-VALU, which the value of new options granted in ExecuComp. Total option value is the sum of old options and new options. Change in the option value is the value of the option in year \( t \) minus the value of the option
in year $t-1$. The total value of CEO’s compensation package is defined as the sum of the flow compensation, the change in the value of stock holding and the change in the value of stock options. The variance of preceding five years stock returns is termed as variance and is used a proxy for stock’s risk. We calculate CEO tenure using BECAMECEO from ExecuComp, which gives us the date an individual has become the CEO. CEO tenure acts a proxy for her abilities when we run pay performance sensitivity regressions.


## 8 Tables

### Table 1: Descriptive Statistics of mean of sales growth

<table>
<thead>
<tr>
<th>Div Payment</th>
<th>LR Credit Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sales Growth</td>
<td>5.956</td>
</tr>
<tr>
<td>21.269</td>
<td>17.967</td>
</tr>
<tr>
<td>-17.18***</td>
<td>-5.29***</td>
</tr>
<tr>
<td>Sales Growth Industry Adjusted</td>
<td>-2.133</td>
</tr>
<tr>
<td>6.649</td>
<td>5.119</td>
</tr>
<tr>
<td>-10.82***</td>
<td>-3.78***</td>
</tr>
<tr>
<td>N</td>
<td>2659</td>
</tr>
</tbody>
</table>

Industry adjusted sales growth is the sales growth of the firm minus the median sales growth of the firms in the industry, where industry is defined by the three digit NAICS code. Every entry has three values. The first value is the value for the financially unconstrained firms and the second value is that of the financially constrained firm. The third value is the t statistic value to test if the mean of financially constrained firm is equal to that of financially unconstrained firm. The data definition is from Kaplan and Zingales 1997. Note that * correspond to significant at 10 percent, ** correspond to significant at 5 percent and *** correspond to significant at 1 percent.
<table>
<thead>
<tr>
<th></th>
<th>Div Payment</th>
<th>KZ Index</th>
<th>LR Credit rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lag Sales Growth Industry Adjusted</td>
<td>-0.049***</td>
<td>-0.078***</td>
<td>-0.055***</td>
</tr>
<tr>
<td></td>
<td>0.018</td>
<td>0.022</td>
<td>0.024</td>
</tr>
<tr>
<td></td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
</tr>
<tr>
<td></td>
<td>0.001</td>
<td>0.001</td>
<td>0.001</td>
</tr>
<tr>
<td>Profitability</td>
<td>-0.309*</td>
<td>-0.200</td>
<td>-0.097</td>
</tr>
<tr>
<td></td>
<td>0.182</td>
<td>0.235</td>
<td>0.256</td>
</tr>
<tr>
<td>Lag Profitability</td>
<td>-0.919***</td>
<td>-0.974***</td>
<td>-0.1.046***</td>
</tr>
<tr>
<td></td>
<td>0.176</td>
<td>0.221</td>
<td>0.249</td>
</tr>
<tr>
<td>Investment</td>
<td>0.909***</td>
<td>0.839***</td>
<td>0.857****</td>
</tr>
<tr>
<td></td>
<td>0.156</td>
<td>0.201</td>
<td>0.224</td>
</tr>
<tr>
<td>Lag Investment</td>
<td>0.487***</td>
<td>0.540***</td>
<td>0.561***</td>
</tr>
<tr>
<td></td>
<td>0.153</td>
<td>0.192</td>
<td>0.223</td>
</tr>
<tr>
<td>Leverage</td>
<td>0.114***</td>
<td>0.079*</td>
<td>0.081</td>
</tr>
<tr>
<td></td>
<td>0.036</td>
<td>0.047</td>
<td>0.055</td>
</tr>
<tr>
<td>Lag Leverage</td>
<td>-0.035</td>
<td>-0.021</td>
<td>-0.051</td>
</tr>
<tr>
<td></td>
<td>0.036</td>
<td>0.044</td>
<td>0.049</td>
</tr>
<tr>
<td>Cash Capital</td>
<td>0.000</td>
<td>0.006*</td>
<td>0.000</td>
</tr>
<tr>
<td></td>
<td>0.001</td>
<td>0.003</td>
<td>0.001</td>
</tr>
<tr>
<td>Variance</td>
<td>-4.655</td>
<td>-3.841</td>
<td>-5.848</td>
</tr>
<tr>
<td></td>
<td>10.222</td>
<td>10.539</td>
<td>58.129</td>
</tr>
<tr>
<td>FC dummy</td>
<td>4.733*</td>
<td>7.000**</td>
<td>2.653*</td>
</tr>
<tr>
<td></td>
<td>3.793</td>
<td>3.218</td>
<td>1.563</td>
</tr>
<tr>
<td>N</td>
<td>3180</td>
<td>2013</td>
<td>1868</td>
</tr>
<tr>
<td>R Square</td>
<td>0.385</td>
<td>0.472</td>
<td>0.457</td>
</tr>
</tbody>
</table>

Dependent variable is industry adjusted sales growth, which is \((sales_t - sales_{t-1})/sales_{t-1}\). The top value is the coefficient of the regression coefficient and the bottom one is the corresponding standard error. The data definition is from Kaplan and Zingales 1997. Note that * correspond to significant at 10 percent, ** correspond to significant at 5 percent and *** correspond to significant at 1 percent.
Table 3: Regression of Sales Growth on Managerial Compensation. 2 Stage Least Square Approach.

<table>
<thead>
<tr>
<th>Lag Sales Growth Industry Adjusted</th>
<th>-0.038***</th>
<th>-0.047***</th>
<th>-0.063***</th>
<th>-0.039***</th>
<th>-0.058***</th>
<th>-0.054***</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0.018</td>
<td>0.017</td>
<td>0.019</td>
<td>0.018</td>
<td>0.018</td>
<td>0.018</td>
</tr>
<tr>
<td>Size</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
</tr>
<tr>
<td>Profitability</td>
<td>-0.312*</td>
<td>-0.327*</td>
<td>-0.263</td>
<td>-0.304*</td>
<td>-0.333*</td>
<td>-0.236</td>
</tr>
<tr>
<td></td>
<td>0.180</td>
<td>0.179</td>
<td>0.189</td>
<td>0.180</td>
<td>0.183</td>
<td>0.187</td>
</tr>
<tr>
<td>Lag profitability</td>
<td>-0.907***</td>
<td>-0.959***</td>
<td>-0.933***</td>
<td>-0.898***</td>
<td>-0.920***</td>
<td>-0.884***</td>
</tr>
<tr>
<td></td>
<td>0.175</td>
<td>0.174</td>
<td>0.183</td>
<td>0.175</td>
<td>0.177</td>
<td>0.180</td>
</tr>
<tr>
<td>Investment</td>
<td>0.849***</td>
<td>0.799***</td>
<td>0.835***</td>
<td>0.887***</td>
<td>0.884***</td>
<td>0.855***</td>
</tr>
<tr>
<td></td>
<td>0.155</td>
<td>0.155</td>
<td>0.161</td>
<td>0.156</td>
<td>0.157</td>
<td>0.160</td>
</tr>
<tr>
<td>Lag Investment</td>
<td>0.522**</td>
<td>0.587***</td>
<td>0.614***</td>
<td>0.484***</td>
<td>0.551***</td>
<td>0.517***</td>
</tr>
<tr>
<td></td>
<td>0.152</td>
<td>0.152</td>
<td>0.161</td>
<td>0.152</td>
<td>0.156</td>
<td>0.157</td>
</tr>
<tr>
<td>Leverage</td>
<td>0.121***</td>
<td>0.109***</td>
<td>0.128***</td>
<td>0.125***</td>
<td>0.118***</td>
<td>0.127***</td>
</tr>
<tr>
<td></td>
<td>0.036</td>
<td>0.036</td>
<td>0.038</td>
<td>0.036</td>
<td>0.037</td>
<td>0.038</td>
</tr>
<tr>
<td>Lag Leverage</td>
<td>-0.059</td>
<td>-0.040</td>
<td>0.045</td>
<td>-0.057</td>
<td>-0.036</td>
<td>-0.054</td>
</tr>
<tr>
<td></td>
<td>0.036</td>
<td>0.036</td>
<td>0.038</td>
<td>0.036</td>
<td>0.036</td>
<td>0.037</td>
</tr>
<tr>
<td>Cash Capital</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>-0.001</td>
</tr>
<tr>
<td></td>
<td>0.001</td>
<td>0.001</td>
<td>0.001</td>
<td>0.001</td>
<td>0.001</td>
<td>0.001</td>
</tr>
<tr>
<td>Variance</td>
<td>-1.671</td>
<td>-1.428</td>
<td>-5.135</td>
<td>-4.043</td>
<td>-3.955</td>
<td>-5.135</td>
</tr>
<tr>
<td></td>
<td>10.136</td>
<td>10.125</td>
<td>10.183</td>
<td>10.149</td>
<td>10.107</td>
<td>10.262</td>
</tr>
<tr>
<td>SR Bonus</td>
<td>0.103***</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.026</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tot comp</td>
<td>0.018</td>
<td>0.017</td>
<td>0.019</td>
<td>0.018</td>
<td>0.018</td>
<td>0.018</td>
</tr>
<tr>
<td>Flow comp</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>-0.001</td>
</tr>
<tr>
<td>Ch stock holding</td>
<td>0.058**</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.028</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ch stock option</td>
<td>0.044</td>
<td>0.044</td>
<td>0.044</td>
<td>0.044</td>
<td>0.044</td>
<td>0.044</td>
</tr>
<tr>
<td>N</td>
<td>3165</td>
<td>3180</td>
<td>2817</td>
<td>3165</td>
<td>3007</td>
<td>2983</td>
</tr>
<tr>
<td>R Square</td>
<td>0.387</td>
<td>0.398</td>
<td>0.408</td>
<td>0.399</td>
<td>0.378</td>
<td>0.398</td>
</tr>
</tbody>
</table>

Dependent variable is industry adjusted sales growth, which is \((sales_t - sales_{t-1})/sales_{t-1}\). We include firm fixed effect and time effect. The top value is the coefficient of the regression coefficient and the bottom one is the corresponding standard error. The data definition is from Kaplan and Zingales 1997. Note that * correspond to significant at 10 percent, ** correspond to significant at 5 percent and *** correspond to significant at 1 percent.
Table 4: Regression of Sales Growth on Managerial Compensation. Instrumental Variable approach.

<table>
<thead>
<tr>
<th></th>
<th>L Sales Growth</th>
<th>Indus</th>
<th>Size</th>
<th>Profitability</th>
<th>Lag profitability</th>
<th>Investment</th>
<th>Lag investment</th>
<th>Leverage</th>
<th>Lag leverage</th>
<th>Variance</th>
<th>SR Bonus</th>
<th>Tot comp</th>
<th>Flow comp</th>
<th>Ch of stock holding</th>
<th>Ch of stock option</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>-0.036**</td>
<td>-0.032*</td>
<td>-0.114***</td>
<td>-0.035**</td>
<td>-0.087***</td>
<td>-0.103***</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.017</td>
<td>0.017</td>
<td>0.019</td>
<td>0.017</td>
<td>0.018</td>
<td>0.019</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>-0.0004</td>
<td>-0.001</td>
<td>0.002</td>
<td>0.001</td>
<td>0.002</td>
<td>0.003**</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.001</td>
<td>0.001</td>
<td>0.001</td>
<td>0.001</td>
<td>0.001</td>
<td>0.001</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>-0.190</td>
<td>-0.198</td>
<td>-0.131</td>
<td>-0.077</td>
<td>-0.171</td>
<td>-0.082</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.168</td>
<td>0.167</td>
<td>0.179</td>
<td>0.165</td>
<td>0.170</td>
<td>0.180</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>-0.605***</td>
<td>-0.627***</td>
<td>-0.656***</td>
<td>-0.547***</td>
<td>-0.711***</td>
<td>-0.373**</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.159</td>
<td>0.159</td>
<td>0.178</td>
<td>0.157</td>
<td>0.172</td>
<td>0.170</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Investment</td>
<td>0.688***</td>
<td>0.568***</td>
<td>0.569***</td>
<td>0.607***</td>
<td>0.589***</td>
<td>0.573***</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.139</td>
<td>0.139</td>
<td>0.145</td>
<td>0.136</td>
<td>0.139</td>
<td>0.148</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lag investment</td>
<td>0.209</td>
<td>0.306**</td>
<td>0.177</td>
<td>0.538****</td>
<td>0.221</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Leverage</td>
<td>0.133</td>
<td>0.134</td>
<td>0.131</td>
<td>0.152</td>
<td>0.142</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.090***</td>
<td>0.102***</td>
<td>0.104***</td>
<td>0.108***</td>
<td>0.096**</td>
<td>0.110***</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.034</td>
<td>0.034</td>
<td>0.037</td>
<td>0.034</td>
<td>0.036</td>
<td>0.038</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lag leverage</td>
<td>-0.052</td>
<td>-0.079**</td>
<td>-0.029</td>
<td>-0.058*</td>
<td>-0.032</td>
<td>-0.052</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Variance</td>
<td>-1.716</td>
<td>-1.823</td>
<td>-4.543</td>
<td>-5.232</td>
<td>-3.498</td>
<td>-4.377</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SR Bonus</td>
<td>0.295***</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tot comp</td>
<td>0.060**</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Flow comp</td>
<td>0.004</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ch of stock holding</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.078**</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ch of stock option</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.035</td>
<td></td>
<td>0.145**</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Dependent variable is industry adjusted sales growth, which is \((sales_t - sales_{t-1})/sales_{t-1}\). We include firm fixed effect and time effect. Instrument of a variable is the lag of the variable. Every entry has two values. The top value is the coefficient of the regression coefficient and the bottom one is the corresponding standard error. The data definition is from Kaplan and Zingales 1997. Note that * correspond to significant at 10 percent, ** correspond to significant at 5 percent and *** correspond to significant at 1 percent.
### Table 5: Regression of Managerial Compensation on Financial Constraint.

Financial Constraint is based on Dividend Payment

<table>
<thead>
<tr>
<th></th>
<th>Tot Comp</th>
<th>Fl Comp</th>
<th>Ch Stock Hold</th>
<th>Ch Stock Opt</th>
<th>SR Bonus</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Ret</strong></td>
<td>0.293***</td>
<td>0.005</td>
<td>0.046***</td>
<td>0.237***</td>
<td>0.014*</td>
</tr>
<tr>
<td></td>
<td>0.021</td>
<td>0.037</td>
<td>0.008</td>
<td>0.014</td>
<td>0.008</td>
</tr>
<tr>
<td>Ret*tenure</td>
<td>-0.0001</td>
<td>-0.0002</td>
<td>-0.001***</td>
<td>0.0011***</td>
<td>-0.0001</td>
</tr>
<tr>
<td></td>
<td>0.0002</td>
<td>0.0004</td>
<td>0.0000</td>
<td>0.0001</td>
<td>0.0001</td>
</tr>
<tr>
<td>Ret*var</td>
<td>2.456***</td>
<td>-0.043</td>
<td>1.0176***</td>
<td>1.408***</td>
<td>0.050</td>
</tr>
<tr>
<td></td>
<td>0.168</td>
<td>0.209</td>
<td>0.065</td>
<td>0.117</td>
<td>0.065</td>
</tr>
<tr>
<td>Ret*size</td>
<td>-0.00002***</td>
<td>-0.000</td>
<td>-0.0000***</td>
<td>-0.0000***</td>
<td>-0.0000*</td>
</tr>
<tr>
<td></td>
<td>0.000000</td>
<td>0.000</td>
<td>0.0000</td>
<td>0.0000</td>
<td>0.0000</td>
</tr>
<tr>
<td>FC Dummy</td>
<td>16.442*</td>
<td>-0.994</td>
<td>-0.176</td>
<td>18.945***</td>
<td>7.37**</td>
</tr>
<tr>
<td><strong>N</strong></td>
<td>1595</td>
<td>1775</td>
<td>1707</td>
<td>1665</td>
<td>1775</td>
</tr>
<tr>
<td><strong>R Square</strong></td>
<td>0.735</td>
<td>0.158</td>
<td>0.3878</td>
<td>0.721</td>
<td>0.424</td>
</tr>
</tbody>
</table>

Sales Growth is \( (sales_t - sales_{t-1}) / sales_{t-1} \). Sales growth in is industry adjusted sales growth. Ret is dollar return to share holder which is defined as the total market value of equity at the beginning of the year multiplied by the stock return including distributions over the year. Variance is the preceding 60 months variance of the monthly return of the stock. Size is the log of assets. Tenure of the manager is calculated from Execucomp. Total compensation is divided into three components, flow compensation, change in value of stock holding (ch of stock holding) and change in value of stock option (ch of stock option). Short run bonus is defined as the ratio of bonus to flow compensation. Every entry has two values. The top value is the coefficient of the regression coefficient and the bottom one is the corresponding standard error. Note that * correspond to significant at 10 percent, ** correspond to significant at 5 percent and *** correspond to significant at 1 percent.
Table 6: Regression of Managerial Compensation on Financial Constraint. Financial Constraint is based on Long Run Credit Rating of the firm.

<table>
<thead>
<tr>
<th>Tot Comp</th>
<th>Fl Comp</th>
<th>Ch Stock Hold</th>
<th>Ch Stock Opt</th>
<th>SR Bonus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ret</td>
<td>0.366***</td>
<td>0.007</td>
<td>0.059***</td>
<td>0.296***</td>
</tr>
<tr>
<td></td>
<td>0.027</td>
<td>0.036</td>
<td>0.008</td>
<td>0.018</td>
</tr>
<tr>
<td>Ret*tenure</td>
<td>-0.0003</td>
<td>-0.0001</td>
<td>-0.001***</td>
<td>0.0006***</td>
</tr>
<tr>
<td></td>
<td>0.0003</td>
<td>0.0004</td>
<td>0.0000</td>
<td>0.0002</td>
</tr>
<tr>
<td>Ret*var</td>
<td>2.229***</td>
<td>0.008</td>
<td>0.938***</td>
<td>1.249***</td>
</tr>
<tr>
<td></td>
<td>0.233</td>
<td>0.311</td>
<td>0.0681</td>
<td>0.153</td>
</tr>
<tr>
<td>Ret*size</td>
<td>-0.00003***</td>
<td>-0.000</td>
<td>-0.0000***</td>
<td>-0.0000***</td>
</tr>
<tr>
<td></td>
<td>0.000000</td>
<td>0.000</td>
<td>0.0000</td>
<td>0.0000</td>
</tr>
<tr>
<td>FC</td>
<td>18.134***</td>
<td>4.76</td>
<td>0.955</td>
<td>11.820***</td>
</tr>
<tr>
<td>Dummy</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>7.027</td>
<td>8.57</td>
<td>1.9717</td>
<td>4.426</td>
</tr>
<tr>
<td></td>
<td>1.533</td>
<td>1475</td>
<td>1437</td>
<td>1.533</td>
</tr>
<tr>
<td>R Square</td>
<td>0.564</td>
<td>0.123</td>
<td>0.360</td>
<td>0.604</td>
</tr>
</tbody>
</table>

Sales Growth is \((sales_t - sales_{t-1})/sales_{t-1}\). Sales growth in is industry adjusted sales growth. ret is dollar return to share holder which is defined as the total market value of equity at the beginning of the year multiplied by the stock return including distributions over the year. Variance is the preceding 60 months variance of the monthly return of the stock. Size is the log of assets. Tenure of the manager is calculated from Execucomp. Total compensation is divided into three components, flow compensation, change in value of stock holding (ch of stock holding) and change in value of stock option (ch of stock option). Short run bonus is defined as the ratio of bonus to flow compensation. Every entry has two values. The top value is the coefficient of the regression coefficient and the bottom one is the corresponding standard error. Note that * correspond to significant at 10 percent, ** correspond to significant at 5 percent and *** correspond to significant at 1 percent.
References


