THE MANAGERIAL LABOR MARKET AND THE GOVERNANCE ROLE OF SHAREHOLDER CONTROL STRUCTURES IN THE UK

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July 2002

Discussion paper

Managerial labor market and the governance role
of shareholder control structures in the UK[a]

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This version: 10 September 2002

ABSTRACT

We simultaneously analyze two mechanisms of the managerial labor market: CEO turnover and monetary remuneration schemes. Sample selection models and hazard analyses applied to a random sample of 250 firms listed on the London Stock Exchange over a six-year pre-Cadbury period show that managerial remuneration and the termination of labor contracts play an important role in mitigating agency problems between managers and shareholders. We find that both the CEOs' industry-adjusted monetary compensation and their replacement are strongly performance-sensitive. Top executive turnover is shown to serve as a disciplinary mechanism for corporate underperformance, whereas the level of monetary compensation rewards good performance. We also investigate whether specific corporate governance mechanisms (different types of blockholders or of boards of directors) have an impact on managerial disciplining or on the pay-for-performance contracts. There is little evidence of outside shareholder monitoring and CEOs with strong voting power successfully resist replacement irrespective of corporate performance. This case of strong managerial entrenchment is even exacerbated when the CEO also holds the position of chairman of the board. In firms with large outside shareholdings, CEO compensation is lower, but outside shareholder do not impose a stricter performance-related incentive remuneration scheme. When insiders have strong voting power, the CEOs remuneration is lower except when the stock price performance is poor: it seems that when the CEOs wealth resulting from their investment goes down due to decreasing stock prices, the CEOs cash compensation is higher. The presence of a remuneration committee has no significant impact on remuneration. Finally, we find strong support for the incentive effect-hypothesis of remuneration: CEOs with higher levels of monetary compensation attain better subsequent accounting and stock price-based measures of corporate performance.

JEL classification: G30; G32; G34; J33
Keywords: corporate governance, agency costs, CEO remuneration, disciplinary managerial turnover, financial performance, ownership structure

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We simultaneously analyze two mechanisms of the managerial labor market: CEO turnover and monetary remuneration schemes. Sample selection models and hazard analyses applied to a random sample of 250 firms listed on the London Stock Exchange over a six-year pre-Cadbury period show that managerial remuneration and the termination of labor contracts play an important role in mitigating agency problems between managers and shareholders. We find that both the CEOs' industry-adjusted monetary compensation and their replacement are strongly performance-sensitive. Top executive turnover is shown to serve as a disciplinary mechanism for corporate underperformance, whereas the level of monetary compensation rewards good performance. We also investigate whether specific corporate governance mechanisms (different types of blockholders or of boards of directors) have an impact on managerial disciplining or on the pay-for-performance contracts. There is little evidence of outside shareholder monitoring and CEOs with strong voting power successfully resist replacement irrespective of corporate performance. This case of strong managerial entrenchment is even exacerbated when the CEO also holds the position of chairman of the board. In firms with large outside shareholdings, CEO compensation is lower, but outside shareholder do not impose a stricter performance-related incentive remuneration scheme. When insiders have strong voting power, the CEOs remuneration is lower except when the stock price performance is poor: it seems that when the CEOs wealth resulting from their investment goes down due to decreasing stock prices, the CEOs cash compensation is higher. The presence of a remuneration committee has no significant impact on remuneration. Finally, we find strong support for the incentive effect-hypothesis of remuneration: CEOs with higher levels of monetary compensation attain better subsequent accounting and stock price-based measures of corporate performance.

1. Introduction

In spite of Jensen's (1989) prediction that the (widely-held) public corporation would eclipse due to large agency costs resulting from the lack of emphasis on value creation by insufficiently monitored managers, this type of corporation survived quite well. Indeed, during the 1990s the public corporation even gained investors' interest and, in Continental European listed firms the level of liquidity increased at the expense of the high control levels of majority shareholders (Becht and Mayer, 2001). Several reasons for the preservation of the public corporation are brought forward. First, the deficiencies of widely-held public corporations – 'strong managers, weak owners', in the words of Roe (1994) – are not that prominent in a corporate governance regime which provides strong protection of shareholder rights. La Porta et al. (1999, 2000) show that shareholder rights are best upheld in the Anglo-American legal tradition. Second, the importance of the widely-held public corporation in the US and the UK is the consequence of a path-dependent process wherein existing corporate ownership structures influence legislation and vice versa (Bebchuk and Roe, 1999). Third, the agency costs mentioned by Jensen have been restrained by mechanisms aligning the interests of managers and shareholders. It is the efficiency of these alignment mechanisms, namely performance-related managerial remuneration and removal, that this paper is addresses.

The delegation of tasks by the principal (owner) to the agent (executive team), resulting from the separation of ownership and control, necessitates governance mechanisms aligning the interests of principal and agent (Jensen and Meckling, 1976). The managerial labor market plays a prominent role in this process (Shleifer and Vishny, 1997). Shareholders' interests can be protected because managerial incentives can be (re)structured such that managers avoid poor performance due to the threat of dismissal and seek to reach high performance as a result of the rewarding and incentive effects of compensation contracts. Jensen and Murphy (1990) argue that the probability of CEO dismissal is too low to align effectively the interests of managers and owners. Likewise, performance-sensitive managerial compensation schemes in isolation only address agency problems at average or high levels of performance. Management may be not be induced to generate further effort when it realizes that the minimal performance thresholds triggering bonuses are out of reach.

This paper contributes to the agency literature in the following ways. First, although a large body of literature exists (especially for the US) on both managerial disciplining and managerial compensation, these two aspects of the managerial labor market are usually - with the notable exception of Coughlan and Schmidt (1985) - treated separately. This paper analyses both incentive mechanisms simultaneously for a sample of UK firms. Second, this simultaneous treatment is econometrically translated into a sample selection technique estimated by type-2 Tobit models which mitigates the sample selection biases affecting many of the studies analyzing managerial compensation. We also deal with the frequently ignored endogeneity problems in

corporate finance research (see e.g. Himmelberg et al., 1999) by using instrumental variables estimation techniques. Third, the paper contributes to the research on the (relative) efficiency of various governance mechanisms. Our models include the impact of a set of governance mechanisms on turnover and the use of compensation: e.g. control concentration by type of shareholder, the market for share blocks, the structure of the internal control mechanism (board of directors) and leverage (as a bonding mechanism).

We analyze a randomly drawn sample of listed UK firms. Our period of analysis, 1988-1993, was chosen for two reasons: (i) it coincides with a recession which makes performance-induced turnover and compensation more interesting a topic and (ii) it is prior to the publication of the Cadbury report's recommendations for good corporate governance which were mandatory for all listed companies on the London Stock Exchange since the end of 1993.

We obtain the following interesting results: (a) Both the CEOs' industry-adjusted monetary compensation and their replacement are strongly performance-sensitive. Top executive turnover is shown to serve as a disciplinary mechanism for corporate underperformance, whereas the level of monetary compensation rewards good performance. (b) Neither total ownership concentration nor the presence of large blockholdings held by outsider shareholders (institutions, families or individuals, other corporations) is related to higher board turnover even in the wake of poor performance. This implies that there is little evidence of shareholder monitoring. (c) CEOs with strong voting power successfully impede replacement irrespective of corporate performance. This case of strong managerial entrenchment is even exacerbated when the CEO also holds the position of chairman of the board. (d) Boards with a high proportion of non-executive directors replace the CEO more frequently, but these boards are not more apt to replace underperforming management. (e) There is also little consistent evidence that the market in large ownership stakes influences CEO turnover. (f) We find that CEO monetary compensation is not only related to corporate size and risk but is also positively related to both accounting and stock price performance. In firms with large outside shareholding, CEO compensation is lower but outside shareholder do not impose a stricter performance-related incentive remuneration scheme. When insiders have strong voting power, the CEOs remuneration is lower except when the stock price performance is poor: it seems that when the CEOs wealth resulting from their investment goes down due to decreasing stock prices, the CEOs cash compensation is higher. (g) The presence of a remuneration committee has no impact on remuneration. (h) Following CEO dismissal, there is little evidence of short-run improvement of corporate performance. (i) We find strong support for the incentive effect of remuneration: CEOs with higher levels of monetary compensation (salary and bonus) attain better subsequent accounting and stock price-based measures of corporate performance.

The remainder of the paper is organized as follows. In the next section, the research hypotheses are motivated. Section 3 discusses the sample selection procedure, describes the variables and reveals the data sources. In the same section, the different estimation techniques are explained. Section 4 presents the results while Section 5 discusses detailed robustness tests. The conclusions are presented in Section 6.

2. Determinants of CEO compensation and of managerial turnover

2.1. Background agency literature

Coughlan and Schmidt (1985) were the first to document that the likelihood of forced turnover is a decreasing function of corporate performance; a finding further corroborated by a.o. Warner et al. (1988), Weisbach (1988), Denis and Denis (1995), and Franks et al. (2001). The disciplinary character of managerial turnover is influenced by board size (Yermack, 1996), board composition (Weisbach, 1988), ownership structure (Kang and Shivdasani, 1995; Denis et al., 1997), and is industry-dependent (Parrino, 1997). Forced executive resignations in the US are accompanied by positive and statistically significant abnormal stock performance (Denis and Denis, 1995) provided that an outsider is appointed as CEO (Borokhovich et al., 1996 and Rosenstein and Wyatt, 1997). Finally, CEO turnover is the ultimate element of an 'error-correcting process', for it affects firm's investment decisions, giving a stimuli to divest poorly performing acquisitions (Weisbach, 1995).

The theoretical blueprint of pay-for-performance remuneration were laid by the principal-agent models of Holmström (1979) and Grossman and Hart (1983). A multi-period setting has enabled the analysis of career concerns that also affect executive compensation contracts (Gibbons and Murphy, 1992). Following Holmström (1982a), it is relative rather than absolute performance that is shown to be a valid determinant of CEO remuneration (Gibbons and Murphy, 1990)[1]. Performance-sensitivity of managerial compensation is empirically well documented (e.g. Coughlan and Schmidt, 1985; Jensen and Murphy, 1990). Executive pay depends on both past stock returns and past accounting measures (Sloan, 1993) as well as on relative measures of performance (Gibbons and Murphy, 1990). Still, the level of executive compensation depends not only on past performance: more important are company size (Murphy, 1985) and CEO age and tenure (Conyon and Murphy, 2000; Murphy, 1986). Furthermore, the following characteristics also explain part of the changes in remuneration: ownership structure (Core et al., 1999), board composition (Hallock, 1997), threat of takeover (Agrawal and Knoeber, 1998), merger and acquisition policy (Girma et al., 2002), company risk, growth opportunities, dividend policy (Lewellen et al., 1987), and the country where the company is operating (Conyon and Murphy,

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[1] Similar arguments are made in the so-called tournament models (Lazear and Rosen, 1981).

2000). The optimal balance of stock- and cash-based compensation solves a trade-off between short- and long-term incentives (Narayanan, 1996). While cash compensation creates short-term incentives (and therefore mitigates long-run overinvestment), stock-based compensation may provide appropriate incentives and reduce long-term underinvestment problems (Dechow and Sloan, 1991). Finally, Kole (1997) argues that optimality of a given compensation structure crucially depends on the characteristics of the assets managed by a given CEO.

2.2. Motivation of hypotheses

The importance of the disciplining role of managerial dismissals is widely accepted. Still, setting a correct performance yardstick is problematic as both accounting and stock price performance have deficiencies. Accounting information records only past corporate performance and can be manipulated over a period of several years by top management. Stock price performance captures the firm's ability to generate value in the future and may hence already include the effects of an expected change in CEO. Therefore, we argue that both stock- and accounting-based measures of performance provide incremental information about executives' productivity.

Hypothesis 1 (Disciplinary role of managerial turnover): *Poor accounting and past stock market-based performance positively affect the likelihood of CEO turnover.*

Managerial compensation schemes may be an appropriate device complementing performance-related turnover for the following reasons. First, many managers can be subjected to this incentive mechanism, while performance-induced disciplinary turnover only affects a few top managers. Second, Chang (1995) argues that for industries where industry-specific skills are required, performance-based compensation is likely to be a more effective solution to agency problems than the threat of dismissal. Third, as disciplinary turnover penalizes underperformance, the mere fact of being able to avoid poor performance (and, hence dismissal) does not constitute the right incentive for well-performing managers to pursue a value-maximizing strategy. If higher managerial effort induces better corporate performance, there is an important rewarding role for performance-dependent bonus and option schemes[2]. Imperfect observability of top management's actions creates opportunities for moral hazard that adversely affect the contracting with a manager (Holmström, 1979). The efficiency of contracting can be improved by using informative signals about executive's effort. Following this argumentation, Bushman and Indjejikan (1993) and Kim and Sloan (1993) develop models in which the CEO's compensation depends on both accounting- and stock-based performance measures. Both indicators are considered noisy signals of managerial effort, but as long as they are incrementally informative about managerial actions, they

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[2] Pay-for-performance compensation schemes may also have a punishing role provided that the bonus is forgone in case of poor performance and the base salary is scaled down. Although such a contract could achieve both the goals of disciplining and rewarding simultaneously, it is not observed empirically. Gregg et al. (1993) document that managerial compensation tends to increase over time, even in periods of bad performance.

enter a performance-dependent wage formula with non-zero weight[3]. They argue that constructing employment contracts dependent on both stock returns and accounting measures of performance shields the CEO from market-wide changes and thus improves contracting efficiency.

Hypothesis 2 (Rewarding effect of compensation): Past performance (both in terms of accounting-based and stock market-based measures) positively influences the level of the CEOs monetary compensation.

The essence of the agency literature is that in order to induce agents to exert (costly) effort, the principal has to provide them with appropriate incentives. Jensen and Meckling (1976) suggest (partial) equity ownership by managers as a way of mitigating this problem, but Murphy (1986) finds only little empirical support for this mechanism. Fama (1980) discounts the idea of pay-for-performance contracts for managers with short track records because, if managers believe that subsequent wage offers will depend on current levels of performance, they will work hard today to build up reputational value independent of incentive compensation[4]. Holmström (1982b) challenges this idea and shows that although the effects of labor-market discipline can be substantial, it is not a perfect substitute for contracts[5]. Gibbons and Murphy (1992) extend the Holmström model by introducing Fama's reputation concept and show that the optimal compensation contract optimizes total incentives: the combination of the implicit incentives from career concerns and the explicit incentives from the compensation contract.

Hypothesis 3 (Incentive effect of compensation): High levels of the CEO's monetary compensation induce better corporate performance in subsequent periods.

Decisions about hiring and firing top management as well as about the remuneration are ultimately taken by the board of directors. The higher the degree of independence of the board from top management, the higher is the level of performance-induced turnover. Still, the empirical US literature comes up with conflicting results. Weisbach (1988) shows that board structure affects the likelihood of disciplinary turnover: poorly performing CEOs are more frequently fired provided that the board is outsider-dominated. This conclusion is challenged by Mikkelson and Partch (1997) and Agrawal and Knoeber (1996) who show that managerial turnover is unrelated to board composition. Instead, turnover seems to result mainly from the pressure of the takeover market (Martin and McConnell, 1991). For the UK, Franks et al. (2001) do not find that a high proportion of independent directors leads to stronger managerial disciplining in the poorly

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[3] This argument of using both types of performance measures (stock- and accounting-based) as determinants of CEO compensation is also included in the recent empirical literature for US firms (Core et al., 1999; John and Senbet, 1998; Mehran, 1995).

[4] There is some evidence that the managerial labor market and hence managerial reputation plays an important role. Top managers leading poorly performing firms will be offered fewer non-executive directorships (Kaplan and Reishus, 1990).

[5] In the absence of contracts, managers are expected to work too hard in their early years (when market is still assessing the manager's ability) and not hard enough in later years.

performing firms. What does seem to matter is separating the functions of CEO and chairman of the board.

For the US, there is ample evidence that forced turnover follows from monitoring by large (activist) block holders and by the external control market (e.g. Denis and Denis, 1995; Bethel et al., 1998). For UK firms, Franks et al. (2001) confirm that these mechanisms also play a leading role in managerial replacement.

Hypothesis 4a (Governance effects on turnover): Ownership concentration as well as independent boards of directors positively affect the likelihood of managerial turnover in poorly-performing firms.

There is little empirical research on the relation between governance mechanisms and CEO employment/remuneration contracts. Still, the degree of independence of the board of directors may have a direct impact on managerial compensation as it is the non-executive directors (or their representatives in a remuneration committee) who set the remuneration contracts. In addition, shareholders will monitor the firm when their share stakes are sufficiently large such that the benefits from monitoring exceed the costs (Admati et al., 1994; Maug, 1998; Kahn and Winton, 1998) and may set the terms of CEO employment contracts. Core et al. (1999) and Crespi et al. (2002) illustrate that the ownership structure influences the level of managerial compensation.

Hypothesis 4b (Governance effects on compensation): Ownership concentration as well as independent boards of directors positively affect the level of performance-based cash compensation of the CEO.

The intensity of monitoring may not only depend on mere ownership concentration but also on the type of blockholders. In particular, substantial insider ownership may lead to managerial entrenchment, which decreases the performance-sensitivity of managerial turnover and reduces the likelihood of CEO dismissal (Chung and Pruitt, 1996; Denis et al., 1997). Outsider blockholders may hold management responsible for poor performance and attempt to remove them. Even across different types of outsider shareholders (institutions, families or industrial firms), the incentives to monitor may differ. Institutions may be passive shareholders in order not to reduce the liquidity of their investment portfolios as a result of insider trading legislation. Other outside shareholders may not be hindered by such constraints. It is also likely that the decision criteria to remove underperforming management may depend on the type of owner. For example, a reduction in share value or negative abnormal returns may trigger intensified monitoring by outside shareholders and increase top management dismissal. In firms with diffuse ownership, in contrast, substitution of top management may only take place (too) late due to lack of large shareholder monitoring and may happen after a substantial decrease in corporate performance, like negative accounting earnings.

Hypothesis 5a (Blockholder identity effect on turnover): *The type of controlling shareholders affects the likelihood of managerial turnover: monitoring by outsider blockholders (institutions, families and individuals, industrial firms or the government) leads to increased performance-related CEO removal whereas insider blockholders impede executive board changes. Furthermore, the decision criterion of CEO dismissal is related to the type of controlling blockholder: in companies with monitoring outside shareholders, the CEO is replaced after poor stock price performance, whereas in widely-held firms or firms with strong insider ownership the decision criterion is based on negative accounting results.*

A similar argument applies to the pay-for-performance schemes of top management. Managers with a high level of decision discretion (resulting from diffuse ownership and weak boards) may set their own pay and performance criteria. In these cases, we expect pay-for-earnings performance contracts to be more prominent as top management can to some extent influence accounting policies. In firms with high outsider control concentration, the value maximization criterion may be translated into pay-for-share price performance remuneration schemes. Core et al. (1999) find that both size of the CEO equity stake and presence of outside block holdings are significant determinants of executive pay in the US. Clay (2000) argues that monitoring activities are delegated to some classes of owners (namely financial institutions) and that the presence of activist shareholders leads to higher levels of CEO compensation, simultaneously increasing performance-sensitivity.

Hypothesis 5b (Blockholder identity effect on compensation): *In firms with a diffuse ownership structure or strong concentration of insider control, pay-for-accounting performance remuneration contracts prevail whereas in outsider shareholder-controlled firms pay-for-share price performance compensation contracts are imposed.*

Denis and Sarin (1999) and Denis and Kruse (2000) show that changes in ownership structure imply adjustments in board composition, and consequently result in changes in the management team. This tends to indicate that monitoring activities are a function of ownership dynamics rather than of a *status quo* of ownership concentration. Not only full takeovers, but also the acquisition of substantial blocks result in substantial policy changes in target firms (Jenkinson and Ljungqvist, 2001).

Hypothesis 6a (Ownership dynamics effect on turnover): *Changes in ownership structure influence the likelihood of managerial turnover: new block holders with strong monitoring abilities are more likely to remove the CEO in the wake of poor performance.*

Hypothesis 6b (Ownership dynamics effect on compensation): *Changes in ownership structure influence the level of the CEO's cash compensation. The presence of new block holders with strong monitoring abilities leads to a stronger pay-for-performance relation.*

3. Sample description and methodological approach

3.1. Sample description

The sample consisting of 250 UK firms is randomly drawn from the population of all companies quoted on the London Stock Exchange, excluding financial institutions, real estate companies and insurance companies. A company is retained if it has at least 3 consecutive years of data in the period 1988-1993. A data panel was constructed for this six-year period. Our sample period terminates in 1993 when the London Stock Exchange imposed the recommendations for good corporate governance of the Cadbury report on all listed firms.[6] Thus, our period is characterized by lower corporate governance standards than more recent years, and is therefore particularly interesting to analyze from an agency-theory point of view. Furthermore, turnover and pay-for-performance are a particularly interesting study object in recession periods.

For a company to be included in the sample we required that data for at least three consecutive years within the six years time window are available. Hence, the sample also includes those firms that were taken over or went bankrupt. Seven of the 250 companies were dropped because accounting data were not available from Datastream.

3.2. Variable definitions, and data description

All data on managerial compensation. turnover and board composition were retrieved from the Directors' Report and the Notes in the annual reports. In our sample, approximately 11% of CEOs lost their position in a given year (Table 1). The mean and median logarithm of cash compensation (salary and bonus) was 11.88 and 11.91, respectively (which corresponds to approximately £ 144,000 and £ 149,000). The median age of a CEO is 52 years (with a mean of 52.6). The median tenure equals 4 years (with a mean of 5.2). Every third CEO also holds the position of chairman of the board of directors. The median board consists of 9 directors, 61.5% of whom are non-executive directors. Finally, in approximately 26% of the sample firm-years, CEO compensation is determined by a remuneration committee[7]. The fraction of companies having such a committee increases substantially towards the end of the sample period (as documented also by Conyon et al., 1995). Turnover data are corrected for natural turnover. We distinguish between natural and forced turnover, classifying a resignation as 'natural' if the director was described as having left the board for reasons of retirement, death or illness. Otherwise the resignation was classified as being forced. The normal retirement age is between 62 and 65 but some voluntary retirement does occur before that; we took 62 as the minimum retirement age and viewed any earlier retirement as forced.

Ownership data both for existing and new shareholders for each year of the period 1988-1993 were also collected from the Directors' Report and the Notes in the annual reports. All the directors' holdings greater than 0.1% are recorded as well as other shareholders' stakes of 5% and

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[6] For the effect of the Cadbury recommendations on performance and turnover, see Dahya et al. (2002).

[7] The presence of such committees (postulated by Cadbury report) can alter compensation policies and eliminate the situation when the remuneration decision is largely influenced by CEOs themselves (Conyon, 1994).

more and of 3% and above (from 1990 when the statutory disclosure threshold was reduced). The status of the directors (executive/non-executive) and the dates of joining and leaving the board were also obtained from the annual reports and from contacting the firms directly by phone or fax. Non-beneficial share stakes held by the directors on behalf of their families or charitable trusts were added to the directors' beneficial holdings. Although directors do not obtain cash flow benefits from these non-beneficial stakes, they usually exercise the voting rights. For equity stakes in Nominees accounts, the identity of the shareholders was found by contacting the listed firms directly. In 97% of these cases, the shareholders of Nominees accounts were institutional investors.

[Insert Table 1 about here]

As is typical for Anglo-American firms, the ownership concentration shown in Table 1 is relatively low. The median Herfidahl-5 index equals only 0.028 (with a mean of 0.057). Most of CEOs do not hold substantial share stakes: the average CEO owns less than 3% of the equity (with a median of zero). The median of the combined shareholdings of all executive directors (excluding CEO) amounts to less than 1%, with an average of slightly below 8%. Stakes of non-executives are lower and do not exceed 4%, on average. The most important class of blockholders consists of financial institutions: they hold a (cumulative) median stake of 13% (a mean of 16.6%). Finally, other outsiders – individuals, families and industrial firms – control on average 8.2% of equity. There is also evidence of a market in (small) blockholdings. Gross increases in holdings by institutions and by other outsiders amount to 6.4% and 1.8%, respectively, which accounts for half and one fourth of the average equity stakes held by those shareholder classes.

As proxies for stock performance, we employ annual abnormal stock returns (in percentage terms), which are collected from the London Share Price Database (LSPD). Abnormal returns are calculated using the market model and corrected for thin trading. The stocks of our sample companies underperformed the benchmark by approximately 2.5% in year t (see Table 1). It should be noted that our time window captures a recession period. We also use alternative performance measures like the percentage dividend changes (between years t - 2 and t - 1, and between t - 1 and t, respectively), which are collected from Datastream, and employ return on assets (earnings before interest and taxes over book value of total assets) as accounting-based performance indicators. All accounting data are collected from Datastream and are cross-checked with the information from annual reports. We use the logarithm of market-to-book ratio as a proxy for firms' growth opportunities and as an alternative measure of stock performance. For the median (average) firm this variable equals 0.51 (0.48).

In order to control for (potential) size effects, we introduce the logarithm of total assets (in £ thousands) at the end of a given year. For the median (mean) company in our sample, this value equals to 11.35 (11.26), which corresponds to approximately £ 85 million (£ 78 million). The median and mean ratios of capital gearing (defined as long term-debt on total assets) equal 29.72% and 32.65%, respectively. Finally, we measure risk by the annual volatility of stock returns, which

is gathered from the LSPD. The median and mean values amount to 34.39% and 37.43%, respectively.

Some important data were not available for this study. First, non-monetary elements of CEO remuneration (in particular stock- and option-grants) are not collected. At best, the annual reports only mention that some managerial options were outstanding without consistently revealing the number of options outstanding, the exercise price, and the number of options exercised in the preceding year. Only in the years subsequent to 1995 (when the Greenbury report was issued), some of this information became available. Second, the presence of director interlocks might affect the level of managerial compensation as well (Hallock, 1997).

Our sample period is relatively short but extending the data set beyond 1993 would be problematic due to structural differences between pre- and post-Cadbury period.

3.3. Methodology

We employ a variety of econometric techniques. Firstly, sample selection models are applied to analyze jointly executive compensation and turnover. Second, in order to assure robustness of conclusions, survival analysis is applied to investigate factors leading to managerial turnover. Finally, corporate performance is analyzed within a panel regression framework.

We simultaneously explain managerial turnover and compensation within a sample selection model framework. The model, often referred to as a type-2 Tobit model, is specified as follows:

$$y_{1it}^{*} = X'_{1it}\,\beta_1 + \varepsilon_{1it} \tag{1a}$$

$$y_{2it}^{*} = X'_{2it}\,\beta_2 + \varepsilon_{2it} \tag{1b}$$

$$y_{1it} = \begin{cases} 1 & \text{if } y_{1it}^{*} > 0 \\ 0 & \text{if } y_{1it}^{*} \le 0 \end{cases} \tag{2}$$

$$y_{2it} = \begin{cases} y_{2it}^{*} & \text{if } y_{2it}^{*} > 0 \\ 0 & \text{if } y_{2it}^{*} \le 0 \end{cases} \tag{3}$$

where $\{\varepsilon_{1it}, \varepsilon_{2it}\}$ are drawn from a bivariate normal distribution with mean 0, variances σ_1^2 and σ_2^2, and covariance σ_{12} (Amemiya, 1984). *y*-variables are quantities of interest while *X*-variables correspond to the explanatory variables. Finally, β_1 and β_2 are vectors of the model coefficients. It is assumed that only the sign of y_{1it}^{*} is observed and that y_{2it}^{*} is observed only when $y_{1i}^{*} > 0$. Moreover, it is assumed that X_{1i} are observed for all *i*, but X_{2i} need not be observed for *i* such that $y_{1it}^{*} \le 0$. Finally the two sets of explanatory variables, i.e., X_{1it} and X_{2it}, are not disjoint (they can differ, however).

In a standard setting, error terms are assumed to be i.i.d. drawings from a bivariate normal distribution. In our models, *i* corresponds to a firm and *t* to a year. We relax the assumption of independence of ε's across *i* and allow clustering of observations corresponding to a given firm, i.e. we assume error terms to be i.i.d. across firms, but not necessarily for different observations

within the same firm. All the reported standard errors of estimates are adjusted for clustering (StataCorp, 2001). This procedure enhances robustness of our findings and allows us to take the panel data structure of our sample explicitly into account. To estimate the type-2 Tobit models, we employ a two-step procedure suggested by Heckman (1979), which yields consistent parameter estimates.

Throughout the paper we call equation (1a) a selection equation, while equation (1b) is referred to as a regression equation. The selection equation explains CEO turnover, i.e., $y_{1it} = 1$ corresponds to those firm-years when the CEO kept his position. The regression equation explains the compensation of such CEOs in the subsequent year. As the notion of compensation sensitivity to previous year performance is not meaningful for new CEOs, we restrict the remuneration analysis to CEOs with a tenure of more than one year. Estimating the parameters of the regression equation (1b) on the basis of the non-turnover sample only, would not be a valid alternative to the proposed method because the OLS estimator of β_2 is biased when the selection of the regression sample is endogenous (i.e., $\sigma_{12} \neq 0$). Instead, our sample selection model deals with the endogeneity of selection, and therefore renders reliable parameter estimates for the regression equation (Greene, 2000).

In order to investigate robustness of the type-2 Tobit models, the determinants of CEO turnover are also analyzed with Cox proportional hazard regressions (Cox, 1972; Cox and Oakes, 1984). The hazard function is defined as

$$h_i(t) = \lim_{\Delta \to 0^+} \frac{\Pr(t \leq T_i < t + \Delta | t \leq T_i)}{\Delta}, \tag{4}$$

where T_i is the date of dismissal of CEO i. Hence, the hazard function for a given manager can be interpreted as the marginal conditional probability of being replaced in the time instant Δ given that he or she was not replaced up to time t. Consequently, a positive parameter estimate for a given variable reflects that larger values of this variable increase the probability of CEO dismissal.

The basic proportional hazard model looks as follows:

$$h_i(t) = \psi(X_i, \beta) \cdot h_0(t), \tag{5}$$

where $h_i(\cdot)$ is the hazard function for individual i, $\psi(\cdot)$ is some function of model covariates X_i and of parameters β, and $h_0(\cdot)$ is the underlying (unspecified) baseline hazard function. Following the literature, we use for a log-linear specification, i.e. we impose the following form of the function ψ:

$$\psi(X_i, \beta) = \exp(X_i'\beta). \tag{6}$$

The advantage of this approach is that we do not have to parameterize the baseline hazard function. Instead, since we are mainly interested in the values of model parameters β, we need to maximize only the partial likelihood, which for a given observation is given by:

$$L_i = \frac{\exp(X_i'\beta)}{\sum_{j \neq i} \exp(X_j'\beta)} \tag{7}$$

and does not depend on h_0 (Geddes and Vinod, 1997).

We allow the explanatory variables to be time-varying, which results in multiple observations for each of the analyzed firms. In order to assure robustness of the results, we account for possible dependence between different observations corresponding to the same firm. We allow for clustering and implement the procedure, which assumes the observations to be independent across firms, but does not require different observations on the same firm to be independent (StataCorp, 2001). Finally, a robust estimate of the coefficient covariance matrix is computed as in Lin and Wei (1989).

Finally, we also employ panel-data regression models to examine the impact of the managerial labor market on corporate performance. The basic panel-data regression model looks as follows:

$$y_{it} = \alpha_i + X_{it}'\beta + \varepsilon_{it}, \tag{8}$$

where y_{it} stands for compensation or performance for company i in year t. X_{it} is a vector of covariates (again for individual i at time t). α_i is a firm-specific effect characterizing i-th company, β is the vector of model parameters, and ε_{it} is an error term[8].

Two techniques are frequently used to estimate equation (8): the fixed-effects and random-effects approaches. In the former, α_i's are treated as model parameters and are hence estimated. The random-effect model treats α_i's as the result of a random draw from some distribution (e.g., the normal one). For a data panel like ours (relatively large number of firms drawn randomly from an even larger population of companies), the use of a random-effects model is recommended (Verbeek, 2000), as the number of parameters to be estimated is substantially lower with this technique. Furthermore, more efficient estimates are obtained than with fixed-effects models. Still, the consistency criterion of such a random-effects approach requires α_i's to be uncorrelated with explanatory variables of the model, i.e. the X's (Baltagi, 1995). Since the Hausman specification tests points out that in almost all our specifications this assumption is violated, we report the results from the fixed-effects approach.

In panel regressions explaining performance, we controlled for features characterizing ownership structure. Since ownership is often argued to be endogenous with respect to corporate performance (Agrawal and Knoeber, 1996; Jensen et al, 1992), it is likely to result in inconsistency of fixed-effect estimators. In order to circumvent this endogeneity problem, we apply an instrumental-variable method while estimating the performance regressions. This

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[8] In some robustness tests, we also employed panel-data binary choice models (such as random-effect probit and fixed-effect logit). Since we restrict ourselves to brief discussion of the conclusions, we do not discuss that methodology here. Extensive treatment of such specifications can be found in Baltagi (1995), Verbeek (2000), and Greene (2000).

instrumental variable approach is then embedded in the estimation of fixed-effect panel-data models.

4. Results

In Section 4.1, the sample selection models simultaneously explaining CEO turnover and compensation are discussed. Subsequently, hazard rate analyses of managerial survival are presented. Section 4.3 outlines the panel-data models explaining firm performance as a function of managerial labor market factors.

4.1. Sample selection models explaining managerial compensation

The results of Panel A of Table 2 support the disciplinary role of managerial turnover (Hypothesis 1) as performance is positively correlated to future turnover in the selection equations. This effect is highly significant for the accounting-based performance measure, but not so for stock performance. Managers generating high corporate performance (above the industry return on assets) are more likely to keep their position during the subsequent year.

Strong support for Hypothesis 2 (the rewarding effect of compensation) can be found in Panel B of Table 2. In all models, cash compensation, consisting of salary and bonus, is sensitive to both past accounting and stock price performance within the 5% (and frequently 1%) level of statistical significance.

[Insert Table 2 about here]

Strong results are obtained for the relationship between turnover and board characteristics (Panel A). Contrary to the US evidence of e.g. Yermack (1996), the presence of larger boards facilitates the replacement of the CEO in the UK. It may be that larger boards are a proxy for a larger internal pool of managerial talent. Our findings also confirm the intuition of the 1993 Cadbury report, the 'Recommendations for Good Corporate Governance': boards with a larger percentage of outside directors replace CEOs more frequently. Still, the interaction terms of the proportion of non-executive directors and both performance measures (not shown)[9] are not statistically significant. Boards with a high proportion of non-executive directors do not appear significantly more apt to replace underperforming management. Therefore, we cannot support that part of Hypothesis 4a referring to the board of directors. Our results do not confirm Weisbach's (1988) findings that outsider-dominated boards, supposedly more independent from management, are more able to enforce disciplinary turnover. Finally, when a person fulfills the tasks of CEO and chairman of the board simultaneously, the likelihood of his or her replacement is significantly

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[9] Models with interactive terms of board characteristics and performance are available upon request.

decreased. This danger of conflicts of interest provides further support for the need to separate the positions of CEO and chairman.

There is no significant relation of board characteristics (including those interacted with performance) with the CEO's cash remuneration with the exception of board size (Panel B of Table 2). CEOs of firms with large boards receive a large compensation. Finally, the presence of a remuneration committee (consisting of non-executive directors) has a negative impact on CEO compensation, which hints that these committees mitigate managerial remuneration although this effect is statistically insignificant. We therefore reject that part of Hypothesis 4b which refers to the board of directors.

There is no relation between total ownership concentration, measured by the Herfindahl-5 index, and CEO turnover (Model 2 of Panel A).[10] Also, the interactive terms of total ownership concentration with performance are not statistically significant. Hence, these results reject Hypothesis 4a. Still, when we dissect ownership concentration into insider ownership concentration (shareholdings controlled by the CEO, other executive directors and non-executive directors), we find that strong insider control induces a higher probability that the CEO will not be removed (Model 3). The insignificant interaction terms with accounting returns indicate that insiders with large ownership stakes are able to successfully ward off any attempts to replace the CEO regardless of accounting performance.[11] The negative interaction term with abnormal returns (counter-intuitively) suggests that the CEO with strong voting power is even in a stronger position when the stock price performance of his firm is weaker. Neither an analysis with outsider ownership concentration (Model 3) nor a more detailed analysis with ownership concentration held by institutions, families and individuals, other corporations and the government (not shown) yields any evidence of outside shareholder monitoring. Thus, we conclude that there is only partial support for Hypothesis 5a: CEOs with strong voting power seem immune for substitution (be it performance-related or not) and outside shareholders do not seem to play a role in replacing underperforming management. Lai and Sudarsanam (1998) and Franks et al. (2001) also present evidence of managerial entrenchment. We do not find any support that different performance criteria are used by different large shareholders to remove the CEO.

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[10] It should be noted that the stakes (both in simple terms and in interactions) are median-centered: zero corresponds to the sample median (i.e. 2.14% of equity is controlled by insiders and 22.8% by outsiders). In models with interaction terms, variable-centering is applied for two reasons: (i) it mitigates collinearity problems; (ii) it results in straightforward interpretation of the main-effect coefficient - such a coefficient shows the strength of the relationship for a median (or mean) level of the moderating variable (Aiken and West, 1991).

[11] When we estimate the models with ownership concentration held by the CEO, executive and non-executive directors separately, we find that it is only the CEO's ownership stake which matters in terms of impeding the CEO's removal. The variables capturing the voting power of the other director classes (and their interaction terms) are not significant but have the same sign as the CEO's ownership concentration. This suggests that little monitoring is performed by non-executive directors. This is in line with the findings of Franks et al. (2001) who state that non-executive directors frequently support incumbent management even in the wake of poor performance. Poor performance is not only the result of poor management but maybe also of poor corporate governance.

The insights of the tables discussed above are visualized in Figures 1 and 2.[12] Figure 1 exhibits a considerable weakening of stock-based performance sensitivity for larger insider stakes, almost irrespective of the size of outside block holdings. The picture of accounting performance-sensitivity of turnover (Figure 2) shows that the sensitivity also weakens for strong insider ownership. In the low range of insider ownership, the sensitivity increases with the insiders' stake, but it starts to decrease after passing a (relatively low) threshold of about 7% of equity. Figure 2 shows also that turnover sensitivity with respect to performance varies considerably and non-monotonically across different levels of outside ownership concentration.

[Insert Figures 1 and 2 about here]

In the remuneration regression equation (Panel B), we find that when insiders hold large share stakes, the CEO's monetary remuneration is lower. It may be that CEOs deriving substantial wealth from their equity investment in their corporation, may care less about their cash income. Still, when the firm's stock performance is low and the wealth of a CEO with a large ownership stake decreases[13], the CEO is paid a high level of cash compensation. Thus, CEOs receive high monetary compensation in the wake of poor stock performance provided that they have high voting power. It seems that managerial entrenchment not only eliminates the disciplining of poorly performing management but also introduces a pernicious remuneration incentive scheme. When outside shareholders hold large stakes, the monetary compensation of the CEO is lower, but as the interactive terms are not significant, there is no evidence that CEO remuneration is more performance-related in outsider-dominated firms than in widely-held firms.[14] Thus, we conclude that we only find partial evidence supporting Hypothesis 5b: (i) in firms with median (i.e., very low) insider and median outsider ownership concentration, both accounting and stock price performance are positively related to CEO compensation, (ii) in firms with strong insider voting power the CEOs remuneration is lower except when the stock price performance is poor and (iii) in firms with strong outside shareholders, CEO compensation is lower but outside shareholder do not impose a stricter performance-related incentive remuneration scheme. Figures 3 and 4 illustrate performance sensitivity of the CEO's monetary compensation. Figure 3 confirms that substantial inside ownership considerably weakens the pay-for-stock-performance relationship for virtually all levels of outside block holdings. The (non-monotonic) impact of outside block holdings is most outspoken at the low range of insider ownership. Figure 4 reveals that positive remuneration-sensitivity of accounting performance is the strongest in companies with moderate sizes of inside and outside block holdings. This positive effect is significant for a broad range of

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[12] The calculation of conditional z-statistics is explained in the appendix.

[13] See the interactive term of abnormal return with insider ownership in model 3 (panel B of table II).

[14] An analysis of the different types of outside blockholders does not give any significant results apart from the fact that in firms with high ownership concentration held by institutions, the CEOs compensation is lower. This effect is not performance-related.

ownership concentrations, although the presence of large insider-controlled blocks obliterates the sensitivity of CEO compensation.

[Insert Figures 3 and 4 about here]

Finally, we show that the ownership dynamics are not a relevant determinant of CEO turnover (Hypothesis 6a) in Model 4 of Panel A. Contrary to what was postulated in Hypothesis 6b, ownership changes do not influence CEO pay (Model 4 of Panel B).

Table 2 also provides some interesting insights concerning the impact of firm-specific control variables (size, gearing and risk) on CEO remuneration (Panel B). In line with the UK remuneration literature, CEOs of larger firms enjoy significantly higher industry-adjusted cash compensation. Top management usually tries to justify – rightly so or not – size-related compensation by the fact that to manage larger firms, more managerial skills are needed which are in short supply. We also document that firm leverage has no impact on compensation.

Our results show that CEO remuneration increases with corporate risk. Aggarwal and Samwick (1999) and Jin (2002) argue, however, that in an agency framework, managerial risk aversion implies that firm risk moderates performance sensitivity of executive compensation. We verified this claim and expanded our models with interaction terms of company risk and performance (tables available upon request). None of these interaction terms are statistically significant which fails to corroborate the hypotheses in the above studies.

As reported in Panel C, the estimate of the correlation coefficient of the error terms in the selection and the regression equations is highly significant (Models 1-3). This result confirms that the analysis of compensation performance-sensitivity in the simple OLS regression framework (based on a censored sample only) is likely to suffer from a severe selection bias (see Section 3.3 above). The methodology applied in this paper allows us to argue that the strong rewarding effect of CEO remuneration is present, even after taking into account the selectivity resulting from disciplinary turnover.[15]

4.2. Hazard rate analysis on CEO survival.

Survival analysis allows us to investigate the determinants of managerial replacement and the robustness of our conclusions from the simultaneous estimation of previous section. Using a series of Cox regression models, we find that strong support for Hypothesis 1 in Table 3. Previous year's poor accounting performance (measured by industry-adjusted ROA) significantly increases the likelihood of CEO removal. Although, in some of the models, past stock market performance

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[15] It should be noted that all results discussed above remain valid for a model which includes interactive terms of ownership (model 3), changes in ownership (model 4) and board characteristics simultaneously.

is marginally significant, it is accounting- rather than market-based performance measures that are the dominating criterion for replacing a CEO (Models 5-8).[16]

[Insert Table 3 about here]

Significant results, in line with those reported in Section 4.1, are obtained for the relationship between turnover and board characteristics. Large boards and boards with a high proportion of outside directors facilitate the removal of CEOs. Still the interactive term of the proportion of non-executive directors with performance is not significant which implies that non-executive directors who are more independent from management are not more able to discipline underperforming management.[17] When the CEO dominates the board by also holding the chairmanship, he is more likely to 'survive' longer.

Whereas total ownership concentration does not seem to influence the likelihood of CEO dismissal (Model 6), Model 7 shows that the presence of specific types of blockholders determines the (non-natural) CEO dismissal. In companies where insiders hold larger fraction of equity, entrenchment is more likely, especially when the company generates losses. A more detailed analysis of insider ownership concentration – more specifically of that of the CEO, executive and non-executive directors – reveals that the CEO's stake and its interaction terms are statistically significant. CEOs holding a large proportion of voting rights can make themselves to some extent immune to dismissal.[18]

Model 8 analyses the impact of ownership structure on managerial turnover from another angle, namely that of ownership dynamics rather than that of block holdings. As before, the ownership dynamics are not related to CEO turnover.

The annual volatility of stock returns, our proxy for firm risk, is always significant with a positive sign, implying that top executives of high-risk firms are more vulnerable to dismissal. Finally, the other control variables (leverage and firm size) are insignificant in all the Cox models explaining CEO turnover.

4.3. Performance panel regressions

To test Hypothesis 3, we estimated both accounting and stock performance models. The results for the industry-adjusted ROA models are reported in Table 4. With respect to the stock performance, we have used abnormal stock returns but did not obtain any significant or economically meaningful results. Subsequently, we employed a proxy for Tobin's Q as our measure of stock-based performance (Table 5) and yearly dividend changes (Section 5.3).

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[16] All turnover figures in these models are corrected for natural turnover. We distinguish between natural and forced turnover, classifying a resignation as 'natural' if the director was described as having left the board for reasons of retirement, death or illness. Otherwise the resignation was classified as being forced. The normal retirement age is between 62 and 65 but some voluntary retirement does occur before that; we took 62 as the minimum retirement age and viewed any earlier retirement as forced.

[17] The results from the models with board interactive terms are available upon request.

[18] The results from this model are available upon request.

[Insert Tables 4 and 5 about here]

The results from Tables 4 and 5 strongly support Hypothesis 3: the incentive effect is statistically significant in most models.[19] CEOs with a higher level of monetary compensation attain better subsequent corporate performance. These results hold for both accounting- and stock-based measures and are not altered by inclusion of the ownership variables.

We also correct for recent CEO replacement and we find no significant short-run improvement of corporate performance following the (non-natural) CEO replacement. This may result from the 'big bath' logic (Murphy and Zimmerman, 1993) that states that in the year(s) subsequent to CEO removal, there is a substantial increase in the amounts expensed. The reason is that in his first (few) year(s), the CEO can still blame the predecessor's strategy and also attempts to lower the performance benchmark such that performance improvements can be more easily attained in subsequent years.

Ownership structure is often argued to be endogenous with respect to performance. Therefore, in Models 10a-12a and 10b-12b of Tables 4 and 5 we employed an instrumental-variable estimation technique rather than simple panel regression.[20] Both Models 10a and 10b confirm that total ownership concentration is insignificant as a determinant of corporate performance. Still, distinguishing between insider and outsider ownership concentration in Model 11a shows that the presence of large outside shareholders is correlated to higher future accounting earnings. A more detailed analysis of the type of outside blockholder reveals that this is due to the presence of financial institutions.[21] This is somehow surprising as institutions tend not to be involved in managerial decision making. The reason is that they may not have the resources to monitor every single firms they invest in and they may wish not to receive inside information such that the liquidity of their portfolio investments is not reduced. The fact that institutions are passive shareholders is also reflected in the fact that a government committee (the Newbold committee) came up with recommendations to stimulate the exertion of voting rights by institutions in 1999 (Stapledon and Bates, 2002). Whereas the impact of institutional ownership is positive in Model 11a, that of increases of institutional ownership is negative in Model 12a. We do not find any impact of ownership on our stock performance measures. The results also reveal that larger firms

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[19] Hayes and Schaefer (2000) propose an alternative explanation of this finding. They argue that implicit incentive contracts may be based on performance measures that are observable only to the contracting parties. If corporate boards optimally use both observable and unobservable (to outsiders) indicators of *executive* performance and if the unobservable measures are correlated with future *firm* performance, then unexplained variation in current compensation could predict future variation in firm performance.

[20] In order to circumvent this endogeneity problem in models 10a and 10b, the ownership concentration measure is instrumented by its lagged values. A similar procedure (i.e. using lagged values as instruments) was applied in models 11a and 11b. However, in models 12a and 12b lagged changes in ownership have two disadvantages. First, the use of such instrument causes the loss of one panel wave. Second, lagged ownership changes are not good potential instruments, as their correlation with the variables that are to be instrumented is low. To overcome both problems, in models 12a and 12b we use the same set of instruments as in models 11a and 11b.

[21] Tables available upon request

generate higher returns on assets (Table 4) but are performing worse in terms of stock market performance proxied by Tobin's Q (Table 5). Whereas high gearing and its tax shield is reflected in higher stock performance (Table 5), it depresses accounting returns (Table 4). Finally, high risk is reflected in neither higher stock market nor accounting performance.

5. Robustness tests

5.1. Alternative variable specifications in the simultaneous equations estimation.

5.1.1. Remuneration

We re-estimated the Models of Section 4.1 using the logarithm of CEO compensation rather than the logarithm of industry-adjusted CEO pay as a dependent variable in the regression equation. Such specifications failed to explain managerial remuneration, even after the inclusion of industry dummies to control for industry-specific effects. Therefore, we argue that Hypothesis 2 only holds for the appropriate measure of compensation. The lack of performance sensitivity of compensation found in the UK compensation literature (compare Conyon et al., 1995) may be attributable to the different variable specifications.

5.1.2. Corporate performance

We substituted unadjusted ROA and (yearly) changes in EBIT for our accounting performance measure and obtained similar results both in the regression and the selection equation. For two other proxies tried (adjusted and unadjusted ROE), the relation with CEO turnover and industry-adjusted compensation not significant. An alternative measure of stock performance (dividend changes as a signal of future value) gave results similar to those obtained with stock returns. Tobin's Q correlates positively with remuneration in the regression equations, but is not a used as a benchmark to remove the CEO (selection equation).

Finally, we extended the models by also including two-year lags of the performance indicators. In most of the specifications, both accounting- and market-based proxies lagged two years appeared insignificant. Thus, it seems that the decisions to CEO removal as well as remuneration are taken swiftly, once poor or good performance thresholds are reached.

5.1.3. Ownership and control

In the selection equations, the variables measuring total ownership concentration mostly turn out to be insignificant, irrespectively of the proxy tried. Only when we employ a Shapley value of the largest block holder, which captures the relative voting power of this blockholder, we obtain a positive correlation (at the 10% level) with the likelihood of CEO dismissal (Hypothesis 4a). In relation to the tests of Hypothesis 5a and b, we tried alternative proxies to measure stakes and voting power of different types of owners (e.g. the largest stake in each of the classes, Herfindahl-3 concentration indices within each shareholder class, the largest Shapley value for the largest blockholder by shareholder classes, the Shapley values by class of owner). The results are

in line with those reported in Section 4.1: we only find consistent support for managerial entrenchment as larger stakes controlled by insider (mainly the CEO) mitigate the likelihood of CEO dismissal.

With respect to the regression equations, our results appear robust to different proxies of ownership structure: total ownership concentration has not impact on the level of CEO compensation. Thus, Hypothesis 4b can be rejected. Replacing cumulative stakes of various classes of owners by the largest block in each of the groups, by Shapley values of the largest investor in each of the owner-type classes, by Herfidahl-3 indices for different groups, or by class Shapley values produces results that are comparable to those reported earlier in Section 4.1.

5.1.4. Leverage

The results are also robust to the choice of leverage proxy (using book or market value) as none of the conclusions concerning the research hypotheses is challenged in alternative specifications. Also extending model specifications by adding additional firm-specific control variables capturing changes in capital structure (such as dummy variable for firms issuing new equity) does not materially affect the results.

5.1.5. Model extensions by CEO age

Several studies argue that CEO age is one of the crucial determinants of compensation and of turnover. We extended the models by including CEO age but did not do so in the models of Table 2 because CEO age variable is only available for 60% of our the sample. CEO age has no impact on the CEO replacement but is positively related to CEO cash compensation (at the 10% of statistical significance). None of the other results presented in Table 2 are rejected.

5.2. Robustness tests for hazard models

In spite of the advantages of the methodology applied in Section 4.2 - more specifically the fact that we do not need a full parameterization of the hazard function - we estimate panel-data fixed-effect logit models to verify robustness further. Due to the requirements of estimation procedure (i.e., conditional maximum likelihood) sample size was shrunk substantially (by approximately 60%), which brings about lower levels of statistical significance. Nevertheless, the major qualitative conjectures concerning CEO turnover are upheld irrespectively of the choice of methodology.

Next, we re-estimated Cox models of Section 4.2 using alternative proxies for stock price performance (yearly dividend changes, Tobin's Q proxy), for accounting-based performance (unadjusted ROA and changes in EBIT), for ownership concentration (Herfindahl-10 index, the largest block holding, Herfidahl-3 indices for each shareholder class and Shapley values of the largest shareholder of each class), for leverage (book- or market-based) and generated results that hardly differ from those presented in Table 3. Two-year lags of the performance variables were insignificant. Franks et al. (2001) state that new equity issues present the ideal opportunity to

replace poorly performing CEOs, but we find no evidence that the dummy variable capturing the fact that a new equity issue took place, is correlated with CEO replacement.

5.3. Robustness tests for performance panel regressions

In Section 4.3, we discussed the impact of CEO remuneration and replacement on future industry-adjusted ROA. Models with unadjusted ROA and with changes in EBIT did equally well as those shown in Table 4. The models explaining changes in EBIT yielded an additional interesting result: in the year subsequent to a CEO's dismissal, the new CEO tends to increase the EBIT significantly (which does not happen for other accounting or stock market measures). We also re-estimated the models of Table 5 with the dependent variable being yearly dividend changes (instead of the Tobin's Q proxy) and obtain robust results.

In both series of models (in Tables 4 and 5), we replaced industry-adjusted lagged CEO compensation by logarithm of lagged compensation (without industry adjustments) but failed to find support for the incentive effect. This result also advocates that the relevant measure of managerial pay is industry-adjusted: CEOs with salaries that exceed those of their industry peers seem more incentivized. Including the alternative ownership measures and control variables (leverage, size, risk), described in Sections 5.1 and 5.2, into the models of Tables 4 and 5 yields robust results. Including a dummy variable for companies issuing new equity does not alter any of the conclusions. As expected, the new equity issue dummy is statistically and positively significant in models with growth opportunities as dependent variable.

6. Conclusion and discussion

In this paper we simultaneously analyze two mechanisms of the managerial labor market: CEO turnover and monetary remuneration schemes. Sample selection models and hazard analyses applied to a random sample of 250 firms listed on the London Stock Exchange over a six-year pre-Cadbury period show that managerial remuneration and the termination of labor contracts play an important role in mitigating agency problems between managers and shareholders. We find that both the CEOs' industry-adjusted monetary compensation and their replacement are strongly performance-sensitive. Top executive turnover is shown to serve as a disciplinary mechanism for corporate underperformance, whereas the level of monetary compensation rewards good performance. Past UK literature uncovers little evidence of performance-sensitivity which may be the result of biases in estimation techniques as well as the incorrect choice of remuneration measures and performance benchmarks. We find that CEO turnover has the strongest performance-sensitivity for industry-corrected accounting measures and less strong a relation with stock performance measures. This suggests that CEOs are only dismissed at a rather late stage, namely when poor performance is reflected in the accounting returns. The CEO's monetary remuneration reflects both past good accounting performance and stock price performance

(abnormal returns, Tobin's Q and dividend increases). As such we document both the disciplinary effect of turnover and the rewarding effect of monetary compensation.

We also investigate whether specific corporate governance mechanisms (different types of blockholders, of boards of directors or of leverage) have an impact on managerial disciplining or on pay-for-performance contracts. We find that neither total ownership concentration nor the presence of large blockholdings held by outsider shareholders (institutions, families or individuals, other corporations) leads to higher CEO turnover even in the wake of poor performance. This implies that there is little evidence of shareholder monitoring. Still, there is one type of blockholder that impedes CEO dismissal: CEOs with strong voting power successfully resist replacement irrespective of corporate performance. This case of strong managerial entrenchment is even exacerbated when the CEO also holds the position of chairman of the board. Boards with a high proportion of non-executive directors replace the CEO more frequently, but these boards are not more apt to replace underperforming management. There is also little consistent evidence that the market in large ownership stakes and leverage influence CEO turnover.

We find that CEO monetary compensation is not only related to corporate size and risk but is also positively related to both accounting and stock price performance in firms with low insider and median outsider ownership concentration. In firms with large outside shareholdings, CEO compensation is lower but outside shareholder do not impose a stricter performance-related incentive remuneration scheme. When insiders have strong voting power, the CEOs remuneration is lower except when the stock price performance is poor. This suggests that when the CEOs wealth resulting from an investment in their own company goes down due to decreasing stock prices, the CEOs cash compensation is set at a higher level. The presence of a remuneration committee has no impact on remuneration.

Finally, we analyze the impact of CEO replacement on future performance and the incentive effects of monetary compensation. Following CEO dismissal, there is little evidence of short-run improvement of corporate performance. This may be the consequence of the fact that incoming CEOs increase the amounts expensed. In their first (few) year(s), CEOs can still blame their predecessor's strategy and may also attempt to lower the benchmark such that performance improvements will be easily attained in subsequent years. In contrast, we find strong support for the incentive effect-hypothesis of remuneration: CEOs with higher levels of monetary compensation (salary and bonus) attain better subsequent accounting and stock price-based measures of corporate performance.

Appendix

The conditional z-statistics illustrated by Figures 1-4 were calculated as follows. Consider a given model equation of the form:

$$y_i = \beta_0 + \beta_1 \cdot Perf_i + \beta_2 \cdot InsOwn_i + \beta_3 \cdot OutOwn_i + \\ + \beta_4 \cdot Perf_i \cdot InsOwn_i + \beta_5 \cdot Perf_i \cdot OutOwn_i + B \cdot X_i + \varepsilon_i, \tag{9}$$

where y is a dependent variable; $\beta_0, \beta_1, \ldots, \beta_5$ and a vector B are model parameters; $Perf_i$ is the analyzed performance indicator; $InsOwn_i$ and $OutOwn_i$ are (median-centered) stakes controlled by insiders and outsiders, respectively; X_i is a vector containing other regressors; and ε_i is an error term. The conditional estimate of the effect of performance variable on y in such a model can be expressed as:

$$\hat{CE}_{Perf}(InsOwn_i, OutOwn_i) = \hat{\beta}_1 + \hat{\beta}_4 \cdot InsOwn_i + \hat{\beta}_5 \cdot OutOwn_i, \tag{10}$$

where ^ denote estimates of the parameters.

The variance of this conditional estimate is given by:

$$\text{var}\left\{\hat{CE}_{Perf}(InsOwn_i, OutOwn_i)\right\} = \text{var}\left\{\hat{\beta}_1\right\} + InsOwn_i \cdot \text{var}\left\{\hat{\beta}_4\right\} + \\ + OutOwn_i \cdot \text{var}\left\{\hat{\beta}_5\right\} + 2 \cdot InsOwn_i \cdot \text{cov}\left\{\hat{\beta}_1, \hat{\beta}_4\right\} + \\ + 2 \cdot OutOwn_i \cdot \text{cov}\left\{\hat{\beta}_1, \hat{\beta}_5\right\} + 2 \cdot InsOwn_i \cdot OutOwn_i \cdot \text{cov}\left\{\hat{\beta}_4, \hat{\beta}_5\right\} \tag{11}$$

Finally, the conditional z-statistic is defined as:

$$z = \frac{\hat{CE}_{Perf}(InsOwn_i, OutOwn_i)}{\sqrt{\text{var}\left\{\hat{CE}_{Perf}(InsOwn_i, OutOwn_i)\right\}}}. \tag{12}$$

Under the null hypothesis (H_0: Conditional performance sensitivity = 0), it has an asymptotic standard normal distribution (Aiken and West, 1991).

References

Admati, A. R., Pfleiderer, P., Zechner, J., 1994. Large shareholders activism, risk sharing, and financial markets equilibrium. Journal of Political Economy 102, 1097-1130.

Aggarwal, R. K., Samwick A. A., 1999, The other side of the trade-off: The impact of risk on executive compensation. Journal of Political Economy 107, 65-105.

Agrawal, A., Knoeber, C. R., 1996. Firm performance and mechanisms to control agency problems between managers and shareholders. Journal of Financial and Quantitative Analysis 31, 377-397.

Agrawal, A., Knoeber, C. R., 1998. Managerial Compensation and the Threat of Takeover. Journal of Financial Economics 47, 219-239.

Aiken, L. S., West, S. G., 1991. Multiple Regression: Testing and Interpreting Interactions. Sage, Newbury Park, CA.

Amemiya, T , 1984. Tobit models: A survey. Journal of Econometrics 24, 3-63.

Baltagi, B. H., 1995. Econometric Analysis of Panel Data. Wiley, Chichester.

Bebchuk, L., Roe, M., 1999. A theory of path dependence in corporate governance and ownership. Stanford Law Review 52, 127-70.

Becht, M., Mayer, C., 2001. Introduction. In: Barca F. and Becht M. (Eds.), The control of corporate Europe. Oxford University Press, Oxford.

Bethel, J. E., Liebeskind, J. P., Opler, T., 1998. Block share purchases and corporate performance. Journal of Finance 53, 605-634.

Borokhovich, K. A., Parrino, R., Trapani, T., 1996. Outside directors and CEO selection. Journal of Financial and Quantitative Analysis 31, 337-355.

Bushman, R. M., Indjejikian, R. J., 1993. Accounting income, stock price, and managerial compensation, Journal of Accounting and Economics 16, 3-23.

Chang C., 1995. Performance-based compensation and outside interventions as alternative incentive mechanisms and the commitment role of the board, Unpublished working paper. University of Minnesota, Minneapolis.

Chung, K. H., Pruitt, S. W., 1996. Executive ownership, corporate value, and executive compensation: A unifying framework, Journal of Banking and Finance 20, 1135-1159.

Clay, D., 2000. The effects of institutional investment on CEO compensation, Unpublished working paper. University of Chicago, Chicago.

Conyon, M., 1994. Corporate governance changes in UK companies between 1988 and 1993. Corporate Governance: An International Review 2, 77-99.

Conyon, M., Gregg, P., Machin, S., 1995. Taking care of business: Executive compensation in the United Kingdom. Economic Journal 105, 704-714.

Conyon, M. J., Murphy, K. J., 2000. The prince and the pauper? CEO pay in the United States and United Kingdom. Economic Journal 110, 640-671.

Core, J. E., Holthausen, R. W., Larcker, D. F., 1999. Corporate governance, chief executive officer compensation and firm performance, Journal of Financial Economics 51, 371-406.

Coughlan, A. T., Schmidt, R. M., 1985, Executive compensation, management turnover, and firm performance: An empirical investigation, Journal of Accounting and Economics 7, 43-66.

Crespi, R., Gispert, C., Renneboog, L., 2002. Cash-based executive compensation in Spain and UK. In: McCahery, J., Moerland, P., Raaijmakers, T., Renneboog, L., (Eds.), Corporate Governance Regimes: Convergence and Diversity. Oxford University Press, Oxford.

Cox, D. R., 1972. Regression models and life tables. Journal of Royal Statistic Society 34, 187-220.

Cox, D. R., Oakes, D., 1984. Analysis of Survival Data, Chapman and Hall, London.

Dahya, J., McConnell, J. J., Travlos, N. G., 2002. The Cadbury committee, corporate performance, and top management turnover. Journal of Finance 57, 461-484.

Dechow, P., Sloan, R., 1991. Executive incentives and the horizon problem, Journal of Accounting and Economics 14, 51-89.

Denis, D. J., Denis, D. K., 1995. Performance changes following top management dismissals. Journal of Finance 50, 1029-1057.

Denis, D. J., Denis, D. K., Sarin, A., 1997. Ownership structure and top executive turnover. Journal of Financial Economics 45, 193-221.

Denis, D. J., Kruse, T. A., 2000. Managerial discipline and corporate restructuring following performance declines. Journal of Financial Economics 55, 391-424.

Denis, D. J., Sarin, A., 1999. Ownership and board structures in publicly traded corporations. Journal of Financial Economics 52, 187-223.

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

Franks, J., Mayer, C., Renneboog, L., 2001. Who disciplines the management of poorly performing companies? Journal of Financial Intermediation 10, 209-248.

Geddes, R. R., Vinod, H. D., 1997. CEO age and outside directors: A hazard analysis. Review of Industrial Organisation 12, 767-780.

Gibbons, R., Murphy, K. J., 1990. Relative performance evaluation for chief executive officers. Industrial and Labour Relations Review 43, 30-S-51-S.

Gibbons, R., Murphy, K. J., 1992. Optimal incentive contracts in the presence of career concerns: Theory and evidence, Journal of Political Economy 100, 468-505.

Girma, S., Thompson, S., Wright, P. 2002. Merger activity and executive pay. CEPR Discussion Paper no. 3255.

Greene, W. H., 2000. Econometric Analysis. Prentice Hall, Upper Saddle River.

Gregg, P., Machin, S., Szymanski, S., 1993. The disappearing relationship between directors' pay and corporate performance. British Journal of Industrial Relations 31, 1-9.

Grossman, S. J., Hart, O., 1983. An analysis of the principal-agent problem. Econometrica 51, 7-45.

Hayes R. M., Schaefer S., 2000, Implicit contracts and the explanatory power of top executive compensation for future performance. RAND Journal of Economics 31, 273-293.

Hallock, K. F., 1997. Reciprocally interlocking boards of directors and executive compensation. Journal of Financial and Quantitative Analysis 32, 331-344.

Heckman J., 1979. Sample selection bias as a specification error. Econometrica 47, 153-161.

Himmelberg, C., Hubbard, R., Palia, D., 1999. Understanding the determinants of managerial ownership and the link between ownership and performance. Journal of Financial Economics 53, 353-384.

Holmström, B., 1979. Moral hazard and observability. Bell Journal of Economics 10, 74-91.

Holmström, B., 1982a. Moral hazard in teams. Bell Journal of Economics 13, 324-340.

Holmström, B., 1982b. Managerial incentive schemes - a dynamic perspective. In: Essays in Economics and Management in Honour of Lars Wahlbeck. Helsinki.

Jenkinson, T., Ljungqvist, A., 2001. The role of hostile stakes in German corporate governance. Journal of Corporate Finance 7, 397-446.

Jensen, M. C., 1989. Eclipse of the public corporation. Harvard Business Review 67, 1-13.

Jensen, M. C., Meckling, W. H., 1976. Theory of the firm: Managerial behaviour, agency costs, and ownership structure. Journal of Financial Economics 3, 305-360.

Jensen, M. C., Murphy, K. J., 1990. Performance pay and top-management incentives. Journal of Political Economy 98, 225-264.

Jensen, G. R., Solberg, D. P., Zorn, T. S., 1992. Simultaneous determination of insider ownership, debt, and dividend policies. Journal of Financial and Quantitative Analysis 27, 247-263.

Jin L., 2002. CEO compensation, diversification, and incentives. Journal of Financial Economics (forthcoming).

John, K., Senbet, L. W., 1998. Corporate governance and board effectiveness. Journal of Banking and Finance 22, 371-403.

Kahn, C., Winton, A., 1998. Ownership structure, speculation, and shareholder intervention. Journal of Finance 53, 99-129.

Kang, J.-K., Shivdasani, A., 1995. Firm performance, corporate governance, and top executive turnover in Japan. Journal of Financial Economics 38, 29-58.

Kaplan, S. N., Reishus, D., 1990. Outside directorships and corporate performance. Journal of Financial Economics 27, 389-410.

Kim, O., Suh, Y., 1993. Incentive efficiency of compensation based on accounting and market performance. Journal of Accounting and Economics 16, 25-53.

Kole, S. R., 1997. The complexity of compensation contracts. Journal of Financial Economics 43, 79-104.

La Porta, R., Lopez-de-Silanes, F., Shleifer, A., Vishny, R., 1999. Ownership around the world. Journal of Finance 54, 471-517.

La Porta, R., Lopez-de-Silanes, F., Shleifer, A., Vishny, R., 2000. Investor protection and corporate governance, Journal of Financial Economics 58, 3-27.

Lazear, E. P., Rosen, S., 1981. Rank-order tournaments as optimum labor contracts. Journal of Political Economy 88, 841-864.

Lai, J., Sudarsanam, S., 1998. Corporate restructuring in response to performance decline: Impact of ownership, governance and lenders. European Finance Review 1, 197-233.

Lewellen, W., Loderer, C., Martin, K., 1987. Executive compensation and executive incentive problems: An empirical analysis. Journal of Accounting and Economics 9, 287-310.

Lin, D. Y., Wei, L. J., 1989. The robust inference for the Cox proportional hazards model. Journal of the American Statistical Association 84, 1074-1078.

Martin, K. J., McConnell, J. J., 1991. Corporate performance, corporate takeovers, and management turnover, Journal of Finance 46, 671-687.

Maug, E., 1998. Large shareholders as monitors: Is there a trade-off between liquidity and control? Journal of Finance 53, 65-98.

Mehran, H., 1995. Executive compensation structure, ownership, and firm performance. Journal of Financial Economics 38, 163-184.

Mikkelson, W. H., Partch, M. M., 1997. The decline of takeovers and disciplinary managerial turnover. Journal of Financial Economics 44, 205-228.

Murphy, K. J., 1985. Corporate performance and managerial remuneration: An empirical analysis. Journal of Accounting and Economics 7, 11-42.

Murphy, K. J., 1986. Incentives, learning, and compensation: A theoretical and empirical investigation of managerial labor contracts. Rand Journal of Economics 17, 59-76.

Murphy, K. J., Zimmerman, J. L., 1993. Financial performance surrounding CEO turnover. Journal of Accounting and Economics 16, 273-315.

Narayanan, M. P., 1996. Form of compensation and managerial decision horizon. Journal of Financial and Quantitative Analysis 31, 467-491.

Parrino, R., 1997. CEO turnover and outside succession: A cross-sectional analysis. Journal of Financial Economics 46, 165-197.

Roe, M., 1994. Strong managers, weak owners: The political roots of American corporate finance. Princeton University Press, Princeton.

Rosenstein, S., Wyatt, J. G., 1997. Inside directors, board effectiveness, and shareholder wealth. Journal of Financial Economics 44, 229-250.

Shleifer, A., Vishny, R. W., 1997. A survey of corporate governance. Journal of Finance 52, 737-783.

Sloan, R. G., 1993. Accounting earnings and top executive compensation. Journal of Accounting and Economics 16, 55-100.

Stapledon, G., Bates, J., 2002. Institutional shareholders and corporate governance: The case of UK pension funds. In: McCahery, J., Moerland, P., Raaijmakers, T., Renneboog, L. (Eds.), Corporate Governance Regimes: Convergence and Diversity. Oxford University Press, Oxford.

StataCorp., 2001. Stata Statistical Software: Release 7.0. Stata Corporation, College Station.

Verbeek, M., 2000. A Guide to Modern Econometrics. Wiley, Chichester.

Warner, J. B., Watts, R. L., Wruck, K. H., 1988. Stock prices and top management changes. Journal of Financial Economics 20, 461-492.

Weisbach, M. S., 1995. CEO turnover and the firm's investment decisions. Journal of Financial Economics 37, 159-188.

Weisbach, M. S., 1988. Outside directors and CEO turnover. Journal of Financial Economics 20, 431-460.

Yermack, D., 1996. High market valuation of companies with a small board of directors. Journal of Financial Economics 40, 185-211.

Tables and figures

Table 1. Sample characteristics.

	Median	Mean	Std. deviation
CEO turnover			
CEO dismissal	0.000	0.110	0.313
CEO compensation			
Industry-adjusted logarithm of salary	0.000	0.002	0.623
Logarithm of salary	11.878	11.909	0.687
CEO characteristics			
CEO age	52.000	52.581	6.343
CEO tenure	4.000	5.151	5.482
CEO is the board chairman	0.000	0.335	0.472
Board composition			
Fraction of outside directors	61.540	61.411	15.035
Board size	2.197	2.173	0.372
Remuneration committee presence	0.000	0.259	0.438
Ownership variables			
Herfindahl-5 concentration index	0.028	0.057	0.084
CEO stake	0.000	2.983	8.095
Executives' stake	0.120	4.572	10.746
Non-executives' stake	0.000	3.914	9.625
Institutions' stake	13.000	16.596	16.116
Families/indiv.'s and corporations' stake	0.000	8.218	14.083
Increase in executives' stake	0.000	0.729	3.376
Increase in non-executives' stake	0.000	0.513	2.935
Increase in institutions' stake	3.100	6.402	8.802
Increase in fam./indiv./corporations' stake	0.000	1.842	5.911
Performance indicators (all but the last variable in percentage terms)			
Abnormal stock return in year *t*	-5.195	-2.506	47.150
Abnormal stock return in year *t*-1	-3.710	-2.418	38.173
Abnormal stock return in year *t*-2	-1.370	2.063	41.054
Return on assets in year *t*	16.315	15.234	26.572
Return on assets in year *t*-1	18.100	17.704	20.420
Return on assets in year *t*-2	19.590	19.000	20.194
Growth opportunities (Tobin's Q proxy)	0.509	0.481	0.772
Firm-specific control variables			
Firm size	11.259	11.349	1.794
Capital gearing	29.715	32.651	24.784
Risk	34.390	37.429	13.070

Note to Table 1: CEO dismissal is a dummy variable that equals one for firm-years in which CEO change took place. Logarithm of salary is a natural logarithm of CEO total cash compensation (including bonuses) expressed in pounds. Industry-adjusted logarithm of salary is an industry-year median-adjusted logarithm of CEO salary (as defined above). CEO age and tenure are measured in years. The last of the CEO characteristics is a dummy variable that equals one for those CEOs who also hold the function of chairman of the board. The fraction of

outside directors is expressed as a percentage of the total number of directors. The board size is defined as a natural logarithm of the total number of directors. The presence of a remuneration committee is a dummy variable equaling one for those firm-years for which a remuneration committee is in place. The Herfindahl-5 concentration-index is calculated using the equity stakes of the five largest shareholders. The following ownership variables represent cumulative total percentage stakes for the CEO, executive directors, non-executive directors, financial institutions, families and individuals, and corporations, respectively (as revealed in company reports). The remaining four ownership variables correspond to increases (in percentage points) of cumulative stakes held by executives, non-executives, financial institutions, families and individual shareholders, and corporations. The first three performance indicators are abnormal stock returns (in percentage terms) and their values lagged one and two years, respectively. Return on assets (contemporaneous, lagged one and two years) is defined as the ratio of EBIT over total assets in a given year. Growth opportunities are proxied by the logarithm of the market-to-book ratio of the firm. Firm size is proxied by a natural logarithm of the total book value of assets. Capital gearing is defined as the ratio of debt to total assets and expressed in percentage terms. Risk is measured as an annual volatility of stock returns.

Table 2. Sample selection models explaining CEO turnover and industry-adjusted cash compensation.

	Model 1		Model 2		Model 3		Model 4	
Panel A: Selection equations	**Dependent variable equals 0 if the CEO is replaced and 1 otherwise**.							
	Estimate	p-value	Estimate	p-value	Estimate	p-value	Estimate	p-value
Intercept	4.235	0.000	4.389	0.000	3.835	0.000	4.896	0.000
Performance indicators								
Industry-adjusted ROA in year *t*-1	0.010	0.001	0.010	0.011	0.011	0.058	0.013	0.001
Abnormal stock returns in year *t*-1	0.003	0.158	0.003	0.163	0.005	0.032	0.003	0.291
Board composition								
Board size	-0.986	0.000	-0.900	0.000	-0.943	0.000	-0.891	0.003
Fraction of outside directors	-0.008	0.058	-0.008	0.050	-0.008	0.046	-0.008	0.545
CEO is also the chairman	0.401	0.006	0.417	0.006	0.405	0.006	0.486	0.299
Firm size, leverage, and risk								
Firm size	0.058	0.179	0.032	0.497	0.085	0.128	0.043	0.702
Capital gearing	0.000	0.909	0.000	0.941	0.000	0.919	0.000	0.949
Risk	-0.008	0.209	-0.007	0.253	-0.005	0.374	-0.006	0.444
Ownership concentration								
Herfindahl-5 concentration index			-0.448	0.541				
Accounting perform. * Herfindahl-5 index			-0.015	0.784				
Stock Price perform. * Herfindahl-5 index			-0.025	0.309				
Insiders' blockholdings					0.012	0.042		
Accounting perform. * insider stakes					-0.000	0.638		
Stock Price perform. * insider stake					-0.000	0.023		
Outside block holdings					-0.004	0.250		
Accounting perform. * outsider stakes					-0.000	0.922		
Stock Price perform. * outsider stakes					0.000	0.944		
Ownership dynamics								
Increase in insiders' blockholdings							0.009	0.789
Accounting perform. * increase insider stakes							-0.001	0.389
Stock Price perform. * increase insider stakes							-0.000	0.844
Increase in outsiders' blockholdings							0.013	0.229
Accounting perform. * increase outsider stakes							-0.000	0.432
Stock Price perform. * increase outsider stakes							0.000	0.429
Year and industry control variables								
Year dummies	Yes		Yes		Yes		Yes	
Industry dummies	Yes		Yes		Yes		Yes	
Wald χ^2	$\chi^2(23) = 86.05$		$\chi^2(26) = 63.69$		$\chi^2(29) = 104.78$		$\chi^2(29) = 161.24$	
P-value for χ^2	< 0.001		< 0.001		< 0.001		< 0.001	

Table continues on next page.

Table 2 - continued.

	Model 1		Model 2		Model 3		Model 4	
Panel B: Regression equations	**Dependent variable is the industry-adjusted CEO cash remuneration**							
	Estimate	p-value	Estimate	p-value	Estimate	p-value	Estimate	p-value
Intercept	-3.511	0.000	-3.489	0.000	-3.139	0.000	-3.747	0.000
Performance indicators								
Industry-adjusted ROA in year t-1	0.004	0.013	0.004	0.008	0.003	0.059	0.006	0.001
Abnormal stock returns in year t-1	0.001	0.002	0.002	0.001	0.002	0.001	0.001	0.025
Board composition								
Board size	0.191	0.023	0.193	0.022	0.189	0.015	0.193	0.154
Fraction of outside directors	0.002	0.306	0.002	0.327	0.002	0.271	0.001	0.620
CEO is the board chairman	0.019	0.675	0.025	0.595	0.030	0.525	0.029	0.655
Remuneration committee presence	-0.009	0.840	-0.013	0.768	-0.019	0.659	-0.043	0.440
Firm size, leverage, and risk								
Firm size	0.236	0.000	0.235	0.000	0.208	0.000	0.253	0.000
Capital gearing	0.001	0.314	0.001	0.383	0.001	0.434	0.000	0.771
Risk	0.008	0.003	0.008	0.003	0.008	0.009	0.011	0.003
Ownership concentration								
Herfindahl-5 concentration index			-0.325	0.522				
Accounting perform. * Herfindahl-5 index			-0.010	0.580				
Stock Price perform. * Herfindahl-5 index			-0.007	0.089				
Insiders' blockholdings					-0.005	0.007		
Accounting perform. * insider stakes					0.000	0.329		
Stock Price perform. * insider stakes					-0.000	0.024		
Outside block holdings					-0.003	0.046		
Accounting perform. * outsider stakes					-0.000	0.506		
Stock Price perform. * outsider stakes					0.000	0.942		
Ownership dynamics								
Increase in insiders' blockholdings							-0.000	0.979
Accounting perform. * increase insider stake							-0.001	0.050
Stock Price perform. * increase insider stake							-0.000	0.251
Increase in outsiders' blockholdings							-0.000	0.863
Accounting perform.* increase outsider stakes							-0.000	0.253
Stock Price perform.* increase outsider stakes							-0.000	0.877
Year control variables								
Year dummies	Yes		Yes		Yes		Yes	
Wald χ^2	$\chi^2(13) = 352.92$		$\chi^2(16) = 363.20$		$\chi^2(19) = 500.90$		$\chi^2(19) = 382.29$	
P-value for χ^2	< 0.001		< 0.001		< 0.001		< 0.001	

Table continues on next page.

Table 2 - continued.

	Model 1	Model 2	Model 3	Model 4
Panel C: Model statistics and tests				
Total no. of observations	851	840	847	695
No. of censored observations	102	94	101	87
No. of uncensored observations	749	746	746	608
Log-likelihood	-644.21	-630.95	-623.95	-495.23
Wald χ^2 statistics for testing joint significance of two equations	$\chi^2(36) = 599.95$	$\chi^2(42) = 586.41$	$\chi^2(48) = 819.24$	$\chi^2(48) = 988.96$
P-value for χ^2	< 0.001	< 0.001	< 0.001	< 0.001
Estimate of ρ	-0.508	-0.465	-0.595	-0.882
Wald χ^2 statistics for testing $\rho = 0$ (tests of equations independence)	$\chi^2(1) = 5.95$	$\chi^2(1) = 3.50$	$\chi^2(1) = 8.21$	$\chi^2(1) = 0.21$
P-value for χ^2	0.015	0.062	0.004	0.648

Note to Table 2: The table presents the estimates of the sample selection models for top executive turnover (selection equation of Panel A) and CEO industry-adjusted compensation (regression equation of Panel B). Standard errors are adjusted for clustering of observations on each firm. The dependent binary variable of Panel A equals one for CEOs that were not replaced in a given year and zero otherwise. As far as regressors are concerned, industry-adjusted ROA is defined as industry-year median adjusted return on equity (in percentage terms) lagged one year. Likewise, abnormal stock return is lagged one year. Board size is defined as a natural logarithm of the total number of directors. Fraction of outside directors is expressed as a percentage of outsiders on the board. The last of the board characteristics is a dummy variable that equals one for CEOs serving at the same time the function of board chairmen. Firm size is proxied by a natural logarithm of the total book value of assets. Capital gearing is expressed in percentage terms. Company risk is measured as an annual volatility of stock returns. The Herfindahl-5 concentration index is calculated using the stakes of the five largest shareholders. The blockholding variables consist of insider stakes (the amalgamation of the shareholdings of the CEO, executive and non-executive directors). The outsider blockholdings are the amalgamation of the stakes held by financial institutions, families and individuals, the government and corporations, respectively, provided the individual stakes are 5% or above. The variables describing ownership dynamics correspond to increases (in percentage points) of cumulative stakes held by insider and outsider shareholders. In the regression equations (Panel B) the dependent variable is an industry-adjusted CEO cash compensation in the subsequent year. The explanatory variables are defined in the same way as in the selection equations. The only difference is that here time-varying regressors are lagged one year less compared to those from Panel A. The remuneration committee presence is a dummy variable that equals one for firm-years, when remuneration committee was in place.

Table 3. Hazard analysis of CEO turnover.

	Model 5		Model 6		Model 7		Model 8	
	Dependent variable is the marginal conditional probability that the CEO is replaced in the time instant Δ given that he was not replaced up to time t.							
	Estimate	p-value	Estimate	p-value	Estimate	p-value	Estimate	p-value
Performance indicators								
Industry-adjusted ROA in year t-1	-0.008	0.002	-0.011	0.002	-0.014	0.041	-0.009	0.053
Abnormal stock returns in year t-1	-0.006	0.082	-0.005	0.132	-0.005	0.178	-0.004	0.354
Board composition								
Board size	1.506	0.000	1.466	0.000	1.562	0.000	1.479	0.000
Fraction of outside directors	0.013	0.026	0.013	0.041	0.012	0.050	0.015	0.020
CEO is the board chairman	-1.073	0.000	-1.058	0.000	-1.036	0.000	-1.087	0.000
Firm size, leverage, and risk								
Firm size	-0.088	0.238	-0.096	0.218	-0.142	0.089	-0.060	0.435
Capital gearing	0.003	0.400	0.003	0.455	0.003	0.453	0.003	0.417
Risk	0.019	0.024	0.017	0.050	0.014	0.117	0.019	0.032
Ownership concentration								
Herfindahl-5 concentration index			0.930	0.438				
Accounting perform. * Herfindahl-5 index			0.096	0.105				
Stock Price perform. * Herfindahl-5 index			0.000	0.988				
Insiders' blockholdings					-0.013	0.153		
Accounting perform. * insider stakes					0.000	0.094		
Stock Price perform. * insider stakes					-0.000	0.870		
Outside block holdings					0.008	0.188		
Accounting perform. * outsider stakes					0.000	0.351		
Stock Price perform. * outsider stakes					-0.000	0.888		
Ownership dynamics								
Increase in insiders' blockholdings							0.021	0.205
Accounting perform. * increase insider stake							0.000	0.858
Stock Price perform. * increase insider stake							0.000	0.630
Increase in outsiders' blockholdings							0.009	0.385
Accounting perform.* increase outsider stakes							0.000	0.594
Stock Price perform.* increase outsider stakes							-0.000	0.306
Year and industry control variables								
Industry dummies	Yes		Yes		Yes		Yes	
Year dummies	Yes		Yes		Yes		Yes	
Log-likelihood	-450.25		-440.56		-437.63		-437.91	
Wald test χ^2	$\chi^2(23) = 168.75$		$\chi^2(26) = 166.36$		$\chi^2(29) = 188.33$		$\chi^2(29) = 199.57$	
P-value for χ^2	< 0.001		< 0.001		< 0.001		< 0.001	
Pseudo-R^2	0.089		0.086		0.092		0.084	
No. of observations	1148		1136		1136		955	

Note to Table 3: The table presents the estimates of the Cox proportional hazard rate model for managerial tenure. Standard errors are adjusted for clustering of observations on each firm. Industry-adjusted ROA is defined as industry-year median adjusted return on equity (in percentage terms) lagged by one year. Abnormal stock return is lagged by one year as well. Board size is defined as a natural logarithm of the total number of directors. The fraction of outside directors is expressed as a percentage of outsiders on the board. 'CEO is board chairman' is a dummy variable that equals one for CEOs serving at the same time as chairman of the board. Firm size is proxied by the natural logarithm of the total book value of assets. Capital

gearing is expressed in percentage terms. Company risk is measured as an annual volatility of stock returns. Herfindahl-5 concentration index is based on stakes of the five largest shareholders. The blockholding measures represent cumulative total percentage stakes held by insiders (CEO, executive directors, non-executive directors) and outsiders (financial institutions, families and individuals, and corporations). The variables describing ownership dynamics correspond to increases (in percentage points) of cumulative stakes held by insiders (CEOs, executives, non-executives) and outsiders (financial institutions, families and individuals, and corporations).

Table 4. Fixed-effect panel regressions explaining industry-adjusted corporate performance (ROA).

	Model 9a		Model 10a		Model 11a		Model 12a	
	Fixed effects		**Fixed effects with IV**		**Fixed effects with IV**		**Fixed effects with IV**	
	Estimate	p-value	Estimate	p-value	Estimate	p-value	Estimate	p-value
Intercept	-49.969	0.141	-63.275	0.128	-85.272	0.038	-30.550	0.446
CEO compensation and turnover								
Industry-adjusted logarithm of salary	7.371	0.031	9.764	0.058	6.428	0.094	8.688	0.029
CEO dismissal (lagged)	-2.422	0.371	-2.218	0.457	-2.497	0.404	-0.794	0.806
Board composition								
Board size	-9.529	0.101	-10.851	0.110	-9.943	0.124	-3.371	0.651
Fraction of outside directors	-0.092	0.410	-0.132	0.320	-0.010	0.939	-0.161	0.224
Firm-specific control variables								
Capital gearing	-0.191	0.001	-0.198	0.002	-0.189	0.003	-0.222	0.001
Firm size	10.398	0.000	10.830	0.000	11.414	0.000	8.814	0.003
Risk	-0.972	0.000	-0.926	0.000	-0.948	0.000	-1.083	0.000
Ownership concentration								
Herfindahl-5 concentration index			241.965	0.524				
Insiders' blockholdings					0.198	0.744		
Outsiders' blockholdings					0.925	0.008		
Ownership dynamics								
Increase in insiders' blockholdings							-0.154	0.900
Increase in outsiders' blockholdings							-1.230	0.004
Other control variables								
Year dummies	Yes		Yes		Yes		Yes	
σ_u	26.522		29.119		26.103		29.757	
σ_e	20.352		21.818		22.325		23.659	
ρ	0.629		0.640		0.578		0.613	
F-test for all $u_i = 0$	F(216,653) = 2.20		F(215,646) = 1.92		F(214,645) = 1.87		F(215,650) = 1.67	
P-value for F	< 0.001		< 0.001		< 0.001		< 0.001	
Corr(u_i, Xb)	-0.746		-0.762		-0.681		-0.750	
Model F-test or χ^2 test	F(11,653) = 11.38		$\chi^2(12) = 109.79$		$\chi^2(13) = 113.95$		$\chi^2(13) = 102.13$	
P-value for F or χ^2	< 0.001		< 0.001		< 0.001		< 0.001	
R^2 - within	0.161		0.046		0.001		0.000	
R^2 - between	0.075		0.042		0.045		0.069	
R^2 - overall	0.071		0.046		0.053		0.060	
No. of groups	217		216		216		216	
No. of observations	881		874		874		879	

Note to Table 4: Model 9a estimates are obtained from standard fixed-effect panel regression approach. Models 10a-12a apply instrumental variable estimation technique within a context of fixed-effect panel regression. In Model 10a, Herfindahl-5 concentration index was instrumented with its lagged variable and all the other regressors. In Model 11a, ownership concentration variables were instrumented by their lagged values and other regressors of the model. In Model 12a, ownership dynamics indicators were instrumented by ownership concentration proxies (stakes held by CEO, executives, non-executives, financial institutions, and families and individuals, and corporations outsiders) and other regressors of the model. The dependent variable in all four models is the industry-year median adjusted return on assets (in percentage terms). Industry-adjusted logarithm of salary is an industry-year median-adjusted logarithm of CEO cash compensation. Lagged CEO dismissal

is a dummy variable that equals one for firm-years in which CEO change took place during the previous year. The board size is defined as the natural logarithm of the total number of directors. The fraction of outside directors is expressed as a percentage of outsiders in the board. Capital gearing is expressed in percentage terms. Firm investment opportunities are proxied by the logarithm of the book value of assets. Firm size stands for the natural logarithm of the total book value of assets. Company risk is proxied by annual volatility of stock returns. Herfindahl-5 concentration index is based on stakes of the five largest shareholders. The blockholding measures represent cumulative total percentage stakes for insiders (CEO, executive directors, non-executive directors) and outsiders (financial institutions, families and individuals, and corporations). The variables describing ownership dynamics correspond to increases (in percentage points) of cumulative stakes held by insiders (CEOs, executives, non-executives) and outsiders (financial institutions, families and individuals, and corporations).

## Table 5. Fixed-effect panel regressions explaining stock performance.

	Model 9b		Model 10b		Model 11b		Model 12b	
	Fixed effects		**Fixed effects with IV**		**Fixed effects with IV**		**Fixed effects with IV**	
	Estimate	p-value	Estimate	p-value	Estimate	p-value	Estimate	p-value
Intercept	4.448	0.000	4.345	0.000	4.152	0.000	4.538	0.000
CEO compensation and turnover								
Industry-adjusted logarithm of salary	0.166	0.009	0.178	0.051	0.161	0.015	0.175	0.008
CEO dismissal (lagged)	0.026	0.610	0.026	0.622	0.025	0.627	0.034	0.525
Board composition								
Board size	-0.178	0.103	-0.174	0.149	-0.172	0.124	-0.126	0.312
Fraction of outside directors	0.0004	0.837	0.0003	0.886	0.001	0.637	0.000	0.991
Firm-specific control variables								
Capital gearing	0.003	0.019	0.003	0.025	0.003	0.020	0.002	0.047
Firm size	-0.270	0.000	-0.267	0.000	-0.262	0.000	-0.278	0.000
Risk	-0.015	0.000	-0.014	0.000	-0.014	0.000	-0.015	0.000
Ownership concentration								
Herfindahl-5 concentration index			1.333	0.843				
Insiders' blockholdings					0.003	0.771		
Outsiders' blockholdings					0.006	0.292		
Ownership dynamics								
Increase in insiders' blockholdings							-0.005	0.812
Increase in outsiders' blockholdings							-0.008	0.258
Other control variables								
Year dummies	Yes		Yes		Yes		Yes	
σ_u	0.784		0.809		0.828		0.777	
σ_e	0.381		0.385		0.385		0.395	
ρ	0.809		0.815		0.822		0.795	
F-test for all $u_i = 0$	$F(216,651) = 11.33$		$F(215,644) = 10.97$		$F(215,643) = 10.60$		$F(215,648) = 10.34$	
P-value for F	< 0.001		< 0.001		< 0.001		< 0.001	
Corr(u_i, Xb)	-0.370		-0.420		-0.458		-0.340	
Model F-test or χ^2 test	$F(11,651) = 12.21$		$\chi^2(12) = 1479.29$		$\chi^2(13) = 1481.05$		$\chi^2(13) =$	
P-value for F or χ^2	< 0.001		< 0.001		< 0.001		< 0.001	
R^2 - within	0.171		0.161		0.162		0.114	
R^2 - between	0.010		0.003		0.002		0.012	
R^2 - overall	0.027		0.016		0.011		0.029	
No. of groups	879		872		872		877	
No. of observations	217		216		216		216	

Note to Table 5: Model 9b estimates are obtained from standard fixed-effect panel regression approach. Models 10b-12b apply instrumental variable estimation technique within a context of fixed-effect panel regression. In Model 10b, Herfindahl-5 concentration index was instrumented with its lagged variable and all the other regressors. In Model 11b, ownership concentration variables were instrumented by their lagged values and other regressors of the model. In Model 12b, ownership dynamics indicators were instrumented by ownership concentration proxies (stakes held by insiders and outsiders) and other regressors of the model.

The dependent variable in all four models is the logarithm of the ratio of market- and book-value of the firm. Industry-adjusted logarithm of salary is the industry-year median-adjusted logarithm of CEO cash compensation. Lagged CEO dismissal is a dummy variable that equals one for firm-years in which CEO change took place during the previous year. Board size is

defined as the natural logarithm of the total number of directors. The fraction of outside directors is expressed as a percentage of outsiders in the board. Capital gearing is expressed in percentage terms. Firm investment opportunities are proxied by the logarithm of the book value of assets. Firm size is defined as the natural logarithm of the total book value of assets. Company risk is proxied by annual volatility of stock returns. The Herfindahl-5 concentration index is based on stakes of the five largest shareholders. The blockholding measures represent cumulative total percentage stakes for insiders (CEO, executive directors, non-executive directors) and outsiders (financial institutions, families and individuals, and corporations). The variables describing ownership dynamics correspond to increases (in percentage points) of cumulative stakes held by insiders (CEOs, executives, non-executives) and outsiders (financial institutions, families and individuals, and corporations).

Figure 1. Significance of CEO turnover sensitivity with respect to the stock price-based corporate performance for various levels of ownership concentration.
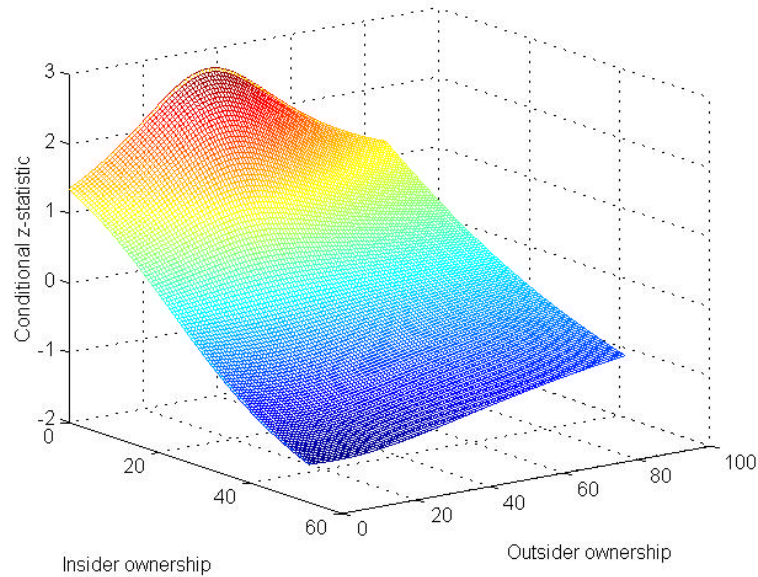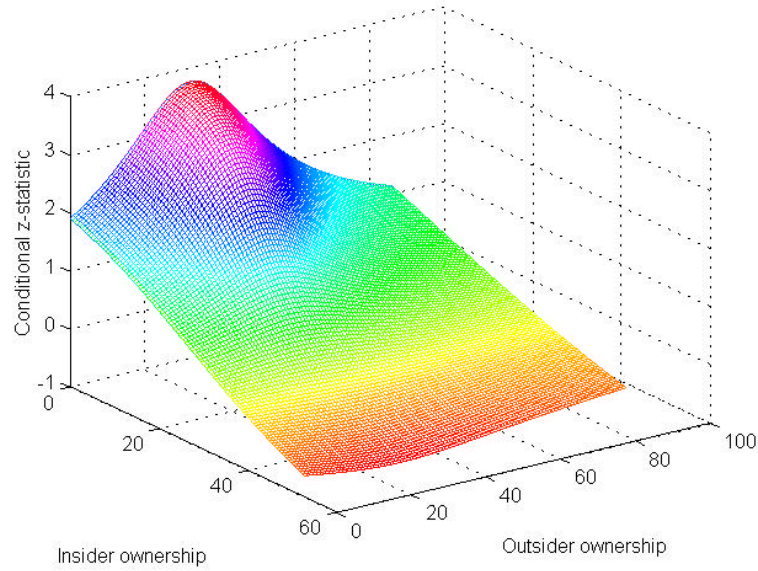

Note: Values of the magnitude exceeding 1.96 are significant at 5% level (2-tail test).

Figure 2. Significance of CEO turnover sensitivity with respect to the accounting-based corporate performance for various levels of ownership concentration.
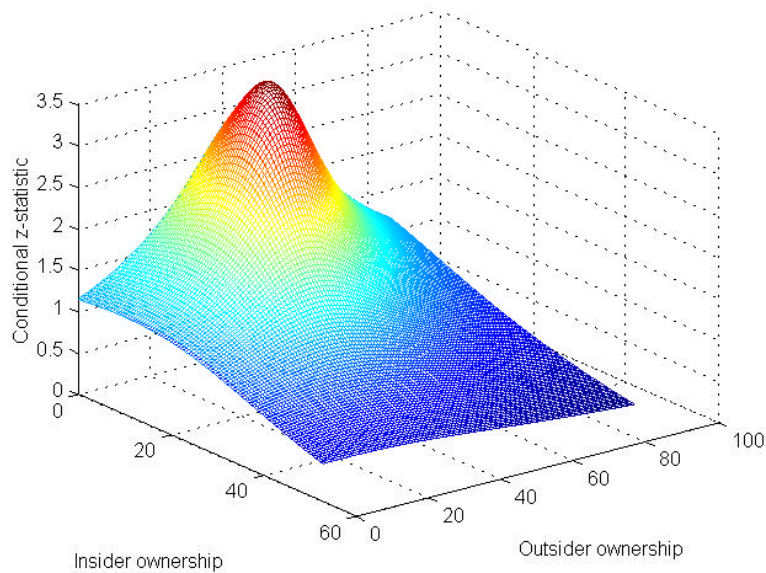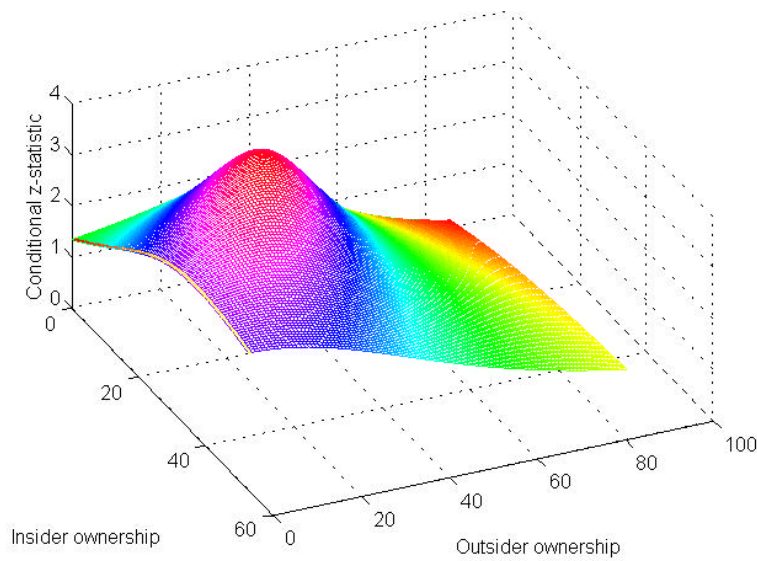

Note: Values of the magnitude exceeding 1.96 are significant at 5% level (2-tail test).

Figure 3. Significance of CEO monetary compensation-sensitivity with respect to the stock price-based corporate performance for various levels of ownership concentration.

Note: Values of the magnitude exceeding 1.96 are significant at 5% level (2-tail test).

Figure 4. Significance of CEO monetary compensation-sensitivity with respect to the accounting-based corporate performance for various levels of ownership concentration.

Note: Values of the magnitude exceeding 1.96 are significant at 5% level (2-tail test).