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PERFORMANCE-VESTED STOCK OPTIONS AND PAY-PERFORMANCE SENSITIVITY

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Performance-vested stock options and pay-performance sensitivity*

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Abstract

The paper investigates the incentive effects of performance-vested stock options (PVSOs) in aligning management interests with shareholder wealth. Performance targets attached to option vesting would prevent executives from receiving rewards from outcomes that are unaffected by their effort. Such targets align executive pay more closely with shareholder wealth. The degree of interest alignment is measured by pay-performance sensitivity (PPS). Using data on 4,238 executive-level observations for 1,383 executive directors in the largest 244 UK non-financial firms from 1999 to 2004, we find that the presence of PVSO schemes in executive-compensation contracts is associated with higher PPS, consistent with the idea that stronger incentives are provided by PVSOs. The empirical evidence also shows that PVSOs outperform unconditional stock options (TSOs) in providing incentives, since higher PPS is associated with the presence of PVSOs. Moreover, the results testify the role of vesting-target difficulty of PVSOs in the pay-performance relation. Specifically, difficult targets are associated with lower PPS levels, implying that too difficult targets negatively affect managers' choice of effort, that relatively lower effort is to be expected, and that the interests of managers will diverge from the interests of shareholders.

Keywords: Stock options, pay-performance sensitivity, equity incentive
JEL classifications: G31, G34, G39, M41

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PERFORMANCE-VESTED STOCK OPTIONS AND PAY-PERFORMANCE SENSITIVITY

1. INTRODUCTION

In the wake of the corporate scandals from the beginning of this decade, increasing concerns have been raised regarding various aspects of corporate governance (DeFond, Hann and Hu 2005). As an important component of corporate governance reforms, managerial compensation, especially equity compensation (stocks and stock options), has come under scrutiny. The vesting of traditional stock options (hereafter TSOs) is simply contingent upon the passage of time. Opponents of TSOs criticize the inadequate link between managers' pay and improvement of firm performance (Gerakos et al. 2005). For example, when the market as a whole rises, managers are generously rewarded even if they underperform the market average or their peers. Accordingly, activist shareholders have proposed that firms attach company-specific performance targets to equity compensation, and condition option vesting on the achievement of performance targets. These proposals have been rapidly implemented. As reported by Mercer Human Resource Consulting, 30 out of 100 major US corporations based a portion of the equity granted to their executives on performance targets in 2005, up from 17 in 2003, and 23 in 2004.

Although the claim is that vesting performance targets provides better incentives, the implications of such an awards mechanism on managerial behavior remain undocumented (Bruce and Buck 2005). Some theoretical studies show that performance-vested stock options (hereafter PVSOs) provide managers with greater incentives than their traditional counterparts have to behave in line with shareholder interests (Johnson and Tian 2000; Kuang and Suijs 2006). Yet, evidence also documents the undesirable consequences of such a compensation instrument. Risk-averse managers with undiversified portfolios have the incentive to influence their own compensation and self-serve in order to maximize their interests (Bertrand

and Mullainathan 2001; Hall and Murphy 2002). Basing payments or promotion opportunities of managers on the achievement of performance targets reduces the incentive effects of the compensation, and even induces managerial game-playing at the expense of shareholders (Healy 1985; Gaver et al. 1995; Jensen 2003). Camara and Henderson (2005) show that managers have incentives to manage earnings when PVSOs are granted. They provide analytical evidence that managers benefit from earnings manipulation, which increases the costs that the shareholders have to bear. Meanwhile, the consensus from the goal-setting literature promotes the idea that "challenging" targets are associated with improvements in firm performance (Merchant and Manzoni 1989; Locke and Latham 2002; Hansen et al. 2003; Jensen et al. 2004). Highly achievable targets, however, are also vulnerable to managerial manipulation, and the effectiveness of limiting managers' gains for moderate or poor performance is questioned (Conyon and Murphy 2000).

The debate on the incentive effects of PVSOs is also conducted in the practitioners' arena. In its Global Best Practice 2006 for "Corporate Performance Management", PWC advocates that firms attach performance targets to stock option compensation. In contrast, some high profile corporations urge shareholders to reject the proposal of PVSOs. They believe that attaching performance targets to stock options puts the company at a competitive disadvantage, in the sense that those performance hurdles constrain the company's ability to recruit and retain top talent.[1] Meanwhile, some executive compensation critics challenge the incentive effects of PVSOs. They allege that firms merely grant PVSOs in order to placate investors who are calling for compensation reforms, and that the symbolically adopted PVSOs with easily achievable performance targets will not provide additional incentives (Gerakos et al. 2005).

This study empirically examines the incentive effects of attaching performance targets to option vesting by testing the relation between PVSO compensation and pay-performance

[1] "Activists sink claws into executives' pay", *Wall Street Journal*, February 27, 2006.

sensitivity (PPS), a measure of interest alignment between owners and managers (Jensen and Murphy 1990; Garen 1994; Aggarwal and Samwick 1999; Conyon et al. 2000b). We attempt to answer two research questions: first, is PVSO compensation associated with greater interest alignment between managers and shareholders, and second, what is the role of vesting-target difficulty in this relationship? The study focuses on the UK because listed firms in the UK disclose more detailed information on managerial compensation compared to firms in the US, an advantage that helps our investigation. Based on a dataset of 4,238 individual-level observations from 1,383 executive directors in the largest 244 UK non-financial firms from 1999 to 2004, we find that the presence of PVSO schemes in managerial compensation contracts is associated with a higher level of pay-performance sensitivity compared with the case where PVSOs are absent, which suggests a better alignment of owner and manager interests through the use of PVSOs. Furthermore, PVSOs exhibit a higher level of PPS relative to their traditional counterparts (TSOs). In addition, we find that target difficulty influences pay-performance sensitivity in the sense that stricter performance targets cause lower interest alignment.

The contribution of this paper to the compensation literature is threefold. First, we are among the first to investigate empirically the incentive effects of PVSOs. Despite the popularity of PVSOs in contemporary compensation packages, the extent to which this incentive instrument is effective remains an open question. Second, we make a methodological contribution in the sense that we adopt multilevel modeling, which allows us to address the fact that some executives are more alike than others (i.e., within one firm), and to show that observations are not completely independent in the full sample. Finally, we are the first to study the issue of target difficulty in stock option compensation and to measure vesting-target difficulty with multiple measurements.

The remainder of the paper is organized as follows. We review the institutional background in Section 2 and develop the hypotheses in Section 3, followed by a description

of our methods and sample selection procedure in Section 4. Data sources are presented in Section 5. We discuss the empirical findings in Section 6. Section 7 presents the results of sensitivity tests. The paper concludes with a summary and discussion in Section 8.

2. INSTITUTIONAL BACKGROUND

UK managerial pay level and its association with firm performance are subjects that generate heated debates among government regulators, capital markets, and academia. Since the '80s, the rapidly increasing managerial compensation in leading companies (largely due to the growing popularity of stock and stock options as incentive devices) has drawn intensive scrutiny from many commentators (Conyon and Murphy 2000). It has become a topical policy issue to consider how managerial compensation should be crafted so as to provide incentives for higher managerial effort. One of the major concerns pertains to the incentive effects of TSOs. The vesting of TSOs is, in general, contingent only upon the passage of time. Opponents argue that managerial benefits might merely mirror be a reflection of the price increases in a rising market. Managers will in such cases receive windfall gains, even if they under-perform relative to the market average or to their peers. These concerns were voiced in influential corporate governance codes, issued by the Cadbury- (1992), Greenbury- (1995), and Hampel- (1998) committees, which describe the general framework of management compensation. Substantial changes were witnessed afterwards. For example, all listed firms must now include an audited report on executive remuneration in their annual reports, stating clearly their compensation policy for top managers and describing fully the remuneration packages of executive and non-executive directors.[2] A remuneration committee chaired by an independent director is responsible for setting the remuneration packages for the CEO and the other directors. At annual general meetings (AGMs), shareholders vote on executive

[2] The information on executive remuneration disclosed in UK annual reports is currently more detailed than under US disclosure regulations ("How the UK checks CEO pay", *Wall Street Journal*, February 8, 2006).

compensation packages. Although it is not mandatory to do so, companies often adhere to the outcomes of these votes (Conyon, Core and Guay 2006). Many reforms also took place on managerial compensation, the most prominent of which was to introduce performance hurdles into executive equity compensation, such as stock options. In the post-reform period, the majority of stock option exercises are conditional on the achievement of predetermined performance targets. In other words, without clearing these hurdles, managers cannot exercise the options, no matter how long they have held them.

Performance targets attached to option vesting are designed to reward managers for performance delivered. The most widely adopted target is the growth rate of earnings per share (EPS) (Conyon et al. 2000a). In its remuneration report of 2004, Allied Domecq describes its executives' Share Option Scheme as follows:

"…Options are normally exercisable after the third anniversary of the date of the grant and lapse ten years after the date of their original grant, subject to a performance condition based on earnings per share growth. Options become exercisable if company's growth in normalized earnings per share exceeds the growth in the UK retail prices index by 9% over three years following the grant of options."

The second most frequently used performance condition is total shareholder return (TSR).[3] When this measure is applied, option vesting usually depends on the market return of a firm relative to the performance of a peer group. The 2004 annual report of Cable & Wireless states the following:

[3] The choice of performance targets might be due to the distinction in accounting treatment between market-based performance targets (e.g., achieving a specified share price or a specified target based on a comparison of the entity's share price with an index of share prices of other entities) and non-market performance targets (e.g., revenues or profits). IFRS 2 states that the accounting for share-based payments depends on whether the performance condition is market-based, non-market based, or both. More specially, non-market-based performance features should not be included in the determination of the fair value of the share-based payments at the grant date. "True-up" adjustments are made at interim reporting dates, and only the options that vest are ultimately expensed. However, market-based performance conditions should be taken into account when estimating the fair value of the equity instrument granted, and thus there is no opportunity for true-up adjusting after option grants. When both performance features are applied to option grants, Paragraph 21 states that the grant date fair value of the share-based payment of a firm with market-based performance conditions that has met all its other vesting conditions should be recognized, irrespective of whether that market condition is achieved. But if all vesting conditions are met except the non-market-based performance condition, nil expense will be charged.

"…The vesting of share options awarded to the Executive Directors is subject to relative TSR performance conditions. Full vesting occurs only if the TSR performance of the Company meets or exceeds the upper quartile (of FTSE 100) on the third anniversary of the date of grant. Where TSR performance meets the median, 50 percent of the initial award vests. A sliding scale operates between median and upper quartile, and nothing vests for TSR performance below the median."

In response to the above-mentioned corporate governance codes, some investors and top managers in the UK have doubts about the proposed changes in the compensation system; they believe that firms suffer a brain drain of top talent when performance targets are attached to option vesting, especially in view of the lack of US-sized pay packages[4]. In spite of this opposition, the recommendations in the corporate governance codes still meet with widespread approval and implementation. In 1997, among the largest 200 UK firms, almost 60% of the operating stock option compensation plans for CEOs were based on performance criteria (Conyon et al. 2000a). In our sample, 54% of the firms that adopted stock option plans in their top manager compensation contracts attached performance targets to these stock options in 1999, and this proportion increased to 94% in 2004.[5]

3. HYPOTHESIS DEVELOPMENT

This section develops our hypotheses regarding the functioning of performance-vested stock options (PVSOs) in aligning shareholder value and management interests. We use the pay-for-performance sensitivity (PPS) to measure the interest alignment between shareholders

[4] "How UK checks CEO pay", *Wall Street Journal,* February 8, 2006.

[5] In the US, pension funds and other activist shareholders have been calling for a reform of TSO plans (Gerakos et al. 2005). Since the beginning of this decade, several high profile companies, from ConAgra Foods Inc. to Peoples Energy Corp., have started to put performance hurdles in stock and stock option compensations. In 2005, 30 out of 100 major US corporations based a portion of the equity granted to their CEOs on performance targets. Some commentators predict that half the nation's big companies will use such awards by the end of 2006 ("US boards tie CEO pay to results", *Wall Street Journal*, February 22, 2006). A variety of performance goals are employed as option vesting constraints in US firms, some of which are based on financial performance (i.e., earnings or revenue growth rate), while others link option exercise price to a market index or a certain price target. Under US regulations, however, firms are not required to disclose numerical goals, because it may give firms "a competitive disadvantage" (William Nuti, NCR Corp. CEO/President/Director).

and managers. PPS measures how managerial compensation changes with firm performance and shareholder wealth (Jensen and Murphy 1990; Garen 1994; Hall and Liebman 1998; Aggarwal and Samwick 1999).

All of the hypotheses are anchored in principal-agent theory. The first focuses on how PPS may differ between firms that grant PVSOs to their top managers and those without such equity compensation. The second hypothesis compares the functioning of PVSOs and TSOs to obtain interest alignment. Finally, the third hypothesis explores the role of target difficulty.

3.1 Compensating managers with PVSOs vs. without PVSOs

PVSOs can be considered as a compensation instrument with ingredients (i.e. target incentive and equity incentive) that stem from contingent pay, such as cash bonuses, and stock options, respectively. We argue the incentive effects of PVSOs from the two aspects as follows.

From a target-incentive perspective, performance targets induce higher managerial effort: managerial effort is private information to managers and not observable to shareholders. This creates a moral hazard problem, and observable performance is employed as an indicator of managerial effort. Managers are compensated based on improvements in observable performance (Holmstrom 1979; Grossman and Hart 1983; Christensen and Demski 2003). Suppose that managerial compensation consists of two elements: fixed salary and contingent pay based on observed performance. Thus, when performance targets are included in the contingent pay, managers receive only their base salary if they miss the predetermined targets.[6] Since observable performance is more likely to exceed the targets with high levels of effort, performance targets increase the incentive to exert high effort.

PVSOs are options with vesting conditional upon achieving predetermined targets.

[6] When the effort choice of managers significantly influences firm risk, convexity will be added to the optimal compensation contracts (Hemmer et al. 1999; Feltham and Wu 2001; Lambert and Larcker 2001; Core et al. 2003).

Such target arrangement would motivate managers to choose high effort, because this increases the probability of achieving targets and benefiting from the options. In addition, managerial effort may enhance the magnitude of managerial gains from stock options. Stock option compensation directly ties managers' gains to market prices. If the market appreciates the managerial effort, the perceived effort will be translated into a market price increase. In sum, managerial effort stimulated by vesting targets increases managerial payoff.

Performance targets are desirable from the shareholders' perspective because induced higher managerial effort promotes shareholder value. Since both managerial payments and shareholder wealth increase with managerial effort, performance targets stimulate high managerial effort and consequently closely align the interests of managers and shareholders[7]. Therefore, higher PPS arises in the presence of PVSOs, given that other factors (e.g. managerial risk aversion and firm risk) remain constant.

From an equity-incentive perspective, PVSOs reduce the interest conflict between shareholders and managers. Agency theorists argue compellingly that when the wealth of managers is not tied directly to firm value by stock ownership, managers may lack incentives to exert the level of effort desired by the shareholders, or may consume perquisites at the expense of the firm (Jensen and Meckling 1976; Stein 2001; Baldenius 2003; Bebchuk and Fried 2003). By granting stock options, shareholders share a value increase of the firm with the managers. As equity holders, managers have a claim to the firm's residual value. It is in the interest of both shareholders and managers to increase the firm's net profit and its market value. Prior studies have documented that with the increase of managerial ownership managers are less likely to undertake short-term myopic activities and are more likely to make decisions benefiting the firm in the long term, which coincides with shareholder interests

[7] Social-cognitive theory yields a similar prediction. As a member of the boardroom, managers usually play an active role in the goal setting process (Grinstein and Hirbar 2003; Buck et al. 2003). High levels of involvement build up managers' confidence in attaining the targets. Social-cognitive theory predicts that people with high self-confidence tend to set higher goals than those with low self-confidence and high self-confidence leads to performance improvements (Locke et al. 1990; Seijts et al. 2001).

(Warfield et al. 1995).[8]

Taken together, the above suggests a better interest congruence associated with performance-vested stock options, which can be demonstrated by a higher PPS level. Our first hypothesis is thus as follows:

H1: *Ceteris paribus,* the presence of performance-vested stock options in managerial compensation packages is associated with a higher level of pay-performance sensitivity.

3.2 Compensating managers with PVSOs vs. with TSOs

With traditional stock options, the payoff of managers depends solely on the difference between market prices at exercise date and exercise prices as determined on the grant day. Market prices are thus used implicitly as a performance measure. Nevertheless, market prices do not necessarily mirror managerial effort. For example, in a bull market, managers receive windfall gains from exercising stock options, even when they under-perform the market (Gerakos et al. 2005). Moreover, if they stay long enough, managers may weather bad periods and ultimately get option-related value, even if shareholder wealth is not promoted.

The Informativeness Principal (Holmstrom 1979) suggests that such noise in evaluating managerial effort constrains the provision of incentives. One remedy commonly recommended is to employ relative performance evaluation (RPE). In contrast to rewarding managers solely on their own performance, RPE compensates managers according to how well they perform relative to the market or their peers. Performance targets attached to PVSOs are usually related to market or peer group performance, and PVSOs are therefore a form of RPE. Indeed, firms condition stock option vesting on performance criteria that measure managerial performance relative to the whole economy or a group of comparable firms.[9] For

[8] Overwhelming managerial ownership may result in entrenchment problem (Claessens et al. 2002; Lennox 2005). In such cases, managers have incentives to pursue their own interests without increasing firm value.

[9] This is consistent with the recommendation of the Greenbury code (1995) that managers should not be rewarded for increases in market prices or other indicators that reflect general price inflation, general movements in share prices or movements in the share prices of an entire market or industry.

instance, in the UK, performance targets attached to stock options are generally classified into accounting-based and market-based targets. When accounting-based targets are applied, improvements are often required with respect to growth in earnings per share (EPS) in excess of inflation (e.g. 3% EPS growth annually above the retail prices index). When market-based targets are employed, option vesting usually depends on the firm's market return relative to a peer group, and only above-group-median performance is rewarded (Greenbury 1995). Rewarding managers on the basis of how well they do relative to the macroeconomic circumstances and/or competitors in the same industry reduces the noise and thus increases precision in inferring the unobservable effort of managers. Theoretical studies have demonstrated that incentive effects, as measured by the pay-performance relationship, are negatively (positively) related with the noise (precision) in performance measures (Baker 2000). PVSOs impose relative performance evaluation on stock option compensation. As a result, the reduction of the noise in performance measures increases the level of pay-performance sensitivity. Our second hypothesis is as follows:

H2: *Ceteris paribus,* the pay-performance relationship is higher for performance-vested stock options relative to traditional stock options.

3.3 Target difficulty in PVSOs

In an agency setting, Kuang and Suijs (2006) find that PVSOs induce higher managerial effort when performance targets are below a certain threshold, indicating that performance targets that are too difficult negatively impact managerial effort choices. 'Too difficult targets' in general are interpreted as those beyond managers' limit of ability (Latham and Locke 2002). In other words, even when managers exert high effort, there is little probability of reaching a too-difficult target, and then the expected benefits from displaying this effort are below a manager's personal cost of doing so. In such a case, maximizing

expected utility implies that a manager will not choose a high level of effort.[10]

Prior studies are consistent with the negative impact of too difficult targets on managerial behavior[11]. A consensus in the goal-setting literature is that performance benefits are associated with challenging but attainable performance targets, while firm performance decreases when the targets are set beyond managers' ability (Locke et al. 1988; Merchant and Manzoni 1989; Hirst and Lowy 1990; Covaleski et al. 2003; Hansen et al. 2003; Jensen et al. 2004). The budgeting literature indicates the common existence of upward ratcheting in managers' budgetary targets. Concern about missing performance budgets gives high-performing managers the incentive to reduce their reported performance in order to avoid the increase in current performance budgets (Leone and Rock 2002; Indjejikian and Nanda 2002). Empirical evidence on performance bonuses also shows that confronted with unattainable bonus targets, managers are less than well motivated. Lower firm performance is correlated with too-difficult targets, suggesting that managers stop exerting higher effort and even save potential performance for future benefits, such as "taking a bath" (Healy 1985; Gaver et al. 1995; Holthausen et al. 1995; Jensen 2003).

Our third hypothesis focuses on the effects of using difficult vesting targets on pay-for-performance sensitivity. Confronted with difficult targets, managers exert lower effort. Firm performance is thus more likely to decrease. We predict that relative to moderate performance targets, difficult targets result in a lower level of interest congruence between managers and shareholders; a lower pay-for-performance sensitivity will consequently be observed. Our third hypothesis:

H3: *Ceteris paribus,* difficult performance targets are related with a lower PPS level.

[10] Our economic reasoning is consistent with theories of motivation in the psychological literature. Expectancy theory (Vroom 1964) states that human behavior is motivated by valence (anticipated satisfaction), instrumentality (the belief that performance is rewarded) and expectancy (the belief that effort will lead to the rewarded performance). Since difficult goals reduce people's expectancy of goal success, lower performance is predicted.

[11] An inverted U-shaped relationship between performance and target difficulty has been documented in goal-setting literature (see Latham and Locke 2002 for a review). We test the existence of such relationship between PPS and target difficulty in the robustness check section.

4. METHODOLOGY

This section quantifies the extent to which management pay is sensitive to corporate performance, and the effect of the presence of PVSOs on PPS. In an attempt to address some of the concerns with prior PPS modeling methodologies, we introduce the multilevel modeling method.

4.1 Measuring compensation and firm performance

Prior PPS studies on the UK only use salary and bonuses to measure executive compensation. By excluding equity-based components of executive overall remuneration, the estimated relationship between compensation and performance may be biased, as the incentive effect of one component of the compensation package depends on how the other components are concurrently adjusted (Lambert et al. 1991; Kole 1997). Moreover, with the increasing popularity of incentive-based executive pay, non-cash elements of pay are now often larger than their cash counterpart (Conyon and Murphy 2000). We thus employ two measures of executive pay:

1. Total Compensation (TotComp): salary, bonus, pension, other cash compensation (e.g. relocation and fringe benefits), and changes in unrealized value of stocks of executive wealth[12].
2. Total Wealth (TotWealth): cash compensation plus estimated value of stock options and shareholdings (as employed in Jensen and Murphy 1990)[13].

Both accounting-based (e.g. earnings per share or return on equity) and market-based (shareholder return or shareholder wealth) measures have been employed in prior empirical

[12] In other words, we use the summation of changes in the Black-Scholes value of stock options, changes in the value of stocks of executives' equity, and changes in estimated value of restricted stocks, as the executive compensation measure used in Buck et al. 2003.

[13] TotComp literally depicts the 'flow' part in the sense that it measures the total executive rewards during a period (i.e. one year) while the 'stock' element of executive pay is represented by TotWealth.

models to measure firm performance (Jensen and Murphy 1990; Garen 1994; Aggarwal and Samwick 1999; Conyon et al. 2000b). However, since the principal-agent model emphasizes the convergence of owner- and management interests, a market-based measure reflecting share-price appreciation and dividend yield (i.e. total shareholder return) seems more intuitive (Conyon and Salder 2001). In this vein, we measure corporate performance using total shareholder return (TSR).[14]

4.2 Measuring the presence of PVSO and TSO, and vesting target difficulty

A dummy variable (PVSO) is coded to equal one for the presence of PVSOs in a manager's compensation contract, and is zero otherwise. Similarly, a dummy variable (TSO) is constructed to indicate the presence of TSO. Regarding the performance targets attached to option vesting, three measures are used to capture target difficulty: absolute target difficulty (ABSDIF), relative target difficulty (RELDIF) and *ex-post* difficulty (DIFF). As mentioned in Section 2, performance targets attached to PVSOs generally take two forms: earnings per share (EPS) growth rate over the index of retail prices, or total shareholder returns (TSR) relative to firm-specific peer groups. Only the former vesting targets are comparable among sample firms, since the benchmark (here the index of retail prices) is common to all firms. In contrast, when peer groups are used, each firm might select a distinct benchmark group with which to compare the TSR performance. Thus, all three measures are based on EPS figures. ABSDIF is the stated EPS target itself. RELDIF measures the distance of EPS target in excess of the industry median. This relative measurement enables a comparison among sample firms from different industries. DIFF is an *ex-post* measurement, which is coded one for missing predetermined targets, and zero for achieving the targets. Each manager has a different perception of target difficulty, and it is not feasible for a large sample study to investigate the perceived target difficulty at the executive level. To the extent that *ex-post* performance

[14] We nevertheless conduct robustness tests with accounting-based performance measures.

results can reflect manager's *ex-ante* perception of target difficulty, this proxy is valid. Following firms' vesting requirements (Camera and Herderson 2005), the target difficulty proxies are constructed on a three-year rolling average basis[15]. Table 1 defines the variables.

Accurately capturing managers' perception of target difficulty is a controversial topic (Locke and Latham 2002). Nevertheless we intend to provide a complete picture of target difficulty perception and thus measure target difficulty from multiple angles (i.e. *ex ante* incentives vs. *ex post* realization; absolute difficulty measure vs. relative difficulty measure). We also admit the possible deficiency of our target difficulty measurements.

4.3 Empirical Models

Prior studies show that PPS is jointly determined by both firm-level factors (e.g. firm size, beta, the uncertainty about firm value) and CEO-individual factors (including age, risk aversion and personal cost related with exerting effort) (Garen 1994). PPS studies need to control for two-level factors. Empirical models are usually estimated on the individual executive level (Hall and Liebman 1998; Aggarwal and Samwick 1999; Buck et al. 2003). While they include firm-level variables (such as firm size, industry sector), these factors are only a subset of the proxies that should be taken into account. Thus, without fully controlling for the entire set of variables that may influence pay-performance sensitivity, this methodology runs the risk of correlated omitted variables, which may bias the results. Meanwhile, in prior studies, the model of interest is usually estimated using first-order differencing. One important econometric feature of this modeling procedure is that first-order differencing estimation mitigates any potential bias in the estimation of coefficients due to time-invariant fixed effects. But the model specification may still be problematic if the

[15] For instance, in 1999, Firm A grants PVSOs with EPS performance target of annual growth 2% above the retail price index growth rate; in 2000, the EPS target for PVSOs newly granted increases to 3% over the inflation growth; and in 2001, the performance target for new PVSO grants remains the same. Then, the annual EPS growth rate calculated on a three-year rolling basis is 2.67% [i.e. (2%+3%+3%)/3] above the retail price index growth rate.

variables that are omitted vary over time, such as factors that are industry-fixed (e.g., an economic boom in certain industries), firm-fixed (e.g., growth, risk, size) or executive-fixed (e.g., ownership, risk preference).

Another concern is that executives within one firm are more alike, on average, than executives in different firms, as are firms within one industry. In other words, executives are clustered according to firms, and firms are clustered by industries. OLS methodology assumes independence among observations. One penalty for ignoring dependence within same clusters is that the standard error of the regression coefficient is too low (Hox 2001).

We employ multilevel modeling to mitigate the aforementioned concerns, allowing for firm level- and executive-level fixed effects within the nested data structure and simultaneously analyzing each level[16]. The fixed effects also address the problem that the firm- or executive-level specific factors (such as the quality of corporate governance, managerial risk aversion, etc.) influence the results. To test the first- and second hypotheses, we construct three-level models, specified as follows:[17]

$$\ln(Compensation\_PROXY)_{ijk} = \beta_{0ijk} + \beta_1 TSR_{ik} + \beta_2 PVSO_{ijk} + \beta_3 TSR_{ik} * PVSO_{ijk} \quad (1)$$

$$\beta_{0ijk} = \gamma_{000} + v_{0k} + u_{0jk} + e_{0ijk}$$

$$\ln(Compensation\_PROXY)_{ijk} = \beta_{0ijk} + \beta_1 TSR_{ik} + \beta_2 PVSO_{ijk} + \beta_3 TSR_{ik} * PVSO_{ijk} + \beta_4 TSO_{ijk} + \beta_5 TSR_{ik} * TSO_{ijk} \quad (2)$$

$$\beta_{0ijk} = \gamma_{000} + v_{0k} + u_{0jk} + e_{0ijk}$$

[16] Severe firm-level and executive-level fixed effects are detected in our sample. More specifically, 61.16% (or 31.22%) of the total variance in ln(TotWealth) (or ln(TotComp)) can be explained by the variance among executives; and the variance at firm-level explains 24.70% (or 19.07%) of the total variance in ln(TotWealth) (or ln(TotComp)).

[17] A detailed description of the construction of three-level hierarchical linear models appears in the appendix. We use Maximum Likelihood (ML) estimators in our multilevel regression analysis in order to relax the normal error assumption in OLS regression method.

$$[v_{0k}] \sim N(0, \Omega_v)$$
$$[u_{0jk}] \sim N(0, \Omega_u)$$
$$[e_{0ijk}] \sim N(0, \Omega_e)$$

where *i, j, k* indicate year, executive and company, respectively;
Compensation_PROXY = TotComp and TotWealth as defined in Section 4.1;
TSR = dividend-adjusted total shareholder return, as defined in Section 4.1;
PVSO = a dummy variable indicating the presence of PVSO compensation, as defined in Section 4.2;
TSO = a dummy variable indicating the presence of TSO compensation, as defined in Section 4.2.

The first hypothesis predicts a closer alignment of owner- and management interests with the presence of PVSOs. Thus, we expect β_3 in equations (1) and (2) to be significantly positive. The second hypothesis concerns the comparison between PVSOs and traditional stock options (TSOs) in terms of their effects on PPS. It predicts that compared with TSOs, PVSOs align owner- and management interests more closely. Thus, we expect β_3 to be greater than β_5 in equation (2).

To test the impact of target difficulty on the association between managerial compensation and firm performance, we adopt the following model tested only on a subset of firms that adopted EPS-based PVSOs:

$$\ln(Compensation\_PROXY)_{ijk} = \beta_{0ijk} + \beta_1 TSR_{ik} + \beta_2 DIF\_PROXY_{ik} + \beta_3 TSR_{ik} * DIF\_PROXY_{ik} \quad (3)$$
$$\beta_{0ijk} = \gamma_{000} + v_{0k} + u_{0jk} + e_{0ijk}$$

where *i, j, k* indicate year, executive and company, respectively;
DIF_PROXY = RELDIF, ABSDIF and DIFF indicating the difficulty level of performance targets attached to PVSO compensation, as defined in Section 4.2.

We interpret a negative coefficient β_3 on the interaction term TSR*DIF_PROXY, as providing support for our third hypothesis that difficult targets are associated with lower pay-performance sensitivity.

5. SAMPLE SELECTION AND DATA SOURCES

Our initial sample consists of the 350 largest non-financial[18] firms in the UK, based on market capitalization at the end of 2004. The reason for focusing on large firms is three-fold. First, large firms are of most concern to investors. Second, large firms are more likely to reward managers with PVSOs (Conyon et al. 2000a), and usually disclose sufficient information, which makes it possible for us to carry out our empirical tests, especially the tests of target difficulty. Third, the vast majority of prior studies employ a sample of large firms (see Buck et al. 2003, among others). By concentrating on large firms, we are able to produce results that are comparable with prior studies. Firms without sufficient information on PVSO compensation or without the required financial data are eliminated. We also remove executives who worked as a board member only for one year, since compensation in such temporary employment may reflect factors other than firm performance improvement. In the end, our final sample included 244 firms with 1,383 executive directors from 1999 to 2004.

Information on managerial compensation was collected from the BoardEx database[19]. Data on performance targets were obtained directly from the proxy statement of the firm's annual report. Firm financial information was gleaned from Compustat Global industrial and commercial files; capital market information was provided by Datastream.

6. EMPIRICAL ANALYSIS

6.1 Descriptive statistics

Top managers in the UK receive two separate forms of compensation: a direct component and deferred rewards. The direct component consists of salary, the annual bonus, the pension, and other cash compensation. The deferred rewards generally comprise stocks and stock options (e.g. PVSOs and TSOs).

[18] The financial sector is excluded from our sample, as prior studies indicate that compensation contracts in these firms exhibit idiosyncratic features.

[19] For more details, see www.boardex.com. We randomly select 50 firms and compare their records in BoardEx with the firms' annual reports. We found no substantial difference between the two data sources.

Figure 1 shows the level of total wealth, including cash compensation and equity holdings (i.e. stock and stock options) of executive directors in our 1999-2004 sample. The total wealth series is right-skewed, since the mean value is much higher than the median each year, but especially so in 2000.

Figure 2 depicts the time series of the composition of total executive pay in our sample. The cash-based component accounts for less than 35% of the average total compensation received by executive directors, and this percentage has declined precipitously since 2002. The decline in the importance of the cash component has been accompanied by the increase of equity-based components in executive total wealth. In particular, PVSOs have become one of the most important elements in executive pay, whereas TSOs have a declining weight. PVSOs (measured at their Black-Scholes value (1973)) account for 24.45% of the total equity holdings of the executives in the 1999 sample. This percentage is approximately twice as much as the proportion of the TSOs' value in equity compensation in the same year. Since then, PVSOs have increased steadily and account for 36.68% of total equity compensation in 2004; in contrast, the value of TSOs has declined to 3.99% of equity compensation, approximately one-tenth of the PVSOs' value.

Table 3 reports summary statistics for 4,328 executive director-years, which comprises 1,234 CEO-years and 3,004 non-CEO executive-years. For both CEOs and non-CEOs, each compensation component is skewed positively (e.g., salary, bonus, total cash payment, stock options), as is total executive pay. Panels B and C report that, on average, CEO total wealth is nearly £19 million within the sample, whereas the corresponding figure for a non-CEO executive director is £3 million. Clearly, CEOs are paid more than non-CEOs, and equity-based compensation is the main driver for the difference.

Panels D and E indicate that with PVSOs in compensation packages managers receive

more cash[20] (e.g. salary, bonus) in general. Meanwhile, the equity compensation[21] for executives with PVSOs in their pay packages is lower than that for executives without PVSOs. Firms that grant PVSOs are larger in size and have lower earnings per share relative to those without PVSO granted. Panel F summarizes the major components of compensation packages for firms with TSOs. Compared to the PVSO (PVSO=1) group, the TSO (TSO=1) group does not differ significantly in terms of cash or equity compensation, but firms using TSOs are relatively larger in size and have lower leverage.

Consistent with the prior literature (Conyon et al. 2000), the overwhelming majority of firms in our sample attach EPS targets to option vesting (84.45%), while the use of TSR performance targets is low (11.17%).

Table 4 summarizes the statistics for the variables used in the empirical tests. Descriptive statistics are reported in Panel A. Skewness in compensation is reduced by taking natural logarithms. The mean of the PVSO dummy is 0.660, indicating that about two-thirds of the executive-year observations have PVSOs in compensation packages.

Pearson correlations are presented in Panel B of Table 4. Compensation measures are positively correlated with firm performance (i.e. TSR). This suggests that high performance is correlated with improvements in executive pay. In Panel B, it is worth noting that the presence of an equity-based compensation instrument (i.e. PVSO or TSOs) is associated with increases in executive total wealth. Finally, the PVSO dummy is negatively correlated with the TSO dummy, which suggests that firms with PVSOs grant fewer TSOs.

Panels C and D illustrate the Pearson correlations between various compensation measures and firm performance (i.e., TSR) for sub-samples grouped by PVSO and TSO, respectively. The correlations are greater when PVSO=1 than when PVSO=0: in the presence

[20] Both parametric (ANOVA) and nonparametric (Kruskal-Wallis) tests show a significant difference with $p<0.01$ in cash compensation between the two groups (PVSO=0/1).

[21] Both parametric (t-test) and nonparametric (Wilcoxon) tests suggest a significant difference, at $p<0.01$, in executive total equity compensation between the two groups (PVSO=0/1).

of PVSOs the pay-performance correlation is stronger. The correlations for sub-samples grouped by TSO do not appear to follow the same pattern, however.

6.2 Main results

The following subsections report the empirical results on the three hypotheses. Section 6.2.1 reports the results of the first two hypotheses, and the discussion focuses on the association between PPS and PVSO compensation. Section 6.2.2 evaluates the role of target difficulty in the association between PPS and PVSOs.

6.2.1 PPS and PVSO compensation

The findings for Model 1 are summarized in Table 5. Two regression equations are presented for each of the two measurements of managerial compensation: TotComp and TotWealth, which capture the "flow" and "stock" of executive rewards, respectively. Chi-square statistics show that both models are significant at $p<0.01$. The variances of u_{0jk} and v_{0k} that capture the executive- and firm-level fixed effects respectively are significant at $p<0.01$, which suggests the efficiency of our multilevel modeling. We measure the model fit by performing a chi-square test (χ^2) based on the differences in the -2 LogLikelihood between the unrestricted model and the intercept-only model relative to the extra degree of freedom. We find significant chi-squares, which suggest an improvement in model fit by adding extra explanatory variables.

For both "flow" and "stock" compensation specifications, the coefficient on the interaction between PVSO and TSR is positive, and the null hypothesis $\beta_3=0$ is rejected at $p<0.01$. The results support our first hypothesis: that the presence of PVSOs in senior manager compensation is associated with higher level of pay-performance sensitivity. In particular, for the TotComp specification, the coefficient on TSR is 0.214 and is significant at $p<0.01$. The coefficient on the interaction item TSR*PVSO is 0.182, with p-value<0.01. This

suggests that, *ceteris paribus*, for an average executive director with PVSOs in his/her compensation package, the sensitivity of total executive rewards to firm performance is 85.0% [i.e. 0.182/0.214] higher than that of an executive director with no PVSO component. Meanwhile, with PVSOs, for a 10% increase in TSR, there is a 4% [i.e., 10*(0.214+0.182)] increase in TotComp. For a firm with the median market capitalization value (£664.620 million) and the median executive compensation of £475,000 in our 1999-2004 sample, employing PVSO plans, a 10% improvement in TSR (which produces an additional £66.462 million shareholder wealth) results in a 4.00% increase in its top managers' total compensation; put differently, in GBP amounts, this means an additional £19,000 increase the top managers' total pay. For the TotWealth specification, the coefficient on the product term TSR*PVSO is 0.233 and significant at $p<0.01$, suggesting that with operating PVSO plans, a 10% increase in total shareholder returns leads to a 1.67% [i.e., 10*(-0.066+0.233)] increase in top managers' total wealth.

The results also confirm our second hypothesis. Wald tests show that the coefficient on the test variable TSR*PVSO is significantly greater than the coefficient on TSR*TSO, and the null hypothesis (i.e. $\beta_3<\beta_5$) is rejected at a significance level of $p<0.01$ in both model specifications. Specifically, in the specification with TotComp as the dependent variable, the presence of TSO compensation increases pay-performance sensitivity by 59.2% [i.e. 0.119/0.201], while with PVSO the PPS increase is 79.1%. Likewise, in the TotWealth specification, for an average executive, a 10% increase in TSR brings about a 0.06% [i.e. 10*(-0.072+0.078)%] increase in TotWealth when TSOs are included in the compensation package, which is much less than the 1.45% [i.e. 10*(-0.072+0.217)%] increase due to PVSOs.

Taken together, a higher pay-performance relation is associated with PVSO compensation, consistent with the conjecture that imposing performance conditions on option vesting induces higher effort from managers. Thus, by issuing PVSOs to executives,

shareholders align managerial welfare with their own wealth to a larger extent; such convergence of interests promotes firm performance and shareholder value.

6.2.2 Pay-performance sensitivity and PVSO target difficulty

The analysis on PVSO target difficulty focuses on the sub-sample of firms that have EPS growth targets attached to option vesting. Three proxies measure the difficulty level: absolute difficulty level (ABSDIF), difficulty level relative to industry median (RELDIF) and *ex-post* difficulties (DIFF). Table 6 summarizes the empirical results. Chi-square statistics show that all models are significant with p-value<0.01. The variances of u_{0jk} and v_{0k} are significant at p<0.01, indicating that after including more explanatory variables the firm- and executive-level fixed effects still, to a large extent, explain the total variance of the dependent variable. The results of chi-square tests show that the model fit is significant at p<0.01.

The results vary somewhat with the model specifications. In the TotComp specifications, the coefficients on the test variable TSR*DIF_PROXY are negative and significant at p<0.01 for the three target difficulty proxies, consistent with the idea that PPS is reduced by difficult targets. Thus, the coefficient on TSR*DIFF is -0.497 at p<0.01. This result shows that for those managers who miss EPS targets, the pay-performance sensitivity is 34.2% (i.e. 0.497/1.452) lower than the PPS level for managers achieving vesting targets.

In the TotWealth specifications, TSR*RELDIF has a negative coefficient, but it is not significant at conventional levels. The coefficients on TSR*ABSDIF and TSR*DIFF are significantly negative, suggesting that PPS is negatively associated with difficult performance targets. The coefficient on TSR is 0.393 with p-value<0.01, and the coefficient on DIFF*TSR is -0.081 with a significance level of p<0.05, implying that for those managers missing EPS targets, the pay-performance sensitivity is 20.6% (i.e. 0.081/0.393) lower than the PPS level for managers achieving performance targets.

In summary, the results show that difficult targets negatively affect the PPS level. We expect a significant decrease of the pay-performance relation when vesting targets are missed.

7. ROBUSTNESS TESTS

This section performs several tests to examine the robustness of the prior findings. We first replicate the analysis using first-differencing models that are not uncommon in pay-performance association studies. Untabulated results are generally consistent with our prior findings. Specifically, the results fully support H1 and H2, while for H3 the signs are consistent with our predictions but not statistically significant. Second, although market-based performance provides a direct measure of shareholder wealth, accounting-based performance measures (i.e., earnings per share (EPS) and return on assets (ROA)) also were employed in prior studies (Conyon et al. 2000b; Zhang et al. 2005). The results (not reported) support our prior findings that PVSOs provide managers with greater incentives to perform in line with shareholder interests. The results on the role of target difficulty are mixed, however, depending on the specification of the target-difficulty measurement. Third, multiple-period observations in our sample may result in the problem of observations clustering over time. In order to control for the year-fixed effect, we included year dummies into the multilevel models and re-performed the analyses. The results are qualitatively the same.

The descriptive statistics show a large difference between CEO pay and non-CEO pay. Prior literature documents that the pay-performance sensitivity of a CEO may be different from that of a non-CEO executive director (Conyon and Sadler 2001). CEOs possess greater financial incentives than other executives because CEOs are already at the top of the organizational hierarchy and have fewer possibilities for further promotion, which to some extent can be seen as an alternative form of financial compensation. To test for the between-group differences in PPS, we split our sample into a CEO group and a non-CEO group and applied the same regression models as in the previous sections within each group.

The results (in Tables 7 and 8) support our prior findings, especially for the non-CEO sub-sample. For the CEO sub-sample, however, the null hypothesis for H2 (i.e. $\beta_3<\beta_5$) cannot be rejected at the conventional significance level (i.e. with $p<0.10$). We did not find a large PPS disparity between CEOs and non-CEOs. A numerical example illustrates the economic significance in terms of PPS between the two groups. For a firm with the median market capitalization value (£664.620 million) and the median total CEO compensation (non-CEO) of £769,000 (£386,000), compensating top managers with PVSOs, a 10% improvement in TSR, which produces an additional £66.462 million shareholder wealth, results in a 4.70% (3.68%) increase in its CEO's (non-CEOs') total compensation (in GBP amounts, an additional £36,143 (£14,205) increase in the CEO's (non-CEOs') total compensation).

Regarding the tests on target difficulty, the interactions between TSR and the target difficulty proxies have a negative sign but are not statistically significant in the TotWealth specifications in the CEO sample. In contrast, in the TotComp specifications, the coefficients on TSR*DIFF-PROXY are in general significantly negative. For the managers missing the vesting targets, the pay-performance sensitivity is 48.5% (i.e. 0.652/1.345) lower than the PPS level with achievable targets.

In the non-CEO sample, both signs and significance levels of the interaction coefficients are consistent with the prior results in the full sample. Specifically, for a non-CEO executive director, the coefficients on the interaction term TSR*DIFF are significantly negative at $p<0.05$ for both compensation specifications, suggesting that the EPS targets that are not achieved *ex-post* are associated with a lower PPS level. Specifically, with unachievable targets, the pay-performance sensitivity of non-CEO directors' TotComp (TotWealth) to firm market performance is 29.2% (25.4%) lower than the PPS level with achievable performance targets.

The Black-Scholes stock option fair-value model might contribute with over-estimated PVSO value because option vesting probability is strictly smaller than 1. Overvalued option

compensation may bias our results upward due to the systematic link between equity compensation and firm market prices. To test this restriction in our analyses, we re-perform the tests using three different discount rates,[22] partially as implied in prior studies (Conyon et al. 2005; Kuang and Suijs 2006). The results show that our prior findings do not depend on the valuation assumption.

We also add lagged performance to our models to control for the fact that executives are paid on the basis of previous performance. The empirical results are reported in Tables 9 and 10. The lagged performance is positively associated with contemporary payment, and this significance does not nullify our prior findings.

Both the natural log transformation on executive compensation measures and the Maximum Likelihood (ML) estimators have already mitigated the influence of extreme observations on our empirical results. We further winsorize the dependent variables (i.e., TotComp and TotWealth) and independent variable (i.e., TSR) at the 1% and 99% levels. In multilevel models, the manipulation serves only to improve the significance level of reported results.

A consensus in the goal-setting literature is there is economic benefit associated with increased target difficulty when it is achievable while managers receive de-motivation from too difficult targets and lower effort will be exerted (Hirst and Lowy 1990; Covaleski et al. 2003; Kuang and Suijs 2006). Untabulated results indicate the existent of such an inverted U-shaped relationship between PPS and target difficulty in our sample.

8. CONCLUSIONS

This paper investigates the incentive effects of performance-vested stock options in aligning shareholder- and management interests. Option vesting conditions would prevent

[22] Conyon et al. (2005) use 80% discount rate to capture the vesting probability of performance-based equity compensation; Kuang and Suijs (2006) show that the optimal vesting probability for PVSOs is above 72%. Furthermore, the sample in the current study indicates a realization probability of 54% for PVSOs.

managers from benefiting from effort-irrelevant factors, and our results are supportive of this proposition. We find that the presence of a PVSO plan in an executive compensation contract is associated with higher pay-for-performance sensitivity, suggesting the convergence of owner- and management interests. Results also show that PVSOs outperform TSOs in providing managerial incentives. In a sample of firms that have adopted PVSOs we find that target difficulty has a negative effect on the PPS.

This study has examined only how PVSO functions with respect to aligning manager and shareholder interests; PVSO may also be used for other purposes, which are beyond the scope of this paper. We also recognize that an endogeneity problem may exist in our models. For example, firms that choose PVSO compensation differ substantially from those without PVSO compensation in aspects such as corporate governance, the structure of managerial compensation and market performance. In our multilevel modeling, we control for these firm- and executive-level fixed effects simultaneously, thereby mitigating the endogeneity problem to a certain extent. Prior studies also show that using fixed effect estimation reduces the endogeneity bias and produces consistent results (Nikolaev and van Lent 2005; Verbeek 2001).

In addition, this study might suffer from measurement error problems. Firstly, although we measure the target difficulty from different angles, they may not fully reflect managerial perception of the difficulty in fulfilling the targets. Secondly, the Black-Scholes stock option fair-value model might result in overestimated PVSO value. Due to the mechanical relationship between equity compensation and firm performance at the market, the overestimation may bias our results. However, we believe that the consistent results from the tests using discounted PVSO value could to some extent mitigate the overestimation problem.

The sample consists of the 244 largest UK firms, which limits the generalizability of the results. Future research could focus more on small- and medium-sized firms, and explore the features regarding incentive compensation in a broader sample. Large firms, however, are

of most concern to the stakeholders, and the current study sheds light on the way in which PVSO can help to align the interests of managers and shareholders.

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Figure 1

Total executive wealth 1999~2004

Unit: '000 £

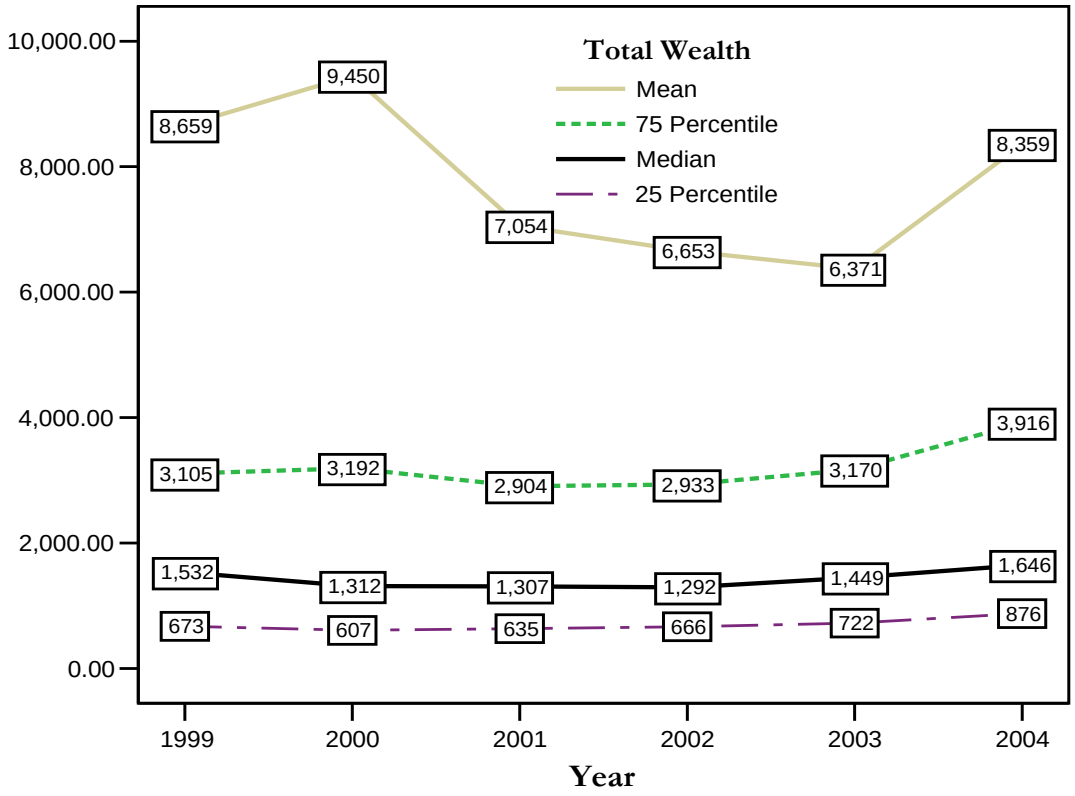
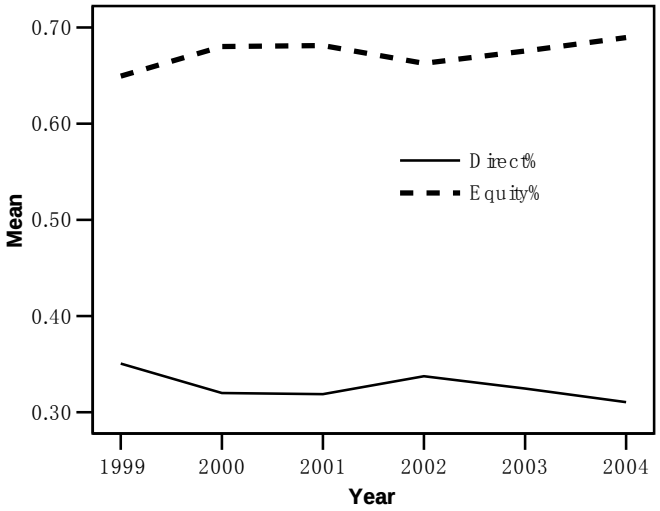


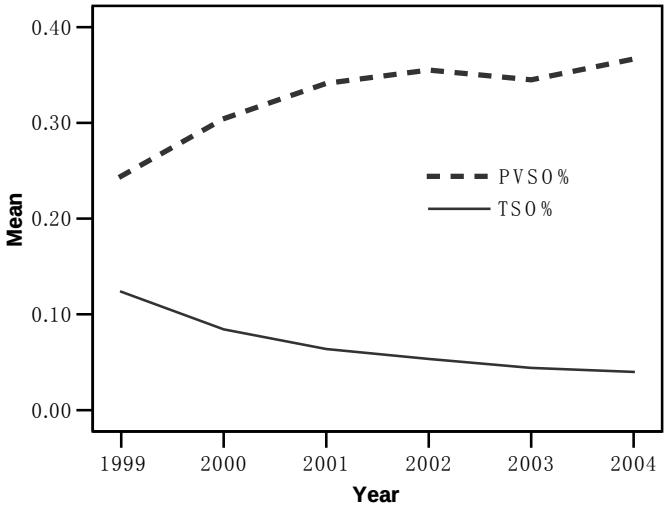
Figure 2

Composition of executive wealth 1999~2004

Panel A: Direct payment/Total wealth vs. Equity compensation/Total wealth



Panel B: PVSOs/Equity compensation vs. TSOs/Equity compensation



Notes:
Direct payment: Salary, bonus, pension and other cash compensation (e.g., relocation and fringe benefits);
Equity compensation: Estimated value of stock options (the Black-Scholes value) and stocks;
Total wealth: Cash compensation plus estimated value of stock options and share holdings.

Table 1

Variable definitions

Variable Name	Description
Dependent variables:	
TotComp	Salary, bonus, pension, other cash compensation (e.g. relocation and fringe benefits), plus the changes in unrealized value of stocks of executives' wealth (i.e. the summation of changes in the Black-Scholes value of stock options, changes in the value of stocks of executives' equity, and changes in estimated value of restricted stocks)
TotWealth	Cash compensation plus estimated value of stock options and share holdings
Independent variables:	
TSR	Total shareholder return (including dividends) in current year
PVSO	A dummy variable indicating the presence of PVSOs in executive compensation (1=yes; 0=no)
TSO	A dummy variable indicating the presence of TSOs in executive compensation (1=yes; 0=no)
RELDIF	Difference between a firm's EPS vesting condition and the average EPS vesting condition for the industry to which the firm belongs.
ABSDIF	Absolute value of a firm's EPS vesting condition
DIFF	A dummy variable, equal to zero if the EPS target is achieved in year t; one otherwise.
Others:	
DirectComp	Salary, bonus, pension and other cash compensation (e.g. relocation and fringe benefits);
TotEquity	Estimated value of stock options (Black-Scholes value) and stocks
ValuePVSOs	Black-Scholes value of PVSOs

Variable Name	Description
ValueTSOs	Black-Scholes value of TSOs
Ln(MV)	Natural logarithm of market value
Ln(Total Assets)	Natural logarithm of book value of total assets
MtB	Ratio of market value of equity to book value of equity
EPS	Earnings per share
ROA	Return on total assets
Leverage	Total debt ratio

Table 2

Summary of sample selection process

Top 350 (by market capitalization) non-financial firms in 2004		350
Less:	Delisted firms afterwards	43
	Firms without sufficient information to make the distinction between PVSOs and TSOs	9
	Firms with incomplete financial information	54
Total:	Firms included	244
	# of executives	1,569
Less:	Executives functioning for less than two years	186
Total:	Executives included	1,383
	# of observations as executive-years	4,328

Table 3

Summary of executive compensation and firm characteristics

(4,238 executive-years)

	Mean	Std. Dev.	1%	25%	Median	75%	99%
Panel A: Total executive directors (N=4,238)							
Salary	271	165	30	165	237	332	816
Bonus	125	204	0	12	71	150	959
DirectComp	451	368	48	239	360	546	1,954
ValuePVSOs	540	1,632	0	0	172	583	5,023
ValueTSOs	217	3,273	0	0	0	6	3,257
TotEquity	7,131	39,661	0	377	987	2,622	131,727
TotWealth	7,582	39,691	161	690	1,429	3,218	132,307
Ln(MV)	6.709	1.471	4.297	5.535	6.499	7.672	10.266
Ln(Total Assets)	6.878	1.581	3.791	5.625	6.807	8.000	10.332
MtB	4.162	16.894	0.325	1.282	1.983	3.270	28.876
TSR	0.160	0.831	-0.705	-0.152	0.090	0.352	1.667
EPS (penny per share)	26.202	59.084	-92.227	6.345	18.397	36.175	263.425
ROA	0.037	0.152	-0.571	0.026	0.050	0.085	0.203
Leverage	0.571	0.175	0.096	0.458	0.579	0.689	0.958
Panel B: CEOs (N=1,234)							
Salary	371	191	61	247	325	454	968
Bonus	184	292	0	1	108	225	1,534
DirectComp	634	501	72	341	508	757	2,771
ValuePVSOs	903	2,749	0	0	287	883	9,355
ValueTSOs	525	6,017	0	0	0	8	9,982
TotEquity	18,233	69,791	0	824	2,365	6,757	402,814
TotWealth	18,867	69,801	279	1,378	3,047	7,483	403,385
Ln(MV)	6.650	1.481	4.260	5.487	6.413	7.519	11.224
Ln(Total Assets)	6.786	1.592	3.715	5.569	6.682	7.832	10.517
MtB	3.934	14.127	0.441	1.285	2.006	3.386	27.719
TSR	0.179	0.815	-0.719	-0.137	0.102	0.378	1.674
EPS (penny per share)	25.639	60.053	-89.940	6.177	18.091	35.549	298.382
ROA	0.041	0.133	-0.434	0.026	0.050	0.086	0.234
Leverage	0.566	0.176	0.085	0.456	0.575	0.689	0.949

	Mean	Std. Dev.	1%	25%	Median	75%	99%
Panel C: Non-CEO executive directors (N=3,004)							
Salary	230	132	28	150	209	288	600
Bonus	100	148	0	12	62	121	761
DirectComp	376	262	40	215	312	461	1,287
ValuePVSOs	391	761	0	0	145	479	3,355
ValueTSOs	90	450	0	0	0	6	1,655
TotEquity	2,571	12,164	0	300	737	1,687	34,428
TotWealth	2,947	12,183	151	573	1,103	2,190	34,654
Ln(MV)	6.733	1.466	4.299	5.562	6.545	7.734	10.192
Ln(Total Assets)	6.915	1.574	3.855	5.643	6.935	8.081	10.253
MtB	4.256	17.906	0.325	1.281	1.980	3.236	30.427
TSR	0.153	0.838	-0.707	-0.161	0.085	0.348	1.668
EPS (penny per share)	26.434	58.690	-92.751	6.468	18.785	36.327	263.425
ROA	0.035	0.159	-0.598	0.026	0.050	0.084	0.195
Leverage	0.573	0.175	0.112	0.460	0.580	0.690	0.966
Panel D: Executive directors with PVSO plans, PVSO=1(N=2,810)							
Salary	286	172	68	177	250	350	823
Bonus	129	202	0	18	78	159	849
DirectComp	474	368	100	254	384	573	1,963
ValuePVSOs	815	1,948	13	176	409	845	6,460
ValueTSOs	109	747	0	0	0	0	2,316
TotEquity	4,507	32,234	51	461	1,024	2,423	62,107
TotWealth	4,981	32,265	220	785	1,466	3,009	62,654
Ln(MV)	6.734	1.386	4.371	5.626	6.551	7.642	9.892
Ln(Total Assets)	6.936	1.474	4.018	5.850	6.932	7.970	10.089
MtB	3.405	5.984	0.316	1.272	1.973	3.138	26.598
TSR	0.152	0.881	-0.684	-0.161	0.092	0.352	1.574
EPS (penny per share)	23.716	53.079	-77.704	5.509	15.577	33.907	303.731
ROA	0.035	0.131	-0.442	0.025	0.047	0.076	0.188
Leverage	0.572	0.181	0.095	0.457	0.580	0.694	0.959
Panel E: Executive directors without PVSO plans, PVSO=0 (N=1,428)							
Salary	242	145	0	150	210	299	759
Bonus	116	208	0	0	59	127	1,182
DirectComp	406	364	4	208	313	484	1,920
ValuePVSOs	0	0	0	0	0	0	0

	Mean	Std. Dev.	1%	25%	Median	75%	99%
ValueTSOs	428	5,535	0	0	0	26	4,712
TotEquity	12,295	50,842	0	234	859	3,316	272,278
TotWealth	12,701	50,881	59	513	1,248	3,875	273,117
Ln(MV)	6.660	1.624	4.272	5.337	6.357	7.809	11.602
Ln(Total Assets)	6.762	1.767	3.685	5.227	6.665	8.153	11.877
MtB	5.661	27.862	0.325	1.325	1.995	3.520	74.403
TSR	0.176	0.723	-0.771	-0.130	0.087	0.365	1.718
EPS (penny per share)	31.122	69.211	-184.348	8.430	24.078	42.318	186.118
ROA	0.041	0.187	-1.538	0.029	0.057	0.093	0.245
Leverage	0.569	0.165	0.193	0.461	0.577	0.672	0.960
Panel F: Executive directors with TSO plans, TSO=1 (N=1,207)							
Salary	299	211	52	171	257	365	952
Bonus	132	232	0	5	70	150	1,161
DirectComp	483	419	75	242	390	566	2,227
ValuePVSOs	441	1,047	0	0	105	491	4,179
ValueTSOs	761	6,105	1	15	74	399	10,649
TotEquity	5,428	32,053	50	511	1,180	2,966	93,338
TotWealth	5,911	32,108	207	831	1,609	3,564	95,691
Ln(MV)	7.084	1.643	4.299	5.654	7.023	8.317	11.602
Ln(Total Assets)	7.201	1.736	3.574	5.877	7.262	8.459	11.976
MtB	3.278	4.859	0.325	1.339	1.927	3.378	26.550
TSR	0.136	0.774	-0.771	-0.180	0.037	0.365	1.817
EPS (penny per share)	22.682	55.543	-198.841	6.624	17.803	36.319	303.731
ROA	0.025	0.203	-1.631	0.027	0.053	0.083	0.195
Leverage	0.553	0.175	0.085	0.443	0.574	0.676	0.906
Panel G: Executive directors without TSO plans, TSO=0 (N=3,031)							
Salary	260	140	28	163	230	321	759
Bonus	122	192	0	15	71	150	901
DirectComp	438	345	33	238	348	534	1,763
ValuePVSOs	580	1,812	0	0	197	607	5,116
ValueTSOs	0	0	0	0	0	0	0
TotEquity	7,810	42,297	0	339	900	2,452	142,954
TotWealth	8,248	42,321	153	636	133	3,054	143,152
Ln(MV)	6.559	1.368	4.276	5.509	6.349	7.368	9.709
Ln(Total Assets)	6.749	1.495	3.857	5.545	6.664	7.770	10.155

	Mean	Std. Dev.	1%	25%	Median	75%	99%
MtB	4.515	19.731	0.327	1.267	2.003	3.201	29.610
TSR	0.170	0.853	-0.682	-0.144	0.103	0.352	1.617
EPS (penny per share)	27.605	60.388	-66.445	6.148	18.787	36.130	263.425
ROA	0.042	0.126	-0.441	0.026	0.050	0.086	0.215
Leverage	0.578	0.175	0.099	0.456	0.580	0.691	0.973
Panel H: PVSO plans with EPS target, EPS=1 (N=2,373)							
Salary	287	157	79	180	251	351	837
Bonus	127	193	0	16	77	158	821
DirectComp	474	353	104	254	386	576	1,932
ValuePVSOs	832	2,079	13	173	400	833	6,867
ValueTSOs	94	730	0	0	0	0	2,131
TotEquity	4,769	34,931	51	445	993	2,346	75,172
TotWealth	5,243	34,962	215	765	1,442	2,944	75,487
Ln(MV)	6.798	1.380	4.421	5.724	6.608	7.696	9.896
Ln(Total Assets)	6.989	1.426	4.069	5.955	6.975	7.987	9.851
MtB	3.411	6.236	0.532	1.301	2.023	3.068	27.167
TSR	0.120	0.453	-0.697	-0.161	0.083	0.351	1.509
EPS (penny per share)	24.564	51.299	-59.746	6.020	15.795	33.968	310.269
ROA	0.037	0.130	-0.479	0.027	0.047	0.075	0.191
Leverage	0.576	0.175	0.096	0.462	0.580	0.691	0.965
Panel I: PVSO plans without EPS target, EPS=0 (N=437)							
Salary	279	239	50	170	250	340	775
Bonus	140	244	0	25	79	171	1,129
DirectComp	478	441	50	249	374	565	2,209
ValuePVSOs	722	954	7	187	449	891	5,901
ValueTSOs	187	831	0	0	0	26	4,991
TotEquity	3,083	7,308	56	540	1,133	2,854	28,000
TotWealth	3,560	7,379	284	909	1,599	3,403	28,341
Ln(MV)	6.375	1.367	4.221	5.195	6.130	7.306	9.683
Ln(Total Assets)	6.640	1.687	3.946	5.137	6.381	7.735	10.248
MtB	3.374	4.338	0.168	1.111	1.512	4.300	25.540
TSR	0.332	1.978	-0.666	-0.168	0.150	0.396	14.826
EPS (penny per share)	19.024	61.876	-224.396	2.433	13.949	31.930	224.957
ROA	0.023	0.136	-0.709	0.009	0.046	0.092	0.166
Leverage	0.552	0.210	0.055	0.413	0.577	0.702	0.948

	Mean	Std. Dev.	1%	25%	Median	75%	99%
Panel J: PVSO plans with TSR target, TSR=1 (N=314)							
Salary	328	269	76	208	293	381	881
Bonus	145	252	0	23	97	176	975
DirectComp	539	453	118	313	459	646	2,187
ValuePVSOs	810	1,377	20	184	421	769	7,075
ValueTSOs	232	965	0	0	0	26	5,257
TotEquity	14,089	89,473	49	444	1,040	2,754	667,443
TotWealth	14,628	89,496	291	848	1,602	3,596	667,961
Ln(MV)	6.603	1.156	4.777	5.724	6.649	7.310	9.635
Ln(Total Assets)	7.210	1.300	4.819	6.278	7.239	7.820	10.248
MtB	2.542	3.593	0.313	0.839	1.205	2.245	24.801
TSR	0.069	0.471	-0.684	-0.246	0.064	0.277	1.646
EPS (penny per share)	34.098	105.638	-218.415	-0.635	7.981	30.977	555.164
ROA	0.013	0.100	-0.373	-0.003	0.028	0.059	0.205
Leverage	0.572	0.240	0.052	0.441	0.587	0.770	0.926
Panel K: PVSO plans without TSR target, TSR=0 (N=2,496)							
Salary	281	155	65	174	248	348	822
Bonus	127	195	0	17	75	155	832
DirectComp	466	355	99	248	374	564	1,949
ValuePVSOs	816	2,009	12	174	409	871	6,339
ValueTSOs	93	714	0	0	0	0	1,800
TotEquity	3,302	12,348	51	465	1,023	2,371	54,105
TotWealth	3,768	12,411	216	782	1,459	2,978	57,519
Ln(MV)	6.750	1.412	4.266	5.614	6.528	7.678	9.892
Ln(Total Assets)	6.901	1.491	3,983	5.722	6.880	7.986	10.060
MtB	3.514	6.213	0.316	1.334	2.057	3.155	28.118
TSR	0.163	0.919	-0.697	-0.145	0.098	0.359	1.517
EPS (penny per share)	22.404	41.851	-76.454	6.342	16.667	34.068	179.957
ROA	0.038	0.134	-0.571	0.027	0.050	0.080	0.189
Leverage	0.572	0.172	0.107	0.459	0.579	0.690	0.965

Notes:
Compensation measures are in ‘000 GBP(£);

Table 4

Summary statistics

Panel A: Descriptive statistics for regression variables

Variables	Mean	Std. Dev.	1%	25%	Median	75%	99%
ln(TotComp)	13.363	1.267	10.210	12.608	13.295	14.040	17.130
ln(TotWealth)	14.334	1.325	12.000	13.444	14.173	14.986	18.701
TSR	0.160	0.831	-0.705	-0.152	0.090	0.352	1.667
PVSO	0.660	0.473	0	0	1	1	1
TSO	0.280	0.451	0	0	0	1	1
ABSDIF	3.273	1.657	1.207	2.330	3.000	3.387	10.000
RELDIF	-0.032	1.590	-2.351	-0.793	-0.180	0.153	6.466
DIFF	0.457	0.498	0	0	0	1	1

Panel B: Pearson correlation coefficients

	TSR	PVSO	TSO
ln(TotComp)	0.247***	-0.021	0.031
ln(TotWealth)	0.087***	-0.017	0.045***
TSR	1	-0.014	-0.019
PVSO		1	-0.105***
TSO			1

Panel C: Pearson correlation coefficients: by PVSO

	TSR (PVSO=1)	TSR (PVSO=0)
ln(TotComp)	0.278***	0.196***
ln(TotWealth)	0.121***	0.044

Panel D: Pearson correlation coefficients: by TSO

	TSR (TSO=1)	TSR (TSO=0)
ln(TotComp)	0.275***	0.239***
ln(TotWealth)	0.105***	0.082***

Notes:
***: significant at the 0.01 level (2-tailed);
Variables are as defined in Table 1.

Table 5

Multilevel models examining the efficiency of PVSOs vs. TSOs (full sample)

Model (1)

$$\ln(Compensation\_PROXY)_{ijk} = \beta_{0ijk} + \beta_1 TSR_{ik} + \beta_2 PVSO_{ijk} + \beta_3 TSR_{ik} * PVSO_{ijk}$$

$$\beta_{0ijk} = \gamma_{000} + v_{0k} + u_{0jk} + e_{0ijk}$$

Model (2)

$$\ln(Compensation\_PROXY)_{ijk} = \beta_{0ijk} + \beta_1 TSR_{ik} + \beta_2 PVSO_{ijk} + \beta_3 TSR_{ik} * PVSO_{ijk} + \beta_4 TSO_{ijk} + \beta_5 TSR_{ik} * TSO_{ijk}$$

$$\beta_{0ijk} = \gamma_{000} + v_{0k} + u_{0jk} + e_{0ijk}$$

Panel A: Estimated coefficients for Model 1 and Model 2

	ln(TotComp)		ln(TotWealth)	
Intercept (β_0)	13.311***	13.319***	14.074***	14.046***
	(0.058)	(0.061)	(0.024)	(0.056)
TSR (β_1)	0.214***	0.201***	-0.066***	-0.072***
	(0.041)	(0.041)	(0.020)	(0.021)
PVSO (β_2)	-0.031	-0.026	0.218***	0.223***
	(0.053)	(0.054)	(0.031)	(0.031)
TSR*PVSO (β_3)	0.182###	0.159###	0.233###	0.217###
	(0.047)	(0.048)	(0.024)	(0.024)
TSO (β_4)		-0.045		0.084**
		(0.056)		(0.033)
TSR*TSO (β_5)		0.119###		0.078###
		(0.047)		(0.024)
Variance of v_{0k} (Ω_v)	0.324***	0.323***	0.419***	0.410***
	(0.045)	(0.045)	(0.058)	(0.058)
Variance of u_{0jk} (Ω_u)	0.506***	0.507***	1.076***	1.081***
	(0.037)	(0.037)	(0.048)	(0049)

Model fit				
Approximate likelihood ratio -2*loglikelihood (deviance[23])	10,456	10,449	9,523	9,503
Difference from intercept-only model likelihood ratio[24]	318***[25]	325***	313***	333***
N	3,501	3,501	4,216	4,216

Panel B: Summary of tests for H1 and H2

	ln(TotComp)		ln(TotWealth)	
H1				
Null hypothesis: $\beta_3=0$	Rejected at p<0.01	Rejected at p<0.01	Rejected at p<0.01	Rejected at p<0.01
H2				
Null hypothesis: $\beta_3<\beta_5$		Rejected at p<0.01		Rejected at p<0.01

Notes:
Standard errors are in parentheses;
*: significant at the 0.10 level (2-tailed);
**: significant at the 0.05 level (2-tailed);
***: significant at the 0.01 level (2-tailed).

#: significant at the 0.10 level (1-tailed);
##: significant at the 0.05 level (1-tailed);
###: significant at the 0.01 level (1-tailed).

[23] The Maximum Likelihood procedure also produces a statistic called the deviance, which indicates how well the model fits the data. In general, models with a lower deviance fit better than models with a higher deviance (Hox 2001).
[24] The intercept-only model is useful as a null-model that serves as a benchmark to which other models are compared. The deviances of the two models can be used to compare their fit statistically.
[25] For nested models, the difference in deviance has a chi-square distribution with degrees of freedom equal to the difference in the number of parameters that are estimated in the two models (three degrees of freedom in the current case).

Table 6

Multilevel models examining the role of vesting target difficulty

Model (3)

$$\ln(Compensation\_PROXY)_{ijk} = \beta_{0ijkl} + \beta_1 TSR_{ik} + \beta_2 DIF\_PROXY_{ik} + \beta_3 TSR_{ik} * DIF\_PROXY_{ik}$$

$$\beta_{0ijk} = \gamma_{000} + v_{0k} + u_{0jk} + e_{0ijk}$$

	ln(TotComp)			ln(TotWealth)		
Intercept (β_0)	12.809*** (0.098)	13.064*** (0.056)	12.990*** (0.064)	14.131*** (0.069)	14.153*** (0.057)	14.175*** (0.058)
TSR (β_1)	1.587*** (0.113)	1.179*** (0.049)	1.452*** (0.081)	0.442*** (0.044)	0.399*** (0.019)	0.393*** (0.031)
ABSDIF (β_2)	0.077*** (0.024)			0.007 (0.012)		
TSR* ABSDIF (β_3)	-0.120### (0.027)			-0.013# (0.010)		
RELDIF (β_2)		0.084*** (0.025)			0.007 (0.012)	
TSR* RELDIF (β_3)		-0.119### (0.028)			-0.012 (0.011)	
DIFF			0.102** (0.049)			-0.042** (0.020)
TSR* DIFF (β_3)			-0.497### (0.106)			-0.081## (0.043)
Variance of v_{0k} (Ω_v)	0.368*** (0.055)	0.363*** (0.054)	0.375*** (0.057)	0.390*** (0.059)	0.390*** (0.059)	0.377*** (0.059)
Variance of u_{0jk} (Ω_u)	0.261*** (0.030)	0.260*** (0.030)	0.252*** (0.032)	0.616*** (0.037)	0.616*** (0.037)	0.621*** (0.038)
Model fit						
-2*loglikelihood (deviance)	5,031	5,033	4,524	4,017	4,017	3,618
Deviances difference	5,743***	5,741***	6,250***	5,819***	5,819***	6,218***
N	1,908	1,908	1,708	2,300	2,300	2,055

Notes:
Standard errors are in parentheses;
*: significant at the 0.10 level (2-tailed);
**: significant at the 0.05 level (2-tailed);
***: significant at the 0.01 level (2-tailed).

#: significant at the 0.10 level (1-tailed);
##: significant at the 0.05 level (1-tailed);
###: significant at the 0.01 level (1-tailed).

Table 7

Multilevel models with CEO sample

Panel A: Multilevel models examining the efficiency of PVSOs vs. TSOs

	ln(TotComp)		ln(TotWealth)	
Intercept (β_0)	14.075***	14.131***	14.923***	14.917***
	(0.097)	(0.103)	(0.087)	(0.089)
TSR (β_1)	0.142**	0.057	-0.141***	-0.182***
	(0.079)	(0.080)	(0.040)	(0.041)
PVSO (β_2)	-0.203**	-0.186*	0.120	0.134**
	(0.106)	(0.104)	(0.063)	(0.062)
TSR*PVSO (β_3)	0.328###	0.303###	0.324###	0.319###
	(0.096)	(0.095)	(0.047)	(0.047)
TSO (β_4)		-0.299***		-0.024
		(0.109)		(0.062)
TSR*TSO (β_5)		0.716###		0.275###
		(0.133)		(0.062)
Variance of v_{0k} (Ω_v)	0.205*	0.211*	0.373**	0.372**
	(0.122)	(0.120)	(0.156)	(0.156)
Variance of u_{0jk} (Ω_u)	0.916***	0.891***	1.550***	1.560***
	(0.145)	(0.141)	(0.173)	(0.174)
Model fit				
Approximate likelihood ratio -2*loglikelihood (deviance)	3,135	3,105	2,945	2,925
Difference from intercept-only model likelihood ratio	82***	112***	85***	105***
N	981	981	1,228	1,228

Panel B: Summary of tests for H1 and H2

	ln(TotComp)		ln(TotWealth)	
H1				
Null hypothesis: $\beta_3=0$	Rejected at p<0.01	Rejected at p<0.01	Rejected at p<0.01	Rejected at p<0.01
H2				
Null hypothesis: $\beta_3<\beta_5$		Not rejected		Not rejected

Panel C: Multilevel models examining the role of vesting target difficulty

	ln(TotComp)			ln(TotWealth)		
Intercept (β_0)	13.595***	13.698***	13.566***	14.756***	14.808***	14.857**
	(0.148)	(0.075)	(0.093)	(0.102)	(0.076)	(0.079)
TSR (β_1)	1.357***	1.000***	1.345***	0.442***	0.391***	0.346**
	(0.221)	(0.092)	(0.154)	(0.078)	(0.034)	(0.057)
ABSDIF (β_2)	0.031			0.016		
	(0.038)			(0.020)		
TSR* ABSDIF (β_3)	-0.106##			-0.014		
	(0.051)			(0.017)		
RELDIF (β_2)		0.041			0.015	
		(0.039)			(0.020)	
TSR* RELDIF (β_3)		-0.116##			-0.011	
		(0.055)			(0.018)	
DIFF			0.243**			-0.039
			(0.095)			(0.037)
TSR* DIFF (β_3)			-0.652###			-0.032
			(0.185)			(0.074)
Variance of $v_{0k}(\Omega_v)$	0.145	0.144	0.086	0.118	0.118	0.074
	(0.126)	(0.126)	(0.134)	(0.144)	(0.144)	(0.151)
Variance of $u_{0jk}(\Omega_u)$	0.575***	0.587***	0.631***	1.053***	1.053***	1.107***
	(0.142)	(0.143)	(0.158)	(0.170)	(0.170)	(0.183)
Model fit						
-2*loglikelihood (deviance)	1,428	1,428	1,302	1,157	1,157	1,068
Deviances difference	1,789***	1,789***	1,915***	1,874***	1,874***	1,963***
N	514	514	466	639	639	575

Notes:
Standard errors are in parentheses;
*: significant at the 0.10 level (2-tailed);
**: significant at the 0.05 level (2-tailed);
***: significant at the 0.01 level (2-tailed).

#: significant at the 0.10 level (1-tailed);
##: significant at the 0.05 level (1-tailed);
###: significant at the 0.01 level (1-tailed).

Table 8

Multilevel models with non-CEO sample

Panel A: Multilevel models examining the efficiency of PVSOs vs. TSOs

	ln(TotComp)		ln(TotWealth)	
Intercept (β_0)	13.003*** (0.059)	13.005*** (0.061)	13.814*** (0.057)	13.780*** (0.058)
TSR (β_1)	0.259*** (0.045)	0.253*** (0.045)	-0.023 (0.024)	-0.023 (0.024)
PVSO (β_2)	0.026 (0.055)	0.029 (0.055)	0.182*** (0.034)	0.186*** (0.034)
TSR*PVSO (β_3)	0.109### (0.051)	0.093## (0.052)	0.181### (0.027)	0.168### (0.027)
TSO (β_4)		-0.013 (0.057)		0.114*** (0.036)
TSR*TSO (β_5)		0.064# (0.047)		0.036# (0.024)
Variance of v_{0k} (Ω_v)	0.351*** (0.044)	0.351*** (0.044)	0.467*** (0.060)	0.457*** (0.059)
Variance of u_{0jk} (Ω_u)	0.118*** (0.023)	0.118** (0.023)	0.610*** (0.034)	0.615*** (0.034)
Model fit				
Approximate likelihood ratio -2*loglikelihood (deviance)	6,956	6,954	6,164	6,151
Difference from intercept-only model likelihood ratio	246***	248***	227***	240***
N	2,520	2,520	2,988	2,988

Panel B: Summary of tests for H1 and H2

	ln(TotComp)		ln(TotWealth)	
H1				
Null hypothesis: $\beta_3=0$	Rejected at p<0.01	Rejected at p<0.01	Rejected at p<0.01	Rejected at p<0.01
H2				
Null hypothesis: $\beta_3<\beta_5$		Rejected at p<0.01		Rejected at p<0.01

Panel C: Multilevel models examining the role of vesting target difficulty

	ln(TotComp)			ln(TotWealth)		
Intercept (β_0)	12.590*** (0.100)	12.844*** (0.055)	12.804*** (0.064)	13.913*** (0.074)	13.911*** (0.057)	13.911*** (0.058)
TSR (β_1)	1.555*** (0.127)	1.179*** (0.056)	1.372*** (0.089)	0.426*** (0.052)	0.391*** (0.023)	0.406*** (0.037)
ABSDIF (β_2)	0.077*** (0.025)			0.000 (0.014)		
TSR* ABSDIF (β_3)	-0.111### (0.030)			-0.011 (0.013)		
RELDIF (β_2)		0.085*** (0.026)			0.000 (0.014)	
TSR* RELDIF (β_3)		-0.110### (0.031)			-0.013 (0.013)	
DIFF			0.039 (0.054)			-0.042* (0.024)
TSR* DIFF (β_3)			-0.399### (0.123)			-0.103## (0.052)
Variance of v_{0k} (Ω_v)	0.371*** (0.053)	0.366*** (0.052)	0.372*** (0.055)	0.412*** (0.059)	0.412*** (0.059)	0.396*** (0.057)
Variance of u_{0jk} (Ω_u)	0.038* (0.020)	0.037* (0.020)	0.034 (0.021)	0.328*** (0.025)	0.328*** (0.025)	0.294*** (0.024)
Model fit						
-2*loglikelihood (deviance)	3,441	3,441	3,060	2,687	2,687	2,337
Deviances difference	3,761***	3,761***	4,142***	3,705***	3,705***	4,055***
N	1,394	1,394	1,242	1,661	1,661	1,480

Notes:
Standard errors are in parentheses;
*: significant at the 0.10 level (2-tailed);
**: significant at the 0.05 level (2-tailed);
***: significant at the 0.01 level (2-tailed).

#: significant at the 0.10 level (1-tailed);
##: significant at the 0.05 level (1-tailed);
###: significant at the 0.01 level (1-tailed).

Table 9

Multilevel models examining the efficiency of PVSOs vs. TSOs

(incl. lagged performance)

Model (1)

$$\ln(Compensation\_PROXY)_{ijk} = \beta_{0ijk} + \beta_1 TSR_{ik} + \beta_2 PVSO_{ijk} + \beta_3 EPS_{ik} * PVSO_{ijk} + \beta_4 TSR_{ik,t-1}$$

$$\beta_{0ijk} = \gamma_{000} + v_{0k} + u_{0jk} + e_{0ijk}$$

Model (2)

$$\ln(Compensation\_PROXY)_{ijk} = \beta_{0ijk} + \beta_1 TSR_{ik} + \beta_2 PVSO_{ijk} + \beta_3 TSR_{ik} * PVSO_{ijk} + \beta_4 TSO_{ijk}$$
$$+ \beta_5 TSR_{ik} * TSO_{ijk} + \beta_6 TSR_{ik,t-1}$$

$$\beta_{0ijk} = \gamma_{000} + v_{0k} + u_{0jk} + e_{0ijk}$$

Panel A: Estimated coefficients for Model 1 and Model 2

	ln(TotComp)		ln(TotWealth)	
Intercept (β_0)	13.011***	13.020***	13.949***	13.926***
	(0.061)	(0.063)	(0.056)	(0.056)
TSR (β_1)	1.094***	1.082***	0.318***	0.328***
	(0.070)	(0.072)	(0.033)	(0.034)
PVSO (β_2)	0.078	0.080	0.329***	0.328***
	(0.055)	(0.056)	(0.032)	(0.032)
TSR*PVSO (β_3)	0.137#	0.128#	0.076##	0.074##
	(0.084)	(0.087)	(0.041)	(0.041)
TSO (β_4)		-0.037		0.088***
		(0.056)		(0.033)
TSR*TSO (β_5)		0.052		-0.025
		(0.088)		(0.041)
TSR_{t-1} (β_6)	0.284***	0.285***	0.133***	0.132***
	(0.033)	(0.033)	(0.010)	(0.010)
Variance of v_{0k} (Ω_v)	0.324***	0.326***	0.379***	0.372***
	(0.045)	(0.045)	(0.057)	(0.056)

Variance of u_{0jk} (Ω_u)	0.451** (0.034)	0.452*** (0.034)	1.086*** (0.051)	1.087*** (0.051)
Model fit				
Approximate likelihood ratio -2*loglikelihood (deviance[26])	8,074	8,074	7,474	7,466
Difference from intercept-only model likelihood ratio[27]	2,700***	2,700***	2,362***	2,370***
N	2,892	2,892	3,461	3,461

Panel B: Summary of tests for H1 and H2

	ln(TotComp)		ln(TotWealth)	
H1 Null hypothesis: $\beta_3=0$	Rejected at p<0.01	Rejected at p<0.01	Rejected at p<0.01	Rejected at p<0.01
H2 Null hypothesis: $\beta_3<\beta_5$		Rejected at p<0.01		Rejected at p<0.01

Notes:
Standard errors are in parentheses;
*: significant at the 0.10 level (2-tailed);
**: significant at the 0.05 level (2-tailed);
***: significant at the 0.01 level (2-tailed).

#: significant at the 0.10 level (1-tailed);
##: significant at the 0.05 level (1-tailed);
###: significant at the 0.01 level (1-tailed).

[26] The Maximum Likelihood procedure also produces a statistic called the deviance, which indicates how well the model fits the data. In general, models with a lower deviance fit better than models with a higher deviance (Hox 2001).
[27] The intercept-only model is useful as a null-model that serves as a benchmark with which other models are compared. The deviances of the two models can be used to compare their fit statistically.

Table 10

Multilevel models examining the role of vesting target difficulty

(incl. lagged performance)

Model (3)

$$\ln(Compensation\_PROXY)_{ijk} = \beta_{0ijkl} + \beta_1 TSR_{ik} + \beta_2 DIF\_PROXY_{ik} + \beta_3 TSR_{ik} * DIF\_PROXY_{ik} + \beta_4 TSR_{ik,t-1}$$

$$\beta_{0ijk} = \gamma_{000} + v_{0k} + u_{0jk} + e_{0ijk}$$

	ln(TotComp)			ln(TotWealth)		
Intercept (β_0)	12.854*** (0.098)	13.065*** (0.059)	12.993*** (0.066)	14.068*** (0.072)	14.118*** (0.058)	14.105*** (0.059)
TSR (β_1)	1.512*** (0.124)	1.196*** (0.058)	1.466*** (0.086)	0.502*** (0.042)	0.457*** (0.020)	0.536*** (0.029)
ABSDIF (β_2)	0.063** (0.028)			0.015 (0.012)		
TSR* ABSDIF (β_3)	-0.091### (0.029)			-0.013# (0.009)		
RELDIF (β_2)		0.066** (0.029)			0.012 (0.013)	
TSR* RELDIF (β_3)		-0.077### (0.031)			-0.007 (0.010)	
DIFF			0.097* (0.050)			0.015 (0.019)
TSR* DIFF (β_3)			-0.491### (0.108)			-0.146### (0.038)
TSR_{t-1} (β_4)	0.204*** (0.054)	0.199*** (0.054)	0.229*** (0.053)	0.332*** (0.018)	0.331*** (0.018)	0.336*** (0.018)
Variance of v_{0k} (Ω_v)	0.386*** (0.058)	0.384*** (0.058)	0.393*** (0.059)	0.388*** (0.062)	0.388*** (0.010)	0.393*** (0.062)
Variance of u_{0jk} (Ω_u)	0.235*** (0.031)	0.235** (0.031)	0.247*** (0.031)	0.639*** (0.039)	0.639*** (0.039)	0.641*** (0.039)
Model fit						
-2*loglikelihood (deviance)	4,214	4,216	4,204	3,143	3,143	3,131
Deviances difference	6,560***	6,558***	6,570***	6,693***	6,694***	6,705***
N	1,611	1,611	1,611	1,936	1,936	1,936

Notes:
Standard errors are in parentheses;
*: significant at the 0.10 level (2-tailed);
**: significant at the 0.05 level (2-tailed);
***: significant at the 0.01 level (2-tailed).
#: significant at the 0.10 level (1-tailed);
##: significant at the 0.05 level (1-tailed);
###: significant at the 0.01 level (1-tailed).

Appendix: Construct of three-level hierarchical linear model

In an attempt to justify the appropriate number of levels within the hierarchical structure of our sample data, we first construct an intercept-only model with four levels:

$$\ln(TotWealth)_{0ijkl} = \beta_{0ijkl}$$
$$\beta_{0ijkl} = 14.224(0.061) + f_{0l} + v_{0kl} + u_{0jkl} + e_{0ijkl}$$
$$[f_{0l}] \sim N(0, \Omega_f) : \Omega_f = [0.020(0.048)]$$
$$[v_{0kl}] \sim N(0, \Omega_v) : \Omega_v = [0.419(0.072)]$$
$$[u_{0jkl}] \sim N(0, \Omega_u) : \Omega_u = [1.044(0.047)]$$
$$[e_{0ijkl}] \sim N(0, \Omega_e) : \Omega_e = [0.240(0.007)]$$

where l stands for industry, k for firms, j for executives and i for executive years.

The average values on the dependent variable (e.g., executive total wealth) vary with groups at each level within the hierarchical structure. Instead of incorporating a number of indicators for these groups (i.e., industry, firm, or executive dummies) into the model, a multilevel model captures group fixed effects by assigning a random intercept that consists of several components, one for each level. Specifically in our models, f_{0l}, v_{0kl} and u_{0jkl} control for the group fixed effects at the level of industry, firm, and individual executive, respectively. As a consequence, the residual term is now partitioned into four components corresponding to each level in the hierarchy. e_{0ijkl} stands for the residual at the lowest level (*i*); u_{0jkl}, v_{0kl}, and f_{0l} control for executive-, firm-, and industry fixed effects, respectively. The residual variance also comprises four components: Ω_f, Ω_v, Ω_u, and Ω_e for variance among industries, firms, executive, and lowest level (executive-years), respectively. The similarity among observations in the same level is measured by the intra-class correlation, which measures the extent to which the value of the dependent variable (e.g., CEO total wealth) of observations within the same group compares with the value of observations from other groups. Put differently, intra-class correlation refers to the proportion of the total residual variation that is due to the difference between groups at a specific level. We calculate the intra-class correlation at the executive level as follows:

$$\rho_u = \frac{\sigma_u}{\sigma_f + \sigma_v + \sigma_u + \sigma_e} = \frac{1.044}{0.020 + 0.419 + 1.044 + 0.240} = 0.6059$$

Likewise, we calculate ρ_v and ρ_f. Approximately 60.59% (24.32% and 1.16%) of the total variance in $\ln(TotWealth)$ can be attributed to differences among executives (firms and industries). Industry groups appear to explain only a small proportion of the total variance. Meanwhile, Ω_f, i.e., σ^2_f, is not significant (Z=0.020/0.048)[28]. We therefore compare the full model with a restricted model that excludes f_{0l}. The value of the likelihood ratio statistic also cannot reject H_0: Ω_f =0. For a robustness check, we employ executive total compensation $\ln(TotComp)$ as the dependent variable in the intercept-only model. The results confirm the use of three levels: firm, executive and executive-year. Thus, we finally construct three-level models specified as follows:

$$\ln(Compensation\_PROXY)_{ijk} = \beta_{0ijk} + \beta_1 TSR_{ik} + \beta_2 PVSO_{ijk} + \beta_3 TSR_{ik} * PVSO_{ijk} + \beta_4 TSO_{ijk} + \beta_5 TSR_{ik} * TSO_{ijk}$$

$$\beta_{0ijk} = \gamma_{000} + v_{0k} + u_{0jk} + e_{0ijk}$$

$$[v_{0k}] \sim N(0, \Omega_v)$$
$$[u_{0jk}] \sim N(0, \Omega_u)$$
$$[e_{0ijk}] \sim N(0, \Omega_e)$$

Again, we calculate ρ_u and ρ_v in the intercept-only model with three levels. Approximately 61.16% and 24.70% of the total variance in $\ln(TotWealth)$ [29] can be explained by the variance among executives and firms, respectively.

[28] In the current study, the estimators in both first-order differencing and multilevel regression analyses are Maximum Likelihood (ML) estimators. Maximum Likelihood estimation includes procedures to generate standard errors for most of the parameter estimates. These can be used in significance testing, by computing the test statistic Z: Z-parameter/st. error.

[29] 31.22% and 19.07% of the total variance in ln(*TotComp)* can be attributed to the differences among executives and firms, respectively.