DEPARTMENT OF ECONOMICS

WORKING PAPER SERIES

2012-05

McMASTER UNIVERSITY

Department of Economics
Kenneth Taylor Hall 426
1280 Main Street West
Hamilton, Ontario, Canada
L8S 4M4

http://www.mcmaster.ca/economics/

CEO Pay with Perks*

Andrew Carrothers, Seungjin Han, Jiaping Qiu

Abstract

This paper develops an equilibrium matching model for a competitive CEO market in which CEOs' wage and perks are both endogenously determined by bargaining between firms and CEOs. In stable matching equilibrium, firm size, wage, perks and talent are all positively related. Perks are more sensitive than wage to changes in firm size if there are economies of scale in the cost of providing perks. Productivity-related perks provide common value by increasing both the CEO's productivity and utility while non productivity-related perks provide private value by increasing the CEO's utility only. The more perks enhance the CEO's productivity, the faster perks increase in firm size. We test the predictions of the model using information on CEO wage and perks for S&P 500 companies and find consistent empirical evidence.

Keywords: Matching, perks, executive compensation, private benefits
JEL Classifications: C78, J33, G30

* Carrothers and Qiu are from DeGoote School of Business, McMaster University, Hamilton, Ontario, L8S 4M4 Canada. Han is from Department of Economics, McMaster University, Hamilton, Ontario, L8S 4M4 Canada. Han and Qiu acknowledge support from the Social Sciences and Humanities Research Council of Canada.

CEO Pay with Perk

Abstract

This paper develops an equilibrium matching model for a competitive CEO market in which CEOs' wage and perks are both endogenously determined by bargaining between firms and CEOs. In stable matching equilibrium, firm size, wage, perks and talent are all positively related. Perks are more sensitive than wage to changes in firm size if there are economies of scale in the cost of providing perks. Productivity-related perks provide common value by increasing both the CEO's productivity and utility while non productivity-related perks provide private value by increasing the CEO's utility only. The more perks enhance the CEO's productivity, the faster perks increase in firm size. We test the predictions of the model using information on CEO wage and perks for S&P 500 companies and find consistent empirical evidence.

Keywords: Matching, perks, executive compensation, private benefits
JEL Classifications: C78, J33, G30

1. Introduction

Compensation for corporate chief executive officers (CEOs) has risen dramatically beyond the rising wage level of average workers over the past decades. Public controversy about such pay disparity has resulted in increased scrutiny of all aspects of CEO compensation, both monetary and nonmonetary. CEO monetary compensation, or simply wage, normally includes cash salary, bonus, equity and options. Nonmonetary compensation, often referred to as perquisites or perks, is benefits offered to CEOs but not to employees at large. CEO perks have various forms such as company car, club memberships, corporate aircraft, legal fees, financial services, security, and relocation benefits. The exclusivity and luxury of CEO perks make them even more controversial than monetary compensation and tend to be perceived by the public as negative.[1] Despite being controversial, executive perks remain widespread. For example, according to 2010/2011 executive compensation survey results from compensation consultant Compdata Surveys, in the midst of the recent financial crisis, 77.6 percent of organizations offer perks to their CEOs in 2010.[2]

The extant literature offers two arguments on the prevalence of CEO perks. One holds that perks are the result of weak corporate governance that allows CEOs to divert corporate resources for personal gain (e.g. Jensen and Meckling, 1976, Bebchuk and Fried, 2004). The optimal contracting argument, however, states that perks could be a cost effective way to enhance executive productivity and should be part of optimal executive compensation packages (e.g. Rosen, 1986, Fama, 1980, Henderson and Spindler, 2005). However, despite the guidance from these two schools of thought on the existence of CEO perks, not much is known about how

[1] For example, in *The New York Times* "Scrutiny of bankers' perks will grow, too" on February 5, 2009, E. Dash calls "for greater corporate review of excessive or luxury items for executives" and gives examples of large dollar perks provided by firms that accepted government bail-out money during the financial crisis.

[2] The Wall Street Journal/Hay Group CEO Compensation Study found that 63% of companies offered personal use of the corporate aircraft in 2010.

executive wage and perks are jointly determined in a competitive CEO market where CEOs differ in their talent and perks may affect a CEO's utility and productivity. The empirical evidence on CEO perks is limited and mixed. Yermack (2004) finds that the disclosure of executives' personal use of corporate jets leads to lower equity returns. Grinstein, Weinbaum, and Yehuda (2010) confirm the punitive market reaction to first-time disclosure of perks. In contrast, Rajan and Wulf (2006) find that firms are more likely to offer perks in situations in which perks enhance CEO productivity. One of the difficulties in investigating CEO perks is data availability. Executive perks information is not offered in standard research data available to researchers. Existing studies rely on the information of one particular type of perk or small random samples or survey data.

This paper makes two main contributions. First, it provides an equilibrium theory on how CEO wage and perks are endogenously determined in a competitive CEO market with heterogeneous firms and CEOs. Second, it investigates the determinants of executive perks in S&P (Standard and Poors) 500 firms using new manually collected panel data. A recent important study by Gabaix and Landier (2008) considers CEOs with different levels of managerial talent matching with firms in a competitive matching model. CEOs are compensated by wage only (i.e., without perks) in their model. We consider the joint determinants of CEO wage and perks in a sufficiently general matching environment in which (i) there is heterogeneity in both CEO talent and firm size and (ii) firms and CEOs competitively bargain multidimensional compensation packages (i.e., wage and perks), fully aware of their outside options in the competitive market. Moreover, we address three key features of perks. First, the cost of providing perks could differ from that of providing wage. On one hand, perks are more cost effective for firms if there are economies of scale in providing perks. For instance, a car

service or financial consultant can be shared by multiple executives. On the other hand, perks could be costly if they magnify agency costs inside the firm or create negative perception among investors. For example, a golf club membership could divert a CEO from working and the negative reaction of investors to the disclosure of personal use of company aircraft, as documented in Yermack (2004), suggests that negative perception of perks by investors could result in significantly higher costs of equity. Second, perks and other consumption goods (purchased with wage) could be complements in a CEO's utility function. As argued in Hirsch (1976) and Rajan and Wulf (2006), perks could be a form of status conveying the relative position of an executive in a firm. Being a positional good, higher perk consumption could increase the marginal utility derived from consuming more other goods. In other words, perks and other consumption goods are complementary (inseparable) in a CEO's utility function. Third, perks could be productivity-related or non productivity-related depending on their ability to enhance CEO productivity. Productivity-related perks provide common value to both the firm and the CEO because they increase both the CEO's utility and productivity. Non productivity-related perks provide only private benefit to the CEO because they increase utility without increasing the CEO's productivity.

Our theory shows how firms compensate CEO talents with both wage and perks in a competitive CEO market, considering the cost of providing perks, the CEO's preferences over wage and perks, and the productivity-related nature of perks. We show that, under mild conditions, stable matching is assortative between firm size and CEO talent in a continuum of firms and CEOs. This assortative matching generates positive relationships among firm size, talent, wage and perks in stable matching equilibrium. Because the stable matching condition is characterized by first-order differential equations for wage and perks in our continuous model,

we can solve these equations to derive closed-form solutions for the equilibrium levels of wage and perks that depend on the CEO's preferences, the cost of providing perks and the production function of the firm. Our results lead to three main predictions regarding wage, perks, and firm size. First, both perks and wage are increasing in firm size. Second, if there are economies of scale in the cost of providing perks, perks are more sensitive than wage to changes in firm size; i.e., firms increase perks faster than wage in their compensation packages as firm size increases. Third, the sensitivity of perks to changes in firm size depends on how much they enhance the CEO's productivity: The more perks enhance the CEO's productivity, the faster they increase in firm size.

To evaluate the predictions of our model, we assemble a new panel database on CEO perks in S&P 500 companies. On January 27, 2006 the SEC (Security and Exchange Commission) released proposed amendments to the rules governing disclosure; they issued the revised and final version of the release on August 29, 2006. The SEC required adherence to the new rules for all filings after December 15, 2006. Under the old 1992 rules, if the aggregate value of perks given to an executive did not exceed $50,000, firms did not have to disclose perks at all. The old rules required firms to itemize the costs of any individual perks if they exceeded 25% of the overall total perk value, given the reporting threshold was reached. The new 2006 rules lowered the $50,000 threshold to $10,000 and required that every individual perk item be identified. In addition to the requirement to identify perks, any perks valued at greater than $25,000 or 10% of the aggregate perk value must be separately quantified (SEC Release No. 33-8732A). The timing of this regulation change ensures that all proxy statements for fiscal years 2006 and beyond provide meaningful and consistent data that enables the analysis of relationships between wage, perks, and firm size. We manually collected information on CEO perks from public disclosures

contained in the proxy statements that S&P 500 companies filed with the SEC between January 1, 2007 and December 31, 2009. To the best of our knowledge, our data provides the most comprehensive CEO perks information to date at S&P 500 companies.

We test the model predictions regarding the sensitivity of perk compensation to changes in firm size, the relative sensitivity of perks and wage to changes in firm size, and the relative sensitivity of more productivity-related and less productivity-related perks to changes in firm size. We demonstrate that both perks and wage are increasing in firm size, while perks are more sensitive than wage to changes in firm size. Based on closed form solution equations, the estimated coefficients for firm size from the wage and perks equations further permit us to recover the exponent parameter in the cost function of providing perks. Our results indicate that this cost function is concave, suggesting, on average, there are economies of scale for our sample firms in providing perks to CEOs. We then classify perks as more or less productivity-related based on their ability to save time for the CEO. We find that more productivity-related perks are approximately thirty percent more sensitive than less productivity-related perks to changes in firm size. The results are consistent with the prediction of the theory that, if perks provide common value and increase the CEO's productivity, firms are willing to offer more perks in their compensation packages. Overall, the empirical evidence on the determinants of CEO wage and perks provide strong support to the predictions of our theory.

The rest of the paper proceeds as follows. Section 2 presents the theoretical model. Section 3 provides empirical evidence. Section 4 summarizes and concludes.

2. Theory

There is a continuum of firms differing in their sizes and a continuum of CEOs differing in their talents. Let s denote the size of a firm. Firm s can negotiate with its potential CEO on perks and

wage. Let p denote the level of perks and w the wage. CEOs differ in their talent. Let t denote the talent level of a CEO. The total measure of CEOs is normalized to one. Let G characterize the measure of CEOs so that $G(t)$ denotes the measure of CEOs whose talents are no greater than t. The market for CEOs is competitive so that there are more firms than CEOs in the market. Let S be the total measure of firms and it is therefore assumed to be no less than one $(S \geq 1)$. The measure of the firms is characterized by F. Let $F(s)$ be the measure of firms whose sizes are no greater than s.

The utility function $u(c, p)$ represents the CEO's preferences on the consumption good c that she purchases with wage and the perks p that she gets. Let the CEO's exogenous non-earned income be normalized to zero. Then, if the CEO's wage is w, she purchases w units of the consumption good ($c = w$). Given this formulation, we denote the utility function by $u(w, p)$ from now on. Assume that the CEO's preferences are monotone, so the marginal utilities $u_w(w, p)$ and $u_p(w, p)$ of wage and the perks are both positive at all $(w, p) \in \mathbb{R}^2_+$.

Let $f(p,t,s)$ be the firm's production function. We normalize the price of output to one. When firm s hires a CEO with talent t at wage w and perks p, its profit is

$$\pi(w, p, t, s) = f(p,t,s) - w - c(p),$$

where $c(p)$ is the cost that the firm incurs in providing perks p. We assume that $f_t(p,t,s) > 0$ and $f_s(p,t,s) > 0$ so that the firm's output is increasing in the CEO's talent and its size. We assume that $f_p(p,t,s) \geq 0$. If $f_p(p,t,s) > 0$ at each (p,t,s), perks have the common value because they increase both the CEO's utility and the firm's output. If $f_p(p,t,s) = 0$ at each (p,t,s), perks have only the private value because they increase only the CEO's utility.

2.1 Stable Matching Equilibrium

We construct a competitive equilibrium with the notion of stable matching where there are no alternative pairs of firms and CEOs who, by matching each other with any compensation package (w, p), can make themselves strictly better off. The stable matching equilibrium defined below endogenizes the firm's supply decision of perks together with the wage offered to a CEO. A stable matching equilibrium in the competitive CEO market is characterized by (i) the market wage function $w(s)$, (ii) the market perks function $p(s)$ and (iii) the market matching function $m(s)$. The market wage and perks functions $\{w(s), p(s)\}$ characterize the wage and perks that firm s gives its CEO in equilibrium. The market matching function $m(s)$ characterizes the talent of the CEO who works for a firm as a function of the firm's size. We use the notation $\varnothing$ so that $m(s) = \varnothing$ means that firm s does not hire a CEO in the market.

First consider the problem for CEO t, that is, the CEO with talent t. If she wants to work for firm s, firm s will agree to any compensation package (w, p) as long as it gives the firm profit at least as high as the one that the firm would have by hiring the CEO with talent $m(s)$ with the compensation package $\{w(s), p(s)\}$. Hence if CEO t wants to work for firm s, she will find a compensation package (w, p) that maximizes her utility subject to $f(p,t,s) - w - c(p) \geq f(p(s), m(s), s) - w(s) - c(p(s))$. Because the CEO will also choose which firm to work for, CEO t therefore solves the following problem:

$$\max_{(w,p,s)} u(w, p)$$

$$\text{subject to } f(p,t,s) - w - c(p) \geq f(p(s), m(s), s) - w(s) - c(p(s)).$$

Let $\{\tilde{w}(t), \tilde{p}(t), \tilde{s}(t)\}$ be a solution to the problem of the CEO with talent t.

Consider firm s's problem. If it wants to hire CEO t, it must offer a compensation package to her that generates a utility level at least as high as $u(\tilde{w}(t), \tilde{p}(t))$. Since the firm needs to choose which CEO to hire for profit maximization, firm s therefore solves the following problem:

$$\max_{(w,p,t)} f(p,t,s) - w - c(p)$$

$$\text{subject to } u(w, p) \geq u(\tilde{w}(t), \tilde{p}(t)).$$

Let $\{w(s), p(s), t(s)\}$ be a solution to the problem of firm s.

CEO t works for firm s and she is compensated with (w, p) when (w, p, s) solves CEO t's problem and (w, p, t) solves firm s's problem. In stable matching equilibrium, the compensation package offered by firm s is equal to what market wage and perks functions specify; $(w, p) = (w(s), p(s))$. Furthermore, the talent of the CEO that firm s hires is exactly the same as what market matching function specifies; $t = m(s)$. Therefore, the market participants' expectations on $\{w(s), p(s), t(s)\}$ are realized in stable matching equilibrium.

Definition 1 *A tuple* $\{w(\cdot), p(\cdot), m(\cdot)\}$ *is a stable matching equilibrium in which, for all* t, *CEO* t *works for firm* s *and the compensation package is* $(w(s), p(s))$ *if (i)* $(w(s), p(s), s)$ *is a solution to CEO t's problem; (ii)* $(w(s), p(s), t)$ *is a solution to firm s's problem; and (iii)* $t = m(s)$.

The tuple $\{w(\cdot), p(\cdot), m(\cdot)\}$ that satisfies conditions (i)-(iii) in Definition 1 leads to stable job matching because it induces no pairs of firms and CEOs who, by matching each other with any compensation package (w, p), can make themselves strictly better off.

Let $\underline{s}$ be the smallest size of the firm from among firms that hire CEOs in equilibrium. Because the production function is increasing in firm size, any firm that hires a CEO in equilibrium has a larger firm size than any firm that does not hire a CEO. This implies that $\underline{s}$ is

determined by $S - F(\underline{s}) = 1$. Then firm $\underline{s}$ is indifferent between hiring a CEO in the market or staying out of the market because its profit in equilibrium is zero,

$$f(p(\underline{s}), m(\underline{s}), \underline{s}) - w(\underline{s}) - c(p(\underline{s})) = 0. \quad (1)$$

Equation (1) can be shown easily. Because there are potentially more firms than CEOs in the market, the competition among firms drives up the equilibrium wage for the CEO hired by firm $\underline{s}$ to $w(\underline{s}) = f(p(\underline{s}), m(\underline{s}), \underline{s}) - c(p(\underline{s}))$. If not, firm $\underline{s}$ enjoys positive profit in equilibrium. In this case, the CEO with $m(\underline{s})$ and a firm that does not hire a CEO with a very similar firm size to $\underline{s}$ can agree on a compensation package that makes both better off. The fact that there are potentially more firms than CEOs determines the equilibrium profit for firm $\underline{s}$.

If the i^{th} best firm hires the i^{th} best CEO in stable matching equilibrium, matching is called (positively) assortative. When matching is assortative, the market matching function is uniquely determined by $S - F(s) = 1 - G(m(s))$ for all $s \geq \underline{s}$. Proposition 1 below characterizes the stable matching equilibrium.

Proposition 1. Suppose that the firm's profit function and the CEO's utility function satisfy conditions 1 and 2 stated in the next subsection 2.2, the stable matching equilibrium is assortative and it is characterized by the tuple of market functions $\{w(\cdot), p(\cdot), m(\cdot)\}$ that satisfies

(a) for all $s \geq \underline{s}$, $S - F(s) = 1 - G(m(s))$ and

(b) for all $s \geq \underline{s}$,

$$w'(s) + \frac{u_p(w(s), p(s))}{u_w(w(s), p(s))} p'(s) = f_t(p(s), t(s), s) m'(s) \quad (2)$$

$$\frac{u_p(w(s), p(s))}{u_w(w(s), p(s))} + f_p(p(s), t(s), s) = c'(p(s)) \quad (3)$$

with the initial condition $(w(\underline{s}), p(\underline{s}))$, which is a solution to the system of the following equations,

$$w'(\underline{s}) + \frac{u_p(w(\underline{s}), p(\underline{s}))}{u_w(w(\underline{s}), p(\underline{s}))} p'(\underline{s}) = f_t(p(\underline{s}), t(\underline{s}), \underline{s}) m'(\underline{s})$$

$$f(p(\underline{s}), t(\underline{s}), \underline{s}) - w(\underline{s}) - c(p(\underline{s})) = 0.$$

Part (a) characterizes the market matching function for assortative matching. In the next subsection, we present conditions 1 and 2 under which assortative matching is a unique stable matching pattern. Equations (2) and (3) of part (b) are the first-order conditions for the problems for both CEOs and firms that are matched. Given the assortative matching function satisfying part (a), these equations are in fact the first-order differential equations for the market perks function and the market wage function with the initial condition. We can solve these differential equations for the market perks function and the market wage function, given the assortative matching function.

Equation (2) shows that in equilibrium, the marginal change in the total value of wage and perks for a CEO is equal to the marginal change of output associated with the change in the talent of the CEO who matches with a larger firm. The right hand side of Equation (2) shows that, as the firm size *s* increases at the margin, it is accompanied by the change in the CEO's talent $m'(s)$, which changes the total output by $f_t(p(s), t(s), s) m'(s)$. Therefore, the right hand side of Equation (2) is the marginal change of output due to the change in the talent of the CEO who matches with a larger firm. In a compeitive CEO market, this change in the total output is fully passed to the CEO through changes in wage and perks, which are captured by the left hand side of Equation (2) where the first term is the marginal change of wage while the second term is

the marginal change in the CEO's utility due to the change in perks normalized by the marginal utility of wage, i.e., the dollar value of the marginal utility of perks.

Equation (3) shows that in equilibrium, the marginal benefit of providing perks equals its marginal cost for a given firm with size *s*. This condition, jointly with equation (2), determines wage and perks in the compensation package for the CEO $m(s)$. The right hand side of equation (3) is the marginal cost of providing perks. The left hand side of equation (3) is the marginal benefit of providing perks which comes from two sources: the increases of the CEO's utility normalized by the marginal utility of wage (i.e., the dollar value of the increase of the utility) and the increase of output.

2.2 Assortative Matching Pattern

In this section we provide sufficient conditions for assortative matching to be the unique stable matching pattern. Readers who are less interested in technical details can skip this section and move directly to subsection 2.3 on closed-form solutions for the determinants of wage and perks in stable matching eqilibrium.

In assortative matching, the i^{th} best CEO works for the i^{th} largest firm. In our model of continuous firms and CEOs, this relationship between CEO talent and firm size implies that the matching function $t = m(s)$ is assortative if $S - F(s) = 1 - G(m(s))$ for all $s \geq \underline{s}$. It implies that the slope of the market matching function is positive, i.e., $m'(s) > 0$ at all $s \geq \underline{s}$.

The supermodular property of payoff functions is closely related to assortative matching. Let us briefly explain the supermodular property.[3] For any x, x' in X , let $x \vee x'$ denote the least upper bound (join) of x and x' in X and let $x \wedge x'$ denote the greatest lower bound (meet). Suppose that $X \subseteq \mathbb{R}^n$. Then, the join of x and x' is simply the component-wise maximum and

[3] See Topkis (1998) for more details on the supermodular functions and matching/assignment problems.

the meet is simply the component-wise minimum. The set X is a lattice if, for any x and x' in X, their join and meet exist and they belong to X. Consider a lattice $X \subseteq \mathbb{R}^n$ with the ordering relation $\geq$ such that $x = (x_1, \ldots, x_n) \geq x' = (x'_1, \ldots, x'_n)$ if $x_i \geq x'_i$ for all $i = 1, \ldots, n$. Any real-valued function $e : X \to \mathbb{R}$ with a lattice $X \subseteq \mathbb{R}^n$ is supermodular (equivalently x_i and x_j are complementary for all i and j such that $i \neq j$) if

$$e(x) + e(x') \leq e(x \vee x') + e(x \wedge x') \tag{4}$$

for all x and x'. The function e is strictly supermodular (equivalently x_i and x_j are strictly complementary for all i and j such that $i \neq j$) if, for all unordered x and x', (4) holds with strict inequality. When the function e is twice differentiable, supermodularity is equivalent to complementarity between all x_i and x_j (i.e., $e_{ij} = \partial^2 e / \partial x_i \partial x_j \geq 0$ for all i and j such that $i \neq j$) and strict supermodularity is equivalent to strict complementarity between all x_i and x_j (i.e., $e_{ij} > 0$ for all i and j such that $i \neq j$). For example, the production function specified in our model is supermodular if it exhibits complementarity between any pair of input factors which means that the marginal productivity of one input factor is nondecreasing in another. Suppose that a firm considers hiring a CEO. The CEO's marginal productivity is nondecreasing in firm size given the complementarity between CEO productivity and firm size. Because perks are complementary to firm size and CEO talent, a larger firm has an added incentive to provide a higher level of perks even when it hires the same CEO. Supermodularity is quite natural in many cases. Separable functions are supermodular but not strictly supermodular. Supermodularity is also sufficiently general to allow for non productivity-related perks.

We now turn to the sufficient conditions for assortative matching as the unique stable matching pattern in our model with continuous firms and CEOs. These conditions are as follows:

Condition 1

(a) The firm's profit function, $f(p,t,s)-w-c(p)$, is concave in p and the CEO's utility function, $u(w,p)$, is concave in (w,p).

(b) Either (i) the CEO's utility function is strictly concave or (ii) the firm's profit function is strictly concave in p and the CEO's utility function is strictly concave in w.

Condition 1 states the concavity properties required by the firm's profit function and the CEO's utility function for assortative matching: The firm's profit function must be concave in perks and the CEO's utility function must be concave in both wage and perks and at least some of them must be strictly concave. If the firm's profit function is not strictly concave in perks, then the CEO's utility function must be strictly concave in both wage and perks. If the CEO's utility function is not strictly concave in both wage and perks, then the firm's profit function must be strictly concave in perks and the CEO's utility function must be strictly concave in wage.

The firm's profit function is concave in perks when the production function is concave in perks and the cost function is convex (i.e., $-c(p)$ is concave) in perks. However, the profit function can be concave in perks even with a concave cost function if the degree of its concavity is not too high. The concavity of the cost function of perks may capture the idea that the marginal cost can decrease due to the economies of scale in providing perks. After all, the shape of the cost function of perks depends on the nature and scope of perks and it should be empirically addressed with the data on perks.

Condition 2 shows another property of supermodularity that is required for assortative matching. This condition is required on the firm's production function only.

Condition 2

(a) The firm's production function is supermodular.

(b) Either (i) t and s are strictly complementary in the firm's production function or (ii) p is strictly complementary to both t and s in the firm's production function and the CEO's utility function is strictly concave in w.

Condition 2 requires that the firm's production function be supermodular. This property is equivalent to the complementarity between any pair of input factors. It also requires that some of them be strictly complementary: If the production function does not exhibit strict complementarities between perks and CEO talent and between perks and firm size, then it must exhibit strictly complementarity between CEO talent and firm size. If the production function does not exhibit strict complementarity between CEO talent and firm size, then it must exhibit strict complementarities between perks and CEO talent and between perks and firm size. In this case, the strict concavity of the CEO's utility function in wage is further required. This point will be clear in the proof of Theorem 1.

Theorem 1 below shows that conditions 1 and 2 are sufficient to ensure that assortative matching is the unique stable matching pattern. For technical simplicity, we assume that functions are twice differentiable.

Theorem 1 Suppose that the firm's profit function and the CEO's utility function satisfy conditions 1 and 2. Then, the stable matching is (positively) assortative.

Proof First, let $v(t) \equiv u(\tilde{w}(t), \tilde{p}(t))$ be the equilibrium utility level that the CEO with talent t receives. If firm s wants to hire the CEO with talent t, it must provide the utility level $v(t)$. Therefore, the firm's problem for the choice of (w, p) can be captured in the following Largrangian function:

$$L = f(p,t,s) - w - c(p) + \lambda[v(t) - u(w,p)]$$

Let $p^*(t,s)$ and $w^*(t,s)$ be the optimal compensation package that firm s would offer to the CEO with talent t if it wanted to hire her.[4] The first-order conditions with respect to p and w are respectively

$$f_p(p,t,s) - c'(p) - \lambda u_p(w,p) = 0$$
$$-1 - \lambda u_w(w,p) = 0$$

at $(p,w) = (p^*(t,s), w^*(t,s))$. Note that the optimal levels of perks and wage $p^*(t,s)$ and $w^*(t,s)$ depend on the talent of the CEO that the firm wants to hire. Let us denote by p_t^* and w_t^* the partial derivatives of $p^*(t,s)$ and $w^*(t,s)$. Taking the partial derivatives of the first-order conditions then yields

$$f_{pt} + f_{pp}p_t^* - c''(p)p_t^* - \lambda u_{pw}w_t^* - \lambda u_{pp}p_t^* = 0, \tag{5}$$

$$-\lambda u_{ww}w_t^* - \lambda u_{wp}p_t^* = 0. \tag{6}$$

One can solve the systems of equations (5) and (6) for p_t^* and w_t^*. The solution for p_t^* is

$$p_t^* = \frac{-f_{pt}\lambda u_{ww}}{(f_{pp} - c'')\lambda u_{ww} + \lambda^2(u_{pw}^2 - u_{pp}u_{ww})}.$$

The Largrangian multipler λ is negative because the higher utility level for the CEO decreases the firm's profit. Given this negative multiplier, (a) and (b) in condition 1 ensure that p_t^* is non-negative so that $p^*(t,s)$ is non-decreasing in the CEO's talent t.

Now let us consider the maximum profit function for firm s when it hires the CEO with talent t:

[4] Note that $p^*(t,s)$ and $w^*(t,s)$ are specified for all possible t. The observed equilibrium compensation package is $p(s) = p^*(m(s),s)$ and $w(s) = w^*(m(s),s)$ with $t = m(s)$.

$$\Pi(t,s) \equiv f(p^*(t,s),t,s) - w^*(t,s) - c(p^*(t,s)) + \lambda[v(t) - u(w^*(t,s), p^*(t,s))].$$

Applying the envelop theorem, the cross partial derivative of $\Pi(t,s)$ is

$$\Pi_{ts}(t,s) = f_{ts} + f_{ps} p_t^*.$$

Conditions 1 and 2 ensure that both terms are non-negative and at least one of them is positive so that $\Pi_{ts}(t,s) > 0$: The firm's maximum profit function is strictly supermodular in (t,s). Therefore, for any t_H, t_L with $t_H > t_L$ and any s_H, s_L with $s_H > s_L$

$$\Pi(t_H, s_H) - \Pi(t_L, s_H) > \Pi(t_H, s_L) - \Pi(t_L, s_L) \tag{7}$$

Equation (7) directly implies that the stable matching must be (positively) assortative. Suppose not, i.e., firm s_L hires the CEO with talent t_H and firm s_H hires the CEO with talent t_L in stable matching equilibrium. Firm s_L hires the CEO with talent t_H only when

$$\Pi(t_H, s_L) \geq \Pi(t_L, s_L) \tag{8}$$

From equations (7) and (8), we can deduce

$$\Pi(t_H, s_H) > \Pi(t_L, s_H),$$

which shows that firm s_H can make a strictly higher profit by hiring the CEO with talent t_H. This contradicts that firm s_H hires the CEO with talent t_L in stable matching equilibrium. Therefore, the stable matching must be (positively) assortative. **QED**

It is now well known how to characterize the stable matching pattern when utility is one-to-one transferable between partners in a match: If the total suplus function in a match satisfies the increasing differences in the partners' inherent attributes, then the stable matching is assortative in terms of partners' attributes. Less known is how to characterize the stable matching pattern when utility is not one-to-one transferable. Our model does not belong to the case of one-to-one

transferable utility because the CEO's utility and the firm's profit are not one-to-one transferable when wage is not separable from perks in the CEO's utility function. For the non-transferable utility case, Legros and Newman (2007) identify the condition called "generalized increasing differences" for stable matching to be assortative.

However, we cannot apply their result directly because their model is based on a finite number of agents on each side but our model is based on a continuum of agents. This is why we identify our own sufficient conditions for stable matching to be assortative in the continuous model. Our sufficient conditions also have added advantages compared to the one in Legros and Newman (2007). The condition of "generalized increasing differences" in Legros and Newman (2007) is not directly defined over an agent's primitive utility function, which specifies the agent's utility as a function of her inherent attributes and characteristics that she endogenously chooses. Rather it is the properties of the indirect utility function that specify the agent's maximum utility as a function of her attributes, the partner's attributes, and the utility level for the partner that the agent has to concede. However, our sufficient conditions are characterized in terms of the properties that are required for the primitive utility functions when the agent bargains a two dimensional compensation package of wage and perks together with her partner. Hence, it is easy to verify whether our sufficient condition is satisfied.

2.3 Closed-Form Analysis

We provide the closed-form solutions for equilibrium wage and perks under a widely used class of function forms that satisfy conditions 1 and 2. The market matching function is derived according to (a) in Proposition 1. For simplicity, assume that distributions of CEOs and firms, G and F, are both probability distributions. Then, because $S = 1$, (a) in Proposition 1 becomes, for all all $s \geq \underline{s}$,

$$1 - F(s) = 1 - G(m(s)).$$

We need to solve this equation for $m(s)$ in order to get the market matching function. Given the market matching function $m(s)$, we can solve the first-order differential equations in (b) in Proposition 1 for the market perks function $p(s)$ and the market wage function $w(s)$. For this purpose, we derive the closed-form solution given the following functional form:

$$m(s) = ks^q, \tag{9}$$

where $k > 0$ and $q > 0$. k is the "shift" parameter and q is the "relative spacing" parameter. Given k, the relative spacing parameter q shows the relative heterogeneity of the CEO's talent to the firm size. This functional form can be derived under several reasonable distributions for firm size and CEO talent. For example, assume that the distributions of firm size and CEO talent follow a class of Weibull distributions. Then we have $1 - F(s) = \exp[-(s/\lambda_1)^{k_1}]$ and $1 - G(t) = \exp[-(t/\lambda_2)^{k_2}]$. In this case, the parameters in equation (9) become $q = k_1 / k_2$ and $k = \lambda_2 / \lambda_1^{k_1/k_2}$. If $k_2 = 1$, it is the exponential distribution. If $k_2 = 3,4$, it is close to the normal distribution. Suppose that the distribution of firm size follows a class of Pareto distributions, so does the distribution of CEO talent. Then, we have $1 - F(s) = (s/s_m)^{-k_1}$ and $1 - G(t) = (t/t_m)^{-k_2}$, where s_m is the mode of the firm size, t_m is the mode of the CEO's talent, and k_1 and k_2 are positive numbers. The parameters in equation (9) become $q = k_1 / k_2$ and $k = t_m / s_m^{k_1/k_2}$.[5]

[5] The Pareto distributions have been very helpful in approximating the distributions of many economic variables such as individual income levels, city sizes, insurance claims, and standardized price returns on individual stocks among many others. It quite nicely approximates firm size and also possibly the CEO's talent in the matching market for CEOs (Gabaix and Landier, 2008). The functional form in equation (9) is also derived when the distributions of firm size and CEO talent follow a class of Fréchet distributions or a class of Gumbel distributions.

For the firm's profit function, we take the widely-used class of Cobb-Douglas functions for its production function. These functional forms are quite general for the parameters to have various economic interpretations in the empirical/theoretical analysis. Let $f(p,t,s) = \delta p^{\alpha} t^{\beta} s^{\gamma}$ denote the production function, where $\delta > 0$, $\alpha \geq 0$, $\beta > 0$, and $\gamma > 0$. The parameters, α, β, and γ, determine the marginal rates of technical substitution of between perks, the CEO's talent and firm size. The parameter δ represents technology level. If $\alpha > 0$, perks are productivity-related and are strictly complementary to both CEO talent and firm size; perks have common value for both the firm and the CEO. If $\alpha = 0$ in the production function, perks have only private value in the sense that they affect the CEO's utility only. The signs of the parameters in the production function ensure its supermodular properties in condition 2. The firm's cost function for providing perks is given by $c(p) = \lambda p^{\phi}$ with $\lambda > 0$ and $\phi > 0$. Therefore, the profit function for firm z is $\Pi = \delta p^{\alpha} t^{\beta} s^{\gamma} - w - \lambda p^{\phi}$.

The CEO's utility function is $u(w,p) = a w^{d} p^{b}$. Assume that $a > 0$, $0 < d \leq 1$, and $0 < b \leq 1$. The parameters, d and b, determine the CEO's marginal rate of substitution of perks for wage. The CEO's utility function is concave and wage and perks are strictly complementary. Because the marginal utility of wage is increasing in perks and the marginal utility of perks is increasing in wage, it is cost saving for the firm to increase both wage and perks slightly in order to raise a utility level instead of increasing only one component of the compensation package.

Given the profit function, the utility function and the market matching function, the first-order conditions in (b) in Proposition 1 become, for all $s \geq \underline{s}$,

$$w'(s) + \frac{bw(s)}{dp(s)} p'(s) = \delta\beta p(s)^{\alpha} m(s)^{\beta-1} s^{\gamma} m'(s), \tag{10}$$

$$\frac{bw(s)}{dp(s)} + \alpha\delta\, p(s)^{\alpha-1} m(s)^{\beta} s^{\gamma} = \phi\lambda\, p(s)^{\phi-1}, \tag{11}$$

with the initial condition $(w(\underline{s}), p(\underline{s}))$.

We normalize the smallest firm size among those firms that hire in equilibrium into zero: $\underline{s} = 0$. This normalization makes the compensation package offered by firm $\underline{s}$ equal to $(w(\underline{s}), p(\underline{s})) = (0,0)$. Given this initial condition and the matching function given in equation (9), we then solve equations (10) and (11) for the equilibrium compensation package $(w(s), p(s))$ yielding

$$w(s) = A \times s^{\frac{\phi(\beta q+\gamma)}{\phi-\alpha}},$$

$$p(s) = B \times s^{\frac{\beta q+\gamma}{\phi-\alpha}},$$

where A and B are constants,

$$B = \left[\frac{\delta k^{\beta}}{\lambda\phi}\left(\frac{b\beta q}{d\left(\frac{\beta q+\gamma}{\phi-\alpha}\right)\left(\phi+\frac{b}{d}\right)}+\alpha\right)\right]^{\frac{1}{\phi-\alpha}} \text{ and } A = \frac{B^{\alpha}\delta\beta q k^{\beta}}{\left(\frac{\beta q+\gamma}{\phi-\alpha}\right)\left(\phi+\frac{b}{d}\right)}.$$

The details on how to derive $w(s)$ and $p(s)$ are provided in Appendix A. By taking the log transformation of $w(s)$ and $p(s)$, the equilibrium wage and perks equations become

$$\ln w(s) = \ln A + \frac{\phi(\beta q+\gamma)}{\phi-\alpha}\ln s. \tag{12}$$

$$\ln p(s) = \ln B + \frac{\beta q+\gamma}{\phi-\alpha}\ln s, \tag{13}$$

Previous studies have shown that CEO wage is positively related to firm size (e.g., Gabaix and Landier, 2008, Graham, Li and Qiu, 2012), suggesting that $\phi-\alpha>0$. Equations (12) and (13)

show that the sensitivities of wage and perks to the change of firm size increase with a higher α because the coefficients of the logarithmic firm size in the two equations increase in α. Recall the firm's production function is $f(p,x,z) = \delta p^{\alpha} t^{\beta} s^{\gamma}$. A higher α indicates the perks are more productivity-related, i.e., the impact of increases in perks on the firm's output is higher.

On the other hand, perks have private value only in the extreme opposite case of $\alpha = 0$ because, in this case, changes in perks have no impact on output but affect the CEO's utility only. In this private-value case, the equilibrium wage and perks equations become

$$\ln w(s) = \ln \tilde{A} + (\beta q + \gamma) \ln s. \tag{14}$$

$$\ln p(s) = \ln \tilde{B} + \frac{\beta q + \gamma}{\phi} \ln s, \tag{15}$$

where $\tilde{A}$ and $\tilde{B}$ are constants that correspond to A and B with $\alpha = 0$.

2.2.3 Implications

Because wage and perks are complementary in CEO utility, the firm can raise the CEO's utility a lot more by increasing both wage and perks at the same time instead of increasing only one. Therefore, from the firm's point of view, it is cost-saving to increase both perks and wage when the firm has to raise the CEO's utility as her talent increases. Because a larger firm hires a more productive CEO in assortative matching, it implies that equilibrium wage and perks are both increasing in the firm size.

The relative slopes of the equilibrium wage equation and the equilibrium perks equation depend on the convexity/concavity of the cost function of perks. If the coefficient of logarithmic firm size in the equilibrium perks function is greater than the corresponding coefficient in the equilibrium wage function, then the cost function of perks is (strictly) concave (i.e., $\phi < 1$). On the other hand, if the coefficient of logarithmic firm size in the equilibrium perks function is

smaller, the cost of perks is (strictly) convex (i.e., $\phi > 1$). Therefore, we can empirically determine the concavity/convexity of the cost function of perks by examining whether or not the estimated coefficient of logarithimic firm size in the perks equation is smaller than the estimated corresponding coefficient in the wage equation. This implication is quite natural to expect. For example, suppose that the cost function of perks is concave. Then, the marginal cost of perks is decreasing in the level of perks but, since wage is linear in money, the marginal cost of the wage is always constant. This implies that larger firms will increase perks more than wage due to the economies of scale in providig perks. As a result, equilibrium perks increase faster in firm size than the equilibrium wage if the cost function for perks is concave. The opposite holds when the cost function of perks is convex.

Equations (13) shows that the equilibrium equation for perks is steeper when they are more productivity-related, i.e., have a higher value of α. This implication is economically straightforward. More productivity-related perks increase the firm's output more than less productivity-related perks do. Therefore, the firm has an added incentive to provide more productivity-related perks as the firm size increases. In the extreme opposite case where perks are non productivity-related, the firm has no added incentive to provide perks because non productivity-related perks increase the CEO's utility only and changes in non productivity-related perks do not affect the firm's output. This is why the equilibrium perks equation for productivity-related perks is steeper than the equilibrium perks equation for non productivity-related perks.

In sum, the above analysis leads to the following testable predications.

1. In equilibrium, logarithmic wages and logarithmic perks are positively linearly related to logarithmic firm size.

2. If the slope of the logarithmic wage equation exceeds that of the logarithmic perks equation, then the cost function of perks is convex. On the other hand, if the slope of the logarithmic perks equation exceeds that of the logarithmic wage equation, then the cost function of perks is concave. In particular, the exponent in the cost function of perks, parameter ϕ, equals the ratio of the coefficient of logarithmic firm size in the wage equation to that in the perks equation.
3. In the equilibrium equations for more productivity-related and less productivity-related perks, the firm-size coefficient for more productivity-related perks exceeds that for less productivity-related perks. In general, the more productivity-related perks are, the more sensitive they are to the change in firm size.

In the next section, we present empirical analysis based on the closed-form solutions derived in this section. We are particularly interested in whether the implications from the closed-form solutions are confirmed from the empirical analysis.

3. Empirical Evidence

3.1 Data

Our source of data on perks originates with public disclosures contained in proxy statements that S&P 500 companies filed with the SEC between January 1, 2007 and December 31, 2009 available from the SEC Edgar database. These proxy statements were all subject to the SEC disclosure rules that came into effect on December 15, 2006. Depending on a company's chosen month for fiscal year end, sample firms' fiscal years are from 2006 to 2009. The SEC defines named officers as CEO, CFO (chief financial officer), and the other top three highest paid officers of the company, and requires publicly traded companies to disclose compensation for named officers in annual proxy statements. Sometimes firms choose to also include

compensation for other executives, such as those recently retired or terminated. Appendix B is a sample of the summary compensation table prescribed by current SEC regulations. The SEC specifies the elements of executive compensation that companies must report in separate columns (designated by lower case letters) in the summary compensation table of the proxy statement: (c) *salary*, (d) *bonus*, (e) *stock awards*, (f) *option awards*, (g) *non-equity incentive plan compensation*, (h) *change in pension value and nonqualified deferred compensation earnings*, (i) *all other compensation*, and (j) *total*. The SEC defines *all other compensation* as executive compensation not otherwise included in columns (c) though (h), and specifies two categories of *all other compensation*: *perquisites and other personal benefits* and *additional all other compensation*.

For the first category, *perquisites and other personal benefits*, the SEC does not specifically define perquisites and personal benefits but provides guidance.[6] *Perquisites and other personal benefits* include, but are not limited to, club memberships, financial or tax advice, personal travel, personal use of company property, housing, relocation and other living expenses, security, and discounts on company products or services (SEC Release No. 33-8732A, p.77).

The second category, *additional all other compensation*, includes severance or any payment related to a change of control, company contributions to vested or unvested pension plans, the value of any company paid insurance premiums, amounts reimbursed during the fiscal year for the payment of taxes (gross-ups), the value of discount on acquired company shares, the value of any dividends or other earnings paid on stock or option awards when the dividends or earnings

[6] In Release No. 33-8732A the SEC expresses concern "that sole reliance on a bright line definition in our rules might provide an incentive to characterize perquisites or personal benefits in ways that would attempt to circumvent the bright lines…. An item is not a perquisite or personal benefit if it is integrally and directly related to the performance of the executive's duties. Otherwise, an item is a perquisite or personal benefit if it confers a direct or indirect benefit that has a personal aspect, without regard to whether it may be provided for some business reason or for the convenience of the company, unless it is generally available on a non-discriminatory basis to all employees."

were not factored into the grant date fair value, director or other fees, commissions, any other miscellaneous cash payment (SEC Release No. 33-8732A, p.79).

There is no standard approach to reporting the details (e.g. items and values) of *all other compensation*. Depending on the company, the detailed information is either in the footnotes to the summary compensation table or summarized in a separate table. We manually collected compensation information in the summary compensation table and detailed information for *all other compensation* for executives at S&P 500 companies. We supplement the hand collected compensation data with company financial statement information from Compustat. The final merged dataset has 1,422 observations on 622 executives CEOs from 523 firms. The number of firms exceeds 500 because of changes to the composition of the S&P 500 over time. We winsorize all variables at the top and bottom one percent. See Appendix C for detailed definitions of variables used in this study.

[Table 1 about here]

Table 1 provides summary statistics of firm characteristics for our sample firms. Given that the sample pool is the S&P 500, the firms in our data set are large (average annual sales of $17.3 billion, average total assets of $45.8 billion and average number of employees of 46,245) and profitable (average return on equity of 14.3% and average return on assets of 5.1%). The average market-to-book ratio is 3.0. The average stock return is negative because our sample time period includes the financial crisis of 2008-2009. Our sample firms span fifty-seven sectors defined by two-digit SIC (standard industry classification) code.

3.2 Perks Provisions in S&P 500 Firms

Since the SEC does not uniformly define perk items, firms choose their own descriptions of perks when disclosing compensation under the category *perquisites and other personal benefits*.

For example, firms describe car service alternatively as car and driver, chauffeur, limousine, and ground transportation. As such it is necessary to exercise some discretion in grouping perks with different descriptions but with common meaning. We consolidate more than 50 perk descriptions into the twenty specific perk items shown in Table 2. For example we group five separate items (travel assistance, moving expenses, temporary accommodation, cash lump sum in lieu of incidentals, and realtor, legal, and other closing costs) into "relocation expenses" because all five items are associated with reimbursement for a job-related move. Companies often disclose miscellaneous or other perks; we consolidate these items with other not-easily-classifiable descriptions as "other perks". The literature provides examples of similar approaches to consolidating perks. Grinstein, Weinbaum, and Yehuda (2010) compile a perk database based on 2007 and 2008 SEC filings for a random sample of small, medium, and large firms that includes 130 large market-capitalization firms. They document 30 descriptions of perks consolidated into ten main perk items, including tax gross-ups. Rajan and Wulf (2006) use a database of 15 perk items based on the responses of approximately 300 companies between 1986 and 1999 to a survey conducted by a well known U.S. based compensation consultant. The perk items on the survey were chosen by the consultant. We believe ours to be the most comprehensive perk database in existence for large market capitalization firms based on consistent, stringent compensation disclosure rules.

[Table 2 about here]

Table 2 provides a summary of *all other compensation* for CEOs in fiscal years 2006 to 2009. For comparison purpose, we also include information for other executives. Almost all executives receive some form of all other compensation (98.2% of CEOs and 95.7% of other named executives, at average values of $332,373 and $212,379, respectively). The percentage of

CEOs (other executives) receiving *additional all other compensation* is 91.2% (89.2%). On average, CEOs (other executives) receive *additional all other compensation* worth $197,527 ($149,532).

CEOs receive *perquisites and other personal benefits* more frequently and at higher levels, on average, than do other executives (78.5% compared to 67.0% and $162,736 compared to $65,137 respectively). The most common perks for CEOs disclosed under the category *perquisites and other personal benefits* are personal use of aircraft (35.1%), financial services (23.0%), other perks (21.9%), personal use of automobile (20.0%), and security (10.6%). The most valuable perks for CEOs are security ($169,610), personal use of aircraft ($147,352), relocation expenses ($148,186), cost of living allowances ($95,847), and personal services/use of company assets ($77,841). The most common perks for executives other than CEO are financial services (21.3%), other perks (19.9%), personal use of automobile (16.7%), personal use of aircraft (10.9%), and medical/health (8.7%). The most valuable perks for executives other than CEO are relocation expenses ($182,557), cost of living allowances ($132,362), personal use of aircraft ($67,425), car service ($53,670), and reimbursement for unused vacation ($35,651).

Personal use of aircraft is a good example of a truly exclusive perk in that CEOs receive it far more frequently than other named executives, and at a higher dollar value. Chauffeur services are also exclusive, even among executives; CEOs are more than twice as likely as the other named executives to benefit from the services of a car and driver. Note that for CEOs, security is the fifth most common perk but the most expensive on average and with a maximum annual value of $1.432 million. Overall, the results indicate that, despite the fact that the use of perks as a form of executive compensation is widespread across S&P 500 companies, there is large variation in value and scope of perks offered to executives of different rank.

We measure wage as the sum of *salary*, *bonus*, *stock awards*, *option awards*, *non-equity incentive plan compensation*, and *change in pension value and nonqualified deferred compensation earnings* (i.e., all elements in the summary compensation table excluding *all other compensation*). We measure perks as the amount reported as *perquisites and other personal benefits*. This amount equals the sum of the 20 perk items described in Table 2.[7]

The Spearman's rank correlation coefficients between wage and perks are 0.3610 and 0.2177 for CEOs and other executives respectively, both significant at the 1% level. The results indicate that higher wages are positively associated with higher perks. The correlation coefficient between CEO wage and firm size is 0.5048 while the correlation coefficient between CEO perks and firm size is 0.2754, both are significant at 1% level. The positive correlations between wage, perks and firm size are consistent with our theory that large firms tend to offer both higher wage and higher perks yielding a positive correlation between wages and perks.

3.3 The Determinants of Perks in S&P 500 Firms

We now conduct formal analyses regarding the relationship between firm size, CEO wage and perks. The equilibrium perk and equilibrium wage equations (i.e. equations (12) through (15)) predict the linear relationships between logarithmic perks and logarithmic firm size and between logarithmic wage and logarithmic firm size. Therefore, we estimate the following regression models:

$$Ln(Wage_{it}) = \alpha_W + \beta_W Ln(Size_{it-1}) + \mathbf{X}'_{it-1}\boldsymbol{\gamma}_W + u_j^w + v_t^w + \varepsilon_{it}^w \quad (16)$$

$$Ln(Perks_{it}) = \alpha_P + \beta_P Ln(Size_{it-1}) + \mathbf{X}'_{it-1}\boldsymbol{\gamma}_P + u_j^p + v_t^p + \varepsilon_{it}^p \quad (17)$$

[7] The SEC specifically classifies tax gross-ups as an item in *additional all other compensation* instead of an item in *perquisite and other personal benefit*. As such, our definition of total perks does not include tax gross-up. Grinstein, Weinbaum, and Yehuda (2010) include tax gross-ups as one of their perk items. We define an alternative definition of total perks that includes tax gross-ups. We repeat all of our empirical analyses using this alternative definition and find no change to the interpretation of our results. The conclusions are actually strengthened because tax gross-ups are large and frequent (34.2% of CEOs and 29.2% of other executives receive tax gross-ups, at average values of $40,619 and $48,594, respectively).

where $Ln(Wage_{it})$ and $Ln(Perks_{it})$ are the natural logarithm of CEO *i*'s wage and perks compensation in year *t*, respectively. $Ln(Size_{i,t-1})$ is the logarithm of firm *i*'s market value in year t-1. Alternative measures for firm size have been used in the literature, including number of employees, total assets, sales, and market capitalization. Gabaix and Landier (2008) argue that market value is a better measure of firm size when the effect of CEO talent on future earnings is permanent. Empirically, they show that, compared to other measures of firm size, the market value of a firm (i.e., sum of book value of debt and market value of equity) offers the highest predictive power in a regression with total compensation as the dependent variable and firm size as the single explanatory variable. In recognition of the benefits of this measure of firm size, we use market value as the proxy for firm size. To check the robustness of our results, we also use total assets, total sales or number of employees as alternative proxies for firm size and find these alternatives have no impact on the conclusions of our results.

X is a vector including control variables for firm and managerial characteristics. Extant literature has investigated how firm characteristics (such as profitability and stock price) and managerial characteristics (such as job tenure and gender) affect executive compensation (e.g. Lazear, 2003, Core, Guay & Larcker, 2008, and Rose & Shepard, 1997). We use this literature as a guide in choosing explanatory variables for our regression analyses. Specifically, we control for growth opportunities of the firm, market performance, accounting performance, cash flow, growth, tenure and gender. u_j is industry *j*'s fixed effect. v_t is year t's fixed effect. β_W and β_P measure the sensitivities of wage and perks to firm size. We also estimate equation (17) separately for more productivity-related and less productivity-related perks and obtain their sensitivities to firm size $\beta_P^{\text{More productivity-related}}$ and $\beta_P^{\text{Less productivity-related}}$. Hence, the predictions of our theory can be translated into the following testable hypotheses:

Hypothesis 1: Wage and perks are positively associated with firm size, i.e., $\beta_W > 0, \beta_P > 0$.

Hypothesis 2: The ratio of β_W / β_P is equal to the parameter ϕ in the cost function of perks. If the cost function of perks is concave, $\phi < 1$, perks are more sensitive to firm size than wage, i.e., $\beta_P > \beta_W$.

Hypothesis 3: More productivity related perks are more sensitive to firm size than less productivity-related perks, i.e., $\beta_P^{\text{More productivity-related}} > \beta_P^{\text{Less productivity-related}}$

[Tables 3 and 4 about here]

Tables 3 and 4 test Hypothesis 1 and report regression results for the impact of firm size on the equilibrium wage and perks equations, respectively. The five columns in each table report results for alternative specifications using different combinations of explanatory variables. Column (1) reports regression results that include only $Ln(Size_{i,t-1})$ as explanatory variable. Column (2) includes $Ln(Size_{i,t-1})$, industry dummy and year dummy as explanatory variables. Column (3) includes $Ln(Size_{i,t-1})$ and other firm and managerial characteristics as explanatory variables. Column (4) includes $Ln(Size_{i,t-1})$, other firm and managerial characteristics, industry dummy and year dummy as explanatory variables. Column (5) adds GIM Governance Index (Gompers, Ishii and Metrick, 2003) as an additional explanatory variable to control for the effect of corporate governance on compensation. 2006 is the last year for which the GIM Governance Index is available because of information collection method changes at the company that provided data for calculating the index. We use the most recent governance index information for our subject companies. King and Wen (2011) show that, in general, the GIM Governance Index is stable over time. Because the index is available for only 1220 observations in our

database of approximately 1400 observations, we treat the column (4) regression as the main specification.

For the equilibrium wage equation in Table 3, the coefficients for $Ln(Size_{i,t-1})$ range from 0.303 to 0.352 over the five regressions and are all significant at the 1% level; for the complete specification in the fourth column of Table 3, the coefficient is 0.310, implying that a 1% increase in market value is associated with a 0.310% increase in the CEO's wage. For the estimated equilibrium perks equation in Table 4, the coefficients for $Ln(Size_{i,t-1})$ range from 0.862 to 1.053 over the five regressions and are all significant at the 1% level. The result from the specification in the fourth column of Table 4 shows that the coefficient for firm size β_P is 1.038, implying that a 1% increase in the market value of the firm is associated with a 1.038% increase in the CEO's total perks. Column 5 in Tables 3 and 4 shows that adding GIM Governance Index as an additional control has a very little impact on the coefficients for $Ln(Size_{i,t-1})$. The results provide strong support for Hypothesis 1 that both wage and perks increase with the firm size.

[Table 5 about here]

To test Hypothesis 2 and evaluate the cost function of perks, Table 5 summarizes the ratios of β_W / β_P using the estimated coefficients from Tables 3 and 4. The model predicts that the exponent ϕ in the perquisite cost function, $c(p) = \lambda p^{\phi}$, is equal to β_W / β_P. Hence, if the slope of the perk equation exceeds that of the equilibrium wage equation, $\beta_W / \beta_P < 1$, then $\phi < 1$ and the cost function of perks is concave. Table 5 show that β_W / β_P ranges from 0.299 to 0.366. Based on the complete specification in the fourth columns of Tables 3 and 4, β_W / β_P is equal to 0.299. The Chi^2 tests for the hypothesis that $\beta_W / \beta_P = 1$ have p-values less than 1% across all

five specifications, rejecting the hypothesis that the firm-size coefficients for logarithmic wage and logarithmic perks are equal. The results indicate that the exponent in the perquisite cost function is less than one ($\phi < 1$) and the perk cost function is concave. Note that the estimated concavity is conditional on the range of perks that have been offered by S&P companies. The result does not imply that the perk cost function will be necceesarily concave for perks outside of the range in our sample. It is possible that the cost function becomes convex if companies provide perks outside of the observed range in our sample. In other words, while our theory is flexible with the perk cost function being concave or convex, the estimated concavity reflects the function form over the range of the actual perks offered by firms.

Now turn to Hypothesis 3 on the implication of more versus less productivity-related perks. Ragan and Wulf (2008) are one of the few examples in the literature to discuss the empirical implications of the assumption that perks improve productivity. They classify perks as productive based on ability to save time, documenting the productive nature of two perks - car service and use of corporate aircraft. Given the potential controversy regarding the classification of any given perk item as more productivity-related, we test our hypothesis using three different classifications.

The first classification divides all of the perk items in Table 2 (except "other perks") as more or less productivity-related based on ability to save time. The "benefit" of this classification is that it includes a large number of individual perk items. The "cost" of being inclusive is increased risk that a specific item is incorrectly categorized as more productivity-related or less so. More productivity-related perks in this classification are "personal use of aircraft", "personal use of automobile", "financial services", "reimbursement for unused vacation", "car service", "legal fees", "parking", and "medical/health"; less productivity-related

perks are “relocation expenses”, “security”, “club memberships”, “tickets and entertainment”, “personal meals”, “personal travel”, “professional association dues”, “perk cash allowance”, “cost of living allowance”, and “charitable gift matching”.

First we elaborate on the inclusion of specific perk items as more productivity-related. The use of corporate aircraft for *business* purposes saves time and improves the productivity of executives (Ragan and Wulf, 2008). *Personal* use of company aircraft could also be linked to time saving in two ways - it is often hard to differentiate between personal and business use of aircraft and even for pure personal use of aircraft, companies normally argue that it is good for the productivity of CEOs.[8] Companies provide automobiles to CEOs for business purposes; having personal access to this transportation asset, maintained by the company, removes distraction from the CEO. Providing legal and financial services, including tax and estate planning, frees the CEO from time-consuming, personally-important matters and helps the CEO focus on business issues. When the company provides cash in lieu of unused vacation, the CEO spends more time on the job. A car service permits the CEO to work effectively while in transit (Ragan and Wulf, 2008). Assigned parking reduces transit time. Annual physicals promote wellness; the results of diagnostic tests either reduce worry by confirming good health or allow for better prognosis through early detection. We argue that healthy CEOs are more time efficient and that early detection of medical problems saves time in the long run.

Next we consider the defined less productivity-related perks in the context of ability to save time. Relocation and cost of living allowances are reimbursements for personal costs associated with changing the location of employment and are not related to saving time for the executive.

[8] *The Wall Street Journal* “Corporate jet set: Leisure vs. business” on June 9, 2011, reports “it is hard to distinguish a CEO's work time from his leisure time” and that “Corporate jets are vital business tools that can efficiently carry busy executives to far-flung meetings, sometimes to multiple cities in a day. Allowing occasional personal use of the company plane can form an important part of a compensation package for a top executive.”

Generally, security covers the cost for installation and ongoing maintenance of home security systems. Infrequently this perk includes more extensive security services required because of safety concerns due to the public profile or country of employment of the executive. Although this second, less common type of security may have a time saving connotation, on the whole we categorize security as less productivity-related. While club memberships, tickets and entertainment may have residual benefits for the firm, they are, from a time saving point of view, distractions for the executive. Personal meals and travel are related to expenses for the executive, family members or guests; in any case, there is no direct time saving element. There is no beneficial time saving impact for the CEO when the company pays for professional association dues, matches the dollar contributions of CEO charitable giving, or provides a cash lump sum in lieu of specific perks.

In classification 2, we classify more productivity-related perks as those that are directly related to transportation which include “personal use of aircraft”, “personal use of automobile”, “car service”, and “parking”. The underlying argument is that by addressing the transportation needs of the CEO, the company reduces transit time or allows the CEO to focus on business while in transit. The contra less productivity-related perks in this specification are leisure consumption goods, discretionary cash, and reimbursements – none of which are related to the transportation needs and which include “club memberships”, “tickets and entertainment”, “personal meals”, “personal travel”, “professional association dues”, “perk cash allowance”, and “charitable gift matching”.

Because of the controversial nature of transportation related perks, especially the personal use of aircraft, our classification 3 defines more productivity-related perks based on the time

saving from service delegation and includes "financial services" and "car service". [9] Less productivity-related perks include "club memberships" and "tickets and entertainment". This specification minimizes potential conflict regarding classification – there is little debate that, by delegating time consuming tasks to others, "financial services" and "car service" allow the CEO to focus on business issues, while the less productivity-related perks, "club membership" and "tickets and entertainment", do not save time for the CEO.

[Table 6 about here]

Table 6 reports the impact of firm size on more versus less productivity-related perks for the three classifications defined above. The table shows that the perk equation is steeper for more productivity-related perks than for less productivity-related perks in all cases. For specification 1, the slope coefficient in the more productivity perk equation is 0.422 at a significance level of 1% while that in the less productivity perk equation is 0.317 at a significance level of 5%. For specification 2, the slope coefficient in the more productivity-related perk equation is 0.437 at a significance level of 1% while that in the less productivity-related perk equation is 0.305 at a significance level of 10%. For classification 3, the slope coefficient in the more productivity-related perk equation is 0.217 at a significance level of 1% while that in the less productivity-related perk equation is 0.198 but not significant at the 10% level. Overall, our empirical results show that more productivity-related perks are more sensitive than less productivity-related perks to changes in firm size which is consistent with Hypothesis 3.

A caveat with the above findings is that we base the empirical tests of our hypotheses on reported dollar values of perks as required by the SEC. As such, our tests are subject to a

[9] Hersch and McDougall (1992) capture both sides of the argument, " subscribing to the view that corporate aircraft provide managers with consumption benefits, providing incentives for ineffectively constrained managers to acquire them" but noting the profit-maximizing nature of aircraft investment in that "a corporate plane can reduce total transportation costs, increase managerial productivity".

relatively narrow perk definition that focuses on personal benefit. According to the SEC, an item is not a perquisite or personal benefit "if it is integrally and directly related to the performance of the executive's duties" (SEC Regulation 33-8732A, page72). Therefore, if a perk item meets this criterion, the company does not need to report its cost as perk compensation. A broader perk definition would include business related perks (e.g. large, well-appointed offices, corporate jets for business travel, and personal communication devices such as smart phones and tablet computers), yet the cost of all of these will not appear as perk compensation in proxy statements if the company classifies them as integral to the job. For example, if an executive chooses to fly business class instead of economy class and is able to accomplish more work during the flight and arrives more rested and better prepared for subsequent meetings, this "broader" perk would be productivity-related, but the cost differential in airfares is not a perk by SEC standards. Contrast this with a company policy that requires an executive to use the corporate jet for all travel (both business and personal) for security reasons, for which the SEC regulations require that the company reports the incremental cost of the personal travel as perk compensation. To the extent that business-integral perks are more productivity-related, empirical analysis that is conditional on personal perks makes it is more difficult to detect the difference between more and less productivity-related perks.

In sum, based on a comprehensive database of perk compensation of S&P 500 companies, we find strong empirical support for our theoretical predictions. Both wages and perks are increasing in firm size. Perks are more sensitive than wage to changes in firm size, indicating that, in general, the cost function for perks is concave, consistent with economies of scale in providing perks. More productivity-related perks are more sensitive than less productivity-related perks to changes in firm size because more productivity-related perks provide common

values to both CEOs and firms, which give firms added incentive to offer higher levels of more productivity-related perks as their sizes increase.

4. Conclusions

This paper develops an equilibrium matching model for the joint determinant of CEO wage and perks in a competitive CEO market. Firms differ in their size and CEOs possess heterogeneous talents. They competitively bargain multidimensional compensation packages (i.e., wage and perks). We show that, in stable matching equilibrium, firm size, wage, perks and talent are all positively related. Moreover, productivity-related perks that provide common value by increasing both firm profitability and executive utility increase faster with firm size compared to non productivity-related perks that provide private value by increasing executive utility only. We test the predictions of the model using manually collected data on CEO perks in S&P 500 companies. The empirical results are consistent with the theoretical predictions. Our theory shows how perks are determined as a part of competitive compensation packages. If perks are complementary to wage in the CEO's utility function, including perks in compensation packages is cost effective for firms and utility improving for CEOs as well. The benefit of including perks in compensation packages will be enhanced if perks are more productivity-related and provide common value to firms and CEOs.

References

Bebchuk, L. A., and J. M. Fried, 2004, *Pay Without Performance: The Unfulfilled Promise of Executive Compensation*, (Harvard University Press, Cambridge, MA).

Core, J. E., W. Guay, and D. F. Larcker, 2008, The power of the pen and executive compensation, *Journal of Financial Economics* 88, 1-25.

Fama, E., 1980. Agency problems and the theory of the firm. *Journal of Political Economy* 88, 288–307.

Gabaix, X. and A. Landier, 2008, Why has CEO pay increased so much? *The Quarterly Journal of Economics* 123(1), 49-100.

Gompers, P., J. Ishii, and A. Metrick, 2003, Corporate governance and equity prices, *Quarterly Journal of Economics* 118, 107-155.

Graham, J. R., S. Li, and J. Qiu, 2012, Managerial attributes and executive compensation, *Review of Financial Studies* 25(1), 144-186.

Grinstein, Y., D. Weinbaum, and N. Yehuda, 2010, The economic consequences of perk disclosure, Johnson School Research Paper Series No. 04-09; AFA 2011 Denver Meetings Paper. Available at SSRN: http://ssrn.com/abstract=1108707

Henderson, T. M., and J. C. Spindler, 2005, Corporate heroin: A defense of perks, executive loans, and conspicuous consumption. *Georgetown Law Journal* 93, 1835-1884.

Hersch, P. L., and G. S. McDougall, 1992, Separation of ownership from control and the demand for corporate aircraft, *Journal of Economics and Business* 44(3), 223-236.

Hirsch, F., 1976, *Social Limits to Growth*, (Harvard University Press, Cambridge, MA).

Jensen, M. C., and W. Meckling, 1976, Theory of the firm: managerial behavior, agency costs, and ownership structure, *Journal of Financial Economics* 3, 360–395.

King, T.D., and M. Wen, 2011, Shareholder governance, bondholder governance, and managerial risk-taking, *Journal of Banking and Finance* 35(3), 512–531.

Lazear, E. P., 2003, Firm-specific human capital: A skill-weights approach, IZA Discussion Paper No. 813. Available at SSRN: http://ssrn.com/abstract=422562

Legros, P., and A. Newman, 2007, Beauty is a beast, frog is a prince: Assortative matching with nontransferabilities, *Econometrica*, 75(4), 1073-1102.

Rajan, R. G., and J. Wulf, 2006, Are perks purely managerial excess? *Journal of Financial Economics* 79(1), 1-33.

Rose, N. L., and A. Shepard, 1997, Firm diversification and CEO compensation: Managerial ability or executive entrenchment? *Rand Journal of Economics* 28(3), 489-514.

Rosen, S., 1986, The theory of equalizing differences, in Ashenfelter, O. and R. Layrad, eds.: *Handbook of Labor Economics*, (Elsevier Science B.V., Amsterdam, The Netherlands).

Topkis, D. M., 1998, *Supermodularity and Complementarity*, (Princeton University Press, Princeton, NJ).

Yermack, D., 2004, Flights of fancy: Corporate jets, CEO perquisites, and inferior shareholder returns, NYU Working Paper No. FIN-04-008. Available at SSRN: http://ssrn.com/abstract=1294443

Table 1
Summary statistics of firm characteristics

The table provides summary statistics of firm characteristics in the sample. The sample includes S&P 500 firms between January 1, 2006 and December 31, 2009. *Return on Assets* is net income divided by total assets. *Sales Growth* is the percentage change in sales between the current fiscal year and the previous fiscal year. *Free Cash Flow* is net income plus depreciation & amortization plus interest after tax minus the increase in working capital minus capital expenditures. *Return on Equity* is net income divided by total equity. *Market to Book Ratio* is fiscal year end share price times common shares outstanding divided by book value of equity. *Stock Return* is fiscal year end share price plus all per share dividend payments during the fiscal year all divided by prior fiscal year end share price. *Market Value* is book value of debt plus market value of equity.

	Mean	Std	Min	Max	P25	Median	P75
Number of Employees	46,245	69,420	733	364,400	7,961	21,100	49,000
Net Sales ($millions)	17,312	27,197	598	171,500	3,750	8,033	16,410
Return on Assets	5.1%	9.2%	-39.4%	27.3%	2.2%	5.5%	9.4%
Sales Growth	7.8%	18.0%	-52.7%	73.2%	-0.4%	7.0%	14.2%
Free Cash Flow ($millions)	1,517	3,976	-4,498	25,677	111	532	1,394
Total Assets ($millions)	45,816	131,241	1,217	979,414	4,956	11,846	30,091
Return on Equity	14.3%	43.5%	-188.4%	256.2%	8.5%	15.6%	23.0%
Market to Book Ratio	3.0	4.0	-16.6	23.2	1.5	2.3	3.8
Stock Return	-6.8%	36.8%	-84.2%	106.8%	-32.7%	-5.8%	16.6%
Market Value ($millions)	31,310	54,361	1,144	344,864	7,107	14,039	28,757

Table 2

Summary statistics of perks provided in S&P 500 firms

The table presents summary statistics for perk benefits provided by S&P 500 firms as detailed in SEC filed proxy statements between January 1, 2006 and December 31, 2009. The SEC classifies "*all other compensation*" into two main categories "*perquisites and other personal benefits*" and "*additional all other compensation*". We further classify perks reported under "*perquisites and other personal benefits"* into 20 main perk items. For each item, the amounts are in $ thousands and Freq is the percentage of firms disclosing a dollar value for the item.

	CEOs only					Top Executives (excluded CEOs)				
	Freq	Mean	Std	Min	Max	Freq	Mean	Std	Min	Max
Total *All Other Compensation*	98.2%	332	563	1.5	4128	95.7%	212	540	1.5	3996
Main Categories										
Perquisites & Other Personal Benefits	78.5%	163	223	1.2	1432	67.0%	65	120	0.4	2196
Additional All Other Compensation	91.2%	198	485	1.1	3745	89.2%	150	442	0.6	3275
Main Perk Items Under *Perquisites & Other Personal Benefits*										
Personal Use Of Aircraft	35.1%	147	150	0.8	734	10.9%	67	106	0.2	595
Relocation Expenses	4.3%	148	236	0.4	1309	5.7%	183	330	0.5	2196
Personal Use Of Automobile	20.0%	25	36	0.5	298	16.7%	16	12	0.3	74
Security	10.6%	170	328	0.2	1432	3.5%	24	74	0.2	481
Financial Services	23.0%	22	48	1.1	403	21.3%	10	8	0.5	53
Club Memberships	7.9%	17	29	0.1	150	6.0%	8	15	0.2	109
Reimbursement for Unused Vacation	2.2%	34	39	0.1	198	2.3%	36	73	0.1	802
Personal Services/Use Of Assets	1.7%	78	159	0.0	776	0.6%	34	48	0.1	165
Car Service (Car And Driver)	6.9%	56	64	0.1	233	3.2%	54	70	0.0	390
Tickets And Entertainment	0.5%	44	57	0.9	135	0.4%	10	11	0.1	34
Personal Meal	0.5%	13	14	1.1	34	0.4%	10	17	0.0	75
Personal Travel	3.5%	34	66	0.2	311	2.6%	15	22	0.1	181
Professional Association Dues	0.4%	52	55	2.2	140	0.4%	26	26	0.3	125
Perk Cash Allowance	5.8%	43	33	1.5	194	5.3%	29	19	1.3	125
Legal Fees	1.8%	34	32	2.9	123	0.4%	34	82	0.0	446
Parking	1.5%	3	2	0.9	7	1.6%	3	2	0.4	11
Cost Of Living Allowance	1.9%	96	83	7.0	278	2.7%	132	184	0.6	1101
Charitable Gift Matching	5.4%	49	128	0.2	1000	4.3%	18	31	0.1	250
Medical/Health	10.3%	7	12	0.3	70	8.7%	6	10	0.2	50
Other Perks	21.9%	42	83	0.1	526	19.9%	28	64	0.0	476

Table 3
Wage and firm size

This table reports the determinants of CEO wage estimated from the following equation:

$$Ln(Wage_{it}) = \alpha_W + \beta_W Ln(Size_{it-1}) + \mathbf{X}'_{it-1}\boldsymbol{\gamma}_W + u_j^w + v_t^w + \varepsilon_{it}^w$$

where $Ln(Wage_{it})$ is the natural logarithm of CEO *i*'s wage in year *t*. Wage is the sum of salary, bonus, stock awards, option awards, non-equity incentive plan compensaton, change in pension value and nonqualified deferred compensation. $Ln(Size_{i,t-1})$ is the natural logarithm of firm *i*'s market value (book value of debt pus market value of equity) in year t-1. u_j is industry *j*'s fixed effect. v_t is year t's fixed effect. $\mathbf{X}_{it-1}$ are control variables including Market to Book Ratio$_{t-1}$, Stock Return$_t$, Stock Return$_{t-1}$, Return on Assets$_t$, Return on Assets$_{t-1}$, Free Cash Flow Ratio$_{t-1}$, Sales Growth$_{t-1}$, Ln(Tenure$_t$), Female and GIM Governance Index. The subscripts $_t$ and $_{t-1}$ indicate current and prior fiscal year respectively. The detail definition of these variables are provided in Appendix C. Cluster-robust standard errors are in parentheses with clustering at firm level. ***, **, * indicate significance level at 1%, 5% and 10% level respectively.

	(1)	(2)	(3)	(4)	(5)
Ln (Size$_{t-1}$)	0.322***	0.303***	0.324***	0.310***	0.352***
	(0.034)	(0.044)	(0.032)	(0.042)	(0.045)
Market to Book Ratio$_{t-1}$			-0.026*	-0.026***	-0.021
			(0.014)	(0.012)	(0.014)
Stock Return$_t$			0.247***	0.256***	0.230**
			(0.066)	(0.092)	(0.101)
Stock Return$_{t-1}$			0.191***	0.162**	0.163*
			(0.072)	(0.081)	(0.085)
Return on Assets$_t$			0.338	0.201	0.011
			(0.321)	(0.283)	(0.301)
Return on Assets$_{t-1}$			0.376	-0.301	0.025
			(0.596)	(0.548)	(0.539)
Free Cash Flow$_{t-1}$			0.189	0.605	0.176
			(0.513)	(0.496)	(0.429)
Sales Growth$_{t-1}$			-0.232	-0.186	-0.147
			(0.178)	(0.176)	(0.153)
Ln(Tenure$_t$)			-0.011	-0.023	-0.017
			(0.032)	(0.041)	(0.041)
Female			0.071	-0.004	0.086
			(0.106)	(0.124)	(0.116)
GIM Governance Index					0.035**
					(0.014)
Constant	12.682***	12.280***	12.772***	12.257***	11.458***
	(0.319)	(0.397)	(0.323)	(0.385)	(0.495)
Year Fixed Effects	N	Y	N	Y	Y
Industry Fixed Effects	N	Y	N	Y	Y
Observations	1,410	1,410	1,410	1,410	1220
R-squared	0.167	0.261	0.198	0.286	0.325

Table 4
Perks and firm size

This table reports the determinants of CEO perks estimated from the following equation:

$$Ln(Perks_{it}) = \alpha_P + \beta_P Ln(Size_{it-1}) + \mathbf{X}'_{it-1}\gamma_P + u_j^p + v_t^p + \varepsilon_{it}^p$$

where $Ln(Perks_{it})$ is the natural logarithm of CEO *i*'s perks compensation in year *t*, respectively. *Perks* is the amount reported in the category - *perquisites and other personal benefits*. $Ln(Size_{i,t-1})$ is the natural logarithm of firm *i*'s market value (book value of debt plus market value of equity) in year t-1. u_j is industry *j*'s fixed effect. v_t is year t's fixed effect. $\mathbf{X}_{it-1}$ are control variables including Market to Book Ratio$_{t-1}$, Stock Return$_t$, Stock Return$_{t-1}$, Return on Assets$_t$, Return on Assets$_{t-1}$, Free Cash Flow Ratio$_{t-1}$, Sales Growth$_{t-1}$, Ln(Tenure$_t$), Female and GIM Governance Index. The subscripts $_t$ and $_{t-1}$ indicate current and prior fiscal year respectively. The detail definition of these variables are provided in Appendix C. Cluster-robust standard errors are in parentheses with clustering at firm level. ***, **, * indicate significance level at 1%, 5% and 10% level respectively.

	(1)	(2)	(3)	(4)	(5)
Ln (Size$_{t-1}$)	0.933***	0.862***	1.053***	1.038***	0.961***
	(0.152)	(0.176)	(0.154)	(0.176)	(0.208)
Market to Book Ratio$_{t-1}$			-0.059	-0.083	-0.052
			(0.055)	(0.052)	(0.057)
Stock Return$_t$			0.237	0.167	0.235
			(0.332)	(0.448)	(0.501)
Stock Return$_{t-1}$			0.270	0.072	0.261
			(0.429)	(0.448)	(0.480)
Return on Assets$_t$			-1.007	-2.786	-2.953
			(1.846)	(1.773)	(1.932)
Return on Assets$_{t-1}$			-5.601*	-7.037**	-8.965***
			(3.219)	(3.047)	(3.283)
Free Cash Flow$_{t-1}$			1.916	3.130*	3.863**
			(1.978)	(1.922)	(1.888)
Sales Growth$_{t-1}$			-2.805***	-1.606*	-1.992*
			(0.964)	(0.966)	(1.043)
Ln(Tenure$_t$)			-0.271	-0.122	-0.104
			(0.219)	(0.245)	(0.250)
Female			1.118	0.593	0.973
			(0.953)	(0.883)	(0.891)
GIM Governance Index					0.083
					(0.086)
Constant	-0.288	-0.687	0.052	-1.848	-2.566
	(1.526)	(1.604)	(1.530)	(1.699)	(2.517)
Year Fixed Effects	N	Y	N	Y	Y
Industry Fixed Effects	N	Y	N	Y	Y
Observations	1,410	1,410	1,394	1,394	1220
R-squared	0.045	0.160	0.073	0.186	0.198

Table 5

Estimation of parameter ϕ in perk cost function

This table summarizes the estimate of parameter ϕ which equals the ratio of the coefficients for $Ln(Size_{i,t-1})$ from the regressions for $Ln(Wage_{it})$ and $Ln(Perks_{it})$ in Table 3 and Table 4, respectively. Parameter ϕ is the exponent in the perk cost function, $c(p) = \lambda p^{\phi}$.

	(1)	(2)	(3)	(4)	(5)
β_W : Coefficient for $Ln(Size_{i,t-1})$ from $Ln(Wage_{it})$ regression (Table 3)	0.323	0.303	0.324	0.310	0.352
β_P : Coefficient for $Ln(Size_{i,t-1})$ from $Ln(Perks_{it})$ regression (Table 4)	0.933	0.862	1.053	1.038	0.961
β_W / β_P **:** Estimates of Parameter ϕ	0.346	0.352	0.308	0.299	0.366
Control Variables (except GIM Governance Index)	N	N	Y	Y	Y
GIM Governance Index	N	N	N	N	Y
Year Fixed Effects	N	Y	N	Y	Y
Industry Fixed Effects	N	Y	N	Y	Y

Table 6

The impact of firm size on the provision of more versus less productivity-related perks

This table reports the difference in the sensitivity of more vs. less productivity-related perks to changes in firm size (book value of debt plus market value of equity). The independent variables are logarithmic more productivity-related or less productivity-related perks. Each regression controls for year and industry fixed effects and for the following specified control variables: Market to Book Ratio$_{t-1}$, Stock Return$_t$, Stock Return$_{t-1}$, Return on Assets$_t$, Return on Assets$_{t-1}$, Cash Flow Ratio$_{t-1}$, Sales Growth$_{t-1}$, Log(Tenure$_t$) and Gender. The subscripts $_t$ and $_{t-1}$ indicate current and prior fiscal year respectively. We adopt three classifications for more productivity-related and less productivity-related perks. In classification 1 more productivity-related perks include "personal use of aircraft", "personal use of automobile", "financial services", "reimbursement for unused vacation", "car service", "legal fees", "parking", and "medical/health"; less productivity perks include "relocation expenses", "security", "club memberships", "tickets and entertainment", "personal meals", "personal travel", "professional association dues", "perk cash allowance", "cost of living allowance", and "charitable matching contribution". In classification 2 more productivity-related perks include "personal use of aircraft", "personal use of automobile", "car service", and "parking"; less productivity-related perks are "club memberships", "tickets and entertainment", "personal meals", "personal travel", "professional association dues", "perk cash allowance", and "charitable matching contribution". In classification 3 more productivity-related perks include "financial services" and "car service"; less productivity-related perks include "club memberships" and "tickets and entertainment". Cluster-robust standard errors are in parentheses with clustering at firm level. ***, **, * indicate significance level at 1%, 5% and 10% level respectively.

	Classification 1		Classification 2		Classification 3	
	More productivity-related perks	Less productivity-related perks	More productivity-related perks	Less productivity-related perks	More productivity-related perks	Less productivity-related perks
Ln (Size$_{t-1}$)	0.422***	0.317**	0.437***	0.305*	0.217***	0.198
	(0.065)	(0.113)	(0.069)	(0.140)	(0.073)	(0.233)
Market to Book Ratio$_{t-1}$	-0.039	0.032	-0.027	-0.034	-0.046	-0.046
	(0.024)	(0.033)	(0.022)	(0.030)	(0.031)	(0.030)
Stock Return$_t$	-0.262	0.555*	-0.106	0.346	0.053	-0.167
	(0.179)	(0.314)	(0.214)	(0.275)	(0.190)	(0.487)
Stock Return$_{t-1}$	-0.017	-0.353	-0.127	-0.381	0.210	-0.423
	(0.187)	(0.316)	(0.214)	(0.295)	(0.196)	(0.586)
Return on Assets$_t$	-0.015	-0.377	-0.030	2.838*	-0.625	2.270
	(0.561)	(1.324)	(0.735)	(1.610)	(0.796)	(1.760)
Return on Assets$_{t-1}$	-0.876	-0.336	-0.466	-0.232	-0.457	2.833
	(1.266)	(2.051)	(1.449)	(2.349)	(1.233)	(5.645)
Free Cash Flow$_{t-1}$	-0.221	-1.318	-0.854	0.336	0.018	-0.630
	(0.810)	(1.494)	(0.948)	(1.250)	(0.724)	(1.838)
Sales Growth$_{t-1}$	-0.574	-0.133	-0.169	-0.179	0.155	-0.708
	(0.428)	(0.559)	(0.576)	(0.560)	(0.349)	(0.937)
Ln(Tenure$_t$)	-0.157	0.051	-0.155	-0.014	0.077	0.409
	(0.098)	(0.179)	(0.100)	(0.185)	(0.116)	(0.379)
Female	-0.043	1.053*	-0.316	0.777*	-0.653*	1.584***
	(0.330)	(0.551)	(0.414)	(0.441)	(0.393)	(0.583)
Constant	10.179***	9.233***	8.975***	6.918***	8.198***	8.468***
	(0.730)	(1.194)	(0.761)	(1.633)	(0.770)	(2.328)
Year Fixed Effects	Y	Y	Y	Y	Y	Y
Industry Fixed Effects	Y	Y	Y	Y	Y	Y
Observations	829	448	684	287	384	115
R-squared	0.254	0.228	0.240	0.361	0.284	0.526

Appendix A: Closed-form Solutions

We first conjecture that the solutions for $w(s)$ and $p(s)$ take the following forms:

$$w(s) = As^C \text{ and } p(s) = Bs^D$$

First of all, the conjectured forms of $w(s)$ and $p(s)$ yield $(w(\underline{s}), p(\underline{s})) = (0,0)$ because $\underline{s} = 0$. Therefore, they satisfy the initial condition. We will derive the exact values of $A, B, C,$ and D by using the first order conditions, i.e., equations (10) and (11), in (b) in Proposition 1.

Given the conjectured forms of the solutions and the market matching function, $m(s) = ks^q$, equation (11) becomes

$$\frac{bA}{dB} s^{C-D} + \alpha\delta B^{\alpha-1} k^{\beta} s^{\alpha D - D + \beta q + \gamma} = \phi\lambda B^{\phi-1} s^{\phi D - D} \tag{A1}$$

Equation (A1) is satisfied when the powers of s in the equation satisfies

$$C - D = \alpha D - D + \beta q + \gamma \tag{A2}$$

$$\alpha D - D + \beta q + \gamma = \phi D - D \tag{A3}$$

Solving equation (A3) for D yields

$$D = \frac{\beta q + \gamma}{\phi - \alpha} \tag{A4}$$

Plugging equation (A4) into equation (A2), we can solve equation (A2) for C:

$$C = \frac{\phi(\beta q + \gamma)}{\phi - \alpha} \text{B} \tag{A5}$$

Because the powers of s on each side of equation (A1) are the same as in equations (A2) and (A3), the coefficients on both sides of equation (A1) must be the same as well:

$$\frac{b}{d} A + \alpha\delta B^{\alpha} k^{\beta} = \phi\lambda B^{\phi} \tag{A6}$$

From equation (A1), we derive the values of C and D in equations (A4) and (A5) and the relationship between A and B.

Given the conjectured forms of $w(s)$ and $p(s)$, the market matching function, $m(s) = ks^q$, and the values of C and D in equations (A4) and (A5), equation (10) becomes

$$A\left(\phi + \frac{b}{d}\right)\left(\frac{\beta q + \gamma}{\phi - \alpha}\right) s^{\frac{\phi(\beta q+\gamma)}{\phi-\alpha}-1} = B^{\alpha}\beta\delta k^{\beta} q s^{\frac{\phi(\beta q+\gamma)}{\phi-\alpha}-1} \tag{A7}$$

The powers of s on both sides of equation (A7) are the same. Therefore, if the coefficients on both sides are the same, then equation (A7) is satisfied:

$$A\left(\phi + \frac{b}{d}\right)\left(\frac{\beta q + \gamma}{\phi - \alpha}\right) = B^{\alpha}\beta\delta k^{\beta} q \tag{A8}$$

Solving equation (A8) for A yields

$$A = \frac{B^{\alpha}\beta\delta k^{\beta}}{\left(\phi + \frac{b}{d}\right)\left(\frac{\beta q + \gamma}{\phi - \alpha}\right)} \tag{A9}$$

Plugging equation (A9) into equation (A6) and solving equation (A6) for B yields

$$B = \left[\frac{\delta k^{\beta}}{\lambda\phi}\left(\frac{b\beta q}{d\left(\frac{\beta q + \gamma}{\phi - \alpha}\right)\left(\phi + \frac{b}{d}\right)} + \alpha\right)\right]^{\frac{1}{\phi-\alpha}} \tag{A10}$$

By plugging equation (A10) into equation (A9), we can derive the exact value of A. Therefore, equations (A2), (A3), (A9), and (A10) completely determine the values of A, B, C, and D.

Appendix B: Sample Summary Compensation Table[11]

Name and Principal Position (a)	Year (b)	Salary ($) (c)	Bonus ($) (d)	Stock Awards ($) (e)	Option Awards ($) (f)	Non-Equity Incentive Plan Compensation ($) (g)	Change in Pension Value and Nonqualified Deferred Compensation Earnings ($) (h)	All Other Compensation ($) (i)	Total ($) (j)
PEO[1]									
PFO[2]									
A									
B									
C									

[1] Refers to principal executive officer
[2] Refers to principal financial officer

[11] See: http://www.sec.gov/news/press/2006/2006-123_table.pdf

Appendix C: Definition of Variables

Variable Name	Variable Definition
Firm Level Variables	
Ln(Size)	natural logarithm of firm size – the proxy for firm size is market value defined as book value of debt plus market value of equity
Market to Book Ratio	fiscal year end share price times common shares outstanding divided by book value of equity
Stock Return	fiscal year end price plus all per share dividend payments during the fiscal year all divided by prior fiscal year end share price
Return on Assets (ROA)	net income divided by total assets
Free Cash Flow	net income plus depreciation & amortization plus interest after tax minus the increase in net working capital minus capital expenditures
Free Cash Flow Ratio	free cash flow divided by total assets
Sales Growth	increase in sales over prior fiscal year divided by prior fiscal year sales
GIM Governance Index	a measure of corporate governance as defined in Gompers, Ishii and Metrick (2003) in which lower values correspond to higher levels of corporate governance
Manager Level Variables	
Ln(Wage)	natural logarithm of the sum of salary, bonus, stock awards, option awards, non-equity incentive plan compensation, and change in pension value and nonqualified deferred compensation earnings
Ln(Perks)	natural logarithm of the sum of personal use of aircraft, relocation expenses, personal use of automobile, security, financial services, club memberships, reimbursement for unused vacation, personal services/use of assets, car service (car and driver), tickets and entertainment, personal meals, personal travel, professional association dues, perk cash allowance, legal fees, parking, cost of living allowance, charitable gift matching, medical/health, and other perks
Ln(Tenure)	natural logarithm of the length of service (in years) of the executive
Female	indicator variable that equals one if the manager is a female and zero if male