# The Role of Perks in CEO Compensation: Theory and Evidence*

Andrew Carrothers, Seungjin Han, Jiaping Qiu, Zi Yang

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Why do perks remain persistent in CEO compensation despite public scrutiny, and why do they grow faster than wages as firm size increases? This paper develops an equilibrium matching model to jointly determine CEO wages and perks in a competitive labor market. By incorporating cost structures, utility complementarities, and the distinction between productivity-related and non-productivity-related perks, the model explains their value to firms and their sensitivity to firm size. Empirical evidence from S&P 500 firms reveals economies of scale in providing perks and differing sensitivities across perk types, highlighting their nuanced nature and strategic role in CEO compensation.

**Keywords:** perks, executive compensation, private benefits, competitive CEO market, productivity-related perks
**JEL Classifications:** C78, J33, G30

* Carrothers is from the University of Prince Edward Island, Qiu is from Shanghai University of Finance and Economics, Han and Yang are from McMaster University. Han and Qiu acknowledge support from the Social Sciences and Humanities Research Council of Canada.

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## Abstract

Why do perks remain persistent in CEO compensation despite public scrutiny, and why do they grow faster than wages as firm size increases? This paper develops an equilibrium matching model to jointly determine CEO wages and perks in a competitive labor market. By incorporating cost structures, utility complementarities, and the distinction between productivity-related and non-productivity-related perks, the model explains their value to firms and their sensitivity to firm size. Empirical evidence from S&P 500 firms reveals economies of scale in providing perks and differing sensitivities across perk types, highlighting their nuanced nature and strategic role in CEO compensation.



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# 1. Introduction

Compensation for corporate chief executive officers (CEOs) has risen dramatically beyond the rising wage level of average workers over the past decades (e.g., Hall and Murphy, 2003; Murphy and Zabojnik, 2004; Mishel and Kandra, 2020). Public controversy about such pay disparity has resulted in increased scrutiny of all aspects of CEO compensation, both pecuniary and nonpecuniary. CEO pecuniary compensation, or simply wage, normally includes cash salary, bonus, equity, and options. Nonpecuniary compensation, often referred to as perquisites or perks, is a benefit 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.

Despite ongoing controversy, executive perks remain widespread. For instance, executives' personal use of corporate jets has surged by 50% since the onset of the COVID-19 pandemic, representing a benefit that collectively costs companies millions. In 2022 alone, S&P 500 companies spent $65 million on personal trips for top executives using corporate aircraft (Francis and Stamm, January 16, 2024). Figure 1 shows that 68% of firms in the S&P 500 provided perks in 2010, and this number remained high at 80% in 2022. This persistence raises the question: why do firms keep offering CEO perks despite the potential to monetize these benefits and avoid controversy?

A straightforward explanation is that perks are a product of weak corporate governance, allowing CEOs to divert corporate resources for personal benefit (e.g., Jensen and Meckling, 1976; Sloan, 2001; Bebchuk and Fried, 2004). However, given the heightened public scrutiny surrounding CEO perks, it is unlikely that such diversions represent the optimal choice for CEOs.

Furthermore, as shown in Figure 2, both wages and perks increase with firm size, but the ratio of perks to total compensation (wages plus perks) rises at an even faster rate with firm size. It would be hard to argue that the quality of corporate governance uniformly declines as firm size grows. This suggests that, while governance could play a role, it is unlikely to fully explain this phenomenon. The widespread adoption of CEO perks indicates that they are likely the result of market-driven selection, benefiting both firms and CEOs. Understanding this phenomenon requires examining the underlying market mechanism that drives the adoption of perks and their relationship to both firm strategy and CEO wage compensation. However, progress in addressing this question has been hindered by two key obstacles: (i) the lack of a theoretical framework that jointly examines the roles of wages and perks in the competitive CEO labor market and (ii) the limited availability of detailed perks data, which constraints systematic analysis of the factors driving CEO perks.

Our study aims to address this question by (i) presenting a novel theory in which firms strategically use both CEO wages and perks to attract talent in a competitive CEO market, accounting for the unique characteristics of perks that differentiate them from wages, and (ii) exploring the determinants of executive perks in S&P 500 firms using a newly compiled panel dataset that, to the best of our knowledge, provides the most comprehensive information on CEO perks to date.

To understand the role of perks in CEO compensation, it is crucial to consider the unique characteristics that distinguish them from wages. First, from the firm's perspective, the costs associated with providing perks may differ from those related to wages. On the one hand, perks can be more cost-effective if economies of scale are achieved—for instance, a car service or financial consultant may serve multiple executives. On the other hand, perks can become costly if

they exacerbate agency problems or generate negative perceptions among investors (Armstrong et al., 2010). For example, a golf club membership might distract a CEO from their responsibilities, while the personal use of corporate aircraft may elicit negative investor reactions, potentially raising the firm's cost of capital (Yermack, 2006).

Second, from the CEO's perspective, perks and other consumption goods (purchased using wages) may complement each other in their utility function. As proposed by Hirsch (1976) and Rajan and Wulf (2006), perks can act as status symbols, reflecting the executive's standing within the firm. As positional goods, the consumption of perks may increase the marginal utility derived from other goods, thereby intertwining perks and wages within the CEO's preference.

Third, from both the firm's and the CEO's perspectives, perks can be categorized as either productivity-related or non-productivity-related, depending on their impact on CEO performance. Productivity-related perks create common value for both the firm and the CEO by enhancing productivity and overall utility. In contrast, non-productivity-related perks offer private benefits to the CEO, increasing their utility without contributing to productivity. Therefore, the type of perks provided may influence the incentives of both the firm and the CEO in their bargaining over compensation.

This paper develops a competitive model of the joint determination of CEO wages and perks. Our equilibrium model incorporates (i) heterogeneity in both CEO talent and firm size, (ii) competitive bargaining over multidimensional compensation packages (including wages and perks) in the CEO labor market, and (iii) consideration of the costs of providing perks, the CEO's preferences over wages and perks, and the productivity-related nature of perks. The generosity of our model allows us to generate novel insights into the relationships among perks, wages, firm size, and CEO talent—insights that previous studies have been unable to provide.

Our model yields three primary predictions regarding the relationship between wages, perks, and firm size in equilibrium. First, in equilibrium, stable matching is assortative between firm size and CEO talent in a continuum of firms and CEOs. Both wages and perks increase with firm size. This result aligns with Gabaix and Landier (2008), who show that the best CEOs manage the largest firms, maximizing the impact of their talent and economic efficiency. However, our contribution extends their findings by demonstrating that this relationship holds even in a multi-dimensional contract (wages and perks) as long as perks and wages are complementary in preferences. Second, if the cost function of providing perks is concave—reflecting economies of scale—perks become more sensitive than wages to changes in firm size, increasing at a faster rate as firms grow. Intuitively, since larger firms offer higher total compensation to attract talented CEOs, they find it cost-effective to allocate a larger portion of this compensation to perks when the marginal cost of providing perks decreases with firm size due to economies of scale. Third, the sensitivity of perks to firm size depends on their productivity-enhancing effects: the greater the productivity benefits of perks, the faster they increase with firm size. If perks enhance productivity, firms have a stronger incentive to include them in compensation packages. This effect is particularly pronounced in large firms, where even a small increase in productivity can lead to significant profit gains.

Our theory explains why perks are widely adopted in CEO compensation despite potential negative public perception and scrutiny and why perks would become a more significant component in compensation when firm size grows. The theoretical predictions also allow us to assess the cost function of providing perks and evaluate the distinct roles of productivity-related versus non-productivity-related perks in CEO compensation.

To empirically examine the joint determinants of CEO wages and perks, we assemble a panel database on CEO perks in S&P 500 companies. On January 27, 2006, the SEC (Securities 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 perk if they exceeded 25% of the overall total perk value, given that the reporting threshold was reached. The 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 wages, perks, and firm size. We use a combination of manual collection and generative artificial intelligence (e.g., ChatGPT) to gather and classify information on CEO perks from public disclosures contained in the proxy statements that S&P 500 companies filed with the SEC between 2007 and 2023. To the best of our knowledge, our data provides the most comprehensive CEO perks information to date at S&P 500 companies.

Our empirical analysis shows that both perks and wages are increasing in firm size, while perks are more sensitive than wages to changes in firm size. Based on closed-form solution equations in our model, the estimated coefficients for firm size from the wage and perks equations further permit us to recover the parameter in the cost function of providing perks. Our results indicate that this cost function is concave, suggesting, on average, that there are economies of scale

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 wages and perks provides strong support for the predictions of our theory and highlights the differential role of perks from wages in CEO compensation.

Our paper makes two key contributions to the literature. First, it develops the first equilibrium theory that incorporates perks into CEO compensation, extending existing theories that primarily focus on wages. Our study advances the literature on CEO compensation by analyzing the economics of CEO perks. We demonstrate that economies of scale in providing perks, complementarities between perks and wages, and the common value of perks (i.e., their productivity-enhancing effects) make a compensation structure that includes both wages and perks more cost-effective than offering wages alone when attracting CEOs. Our model explains why perks are widely included in CEO compensation packages and why their relative importance tends to increase with firm size. Moreover, our theoretical framework is sufficiently general to apply to other settings requiring multi-dimensional contract analysis in matching markets.

Second, we provide the first systematic empirical analysis of CEO perks using a newly assembled and comprehensive dataset from S&P 500 firms. Because executive perks information is not available in standard research databases, prior studies have relied on data from a single type of perk, small random samples, or survey-based information. Consequently, the existing empirical evidence on CEO perks is both limited and mixed. For instance, Yermack (2006) finds that the

disclosure of executives' personal use of corporate jets is associated with lower equity returns. Core et al. (2006) suggest that managers in not-for-profit firms may extract private benefits through excess perquisites or compensation. Rajan and Wulf (2006) show that firms are more likely to offer perks in scenarios where they enhance CEO productivity. Our unique dataset, which includes detailed disclosures on a broad range of perks, enables us to rigorously test our theoretical predictions. By recovering the cost function of providing perks and distinguishing between productivity-related and non-productivity-related perks, our empirical analysis uncovers the strategic determinants of perks and highlights their distinct role in executive compensation. It is important to note that our theory does not exclude the rent-extraction view; rather, it offers a complementary explanation by emphasizing the strategic role of perks, which helps to explain their persistence and widespread use.

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. Model

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 wages. 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 measures of CEOs and firms are 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 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 $p$. $f_t(p, t, s) > 0$ and $f_s(p, t, s) > 0$ so that the firm's output increases in the CEO's talent and its size. If $f_p(p, t, s) > 0$, perks have a 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 private value because they increase only the CEO's utility.

### 2.1 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. 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 $\emptyset$ so that $m(s) = \emptyset$ 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 the firm $s$, firm $s$ will agree to any compensation package $(w, p)$ as long as it gives the firm

a profit at least as high as the one that the firm would have by hiring a 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, the 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 alternative 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 firm size among firms that hire CEOs in equilibrium. We normalize the equilibrium wage $w(\underline{s})$ for the CEO hired by firm $\underline{s}$ to make its equilibrium profit equal to zero:

$$w(\underline{s}) = f\big(p(\underline{s}), m(\underline{s}), \underline{s}\big) - c\Big(p(\underline{s})\Big). \tag{1}$$

If the $i^{\text{th}}$ best firm hires the $i^{\text{th}}$ best CEO in a stable matching equilibrium, matching is called (positively) assortative. When matching is assortative, the market matching function is uniquely determined by $F(s) = G(m(s))$ for all $s \geq \underline{s}$. That is, $m(s)$ denotes the CEO talent that has the same percentile on the CEO side as the firm size $s$ has on the firm side. Proposition 1 below characterizes the stable matching equilibrium.

**Proposition 1**. The stable assortative matching equilibrium is characterized by the tuple of market functions $\{w(\cdot), p(\cdot), m(\cdot)\}$ that satisfies

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

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

for all $s \geq \underline{s}$.

Appendix A shows that assortative matching is a unique, stable matching equilibrium under mild conditions. Equations (2) and (3) are the first-order conditions for the problems for both CEOs and firms that are matched given the assortative matching function $F(s) = G(m(s))$.

Equation (2) shows that in equilibrium, the marginal change in the total value of wages 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 competitive CEO market, this change in the total output is fully passed to the CEO through changes in wages 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 $s$. 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 in the CEO's utility normalized by the marginal utility of wage (i.e., the dollar value of the increase in utility) and the increase in output. Equations (2) and (3) jointly determine wages and perks in the compensation package for the CEO $m(s)$.

### 2.2 Closed-Form Analysis

We provide closed-form solutions for equilibrium wages and perks under a widely used class of functional forms.

Given the market matching function $m(s)$, we can solve the first-order differential equations 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:

$$m(s) = ks^q, \tag{4}$$

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 (4) 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 (4) become $q = k_1/k_2$ and $k = t_m/s_m^{k_1/k_2}$. [1]

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, $\alpha$, $\beta$, and $\gamma$, determine the marginal rates of technical substitution between perks, the CEO's talent, and firm size. The parameter $\delta$ represents technology level. If $\alpha > 0$, perks are productivity-related and are strictly complementary to both CEO talent and firm size; perks have a 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 firm's cost function for providing perks is given

[1] 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 possibly the CEO's talent in the matching market for CEOs (Gabaix and Landier, 2008). The functional form in equation (4) can also be derived when the distributions of firm size and CEO talent follow a class of Fréchet distributions or a class of Gumbel distributions.

by $c(p) = \lambda p^{\phi}$ with $\lambda > 0$ and $\phi > 0$. Therefore, the profit function of firm $z$ is $\Pi = \delta p^{\alpha} t^{\beta} s^{\gamma} - w - \lambda p^{\phi}$.

The CEO's utility function is $u(w, p) = a w^{d} p^{b}$, where $a > 0$, $0 < d \leq 1$, 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 Proposition 1 become, for all $s \geq \underline{s}$,

$$w'(s) + \frac{bw(s)}{dp(s)} p'(s) = \delta\beta p(s)^{\alpha} m(s)^{\beta-1} s^{\gamma} m'(s), \tag{5}$$

$$\frac{bw(s)}{dp(s)} + \alpha\delta p(s)^{\alpha-1} m(s)^{\beta} s^{\gamma} = \phi\lambda p(s)^{\phi-1}, \tag{6}$$

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 the initial condition and the matching function, we then solve Equations (5) and (6) 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,

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

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

$$ln\, w\,(s) = ln\, A + \frac{\phi(\beta q+\gamma)}{\phi-\alpha} ln\, s, \tag{7}$$

$$ln\, p\,(s) = ln\, B + \frac{\beta q+\gamma}{\phi-\alpha} ln\, s. \tag{8}$$

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 (7) and (8) show that the sensitivities of wages and perks to the change of firm size increase with a higher $\alpha$ because the coefficients of the logarithmic firm size in the two equations increase in $\alpha$. Recall the firm's production function is $f(p, x, z) = \delta p^{\alpha} t^{\beta} s^{\gamma}$. A higher $\alpha$ indicates that 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

$$ln\, w\,(s) = ln\tilde{A} + (\beta q + \gamma)\, ln\, s, \tag{9}$$

$$ln\, p\,(s) = ln\tilde{B} + \frac{\beta q+\gamma}{\phi} ln\, s. \tag{10}$$

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

### 2.3 Implications

Because wages and perks are complementary in CEO utility, the firm can raise the CEO's utility more cost-effectively by increasing both wages 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 wages 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 logarithmic 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 decreases in the level of perks, but since wages are linear in money, the marginal cost of the wage is always constant. This implies that larger firms will increase perks more than wages due to the economies of scale in providing 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.

Equation (8) shows that the equilibrium equation for perks is steeper when they are more productivity-related, i.e., have a higher value of $\alpha$. 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 predictions.

1. In equilibrium, wages and perks are positively linearly related to firm size.
2. If the slope of the wage equation exceeds that of the perk equation, then the cost function of perks is convex. On the other hand, if the slope of the perk equation exceeds that of the wage equation, then the cost function of perks is concave. In particular, the exponent in the cost function of perks, parameter $\phi$, equals the ratio of the coefficient of firm size in the wage equation to that in the perk 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.

# 3. Empirical Analysis

## 3.1 Data

Our source of data on perks originates from public disclosures contained in proxy statements that S&P 500 companies filed with the SEC between January 1, 2007 and May 31, 2023, 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 2022. 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 also choose to include compensation for other executives, such as those recently retired or terminated. Appendix C 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 lowercase 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.[2] *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

[2] 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."

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 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*. Some companies include this information in the footnotes of the summary compensation table, while some provide it in a separate table, creating challenges in extracting perks data for each executive. To overcome this obstacle, we use regular expressions to locate the relevant sections of proxy statements that disclose all other compensation for executives at S&P 500 firms. We then employ generative AI (e.g., ChatGPT) to extract the specific perks reported by the firms and their respective values. Finally, we merge the perks data with the CEO data for further analysis.

The final merged dataset used for regression comprises 7,180 observations on 1,508 CEOs from 748 firms. The number of firms exceeds 500 due to changes in the composition of the S&P 500 over time. Any firm that was part of the S&P 500 for at least one year during the sample period is included in our sample. All variables are winsorized at the top and bottom one percent. See Appendix D for detailed definitions of variables used in this study.

[Table 1 about here]

Table 1 presents descriptive statistics for variables related to firm and managerial characteristics, and corporate governance. Given that the sample pool consists of S&P 500 companies, the firms in our dataset are large and generally profitable, as indicated by the positive average return on assets ($ROA_t$) of 0.05, and span 63 sectors defined by two-digit SIC (Standard Industry Classification) codes. Firm size ($Ln(Size_{t-1})$) and assets ($Ln(Asset_{t-1})$) have means of 9.41

and 9.51, respectively. Compared to wages, CEO perks show higher variation, with standard deviations of 1.53 for *Ln(Perks)* and 0.84 for *Ln(Wage)*, respectively. In terms of governance, board independence averages 0.89, and 6% of CEOs hold dual roles as board chair (CEO Dual Role). Our sample firms span 63 sectors defined by two-digit SIC (standard industry classification) codes.

### 3.2 Perk 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 services 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 meanings. We incorporate the classification from Bowie and Yu (2024) and classify perks into these 19 categories reported in Table 2 using ChatGPT (model: GPT 4o).[3] ChatGPT effectively captures different expressions with similar meanings. For example, "Vacation Cash-Out" and "Holiday and unused vacation pay" are both classified as "Payment for unused vacation." Similarly, ChatGPT groups items like "relocation benefits," "moving expenses," and "employee moving allowance" into "relocation expenses" since they all relate to costs associated with executive relocation. Companies often disclose miscellaneous or other perks; we consolidate these items with other not-easily-classifiable descriptions as "other perks." Similar approaches are employed in the literature to consolidate perks. Grinstein, Weinbaum, and Yehuda (2017) compile a perk database based on 2007 and 2008 SEC filings for a random sample of small, medium, and large firms. They document 30 descriptions of perks consolidated into ten main perk items, including tax gross-ups. Rajan and Wulf (2006) used a

[3] Examples of classification are provided in Appendix D.

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 our approach represents the most precise and comprehensive perk database, utilizing consistent, stringent compensation disclosure rules. Furthermore, our use of AI for classification enhances the accuracy and efficiency of consolidating diverse perk descriptions.

[Table 2 about here]

Table 2 provides a summary of *all other compensation* for CEOs in fiscal years 2006 to 2022. 98.79% of CEOs receive "all other compensation," with an average value of $350,410. 94.68% of CEOs receive "additional compensation", with an average of $216,950. 71.19% of CEOs receive "perquisites and other personal benefits," with an average value of $164,110. The most common perks for CEOs under the category "perquisites and other personal benefits" include personal use of corporate aircraft (29.93%), financial/tax planning or services (26.41%), company car/car allowance (20.89%), security services (9.26%), executive physicals (7.43%), and matching gifts/charity (6.50%). The highest-valued perks for CEOs are cash allowance ($278,400), security services ($265,280), relocation expenses ($169,940), personal use of corporate aircraft ($140,200), and housing allowance ($103,950).

The data also reveals significant variation in the types and values of perks offered. For instance, although security services are provided to only 9.26% of CEOs, the average cost of this benefit is among the highest at $265,280. In contrast, financial/tax planning services are offered to 26.41% of CEOs with a considerably lower average value of $35,180. Perks such as the personal use of corporate aircraft, while enjoyed by 29.93% of CEOs, represent an average value of $140,200. Overall, while CEOs of S&P 500 companies broadly benefit from a range of perks, the

usage rates and values differ significantly across firms, reflecting the varying importance and exclusivity of each benefit.

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 19 perk items described in Table 2.[4]

The Spearman's rank correlation coefficients between wage and perks are 0.3216 for CEOs, significant at the 1% level. The results indicate that wages are positively associated with perks. The correlation coefficient between CEO wage and firm size is 0.6107, while the correlation coefficient between CEO perks and firm size is 0.2630; both are significant at a 1% level. The positive correlations between wages, perks, and firm size are consistent with our theory that large firms tend to offer both higher wages and higher perks to attract more talented CEOs, 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 (7) through (10)) 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:

[4] 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 (2017) 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.

$$Ln(Wage_{it}) = \alpha_W + \beta_W Ln(Size_{it-1}) + \boldsymbol{X}'_{it-1}\boldsymbol{\gamma}_W + u_j^w + v_t^w + \varepsilon_{it}^w \quad (11)$$

$$Ln(Perks_{it}) = \alpha_P + \beta_P Ln(Size_{it-1}) + \boldsymbol{X}'_{it-1}\boldsymbol{\gamma}_P + u_j^p + v_t^p + \varepsilon_{it}^p \quad (12)$$

where $Ln(Wage_{it})$ and $Ln(Perks_{it})$ are the natural logarithm of CEO *i*'s wage and perks compensation in year *t*, respectively.[5] $Ln(Size_{i,t-1})$ 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 the number of employees, total assets, and sales. 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., the sum of the book value of debt and market value of equity) offers the highest predictive power in 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. [6]

$\boldsymbol{X}$ 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 and Larcker, 2008; Rose and Shepard, 1997; Edmans, Gabaix and Jenter, 2017). We use this literature as a guide in choosing explanatory variables for our regression analyses. Specifically, we control for firm growth opportunities, market performance, accounting

[5] Note that our regression is conditional on the sample where firms provide perks (Perks>0), as we apply a direct logarithmic transformation. In our main test, we avoid adding one before taking the logarithm to prevent potential bias from the transformation (Cohn et al., 2022; Chen and Roth, 2023). Nevertheless, we conduct a robustness check using this approach to incorporate firms that do not offer perks. Additionally, we employ an alternative method by assigning a value of zero to the dependent variable after taking the logarithm. Our findings remain similar.

[6] The empirical results using an alternative measure of size are presented in Appendix F.

performance, cash flow, growth, tenure, and gender. $u_j$ is industry $j$'s fixed effect. $v_t$ is year t's fixed effect. $\beta_W$ and $\beta_P$ measure the sensitivities of wages and perks to firm size. We also estimate Equation (12) 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 $\beta_W/\beta_P$ is equal to the parameter $\phi$ in the cost function of perks. If the cost function of perks is concave, $\phi < 1$, perks are more sensitive to firm size than wages, 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 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 $Ln(Size_{i,t-1})$, other firm characteristics, industry dummy, and year dummy as explanatory variables. Column (4) includes $Ln(Size_{i,t-1})$, other firm and managerial characteristics, as well as industry and year dummies as explanatory variables. We also control for corporate governance by including board independence and whether the CEO also serves as the board chair since previous research suggests that firms with weaker governance structures are more prone to engaging in value-destructive perquisite consumption. In Column (5), we use the Governance Pillar from the Refinitiv database as an alternative measure of corporate governance.

This measurement consists of the management score, which assesses a company's commitment to best practice corporate governance; the shareholders score, which evaluates the company's treatment of shareholders and use of anti-takeover measures; and the CSR strategy score, which reflects how well the company integrates financial, social, and environmental aspects into its decision-making processes. However, the sample size limitation of this measurement led to the loss of over 1,000 observations, and therefore, we treat the regression in Column (4) as the main specification.

[Tables 3 and 4 about here]

For the equilibrium wage equation presented in Table 3, the coefficients for $Ln\ (Size_{i,t-1})$ vary between 0.258 and 0.284 across the five regressions, all of which are significant at the 1% level. Specifically, in the complete specification shown in the fourth column of Table 3, the coefficient is 0.276, suggesting that a 1% increase in firm size corresponds to a 0.276% rise in the CEO's wage. For the estimated equilibrium perks equation in Table 4, coefficients for $Ln\ (Size_{i,t-1})$ range from 0.351 to 0.453 over the five regressions, all significant at the 1% level. In the complete specification in the fourth column of Table 4, the coefficient is 0.433, indicating that a 1% increase in firm size leads to a 0.433% increase in the CEO's total perks. Column (5) in Tables 3 and 4 includes the Refinitiv G Score as an alternative measurement to control corporate governance, which has no great impact on the coefficients for $Ln\ (Size_{i,t-1})$. These results provide strong evidence supporting Hypothesis 1, which states that both wages and perks increase with firm size.

[Table 5 about here]

To test Hypothesis 2 and evaluate the cost function of perks, Table 5 summarizes the ratios of $\beta_W/\beta_P$ using the estimated coefficients from Tables 3 and 4. The model predicts that the

exponent $\phi$ in the perquisite cost function, $c(p) = \lambda p^{\phi}$, is equal to $\beta_W/\beta_P$. 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 $\beta_W/\beta_P$ ranges from 0.585 to 0.809. Based on the complete specification in the fourth columns of Tables 3 and 4, $\beta_W/\beta_P$ is equal to 0.637. The $Chi^2$ tests for the hypothesis that $\beta_W/\beta_P = 1$ yield p-values below 1% across specifications 2 through 4, and a p-value below 10% for specification 1, 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.

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 the 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 organizes the perks listed in Table 2 (excluding "other perks") based on their relevance to productivity, focusing on their potential to save time. This classification was conducted using ChatGPT, which rated each perk on a scale from 0 to 10 according to its ability to save the CEO's time. The top one-third of perks are categorized as "more productive," while the bottom one-third are labeled as "less productive." Specifically, perks with a score above 7 were categorized as "more productive," while those scoring four or below were labeled as "less productive." Specifically, the following perks are considered more productivity-related due to their ability to save time for CEOs: "payment for unused vacation" (score: 8), "personal use of corporate

aircraft" (score: 9), "financial/tax planning or service" (score: 7), "company car/car allowance" (score: 7), "legal fees" (score: 7), and "relocation expense" (score: 8). In contrast, the less productivity-related perks include: "spouse travel" (score: 3), "matching gifts/charity" (score: 2), "club dues" (score: 4), "tickets and entertainment" (score: 3), "personal meals" (score: 4), and "personal traveling" (score: 4).

In Classification 2, we assess perks using a scoring system generated from a ChatGPT prompt, with a particular focus on transportation-related perks. [7] The rationale remains consistent: perks that address transportation needs are deemed more productivity-related, as they reduce transit time or allow the CEO to focus on business during travel. As in Classification 1, the top one-third of perks are categorized as "more productive," while the bottom one-third is labeled as "less productive."[8] However, some perks classified as "more productive" in Classification 2 are considered "less productive" in Classification 1, such as spouse travel and personal traveling. Although these types of perks are highly transportation-related, they are less likely to increase productivity because they introduce personal distractions or reduce the executive's focus on business. Therefore, to avoid including transportation-related perks that don't genuinely boost productivity, perks labeled 'less productive' in Classification 1 are not reclassified as 'more productive' in Classification 2, and vice versa. The following perks are considered more productivity-related due to their ability to address transportation needs for CEOs: "personal use of corporate aircraft" (score: 10), "company car or car allowance" (score: 10), "parking" (score: 9), and "relocation expense" (score: 7). In contrast, the less productivity-related perks include:

[7] Specifically, we use the following prompt: "Please provide ratings based on whether the perk is directly related to transportation on a scale of 1 to 10, along with a brief explanation for each rating."
[8] With this classification, a high concentration of perks scored 1—exceeding one-third of the total. As such, Perks with a transportation score of 7 or higher are classified as "more productive," while those with a score of 1 are classified as "less productive."

"executive physical" (score: 1), "matching gifts or charity" (score: 1), "club dues" (score: 1), "perquisite allowance" (score: 1), "housing allowance" (score: 1), "personal meal" (score: 1), and "cash allowance" (score: 1).

Classification 3 includes perks only if they are consistently categorized in both Classification 1 and Classification 2. For example, "financial/tax planning or service" is labeled as "more productive" in Classification 1 but not in Classification 2 and is therefore excluded from Classification 3 to maintain precision. This approach eliminates perks that present ambiguities or mixed results in previous classifications. The details of the time scores and transportation-related scores for all perks, as used in classifications 1, 2, and 3, are provided in Appendix G.

[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. Columns (1) and (2) report the results based on Classification 1, showing that the slope coefficient for more productivity-related perks is 0.368, while that for less productivity-related perks is 0.261. Both are significant at the 1% level. Columns (3) and (4) report the results based on Classification 2, showing that the coefficient for more productivity-related perks is 0.379, and for less productivity-related perks, the slope is 0.257. Columns (5) and (6) report the results based on Classification 3. The coefficient for more productivity-related perks is 0.376, while that for less productivity-related perks is 0.307. 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 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, page 72). 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 conditional on personal perks makes it 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 wages to changes in firm size, indicating that, 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 gives firms an added incentive to offer higher levels of productivity-related perks as their sizes increase.

## 4. Conclusions

This study develops an equilibrium matching model to explain the joint determination of CEO wages and perks in a competitive CEO market. By incorporating the unique characteristics of perks—such as their cost structures, complementarity with wages in utility, and the distinction between productivity-related and non-productivity-related nature—our theory provides a framework for understanding the prevalence and persistence of perks despite public scrutiny. We demonstrate that perks, alongside wages, increase with firm size, and that the sensitivity of perks to firm size is higher due to economies of scale in their provision. Furthermore, productivity-related perks, which provide mutual value to both the firm and the CEO, are more responsive to firm size than those offering only private utility.

Our findings provide both theoretical and empirical insights into the role of perks in CEO compensation. Specifically, our results reveal that perks could be a cost-effective and utility-enhancing component of compensation packages, particularly when they improve productivity. These insights have important implications for corporate governance and executive compensation policies. They suggest that perks are not necessarily excessive or something that should always be monetized; rather, they complement wages in retaining talent by enhancing executives' well-being and productivity.

These findings offer implications for both firms and regulators. Firms should consider designing compensation packages that incorporate productivity-enhancing perks tailored to

improve executive well-being and job satisfaction, as such perks can simultaneously boost productivity and attract top talent. At the same time, non-productive perks that offer purely private benefits should be carefully evaluated to ensure they align with shareholder interests. For regulators, the results highlight the need for nuanced policies that distinguish between productivity-related perks and those that merely provide personal utility to executives. Rather than blanket scrutiny, regulatory efforts should focus on enhancing transparency and ensuring that perks with no tangible benefits to the firm face stricter oversight. By addressing these aspects, both firms and policymakers can strike a balance between maintaining effective executive compensation practices and protecting shareholder value.

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Figure 1

**Proportion of Firms Offering CEO Perks Over Time**

The figure displays the percentage of S&P 500 firms providing CEO perks from 2007 to 2022.

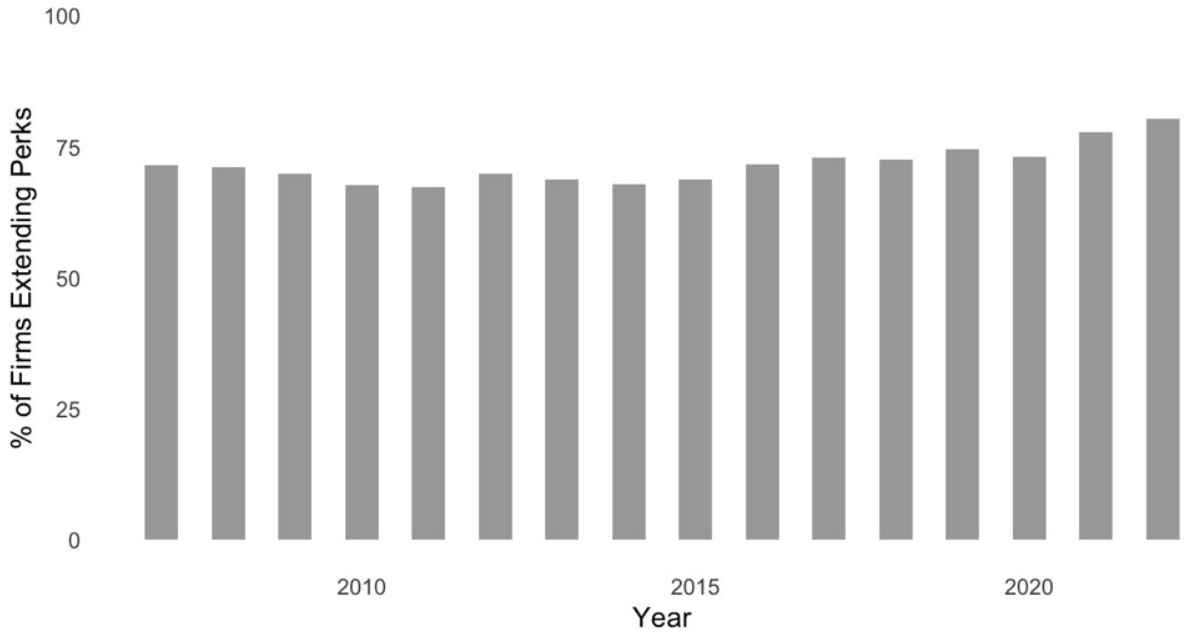

Figure 2
**Median Perks and Wage by Size Quantiles**

This figure plots median CEO perks (dark grey bars, left axis) and median wage (light grey bars, right axis) across five size ‐ based quantiles of firms. The black line shows the median ratio of perks to wage.

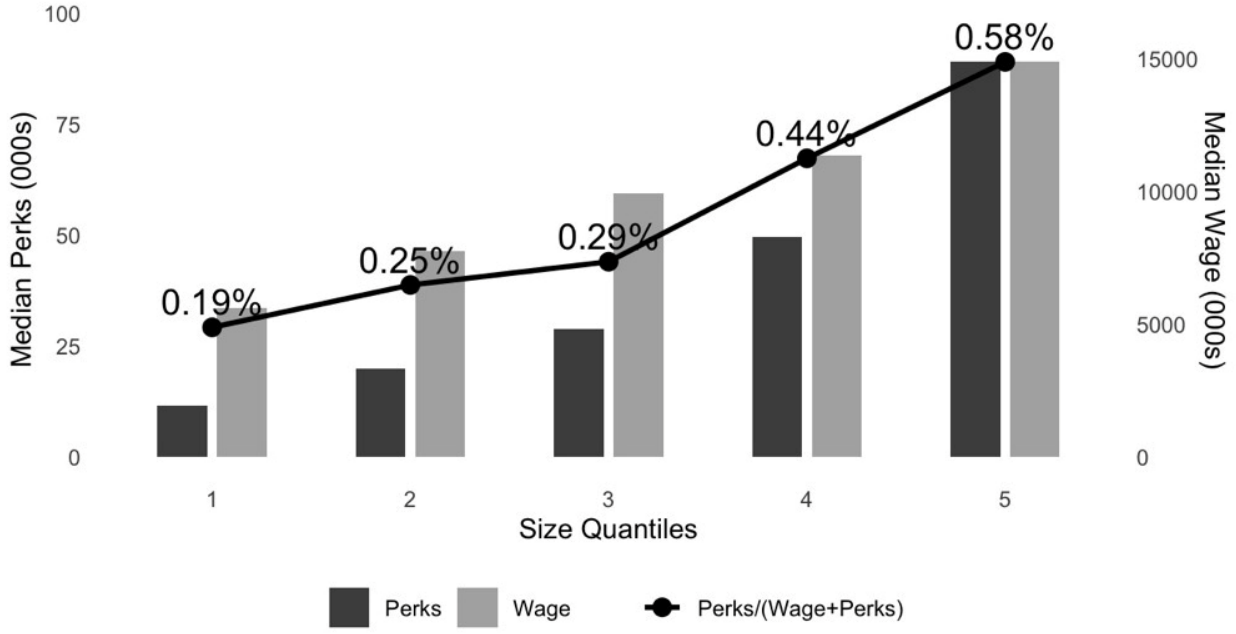

Table 1
**Summary statistics of firm characteristics**

The table provides summary statistics for firm and managerial characteristics, including dependent variables, independent variables, and control variables used in our regression analysis. Perks, wages, and employee counts are expressed in thousands of dollars, while firm size, assets, and sales are reported in millions of dollars.The sample consists of S&P 500 firms from January 1, 2007, to May 31, 2023. Detailed definitions of all variables are provided in Appendix C.

| | Obs | Mean | Std | Min | P25 | Median | P70 | Max |
|---|---|---|---|---|---|---|---|---|
| Ln (Perks$_t$) | 7180 | 4.12 | 1.53 | -0.20 | 3.13 | 4.15 | 5.20 | 7.77 |
| Ln (Wage$_t$) | 7180 | 9.12 | 0.84 | 4.61 | 8.76 | 9.22 | 9.63 | 10.72 |
| Ln (Size$_{t-1}$) | 7097 | 9.41 | 1.37 | 5.63 | 8.49 | 9.38 | 10.29 | 12.60 |
| Ln (Employee $_{t-1}$) | 7134 | 2.88 | 1.43 | -1.51 | 2.01 | 2.90 | 3.86 | 5.93 |
| Ln (Asset$_{t-1}$) | 7172 | 9.51 | 1.51 | 5.73 | 8.44 | 9.41 | 10.46 | 13.69 |
| Ln (Sales$_{t-1}$) | 7171 | 8.93 | 1.30 | 5.26 | 8.06 | 8.87 | 9.70 | 12.05 |
| Market/Book$_{t-1}$ | 7096 | 3.83 | 8.25 | -33.96 | 1.54 | 2.59 | 4.47 | 51.77 |
| Stock Return$_t$ | 7102 | 0.03 | 0.38 | -1.33 | -0.14 | 0.08 | 0.25 | 1.06 |
| Stock Return$_{t-1}$ | 7010 | 0.05 | 0.37 | -1.28 | -0.11 | 0.09 | 0.26 | 1.07 |
| ROA$_t$ | 7178 | 0.05 | 0.08 | -0.29 | 0.02 | 0.05 | 0.09 | 0.28 |
| ROA$_{t-1}$ | 7172 | 0.05 | 0.08 | -0.29 | 0.02 | 0.05 | 0.09 | 0.28 |
| Cash Flow Ratio$_{t-1}$ | 7170 | 0.07 | 0.07 | -0.19 | 0.03 | 0.06 | 0.10 | 0.28 |
| Sales Growth$_{t-1}$ | 7158 | 0.07 | 0.19 | -0.45 | -0.01 | 0.05 | 0.13 | 0.94 |
| Ln (Tenure$_t$) | 7137 | 1.87 | 0.72 | 0.00 | 1.39 | 1.95 | 2.40 | 3.50 |
| Female$_t$ | 7180 | 0.05 | 0.22 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 |
| Board Independence$_t$ | 7051 | 0.89 | 0.13 | 0.00 | 0.83 | 0.91 | 1.00 | 1.00 |
| CEO Dual Role$_t$ | 7051 | 0.06 | 0.24 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 |
| Refinitiv G Score$_t$ | 5831 | 0.60 | 0.26 | 0.00 | 0.40 | 0.63 | 0.83 | 1.00 |

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, 2007 and May 31, 2023. 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 19 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.

| | Freq | Mean | Std | Min | Max |
|---|---|---|---|---|---|
| Total *All Other Compensation* | 98.79% | 350.41 | 713.09 | 0.21 | 5344.72 |
| **Main Categories** | | | | | |
| *Perquisites & Other Personal Benefits* | 71.19% | 164.11 | 279.58 | 0.02 | 1651.10 |
| *Additional All Other Compensation* | 94.68% | 216.95 | 512.24 | 0.07 | 4001.57 |
| **Main Perk Items Under *Perquisites & Other Personal Benefits*** | | | | | |
| Personal use of corporate aircraft | 29.93% | 140.20 | 138.37 | 1.49 | 776.72 |
| Financial/tax planning or service | 26.41% | 35.18 | 88.30 | 0.28 | 724.10 |
| Company car/car allowance | 20.89% | 28.98 | 36.51 | 0.71 | 227.15 |
| Security services | 9.26% | 265.28 | 707.37 | 0.27 | 5017.45 |
| Executive physical | 7.43% | 4.54 | 4.74 | 0.22 | 30.00 |
| Matching gifts/charity | 6.50% | 39.15 | 76.14 | 0.20 | 500.00 |
| Club dues | 4.86% | 12.59 | 15.40 | 0.15 | 96.50 |
| Relocation expense | 3.69% | 169.94 | 247.95 | 0.45 | 1500.00 |
| Spouse travel | 2.76% | 14.73 | 18.13 | 0.04 | 83.04 |
| Perquisite allowance | 2.51% | 44.96 | 34.30 | 2.28 | 224.15 |
| Housing allowance | 1.84% | 103.95 | 115.29 | 0.78 | 503.83 |
| Legal fees | 1.51% | 60.54 | 113.18 | 0.15 | 800.00 |
| Cash allowance | 1.26% | 278.40 | 958.80 | 0.03 | 5900.00 |
| Personal Traveling | 1.26% | 53.87 | 83.19 | 0.14 | 407.27 |
| Parking | 1.18% | 3.73 | 3.97 | 0.42 | 30.00 |
| Payment for unused vacation | 1.10% | 66.34 | 68.26 | 6.06 | 307.80 |
| Tickets and Entertainment | 0.39% | 10.42 | 27.90 | 0.08 | 135.46 |
| Personal Meal | 0.14% | 11.07 | 32.85 | 0.03 | 124.84 |
| Others | 24.40% | 93.30 | 292.99 | 0.10 | 2335.50 |

Table 3
**Wage and firm size**

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

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

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. $\boldsymbol{X}_{it-1}$ are control variables including Market to Book Ratio$_{t-1}$, Stock Return$_t$, Stock Return$_{t-1}$, Return on Assets$_t$, Return on Assets$_{t-1}$, Cash Flow Ratio$_{t-1}$, Sales Growth$_{t-1}$, Ln(Tenure$_t$), Female, Board Independence$_t$ and CEO Dual Role$_t$ and Refinitiv G Score$_t$. 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$_{t-1}$) | 0.284*** | 0.258*** | 0.277*** | 0.276*** | 0.265*** |
| | (0.023) | (0.026) | (0.028) | (0.028) | (0.029) |
| Market/Book$_{t-1}$ | | | -0.003 | -0.003 | -0.004 |
| | | | (0.002) | (0.002) | (0.002) |
| Stock Return$_t$ | | | 0.177*** | 0.185*** | 0.176*** |
| | | | (0.042) | (0.043) | (0.044) |
| Stock Return$_{t-1}$ | | | 0.133*** | 0.137*** | 0.153*** |
| | | | (0.032) | (0.033) | (0.037) |
| ROA$_t$ | | | -0.162 | -0.142 | -0.211 |
| | | | (0.229) | (0.235) | (0.266) |
| ROA$_{t-1}$ | | | -0.608*** | -0.551** | -0.504* |
| | | | (0.227) | (0.230) | (0.258) |
| Cash Flow Ratio$_{t-1}$ | | | -0.220 | -0.289 | -0.251 |
| | | | (0.238) | (0.243) | (0.239) |
| Sales Growth$_{t-1}$ | | | -0.222** | -0.224** | -0.191 |
| | | | (0.102) | (0.105) | (0.117) |
| Ln (Tenure$_t$) | | | 0.006 | 0.011 | 0.022 |
| | | | (0.032) | (0.032) | (0.033) |
| Female$_t$ | | | 0.114 | 0.108 | 0.100 |
| | | | (0.070) | (0.073) | (0.076) |
| Board Independence$_t$ | | | | -0.091 | |
| | | | | (0.108) | |
| CEO Dual Role$_t$ | | | | 0.013 | |
| | | | | (0.048) | |
| Refinitiv G Score$_t$ | | | | | -0.042 |
| | | | | | (0.058) |
| Year FE | NO | YES | YES | YES | YES |
| Industry FE | NO | YES | YES | YES | YES |
| Observations | 7,097 | 7,097 | 6,964 | 6,861 | 5,705 |
| R-squared | 0.216 | 0.314 | 0.330 | 0.331 | 0.305 |

Table 4
**Perks and firm size**

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

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

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. $\boldsymbol{X}_{it-1}$ are control variables including Market to Book Ratio$_{t-1}$, Stock Return$_t$, Stock Return$_{t-1}$, Return on Assets$_t$, Return on Assets$_{t-1}$, Cash Flow Ratio$_{t-1}$, Sales Growth$_{t-1}$, Ln(Tenure$_t$), Female$_t$, Board Independence$_t$ and CEO Dual Role$_t$ and Refinitiv G Score$_t$. 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$_{t-1}$) | 0.351*** | 0.383*** | 0.435*** | 0.433*** | 0.453*** |
| | (0.028) | (0.035) | (0.036) | (0.036) | (0.039) |
| Market/Book$_{t-1}$ | | | -0.002 | -0.002 | -0.004 |
| | | | (0.003) | (0.003) | (0.003) |
| Stock Return$_t$ | | | 0.173*** | 0.179*** | 0.232*** |
| | | | (0.059) | (0.060) | (0.066) |
| Stock Return$_{t-1}$ | | | -0.124** | -0.111* | -0.105 |
| | | | (0.059) | (0.059) | (0.072) |
| ROA$_t$ | | | -1.138*** | -1.148*** | -0.817** |
| | | | (0.352) | (0.358) | (0.382) |
| ROA$_{t-1}$ | | | -1.850*** | -1.820*** | -1.236*** |
| | | | (0.366) | (0.376) | (0.414) |
| Cash Flow Ratio$_{t-1}$ | | | 0.727 | 0.642 | 0.219 |
| | | | (0.476) | (0.486) | (0.517) |
| Sales Growth$_{t-1}$ | | | -0.244* | -0.228 | -0.166 |
| | | | (0.141) | (0.144) | (0.152) |
| Ln (Tenure$_t$) | | | 0.148*** | 0.140*** | 0.161*** |
| | | | (0.048) | (0.048) | (0.053) |
| Female$_t$ | | | 0.006 | 0.003 | 0.009 |
| | | | (0.126) | (0.127) | (0.151) |
| Board Independence$_t$ | | | | -0.222 | |
| | | | | (0.336) | |
| CEO Dual Role$_t$ | | | | -0.339*** | |
| | | | | (0.117) | |
| Refinitiv G Score$_t$ | | | | | -0.289** |
| | | | | | (0.133) |
| Year FE | NO | YES | YES | YES | YES |
| Industry FE | NO | YES | YES | YES | YES |
| Observations | 7,097 | 7,097 | 6,964 | 6,861 | 5,705 |
| R-squared | 0.099 | 0.185 | 0.205 | 0.209 | 0.215 |

Table 5

**Estimation of parameter $\phi$ in perk cost function**

This table summarizes the estimate of parameter $\phi$ 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 $\phi$ is the exponent in the perk cost function, $c(p) = \lambda p^{\phi}$.

| | (1) | (2) | (3) | (4) | (5) |
|---|---|---|---|---|---|
| $\beta_W$: Coefficient for $Ln(Size_{i,t-1})$ from $Ln(Wage_{it})$ regression (Table 3) | 0.284 | 0.258 | 0.277 | 0.276 | 0.265 |
| $\beta_P$: Coefficient for $Ln(Size_{i,t-1})$ from $Ln(Perks_{it})$ regression (Table 4) | 0.351 | 0.383 | 0.435 | 0.433 | 0.453 |
| $\beta_W/\beta_P$: Estimates of Parameter $\phi$ | 0.809 | 0.674 | 0.637 | 0.637 | 0.585 |
| Firm and Manegerial Controls | NO | NO | YES | YES | YES |
| Board Governance Controls | NO | NO | NO | YES | NO |
| Refinitiv G Score | NO | NO | NO | NO | YES |
| Year FE | NO | YES | YES | YES | YES |
| Industry FE | NO | YES | YES | YES | YES |

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$_t$), Female$_t$, Board Independence$_t$, and CEO Dual Role$_t$. The subscripts $_t$ and $_{t-1}$ indicate the 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 "payment for unused vacation," "personal use of corporate aircraft," "financial/tax planning or service," "company car/car allowance," "legal fees," and "relocation expense." Less productivity-related perks include "spouse travel," "matching gifts/charity," "club dues," "tickets and entertainment," "personal meal," and "personal traveling." In classification 2, more productivity-related perks include "personal use of corporate aircraft," "company car/car allowance," "parking," and "relocation expense." Less productivity-related perks are "executive physical," "matching gifts/charity," "club dues," "perquisite allowance," "housing allowance," "personal meal," and "cash allowance." In classification 3, more productivity-related perks include "personal use of corporate aircraft," "company car/car allowance," and "relocation expense." Less productivity-related perks include "matching gifts/charity," "club dues," and "personal meal." Cluster-robust standard errors are in parentheses, with clustering at the firm level. ***, **, * indicate significance level at 1%, 5% and 10% level respectively.

| | Classification 1 | | Classification 2 | | Classification 3 | |
|---|---|---|---|---|---|---|
| | More productivity-related | Less productivity-related | More productivity-related | Less productivity-related | More productivity-related | Less productivity-related |
| Ln (Size$_{t-1}$) | 0.368*** | 0.261*** | 0.379*** | 0.257*** | 0.376*** | 0.307*** |
| | (0.041) | (0.077) | (0.041) | (0.061) | (0.039) | (0.076) |
| Market/Book$_{t-1}$ | 0.001 | 0.007 | -0.001 | -0.007 | -0.001 | 0.001 |
| | (0.003) | (0.006) | (0.003) | (0.005) | (0.003) | (0.006) |
| Stock Return$_t$ | 0.170*** | 0.132 | 0.152** | 0.107 | 0.152** | 0.153 |
| | (0.062) | (0.133) | (0.064) | (0.104) | (0.063) | (0.134) |
| Stock Return$_{t-1}$ | -0.042 | -0.032 | -0.011 | -0.135 | -0.026 | 0.040 |
| | (0.058) | (0.152) | (0.060) | (0.114) | (0.060) | (0.165) |
| ROA$_t$ | -1.112*** | 0.400 | -1.083*** | -0.468 | -1.115*** | 0.231 |
| | (0.360) | (0.718) | (0.395) | (0.598) | (0.396) | (0.738) |
| ROA$_{t-1}$ | -1.426*** | 0.221 | -1.704*** | -0.515 | -1.727*** | 0.560 |
| | (0.390) | (0.784) | (0.446) | (0.695) | (0.446) | (0.869) |
| Cash Flow Ratio$_{t-1}$ | 0.186 | 0.617 | 1.156** | 2.419*** | 1.086** | 0.512 |
| | (0.469) | (1.080) | (0.519) | (0.903) | (0.513) | (1.125) |
| Sales Growth$_{t-1}$ | -0.132 | 0.133 | -0.198 | 0.158 | -0.151 | 0.173 |
| | (0.136) | (0.311) | (0.153) | (0.232) | (0.151) | (0.298) |
| Ln (Tenure$_t$) | 0.104** | 0.038 | 0.096* | -0.087 | 0.075 | 0.011 |
| | (0.049) | (0.100) | (0.057) | (0.075) | (0.056) | (0.099) |
| Female$_t$ | 0.034 | -0.922*** | 0.197 | -0.626*** | 0.178 | -1.427*** |
| | (0.171) | (0.293) | (0.126) | (0.212) | (0.126) | (0.270) |
| Board Independence$_t$ | -0.424 | 0.125 | -0.220 | -0.326 | -0.145 | 0.245 |

| | | | | | | |
|---|---|---|---|---|---|---|
| | (0.362) | (0.631) | (0.489) | (0.643) | (0.486) | (0.661) |
| CEO Dual Role$_t$ | -0.267** | -0.404* | -0.130 | 0.133 | -0.141 | -0.135 |
| | (0.116) | (0.226) | (0.137) | (0.215) | (0.134) | (0.208) |
| Year FE | YES | YES | YES | YES | YES | YES |
| Industry FE | YES | YES | YES | YES | YES | YES |
| Observations | 5,362 | 1,406 | 4,363 | 2,093 | 4,297 | 1,080 |
| R-squared | 0.196 | 0.232 | 0.199 | 0.187 | 0.200 | 0.312 |

## Appendix

### A. Uniqueness of Stable Assortative Matching

This appendix provides sufficient conditions for assortative matching to be the unique stable matching pattern.

In assortative matching, the $i^{\text{th}}$ best CEO works for the $i^{\text{th}}$ 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 $F(s) = G(m(s))$ 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.[10] 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 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 $x = (x_1, \dots, x_n) \geq x' = (x_1', \dots, x_n')$ if $x_i \geq x_i'$ for all $i = 1, \dots, n$. 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

$$e(x) + e(x') \leq e(x \vee x') + e(x \wedge x') \tag{A1}$$

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 $x'$, (A1) holds with strict inequality. When the function $e$ is twice differentiable, supermodularity is equivalent to

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

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 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.

**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.[11] 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

$$f_{pt} + f_{pp}p_t^* - c''(p)p_t^* - \lambda u_{pw}w_t^* - \lambda u_{pp}p_t^* = 0, \quad \text{(A2)}$$

[11] 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 $t = m(s)$.

$$-\lambda u_{ww} w_t^* - \lambda u_{wp} p_t^* = 0. \quad \text{(A3)}$$

One can solve the systems of Equations (A2) and (A3) for $p_t^*$ and $w_t^*$. The solution for $p_t^*$ is

$$p_t^* = \frac{-f_{pt}\lambda u_{ww}}{}.$$

The Largrangian multipler $\lambda$ 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 $t$:

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

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 $s_H > s_L$

$$\Pi(t_H,s_H) - \Pi(t_L,s_H) > \Pi(t_H,s_L) - \Pi(t_L,s_L) \quad \text{(A4)}$$

Equation (A4) 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

$$\Pi(t_H,s_L) \geq \Pi(t_L,s_L) \quad \text{(A5)}$$

From Equations (A4) and (A5), 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 surplus 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 the 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 ones 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 wages and perks together with her partner. Hence, it is easy to verify whether our sufficient condition is satisfied.

**B. 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 (5) and (6), in (b) in Proposition 1.

Given the conjectured forms of the solutions and the market matching function, $m(s) = ks^q$, Equation (6) becomes

$$\frac{bA}{dB}s^{C-D} + \alpha\delta B^{\alpha-1}k^{\beta}s^{\alpha D-D+\beta q+\gamma} = \phi\lambda B^{\phi-1}s^{\phi D-D} \quad \text{(A6)}$$

Equation (A6) is satisfied when the powers of $s$ in the equation satisfies

$$C - D = \alpha D - D + \beta q + \gamma \quad \text{(A7)}$$

$$\alpha D - D + \beta q + \gamma = \phi D - D \quad \text{(A8)}$$

Solving Equation (A8) for $D$ yields

$$D = \frac{\beta q+\gamma}{\phi-\alpha} \quad \text{(A9)}$$

Plugging Equation (A9) into Equation (A7), we can solve Equation (A7) for $C$:

$$C = \frac{\phi(\beta q+\gamma)}{\phi-\alpha}\text{B} \quad \text{(A10)}$$

Because the powers of $s$ on each side of Equation (A6) are the same as in Equations (A7) and (A8), the coefficients on both sides of Equation (A6) must be the same as well:

$$\frac{b}{d}A + \alpha\delta B^{\alpha}k^{\beta} = \phi\lambda B^{\phi} \quad \text{(A11)}$$

From Equation (A6), we derive the values of $C$ and $D$ in Equations (A9) and (A10) 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 (A9) and (A10), Equation (5) becomes

$$A\left(\phi + \frac{b}{d}\right)\left(\frac{\beta q+\gamma}{\phi-\alpha}\right)s^{\frac{\phi(\beta q+\gamma)}{\phi-\alpha}-1} = B^{\alpha}\beta\delta k^{\beta}qs^{\frac{\phi(\beta q+\gamma)}{\phi-\alpha}-1} \tag{A12}$$

The powers of $s$ on both sides of Equation (A12) are the same. Therefore, if the coefficients on both sides are the same, then equation (A12) is satisfied:

$$A\left(\phi + \frac{b}{d}\right)\left(\frac{\beta q+\gamma}{\phi-\alpha}\right) = B^{\alpha}\beta\delta k^{\beta}q \tag{A13}$$

Solving Equation (A13) for $A$ yields

$$A = \frac{B^{\alpha}\beta\delta k^{\beta}}{\left(\phi+\frac{b}{d}\right)\left(\frac{\beta q+\gamma}{\phi-\alpha}\right)} \tag{A14}$$

Plugging Equation (A14) into Equation (A11) and solving Equation (A11) for $B$ yields

$$B = \left[\frac{\delta k^{\beta}}{\lambda\phi}\left(\frac{b\beta q}{d\left(\frac{\beta q+\gamma}{\phi-\alpha}\right)\left(\phi+\frac{b}{d}\right)} + \alpha\right)\right]^{\frac{1}{\phi-\alpha}} \tag{A15}$$

By plugging Equation (A15) into Equation (A14), we can derive the exact value of $A$. Therefore, Equations (A7), (A8), (A14), and (A15) completely determine the values of $A, B, C,$ and $D$.

## C. Sample Summary Compensation Table[12]

| 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 the principal executive officer
[2] Refers to the principal financial officer

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

**D. 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 |
| Ln(Employee) | alternative proxy of firm size – natural logarithm of total employee |
| Ln(Asset) | alternative proxy of firm size – natural logarithm of total asset |
| Ln(Sales) | alternative proxy of firm size – natural logarithm of sales |
| Market/Book | fiscal year end share price times common shares outstanding divided by book value of equity |
| Stock Return | the difference between the natural logarithm of the fiscal year-end closing price and the log of the prior fiscal year-end closing price. |
| Return on Assets (ROA) | net income divided by total assets |
| Cash Flow Ratio | free cash flow divided by total assets, free cash flow is calculated as operating cash flow (oancf) minus extraordinary items (xidoc), plus net interest paid (intpn), adjusted for interest expense ((pi- ni) /pi *xint), and minus capital expenditures (capx). |
| Sales Growth | increase in sales over prior fiscal year divided by prior fiscal year sales |
| Refinitiv G Score | Governance Pillar Score from Refinitiv database. This measurement consists of the management score, which assesses a company's commitment to best practice corporate governance; the shareholders score, which evaluates the company's treatment of shareholders and use of anti-takeover measures; and the CSR strategy score, which reflects how well the company integrates financial, social, and environmental aspects into its decision-making processes. |
| Board Independence | the ratio of independent directors to the total number of directors on the board, calculated as the number of independent directors divided by the board size. |
| 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 corporate aircraft, financial/tax planning or service, company car/car allowance, security services, executive physical, matching gifts/charity, club dues, relocation expense, spouse travel, perquisite allowance, housing allowance, legal fees, cash allowance, personal traveling, parking, payment for unused vacation, tickets and entertainment, personal meal, and others |
| 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 |

| | |
|---|---|
| CEO Dual Role | an indicator variable that equals 1 if the CEO also serves as the board chair, and 0 otherwise |

**E. ChatGPT Classification Example**

| System | User Prompt | Assistant |
|---|---|---|
| I will give you a benefit provided by the firm to executive. Classify the perk into one of the following categories based on the definition you know:<br>1. Payment for unused vacation<br>2. Personal use of corporate aircraft<br>3. Financial/tax planning or service (eg. tax gross-up)<br>4. Executive physical<br>5. Company car/car allowance<br>6. Security services<br>7. Spouse travel<br>8. Matching gifts/charity<br>9. Club dues<br>10. Perquisite allowance<br>11. Housing allowance<br>12. Tickets and Entertainment<br>13. Parking<br>14. Personal Meal<br>15. Cash allowance<br>16. Legal fees<br>17. Relocation expense<br>18. Personal Traveling<br>Only reply with the category number. If there are multiple categories, use ";" to separate them (e.g., 2; 3; 5) | Spouse/Guest Travel to Company Business Functions | 7 |
| | Company Match of Charitable Contributions | 8 |
| | Use of Company Plane | 2 |

## F. Alternative Measurement

This table replicates the regressions from Table 3 and Table 4, Column (4), using alternative proxies for firm size, including the logarithm of employee count, book assets, and sales. 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$_t$), Female$_t$, Board Independence$_t$, and CEO Dual Role$_t$. The subscripts $_t$ and $_{t-1}$ indicate the current and prior fiscal year respectively. We adopt three classifications for more productivity-related and less productivity-related perks. We also report the Chi-square test statistic, which is used to assess whether the coefficients of size in two different models—one for perks and the other for wages—are significantly different.

| | (1) Perks | (2) Wage | (3) Perks | (4) Wage | (5) Perks | (6) Wage |
|---|---|---|---|---|---|---|
| Ln (Employee$_{t-1}$) | 0.424*** | 0.251*** | | | | |
| | (0.037) | (0.018) | | | | |
| Ln (Asset$_{t-1}$) | | | 0.407*** | 0.260*** | | |
| | | | (0.036) | (0.023) | | |
| Ln (Sales$_{t-1}$) | | | | | 0.473*** | 0.291*** |
| | | | | | (0.039) | (0.026) |
| $Chi^2$ Statistics | 21.94*** | | 12.88*** | | 15.76*** | |
| Controls | YES | YES | YES | YES | YES | YES |
| Year FE | YES | YES | YES | YES | YES | YES |
| Industry FE | YES | YES | YES | YES | YES | YES |
| Observations | 6,847 | 6,847 | 6,861 | 6,861 | 6,860 | 6,860 |
| R-squared | 0.205 | 0.309 | 0.205 | 0.327 | 0.217 | 0.333 |

**G. ChatGPT Classification**

| Item | Time Score | Classification 1 | Transportation Score | Classification 2 | Classification 3 |
|---|---|---|---|---|---|
| Payment for unused vacation | 8 | More productive | 1 | | |
| Personal use of corporate aircraft | 9 | More productive | 10 | More productive | More productive |
| Financial/tax planning or service | 7 | More productive | 1 | | |
| Executive physical | 6 | | 1 | Less productive | |
| Company car/car allowance | 7 | More productive | 10 | More productive | More productive |
| Security services | 5 | | 2 | | |
| Spouse travel | 3 | Less productive | 8 | | |
| Matching gifts/charity | 2 | Less productive | 1 | Less productive | Less productive |
| Club dues | 4 | Less productive | 1 | Less productive | Less productive |
| Perquisite allowance | 5 | | 1 | Less productive | |
| Housing allowance | 6 | | 1 | Less productive | |
| Tickets and Entertainment | 3 | Less productive | 2 | | |
| Parking | 6 | | 9 | More productive | |
| Personal Meal | 4 | Less productive | 1 | Less productive | Less productive |
| Cash allowance | 5 | | 1 | Less productive | |
| Legal fees | 7 | More productive | 1 | | |
| Relocation expense | 8 | More productive | 7 | More productive | More productive |
| Personal Traveling | 4 | Less productive | 10 | | |