Journal of Empirical Finance 27 (2014) 97–115

Contents lists available at ScienceDirect

Journal of Empirical Finance

journal homepage: www.elsevier.com/locate/jempfin

CEO compensation and future shareholder returns: Evidence from the London Stock Exchange☆

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ARTICLE INFO

Article history:
Received 30 July 2013
Received in revised form 24 October 2013
Accepted 29 October 2013
Available online 6 November 2013

JEL classification:
J33
G32
G34

Keywords:
CEO compensation
Incentive/equity-based pay
Executive pay
Stock returns
Operating performance

ABSTRACT

This study examines the ex-post consequences of CEO compensation for shareholder value. The main objective is to explore whether companies that pay their CEO excessive fees (in comparison to those of peer firms in the same industry and size group) generate superior future returns and better operating performance. Our analysis, which separately considers the cash-based and incentive/equity-based components of CEO compensation, is based on a large sample of UK-listed companies over the period 1998–2010. We find that CEO incentive pay is negatively associated with short-term subsequent returns. Interestingly, firms that pay their CEOs at the bottom of the incentive-pay distribution earn positive abnormal returns and, also, significantly outperform those at the top of the incentive-pay distribution. Further analysis reveals that such outperformance can be largely explained by the excessive exposure of low-incentive-pay firms to idiosyncratic risk. Finally, evidence from panel regressions suggests that, in addition to its negative relationship with returns, incentive pay is also inversely associated with future operating performance.

1. Introduction

Chief executive officer (CEO) pay has long attracted a large amount of scrutiny and public controversy. Following the recent financial crisis, which revealed severe flaws in corporate compensation practices, a subject of intense debate is whether cross-sectional variations in CEO pay can be fully justified by economic fundamentals (Bizjak et al., 2011; Faulkender and Yang, 2010). Prior empirical research that attempts to address this issue provides contradictory results. On the one hand, a large strand of literature documents evidence consistent with the view that compensation serves as a broadly effective means of aligning the interests of managers with those of shareholders (Bizjak et al., 2008; Gabaix and Landier, 2008; Hall and Liebman, 1998; Himmelberg and Hubbard, 2000; Kaplan, 2008; Kaplan and Rauh, 2010). Accordingly, it is argued that any increase in CEO pay reflects significant changes in the market for CEOs (e.g. shortage of skills and talent) and can be explained by the nature of the CEO job itself (e.g. tight corporate governance) (see Murphy and Zábojník, 2004). On the other hand, another line of research, which draws upon the managerial power approach, treats CEO pay as a complicating factor rather than a solution to the agency problem (Bebchuk and Fried, 2003, 2004; Bebchuk and Grinstein, 2005; Bertrand and Mullainathan, 2001; Yermack, 1997). The proponents of this so-called “skimming view” of CEO compensation emphasize the ability of managers to expropriate wealth from shareholders.[1]

☆ We would like to thank the Editor, Ania Zalewska, two anonymous reviewers, Thomas Bates, Alex Edmans, Murray Dalziel, Piotr Korczak, Alexandros Kostakis, Anthony Patterson, Dimitris Petmezas, Yiqing Lü, Darius Palia, Abhishek Srivastav, Agnieszka Trzeciakiewicz, Christos Arvanitis Jr., and conference participants at the 2013 FMA European Meeting (Luxemburg) and at the 2013 conference “Twenty Years after Cadbury, Ten Years after Sarbanes–Oxley: Challenges of Corporate Governance” (University of Bath).

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[1] Goergen and Renneboog (2011) provide a comprehensive review of the literature on managerial compensation.

0927-5398/$ – see front matter
http://dx.doi.org/10.1016/j.jempfin.2013.10.011

A common feature of much of the prior literature is that it examines CEO pay from an *ex-ante* perspective, based on the view that current pay arrangements should be linked to past performance. This perspective assumes that a positive association between CEO pay and past performance is attributed to the fact that past performance signals a CEO's ability to successfully manage the firm (Danker et al., forthcoming). However, another perspective is that boards of directors use non-observable (to outsiders) information to reward CEOs for actions that may benefit the firm in the long run. Importantly, such actions are not always reflected in currently observable performance (Hayes and Schaefer, 2000).[2] This implies that effective compensation policies, particularly incentive-based pay, may induce managers to exert costly effort to increase their firms' future growth opportunities (see Grout and Zalewska, 2010), which helps eliminate agency conflicts between top managers and shareholders and creates shareholder value in the long term. According to this view, CEO compensation should be linked to future shareholder returns.

This study adopts the latter perspective and examines the *ex-post* consequences of different CEO pay arrangements for shareholder value in the UK. Drawing upon and extending a growing body of literature on the consequences of CEO compensation,[3] our objective is to explore whether companies that pay their CEOs higher fees generate superior subsequent stock returns and better operating performance. Using a sample of 1787 companies listed on the London Stock Exchange (LSE) over the period from 1998 to 2010, we firstly sort firms on the basis of their raw as well as industry- and size-adjusted measures of CEO compensation and assign them to the corresponding decile, quintile and percentile portfolios. Post-ranking equally-weighted portfolio returns are then calculated. To classify firms, we use total CEO pay as well as measures of the cash-based and equity-based (or incentive) components of compensation. This allows testing the conjecture that different components of compensation are associated with different outcomes for future shareholder returns. Abnormal portfolio returns are estimated on the basis of both commonly used asset-pricing models (the CAPM, Fama–French and Carhart models) and asset-pricing models that account for higher co-moment factors and idiosyncratic volatility. Additionally, we use panel regressions to investigate how CEO pay affects future operating performance.

Our results reveal the existence of a strong negative relationship between (excess) CEO incentive pay and future shareholder returns. More specifically, firms in the lowest incentive-pay decile earn significant abnormal returns of between 6.58% and 10.37% p.a., depending on the asset-pricing model used. Conversely, firms in the highest incentive-pay decile yield considerably lower and statistically insignificant risk-adjusted returns. Moreover, our panel-data results suggest that, in addition to its negative relationship with returns, CEO incentive pay is also negatively associated with future operating performance. We subject these results to a series of robustness tests (e.g. considering different portfolio-formation criteria, using alternative measures of excess pay, excluding firm-years characterized by CEO turnover, excluding firms with high ownership concentration, allowing for different lags between the period that elapses from the end of the financial year until the actual publication of the annual report, and using various asset-pricing models and alternative panel-data estimators).

We then perform several tests to understand the drivers of the outperformance of low-incentive-pay firms. First, we check whether performance differences between low-incentive-pay and high-incentive-pay portfolios are driven by differences in exposure to higher co-moment factors, such as negative coskewness and positive cokurtosis, or “tail risk”. Our empirical tests rule out this possibility. Our results are also inconsistent with the overconfidence hypothesis, which suggests that overconfident CEOs accept large amounts of incentive pay and subsequently engage in firm-value-destroying activities that are associated with lower future returns (see Cooper et al., 2013). Finally, we check whether low-incentive-pay and high-incentive-pay firms are exposed to different levels of idiosyncratic risk. We provide evidence supporting the view that the outperformance of low-incentive-pay firms can, to a large extent, be explained by their excessive exposure to idiosyncratic risk.

This study contributes to a growing body of research on the *ex-post* shareholder value consequences of CEO pay in several ways. To the best of our knowledge, this is the first study to examine the relationship between CEO pay and future shareholder returns for firms listed on the LSE. The UK market is often used as a model for sound governance when it comes to CEO pay. This is due to the perception that UK CEOs' pay is relatively low, and also to the existence of legislation that mandates an advisory shareholder vote (“say on pay”) on the executive compensation report (see Ferri and Maber, 2013). However, a recent study by Conyon et al. (2011) shows that risk-adjusted pay for US CEOs is not consistently higher than that for UK CEOs. In particular, Conyon et al. (2011, p. 433) find that “while US CEOs have higher risk-adjusted pay in 1997, UK CEOs have higher risk-adjusted pay in 2003”. Likewise, Fernandes et al. (2013) show that after controlling for firm, ownership, and board characteristics, 2006 CEO pay in the UK is the highest among 14 countries with mandated pay disclosures. Moreover, following poor performance relative to their peers during the recent financial crisis, several leading UK companies have suffered the embarrassment of losing (or coming close to losing) a shareholder vote on executive pay (e.g. Aviva, Barclays, Xstrata, Premier Foods).[4] To this end, the UK market provides an interesting setting to study the relationship between CEO compensation and shareholder value.[5] So far, only one study has addressed the link between CEO compensation and future (long-term) stock price performance, and it focused on the US market (see Cooper et al., 2013).

A notable difference between the present study and that of Cooper et al. (2013) stems from the methodology used. In addition to panel regressions that help establish the link between CEO pay and operating performance, we also put forward a flexible multi-factor asset-pricing framework to examine the link between CEO pay and stock returns. We employ both standard asset-pricing models, which account for the market, size, value and momentum factors, and also models that control for higher

[2] For instance, the costs of certain actions, such as acquisitions or R&D expenditures, are usually incurred immediately while the benefits are unlikely to be observed for several years (see Lerner et al., 2011).

[3] See, for example, Abowd (1990), DeFusco et al. (1991), Yermack (1997), Hayes and Schaefer (2000), Hanlon et al. (2003), Conyon and Freeman (2004), Bebchuk et al. (2011), Minnick et al. (2011), Grout and Zalewska (2010, 2012) and Cooper et al. (2013).

[4] See BBC News—Business: “Aviva boss Andrew Moss to step down”, 8th May 2012.

[5] See Zalewska (2013), Ferri and Maber (2013) and Voulgaris et al. (2010) for a detailed discussion on the key features of the UK corporate governance system, and its differences from the US one.

co-moment factors (e.g. negative coskewness and positive cokurtosis). Higher co-moment factors are used to capture tail risk (e.g. extreme movements in stock prices) (see Dittmar, 2002; Harvey and Siddique, 2000). Controlling for such risk is crucial for our analysis because firms with certain pay arrangements (e.g. high levels of option-based compensation) are heavily exposed to tail risk.[6] Additionally, our asset-pricing framework controls for other risk factors such as idiosyncratic volatility/risk. Controlling for such risk is also important because incentive-based pay induces (risk-averse) CEOs to alter their firms' exposure to systematic and idiosyncratic risks (see Armstrong and Vashishtha, 2012). Last but not least, a further contribution of this study is that it goes beyond earlier research that is restricted to event-study methodologies, focusing only on the very short-term effects of CEO compensation on stock returns (see e.g., Yermack, 1997; Fich and Shivdasani, 2005).

The rest of the chapter is organized as follows: Section 2 provides a brief overview of the literature on managerial compensation and positions our study in relation to previous work. Section 3 describes our dataset and portfolio construction methods. Sections 4 and 5 present our empirical results on the link between CEO pay and stock returns. Section 6 presents our results on the link between CEO pay and operating performance. Finally, Section 7 presents our conclusions.

2. Related research

Agency theory postulates that the interests of managers do not always correspond exactly with those of shareholders (Jensen and Meckling, 1976). In an attempt to maximize their own welfare, managers may take actions that disadvantage certain types of shareholders (e.g. excessive risk-taking). Drawing upon agency theory, a large academic literature suggests that CEO pay can be appropriately designed to resolve this problem (Bizjak et al., 2008; Gabaix and Landier, 2008; Hall and Liebman, 1998; Himmelberg and Hubbard, 2000; Kaplan, 2008; Kaplan and Rauh, 2010). A contrasting view, which draws upon the managerial power approach (see Bebchuk and Fried, 2003, 2004), suggests that CEO pay exacerbates rather than alleviates agency conflicts (Bebchuk and Grinstein, 2005; Bertrand and Mullainathan, 2001; Yermack, 1997).

Building upon this strand of the literature, which largely examines CEO pay from an *ex-ante* perspective, a growing body of research focuses on how *ex-ante* compensation arrangements are related to *ex-post* indicators of firm value and performance (e.g., Abowd, 1990; Bebchuk et al., 2011; Brick et al., 2006; Conyon and Freeman, 2004; Cooper et al., 2013; Core et al., 1999; DeFusco et al., 1991; Hanlon et al., 2003; Hayes and Schaefer, 2000; Malmendier and Tate, 2009; Minnick et al., 2011; Yermack, 1997). Once again, there is no consensus regarding the nature of the relationship between executive pay and firms' subsequent performance/value.

A number of studies provide evidence consistent with the alignment role of CEO pay. Abowd (1990) finds that increased performance sensitivity in compensation leads to superior economic and market-based performance in the following fiscal year. Hayes and Schaefer (2000) find that CEO pay is informative about future accounting performance. They view their results as support for the assertion that boards reward top executives for value-maximizing actions with effects that have not materialized yet, and hence that are not observable to outsiders (e.g. shareholders). Conyon and Freeman (2004) report a positive relationship between shared compensation plans (profit sharing, profit-related pay, save as you earn schemes and company stock option plans) and stock market performance. By focusing on the equity-based component of pay, Hanlon et al. (2003) find a positive relation between option grants and operating income.[7]

On the other hand, several studies provide evidence consistent with the "managerial power" or "skimming view" of managerial compensation. DeFusco et al. (1991) find that cumulative abnormal stock returns and accounting performance decline following stock-option plan adoption. Yermack (1997) uses an event-study methodology and finds that CEO option awards are followed by positive cumulative abnormal stock returns.[8] Core et al. (1999) document a negative relationship between excess compensation and subsequent operating and stock return performance. Along the same lines, Brick et al. (2006) provide evidence consistent with the cronyism hypothesis, which suggests that excessive compensation is symptomatic of agency conflicts between managers and shareholders, and hence is value-destroying. Malmendier and Tate (2009) find that "superstar" CEOs (i.e. those winning prestigious business awards) extract more compensation from their firms, which subsequently underperform in terms of both stock market and accounting performance. Bebchuk et al. (2011) construct a measure of CEO pay slice (CPS), defined as the fraction of the aggregate compensation of the top-five executive team captured by the CEO, and document a negative relationship between CPS and firm value, accounting profitability and stock performance.[9]

The study that is closest to ours is the one by Cooper et al. (2013). It also examines the link between CEO pay and stock returns using a comprehensive sample of NYSE, AMEX and NASDAQ firms. They find that excess incentive-pay, defined as payment of restricted stock, options and other long term compensation in excess of the median pay to peer firms in the same industry and size group, is negatively related to future shareholder returns. Using a panel-data regression framework, Cooper et al. (2013) also examine the drivers of the underperformance of firms in extreme excess-pay deciles. Their findings are consistent with the overconfidence hypothesis, which suggests that overconfident CEOs attract high levels of incentive pay, leading investors to overreact to these pay arrangements and subsequently to be disappointed. Their results rule out explanations related to managerial risk-shifting, which occurs when managers

[6] For instance, Benmelech et al. (2010) suggest that equity-based compensation creates incentives for the CEO to conceal bad news about future growth options, which leads to suboptimal investment policies, temporary overvaluation and a subsequent crash in the stock price.

[7] Earlier studies have also demonstrated that certain remuneration practices exert a significant short-term impact on stock returns (see, for example, Chang et al., 2010; Fich and Shivdasani, 2005; Minnick et al., 2011).

[8] However, Yermack's study concludes that this outperformance is not necessarily linked to superior managerial decisions but rather to the informational advantage of managers.

[9] Building on Bebchuk et al.'s (2011) study, Grout and Zalewska (2012) develop a theoretical model which shows that stock options should not necessarily be viewed as an effective mechanism to resolve asymmetric information problems between managers and shareholders. While an increase in option holdings may induce more managerial effort, it may also lead to a reduction in (managerial) profit from purchasing stock, thereby limiting the financial benefit of options.

with high levels of in-the-money options and high exposure to idiosyncratic (firm-specific) risk make decisions that benefit themselves but not shareholders (e.g. discourage risk-taking in an attempt to diversify away an excessive risk-exposure to their own firms).

3. Data and methodology

We use the *BoardEx* database to obtain detailed information on CEO pay for companies listed on the LSE during the period 1998–2010. We begin with 1998 because *BoardEx* has only limited coverage prior to that year. We initially construct three measures of CEO compensation: i) cash-based pay (i.e. salary, bonus and pension payments), ii) incentive-based pay (i.e. options, long-term incentive plans and other non-cash compensation) and iii) total pay (i.e. the sum of cash- and incentive-based pay). We also construct industry- and size-adjusted compensation measures to control for the fact that firms benchmark pay on peer groups (see Bizjak et al., 2008).

In the spirit of Cooper et al. (2013), we calculate industry- and size-adjusted compensation as follows: firstly, firms are assigned into industry portfolios (using the FTA Level 3 Sector Code (FTAG3) from Thomson DataStream in our case). Secondly, firms in each industry are allocated into two size groups (small or large) based on their sales levels relative to the industry median in the year of classification. Industry- and size-adjusted compensation is the difference between the compensation of firm *i* and the median compensation of firms in the same industry and size portfolio.

CEO compensation data are matched at a firm/year level with stock returns data obtained from Thomson DataStream. We construct a series of different holding period returns using the data type RI, a return index that shows the growth in value of a share over a specified period assuming that dividends are reinvested for the purchase of additional units of equity. To ensure that our dataset is free of any potential survivorship bias, our analysis covers both active and dead stocks (i.e. stocks of firms that were delisted at some point during the sample period). To this end, particular attention is paid to the reasons for firms' delisting. Using the London Share Price Database (LSPD) and following Soares and Stark (2009), we set the return in the delisting month equal to −100% when a share's death code is assigned by LSPD as 7, 14, 16, 20 or 21. Following common practice in UK studies, we exclude from the analysis unit trusts, investment trusts and ADRs (see Florackis et al., 2011). Our final sample includes an unbalanced panel of 1787 firms.[10]

The next step involves classifying firms into portfolios according to their level of CEO compensation and calculating these portfolios' post-ranking returns. Stocks are assigned to portfolios according to both raw and industry- and size-adjusted measures of CEO compensation. Following the practice of Soares and Stark (2009) for accounting data, we allow for a 6-month gap between financial year-end and the calculation of the initial portfolio returns. This accounts for the fact that the Financial Services Authority (FSA) allows firms in the UK to make public their annual financial report within a certain period after the end of each financial year. We use equal-weighted portfolio returns so that our results are directly comparable to those reported in Cooper et al. (2013).

To illustrate the portfolio construction process, consider an investor who rebalances her portfolio every end of June (i.e. annual rebalancing).[11] Data on CEO compensation are available from 1998 onwards. As a result, the first portfolio construction in our study takes place in June 1999, and the first 1-month return is calculated in July 1999. In addition to the July 1999 return, the investor also considers 11 subsequent returns (from August 1999 to June 2000) for each portfolio, which leads into a total of 12 post-ranking returns. Put differently, using publicly available compensation information for all companies in June 1999, we sort them into portfolios and calculate returns for each subsequent 12 months. At the end of June 2000, we rebalance the portfolios by re-sorting companies into portfolios on the basis of the publicly available information on compensation at that point of time. Then, the post-ranking returns from July 2000 to June 2001 are constructed. This process continues until the last portfolio construction, which occurs in June 2010. As a result, we have a time series of all monthly portfolio returns for the entire sample period. A similar methodology is adopted by Soares and Stark (2009), Morelli (2007) and Anderson and Brooks (2006) to construct portfolios using UK data.[12] Importantly, in addition to the analysis based on monthly returns, we also assess the performance of each portfolio after considering lower-frequency returns (e.g. 3 months, 6 months, 1 year, 2 years and 3 years).[13]

Portfolios' performance is assessed using both raw and risk-adjusted returns, which are calculated using three popular asset pricing models: the Capital Asset Pricing Model (CAPM), the three-factor Fama and French (1993) model and the four-factor Carhart (1997) model. These models account for returns' exposure to the market, size, value and momentum factors. The market portfolio return is proxied by the FTSE All Share Index returns. We use the size, value and momentum factors constructed for the UK market by Gregory et al. (forthcoming).[14] Moreover, we employ asset-pricing models that account for higher co-moment factors, in the spirit of Harvey and Siddique (2000) and Kostakis et al. (2012), and idiosyncratic volatility/risk.

Following Cooper et al. (2013), we also assess the relationship between CEO compensation and operating performance using panel regressions. Specifically, we regress one-year-ahead return on assets (ROA) and return on capital employed (ROCE) on

[10] Some of these firms are only observed for a limited period of time in our sample (e.g. they may appear at time *t* among listed companies after an IPO, but then get delisted for various reasons). For a firm to qualify for inclusion in our sample, it must have a minimum of 36 months of return data.

[11] We prefer annual to monthly rebalancing to minimize the effect of transaction costs (see Dimson et al., 2003) and mitigate potential rebalancing bias (see Lyon et al., 1999).

[12] The use of a 6-month gap relative to the financial year-end might affect our results, because this is the maximum period allowed for firms to make public their annual report. To ensure that our findings are not driven by the use of a 6-month gap, we conduct the following robustness test: we lag compensation data relative to the financial year-end only by 4 months (i.e. construct portfolios in April of $t + 1$ and then calculate monthly returns from May $t + 1$ to April $t + 2$). Our results are not significantly affected by the choice of gap.

[13] For the analysis based on monthly returns, the last portfolio construction takes place in June 2010. However, the last portfolio-construction date is different for the analysis based on returns that are calculated at a lower frequency. This is because our dataset includes data up to December 2010. For example, for the analysis based on a 24-month return frequency, the last portfolio construction takes place in June 2007. For the analysis based on a 36-month return frequency, the last portfolio construction takes place in June 2006.

[14] Factors are available at http://xfi.exeter.ac.uk/researchandpublications/portfoliosandfactors.

lagged excess compensation and a set of firm, director and board characteristics that have been previously suggested as important drivers of performance. The use of lagged explanatory variables in our models helps address potential issues related to reverse causality. The estimation is performed using various fixed-effect estimators over the period 2000–2010. [15]

Table 1 reports the mean, median, standard deviation, skewness and kurtosis for both components of compensation, namely CEO cash pay and CEO incentive pay, as well as for CEO total pay, which is the sum of cash pay and incentive pay. The statistics are presented for each year separately, along with those for the pooled sample. Table 2 provides details on all control variables used in our panel regressions (i.e. definitions and descriptive statistics).

4. Results

4.1. Evolution of CEO compensation

We start by presenting descriptive statistics on raw levels of CEO compensation. As shown in Panel C of Table 1, the mean (median) value of total pay over the sample period is £823K (£349K). The distribution has a standard deviation of £1567K and a skewness of 6.51, indicating considerable pay variation among the CEOs included in our sample. The mean (median) value of cash pay (Panel A) is £404K (250K) and that for incentive pay (Panel B) is £419K (46K). At the mean level, the proportion of incentive pay to total pay is approximately 50.9%. The distribution of incentive pay is characterized by high values for both standard deviation (£1247K) and skewness (8.27), which possibly suggests that a large proportion of CEOs in our sample receive little or no incentive compensation (e.g. options and LTIPs). The corresponding numbers for cash pay are £494K and 4.34, respectively.

We then move to the evolution of CEO pay over time. We observe that average total pay has increased from £664K in 1999 to £912K in 2007. It declined substantially in 2008 due to the financial crisis but rebounded and reached a peak of £948K in 2010. The cash component of CEO pay reached a peak in 2010, at £453K, while the incentive component of CEO pay reached a peak in 2009, at £501K. At the median level, however, total pay displays an almost monotonic negative trend from 1999 to 2006. It temporarily increased in 2007 but then dropped again during the period of the financial crisis. Median incentive pay is found to be more volatile over the period 1999–2010, while its post-2007 levels are significantly lower than those prevailing in the pre-crisis period.

4.2. Preliminary results

We then compare the equally-weighted (post-ranking) annualized returns for firms with different levels of CEO compensation over the period July 1999 to December 2010. Portfolios are formed on the basis of both raw measures of compensation (Panel A of Table 3) and industry- and size-adjusted measures of compensation (Panel B of Table 3). Results are reported separately for cash-pay-, incentive-pay- and total-pay-sorted portfolios. Columns 2, 3 and 4 present the results for firms that lie on the left tail of the pay distribution (lowest 2% or Portfolio_2%, lowest 10% or Portfolio_10% and lowest 20% or Portfolio_20%). Columns 5, 6 and 7 present the results for firms that lie on the right tail of the pay distribution (highest 20% or Portfolio_80%, highest 10% or Portfolio_90% and highest 2% or Portfolio_98%). We also report the average return of the strategy that buys firms with low CEO pay and sells short firms with high CEO pay (denoted as spread), along with the corresponding t-statistic under the null hypothesis of equal average returns.

Starting with Panel A, the findings suggest that the post-ranking returns of Portfolio_2%, Portfolio_10% and Portfolio_20% are all statistically significant at 11.96%, 16.87% and 13.95% p.a., respectively. These are much higher than the corresponding returns of Portfolio_80%, Portfolio_90% and Portfolio_98%, which are all insignificant (at 6.19%, 6.11% and 2.92% p.a., respectively). The annualized spreads are 9.04%, 10.76% and 7.76%, which are all statistically significant. The outperformance of low-CEO-pay portfolios is weakened (or not preserved at all) when portfolios are sorted on the basis of cash pay or total pay. This suggests that the negative association between CEO pay and subsequent stock returns is found only for the incentive component of CEO compensation.

Moving to Panel B of Table 3, which reports results for portfolios constructed using industry- and size-adjusted compensation measures, we observe a significant outperformance of portfolios with low incentive pay over portfolios with high incentive pay. The corresponding spread, which ranges from 3.68% to 12.93%, is also statistically significant. Once again, the results do not provide evidence for superior performance of low pay portfolios when cash pay and total pay are used for the portfolio construction. Overall, the findings presented in Table 3 provide some preliminary evidence supporting a negative association between CEO incentive pay and subsequent shareholder returns.

The next step involves assessing the cumulative performance of low-pay- and high-pay-decile portfolios (P1 vs P10). For brevity, we report the results based on industry- and size-adjusted compensation measures.[16] Fig. 1 plots the cumulative return of decile portfolios P1 and P10 over time, expressed as the growth of a £1 investment in June 1999, using cash pay (Fig. 1a), incentive pay (Fig. 1b) and total pay (Fig. 1c) to sort firms and construct portfolios. The dark line shows the cumulative value of P1 while the compound line shows the cumulative value of P10 over the period June 1999 to December 2010. For ease of comparison, we also plot the performance of the market portfolio (FTSE All Share) and the compound return of the risk-free rate over the same period.

For portfolios sorted on the basis of cash pay (Fig. 1a), the results suggest that P1 beats P10 but not by very much: £1 invested in P1 (P10) in June 1999 would have grown into £2.47 (£2.00) by December 2010. As shown in Fig. 1b, however, for incentive-pay-based portfolios P1 beats P10 by a large amount: £1 invested in P1 in June 1999 would have grown to £4.21 by December 2010. In contrast, £1 invested in P10 would have grown to £1.82 over the same period. This is equivalent to annualized

[15] Data on executive ownership and ownership concentration are not available prior to 2000. Data on corporate ownership structure are obtained from Hemscott Company Guru (acquired by Morningstar in early 2008).

[16] The results based on raw compensation measures are qualitatively similar. For portfolios sorted on the basis of incentive pay, we find that £1 invested in P1 (P10) in June 1999 would have grown into £5.03 (£1.53) by December 2010. The complete set of results is available upon request.

Table 1
Descriptive statistics on CEO compensation.
This table presents descriptive statistics (mean, median, standard deviation, skewness and kurtosis) on CEO compensation for our sample firms over the period 1998–2010. The statistics are reported separately for CEO cash pay (sum of all cash-based compensation for the period, such as salary and bonus) in Panel A, CEO incentive pay (sum of shares awarded, estimated value of options awarded and value of LTIPs awarded) in Panel B and CEO total pay (sum of cash pay and incentive pay) in Panel C. The value of stock options awarded is estimated using a generalised Black–Scholes option pricing model. The statistics are presented for each year separately as well as for the entire sample period.

		Year													All years
		1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	(1998–2010)
Panel A	Mean	531.05	365.65	372.2	382.91	386.78	385.84	383.95	368.55	383.40	438.26	425.70	420.97	452.49	403.98
CEO cash pay	Median	473.00	300.00	276.00	270.00	280.50	255.50	249.0	230.00	215.00	233.00	245.00	250.50	252.00	250.00
	St. dev.	302.71	241.72	335.77	441.28	382.33	413.30	424.22	443.60	505.26	665.15	561.30	506.69	540.16	494.18
	Skewness	1.14	1.74	3.29	6.23	3.08	3.69	3.31	3.13	3.65	5.75	4.03	2.94	3.02	4.34
	Kurtosis	4.69	7.01	22.01	64.41	15.80	23.72	20.68	16.86	24.45	60.27	31.10	15.63	16.30	40.74
Panel B	Mean	357.96	297.95	431.80	385.58	394.95	393.80	367.34	376.48	408.88	473.28	391.36	500.55	495.21	419.15
CEO incentive pay	Median	93.00	55.00	73.00	59.00	38.00	62.00	39.00	44.50	48.50	64.50	38.00	33.50	14.00	46
	St. dev.	766.84	805.38	1238.55	1396.73	1718.98	1281.59	1156.13	1016.70	1077.69	1289.10	1160.04	1371.25	1293.60	1247.18
	Skewness	3.83	6.19	6.56	9.68	9.94	8.57	9.92	7.03	7.76	6.47	7.82	7.17	6.67	8.27
	Kurtosis	18.53	48.71	60.28	118.98	117.88	92.00	143.21	72.48	93.05	59.17	89.98	79.38	76.84	101.39
Panel C	Mean	889.01	663.61	804.01	768.47	781.72	779.63	751.28	745.02	786.27	911.53	817.06	921.51	947.69	823.12
CEO total pay	Median	690.00	420.50	401.00	405.00	361.0	367.50	342.00	314.50	307.00	342.00	319.50	320.50	340.5	349
	St. dev.	918.94	915.04	1372.29	1696.78	1885.41	1526.46	1422.46	1316.09	1443.91	1710.06	1570.22	1746.83	1678.08	1566.95
	Skewness	3.20	5.09	5.86	8.84	8.42	6.90	7.22	5.71	6.10	5.24	6.24	5.75	5.24	6.51
	Kurtosis	14.91	35.32	51.60	100.28	89.59	63.26	79.70	52.76	61.27	42.11	60.88	55.38	50.88	66.32
Number of observations		69	312	490	531	686	802	933	1068	1150	1166	1096	1032	1138	10,473

Table 2
Descriptive statistics on CEO, board and firm characteristics.
This table presents detailed descriptive statistics for several CEO, board and firm characteristics over the period 2000–2010. ROA is defined as net income (available to common) scaled by total assets. ROCE is the return on capital employed (i.e. net income − bottom line + ((interest expense on debt − interest capitalized) ∗ (1 − tax rate)))/average of last year's and current year's (total capital + short-term debt & current portion of long-term debt). CEO tenure is the number of years since becoming CEO. CEO duality is a dummy variable that equals to one if the CEO is also the Chairman of the board, and zero otherwise. Non-executive dirs is the proportion of non-executive directors sitting on the board. Board size stands for the number of directors on the board. Executive ownership is the percentage of equity ownership held by executive directors. Owner concentration is the sum of stakes of firm's shareholders with equity ownership greater than 10%. Leverage is the ratio of total debt to total assets. Finally, firm size is the natural logarithm of total assets.

	Mean	St. dev.	Min	25%	Median	75%	Max	Skewness	Kurtosis
ROA	−0.03	0.30	−2.00	−0.05	0.03	0.08	0.39	−3.09	16.32
ROCE	0.04	0.42	−2.00	−0.05	0.07	0.17	0.93	−1.42	8.54
CEO tenure	4.35	4.70	0	1.2	2.8	5.8	31	2.06	8.02
CEO duality	0.09	0.29	0	0	0	0	1	2.78	8.73
Non-executive dirs	0.51	0.13	0.17	0.43	0.50	0.60	0.83	−0.19	2.59
Board size	6.96	2.23	3	5	7	8	15	0.90	3.80
Executive ownership	0.13	0.21	0	0.002	0.02	0.16	0.75	1.15	4.82
Owner concentration	0.12	0.17	0	0	0	0.17	0.56	1.41	3.87
Leverage	0.18	0.19	0	0.01	0.14	0.28	1.00	1.39	5.42
Firm size	11.35	2.72	3.40	9.63	11.36	13.10	16.86	−0.15	2.93

Table 3
Performance of CEO compensation-sorted portfolios.
This table reports equally-weighted post-ranking annualized returns (expressed in percentages) for firms with different levels of CEO compensation over the period July 1999 to December 2010. Portfolios are formed on the basis of both raw measures of compensation (Panel A) and industry- and size-adjusted measures of compensation (Panel B). Results are reported separately for cash-pay-, incentive-pay- and total-pay-sorted portfolios. Columns 2, 3 and 4 present the results for firms that lie on the left tail of the pay distribution (lowest 2% or Portfolio_2%, lowest 10% or Portfolio_10% and lowest 20% or Portfolio_20%). Columns 5, 6 and 7 present the results for firms that lie on the right tail of the pay distribution (highest 20% or Portfolio_80%, highest 10% or Portfolio_90% and highest 2% or Portfolio_98%). The table also reports the average return of the strategy buying firms with low CEO pay and selling short firms with high CEO pay, along with the corresponding *t*-statistic (in parentheses) under the null hypothesis of equal returns for each pair of portfolios. All *t*-statistics are constructed using Newey–West standard errors corrected for heteroscedasticity and serial correlation.

	Lowest pay firms			Highest pay firms			Spread: Lowest pay–highest pay		
	(2)	(3)	(4)	(5)	(6)	(7)	(4)–(5)	(3)–(6)	(2)–(7)
	Portfolio_2%	Portfolio_10%	Portfolio_20%	Portfolio_80%	Portfolio_90%	Portfolio_98%			
Panel A: Portfolios of firms based on raw compensation measures									
CEO cash pay	2.16	10.17	11.45	10.06*	9.91*	4.61	1.38	0.26	−2.47
	(0.27)	(1.23)	(1.60)	(1.71)	(1.69)	(0.79)	(0.29)	(0.04)	(−0.38)
CEO incentive pay	11.96*	16.87**	13.95**	6.19	6.11	2.92	7.76*	10.76**	9.04*
	(1.88)	(2.39)	(2.17)	(0.98)	(0.95)	(0.39)	(1.89)	(2.11)	(1.85)
CEO total pay	−0.88	15.51*	13.58*	7.79	7.63	3.95	5.79	7.88	−4.83
	(−0.10)	(1.86)	(1.89)	(1.26)	(1.19)	(0.56)	(1.14)	(1.23)	(−0.59)
Panel B: Portfolios of firms based on industry- and size-adjusted compensation measures									
CEO cash pay	3.63	10.10	8.70	10.06*	8.16	9.14	−1.36	1.94	−5.51
	(0.42)	(1.63)	(1.42)	(1.66)	(1.35)	(1.46)	(−0.44)	(0.48)	(−0.65)
CEO incentive pay	15.08*	15.14**	10.17*	6.49	7.77	2.15	3.68*	7.37*	12.93*
	(1.80)	(2.25)	(1.68)	(1.06)	(1.17)	(0.29)	(1.70)	(1.93)	(1.68)
CEO total pay	15.86*	11.36*	9.02	8.71	8.48	3.68	0.31	2.88	12.18
	(1.90)	(1.85)	(1.48)	(1.40)	(1.32)	(0.51)	(0.11)	(0.72)	(1.52)

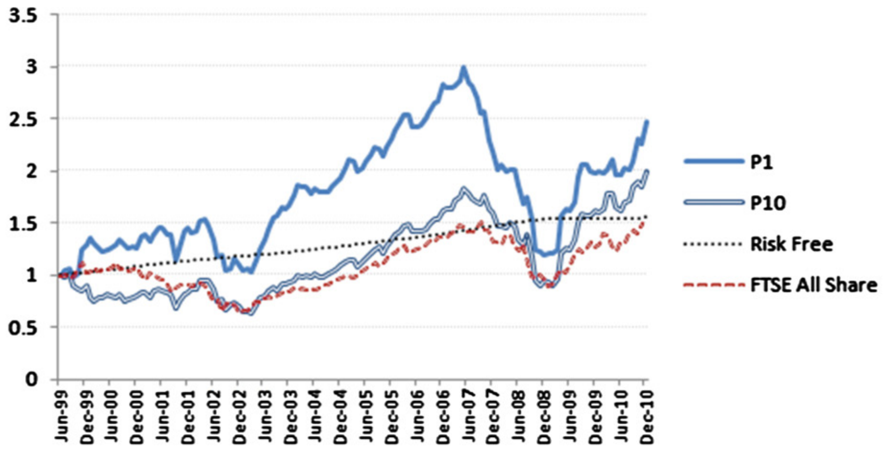
* Indicates statistical significance at the 10% level.
** Indicates statistical significance at the 5% level.

returns of about 12.6% for P1 and 5.2% for P10, a spread of 7.4%. Moreover, while P10 only marginally outperforms the market and the risk-free-rate strategy, P1 outperforms both these strategies by a wide margin. The performance difference between P1 and P10 persists but it is less pronounced in Fig. 1c, which refers to portfolios formed on the basis of total CEO pay.

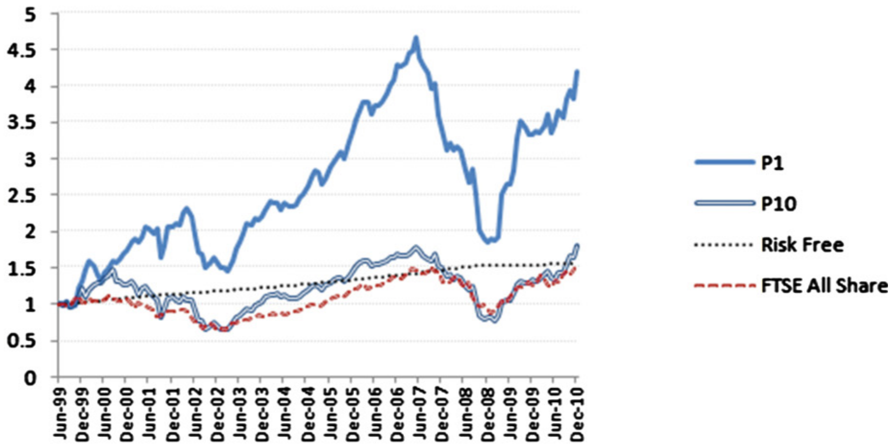
In summary, these results indicate a negative relationship between CEO incentive pay and future shareholder returns. The average post-ranking returns of portfolios containing firms with the lowest incentive pay are significantly higher than the corresponding returns of portfolios containing firms with the highest incentive pay. Moreover, £1 invested in June 1999 in the decile portfolio consisting of the lowest-incentive-pay firms would have produced a cumulative return of 321% by December 2010. The same £1 invested in the portfolio consisting of the highest-incentive-pay firms would have returned 82%, which only marginally beats the cumulative return of the FTSE All Share Index.[17]

[17] In unreported results, we find that the relationship between CEO incentive pay and shareholder returns is non-monotonic. In line with expectations, some decile portfolios underperform the market. For example, £1 invested in June 1999 in portfolio 9 (i.e. 9th decile of the incentive-pay distribution) would have grown to £1.48 by December 2010.

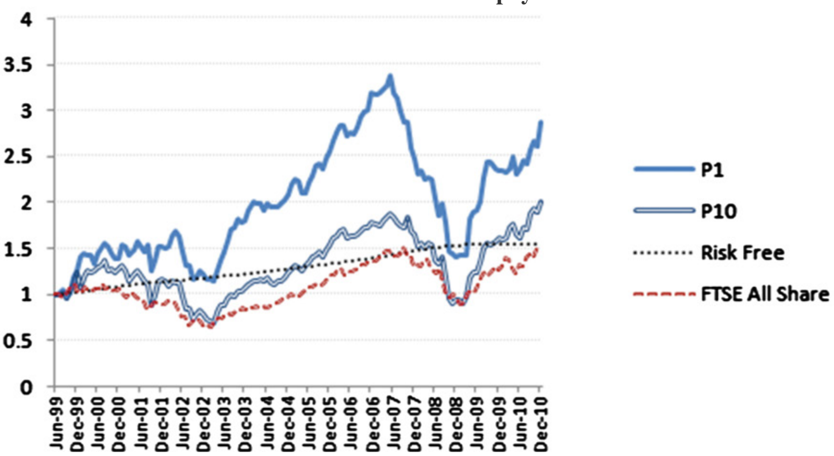
a) **Cumulative value of £1 invested in firms in the lowest decile (P1) and highest decile (P10) of CEO cash pay**



b) **Cumulative value of £1 invested in firms in the lowest decile (P1) and highest decile (P10) of CEO incentive pay**



c) **Cumulative value of £1 invested in firms in the lowest decile (P1) and highest decile (P10) of CEO total pay**



4.3. Risk-adjusted performance: Market, size, value and momentum risk factors

In this section, we assess the relative performance of different portfolios using three commonly used asset-pricing models. The use of an asset-pricing framework allows us to test whether the return differentials across the portfolios are due to differences in their riskiness or "style". In other words, we calculate risk-adjusted portfolio returns over the period July 1999 to December 2010, adjusting for the market, size, value and momentum factor exposures of each portfolio. Firstly, we estimate the Jensen alpha from the CAPM regression:

$$R_{i,t} - R_t^f = \alpha_i + \beta_{i,MKT}\left(R_{m,t} - R_t^f\right) + \varepsilon_{i,t} \tag{1}$$

where $R_{i,t}$ is the return of portfolio i in month t, R_t^f is the risk free rate for month t, $R_{m,t} - R_t^f$ is the excess market portfolio return in month t and $\beta_{i,MKT}$ is the market beta of portfolio i. Secondly, we compute the Fama–French alpha, i.e. the intercept of the three-factor Fama and French (1993) model:

$$R_{i,t} - R_t^f = \alpha_i + \beta_{i,MKT}\left(R_{m,t} - R_t^f\right) + \beta_{i,SMB} SMB_t + \beta_{i,HML} HML_t + \varepsilon_{i,t} \tag{2}$$

where SMB_t and HML_t stand for the size and value factors respectively, while $\beta_{i,SMB}$ and $\beta_{i,HML}$ denote the corresponding factor loadings of portfolio i.

Thirdly, we estimate the Carhart alpha, i.e. the intercept of the four-factor Carhart (1997) model:

$$R_{i,t} - R_t^f = \alpha_i + \beta_{i,MKT}\left(R_{m,t} - R_t^f\right)_t + \beta_{i,SMB} SMB_t + \beta_{i,HML} HML_t + \beta_{i,MOM} MOM_t + \varepsilon_{i,t} \tag{3}$$

where MOM_t stands for the momentum factor and $\beta_{i,MOM}$ denotes the corresponding factor loading of portfolio i.

We opt for a system-based estimation. In particular, factor loadings and alphas are estimated via GMM, with Newey–West standard errors corrected for heteroscedasticity and serial correlation. We further test and report in each case the significance of the risk-adjusted performance of the return differential (spread) between portfolios consisting of the lowest-CEO-pay companies and portfolios consisting of the highest-CEO-pay companies.

Table 4 reports the estimated alphas for portfolios of firms constructed on the basis of raw measures of cash pay (Panel A), incentive pay (Panel B) and total pay (Panel C). With respect to cash pay, the results do not suggest any significant association between pay and post-ranking returns. For example, firms in the lowest cash-pay decile earn a market-adjusted return (i.e. CAPM alpha) of 5.40% p.a. Firms in the highest cash-pay decile earn a similar market-adjusted return of 5.05% p.a. A strategy of buying firms in the lowest decile and selling short firms in the highest decile would have earned 0.35% p.a., which is statistically insignificant. This finding holds for other measures of abnormal performance (e.g. Fama–French alpha and Carhart alpha) as well as for the cases when portfolios at the extreme tails of the distribution or quintile portfolios are considered.

As shown in Panel B of Table 4, however, our findings support a negative and statistically significant relationship between incentive pay and post-ranking shareholder returns. Portfolio_10% (Portfolio_90%) earns a market-adjusted return of 12.21% (1.16%) p.a. The corresponding spread of 11.05% is statistically significant. That is, an investment strategy of buying firms in the lowest decile and selling short firms in the highest decile would have earned 11.05% p.a. The return on this strategy varies between 7.45% and 11.05% p.a., depending on the asset-pricing model utilized, and remains statistically significant in all cases considered. As expected, a lower spread is observed for the case of quintile portfolios. For example, a strategy of buying Portfolio_20% and selling short Portfolio_80% would have yielded a return between 5.46% and 7.97% p.a. The decline of the spread can be explained by the fact that quintile portfolios include a much larger number of firms (about 150 on average). The spread remains above the level of 9% p.a. when portfolios at the extreme tails of the distribution are considered, even under the Carhart model.

In Panel C of Table 4, we present the results for portfolios sorted on total pay. Although a strategy of buying firms in the lowest pay decile and selling short firms in the highest pay decile would have yielded a non-negligible abnormal return of 8.10% p.a. under the CAPM, 7.04% p.a. under the three-factor model and 4.78% p.a. under the four-factor model, these alphas are not statistically significant. The spread declines for the case of quintile portfolios and turns into a negative one when extreme portfolios are considered. These findings suggest that the negative link between CEO pay and future shareholder returns holds only for the incentive component of CEO pay.

In Table 5, we conduct the same exercise using industry- and size-adjusted measures of pay to construct portfolios. The results are similar to those obtained using raw compensation measures. We document evidence supporting a negative association between incentive pay and post-ranking shareholder returns. Specifically, portfolios of low-incentive-pay firms earn a much higher alpha than portfolios of high-incentive-pay firms. The return differential between Portfolio_10% and Portfolio_90% is also statistically significant for most of the cases considered (i.e. 7.58% p.a. for the CAPM model and 5.92% p.a. for the three-factor model). The four-factor model yields a spread of 4.26% p.a., which is statistically insignificant ($t = 1.25$). However, our findings show that firms at the extreme portfolios differ significantly in terms of their returns, both in statistical and economic terms,

Fig. 1. a: Cumulative value of £1 invested in firms in the lowest decile (P1) and highest decile (P10) of CEO cash pay. b: Cumulative value of £1 invested in firms in the lowest decile (P1) and highest decile (P10) of CEO incentive pay. c: Cumulative value of £1 invested in firms in the lowest decile (P1) and highest decile (P10) of CEO total pay.

Table 4
Risk-adjusted performance of CEO compensation-sorted portfolios.
This table reports the estimated annualized alphas for different portfolios of firms as constructed using raw measures of CEO cash pay (Panel A), CEO incentive pay (Panel B) and CEO total pay (Panel C). Alphas are estimated using three asset-pricing models, namely the CAPM, the Fama and French (1993) three-factor model and the Carhart (1997) four-factor model, as discussed in Section 4.3. Columns 2, 3 and 4 present the results for firms that lie on the left tail of the pay distribution (lowest 2% or Portfolio_2%, lowest 10% or Portfolio_10% and lowest 20% or Portfolio_20%). Columns 5, 6 and 7 present the results for firms that lie on the right tail of the pay distribution (highest 20% or Portfolio_80%, highest 90% or Portfolio_90% and highest 2% or Portfolio_98%). The table also reports the average (abnormal) return of the strategy of buying firms with low CEO pay and selling short firms with high CEO pay, along with the corresponding *t*-statistic (in parentheses) under the null hypothesis of equal returns for each pair of portfolios. All *t*-statistics are constructed using Newey–West standard errors corrected for heteroscedasticity and serial correlation.

	Lowest-pay firms			Highest-pay firms			Spread: Lowest pay–highest pay		
	(2)	(3)	(4)	(5)	(6)	(7)	(4)–(5)	(3)–(6)	(2)–(7)
	Portfolio_2%	Portfolio_10%	Portfolio_20%	Portfolio_80%	Portfolio_90%	Portfolio_98%			
Panel A: CEO-cash-pay-based portfolios									
CAPM alpha (% p.a.)	−2.61	5.40	6.71	5.20*	5.05*	−0.12	1.51	0.35	−2.49
	(−0.36)	(0.56)	(0.95)	(1.72)	(1.71)	(−0.03)	(0.25)	(0.04)	(−0.34)
Fama–French alpha (% p.a.)	−6.10	2.57	3.33	2.84	2.99	−1.64	0.49	−0.42	−4.46
	(−1.02)	(0.40)	(0.74)	(1.41)	(1.39)	(−0.42)	(0.11)	(−0.06)	(−0.67)
Carhart alpha (% p.a.)	−3.10	2.79	3.93	4.17**	4.36**	0.53	−0.24	−1.57	−3.63
	(−0.47)	(0.40)	(0.77)	(2.12)	(1.98)	(0.13)	(−0.05)	(−0.21)	(−0.48)
Panel B: CEO-incentive-pay-based portfolios									
CAPM alpha (% p.a.)	7.22	12.21	9.23	1.26	1.16	−2.06	7.97*	11.05*	9.28*
	(1.31)	(1.63)	(1.62)	(1.42)	(0.38)	(−0.42)	(1.70)	(1.73)	(1.89)
Fama–French alpha (% p.a.)	4.14	9.44**	6.49*	−1.29	−0.70	−2.58	7.78**	10.14**	6.72
	(1.21)	(2.23)	(1.93)	(−0.62)	(−0.27)	(−0.68)	(2.32)	(2.39)	(1.60)
Carhart alpha (% p.a.)	5.03	8.98**	6.83*	1.37	1.53	−4.14	5.46	7.45*	9.17**
	(1.34)	(2.09)	(1.89)	(0.69)	(0.60)	(−1.01)	(1.58)	(1.76)	(2.01)
Panel C: CEO-total-pay-based portfolios									
CAPM alpha (% p.a.)	−5.55	10.76	8.86	2.88	2.66	−0.97	5.98	8.10	−4.58
	(−0.69)	(1.13)	(1.22)	(1.01)	(0.92)	(−0.21)	(0.94)	(0.95)	(−0.51)
Fama–French alpha (% p.a.)	−8.66	7.92	5.64	0.46	0.88	−1.08	5.18	7.04	−7.58
	(−1.19)	(1.28)	(1.25)	(0.25)	(0.35)	(−0.32)	(1.18)	(1.17)	(−0.93)
Carhart alpha (% p.a.)	−7.30	7.80	6.17	2.72	3.02	−2.52	3.45	4.78	−4.78
	(−0.99)	(1.19)	(1.22)	(1.50)	(1.24)	(−0.71)	(0.69)	(0.73)	(−0.61)

* Indicates statistical significance at the 10% level.
** Indicates statistical significance at the 5% level.

regardless of the asset-pricing model utilized. An investment strategy of buying Portfolio_2% and selling short Portfolio_98% would have earned a statistically significant CAPM alpha of 13.21% p.a., a Fama–French alpha of 11.06% p.a. and a Carhart alpha of 14.57% p.a.

Overall, we find significant evidence that portfolios containing low-incentive-pay firms outperformed those portfolios containing high-incentive-pay firms during the period July 1999 to December 2010. These results hold after controlling for common factors such as market, size, value and momentum. On the other hand, the reported results do not indicate any significant relationship between cash/total pay measures of CEO pay and future shareholder returns.[18]

5. What explains the negative link between incentive pay and stock returns?

5.1. Higher co-moment risk factors

In addition to the market, size, value and momentum factors, performance differences between low-incentive-pay and high-incentive-pay portfolios may be explained by differences in exposure to higher co-moment factors, such as negative coskewness and positive cokurtosis. Higher co-moment factors are used to capture tail risk (e.g. extreme movements in stock prices) (see Dittmar, 2002; Harvey and Siddique, 2000). Controlling for such risk is crucial for our analysis for two reasons. First, according to Benmelech et al. (2010), firms with high incentive pay may be heavily exposed to tail risk. This is because certain components of incentive pay (e.g. options) create incentives for the CEO to conceal bad news about future growth options, an action which may lead to suboptimal investment policies, temporary overvaluation and a subsequent crash in the stock price. Second, Kostakis et al. (2012) show that coskewness and cokurtosis risks are priced in the UK market.[19]

[18] An interesting avenue for future work would be to check whether these results hold under alternative measures of incentives. Edmans et al. (2009) propose the dollar change in wealth for a percentage change in firm value, divided by annual pay. This measure is independent of firm size. Another possibility would be the use of an incentive measure that is based on cumulative compensation. Due to limited data availability on these measures for UK firms, we leave these intriguing possibilities for future research.

[19] In particular, they find that firms whose returns exhibit negative coskewness or positive cokurtosis yield higher premiums relative to counterpart firms with positive coskewness and negative co-kurtosis, respectively.

Table 5
Risk-adjusted performance of CEO-compensation-sorted portfolios — adjusted measures.
This table reports the estimated annualized alphas for different portfolios of firms as constructed using industry- and size-adjusted measures of CEO cash pay (Panel A), CEO incentive pay (Panel B) and CEO total pay (Panel C). Alphas are estimated using three asset-pricing models, namely the CAPM, the Fama and French (1993) three-factor model and the Carhart (1997) four-factor model, as discussed in Section 4.3. Columns 2, 3 and 4 present the results for firms that lie on the left tail of the pay distribution (lowest 2% or Portfolio_2%, lowest 10% or Portfolio_10% and lowest 20% or Portfolio_20%). Columns 5, 6 and 7 present the results for firms that lie on the right tail of the pay distribution (highest 20% or Portfolio_80%, highest 10% or Portfolio_90% and highest 2% or Portfolio_98%). The table also reports the average (abnormal) return of the strategy of buying firms with low CEO pay and selling short firms with high CEO pay, along with the corresponding t-statistic (in parentheses) under the null hypothesis of equal returns for each pair of portfolios. All t-statistics are constructed using Newey–West standard errors corrected for heteroscedasticity and serial correlation.

	Lowest-pay firms			Highest-pay firms			Spread: Lowest pay–highest pay		
	(2)	(3)	(4)	(5)	(6)	(7)	(4)–(5)	(3)–(6)	(2)–(7)
	Portfolio_2%	Portfolio_10%	Portfolio_20%	Portfolio_80%	Portfolio_90%	Portfolio_98%			
Panel A: CEO-cash-pay-based portfolios									
CAPM alpha (% p.a.)	−0.97	5.38	4.00	5.20	3.29	4.43	−1.20	2.09	−5.40
	(−0.15)	(1.20)	(0.84)	(1.61)	(0.89)	(0.92)	(−0.43)	(0.46)	(−0.61)
Fama–French alpha (% p.a.)	−3.62	2.02	0.48	2.52	0.89	2.76	−2.04	1.13	−6.38
	(−0.69)	(0.78)	(0.16)	(1.13)	(0.31)	(0.59)	(−0.79)	(0.34)	(−0.85)
Carhart alpha (% p.a.)	−3.55	3.16	1.95	4.05*	2.59	4.46	−2.10	0.57	−8.00
	(−0.63)	(1.14)	(0.58)	(1.82)	(0.84)	(0.94)	(−0.73)	(0.17)	(−1.07)
Panel B: CEO-incentive-pay-based portfolios									
CAPM alpha (% p.a.)	10.39	10.37**	5.40	1.62	2.79	−2.82	3.78*	7.58*	13.21*
	(1.13)	(1.96)	(1.31)	(0.49)	(0.84)	(−0.55)	(1.93)	(1.83)	(1.67)
Fama–French alpha (% p.a.)	7.70	6.58**	2.04	−1.01	0.66	−3.36	3.05*	5.92*	11.06*
	(1.14)	(2.34)	(0.89)	(−0.42)	(0.25)	(−0.84)	(1.89)	(1.80)	(1.89)
Carhart alpha (% p.a.)	9.58	7.26**	3.49	1.36	3.00	−4.99	2.13	4.26	14.57*
	(1.41)	(2.55)	(1.42)	(0.55)	(1.16)	(−1.15)	(1.30)	(1.25)	(1.84)
Panel C: CEO-total-pay-based portfolios									
CAPM alpha (% p.a.)	11.29	6.69	4.31	3.82	3.53	−1.27	0.48	3.16	12.56
	(1.19)	(1.47)	(0.95)	(1.12)	(1.23)	(−0.28)	(0.22)	(1.01)	(1.52)
Fama–French alpha (% p.a.)	8.11	3.31	0.67	1.10	1.65	−1.27	−0.43	1.66	9.38
	(1.22)	(1.29)	(0.96)	(0.50)	(0.74)	(−0.38)	(−0.22)	(0.67)	(1.38)
Carhart alpha (% p.a.)	10.09	4.17	2.15	3.17	3.66	−2.85	−1.02	0.51	12.94*
	(1.56)	(1.50)	(0.74)	(1.46)	(1.64)	(−0.81)	(−0.47)	(0.19)	(1.73)

* Indicates statistical significance at the 10% level.
** Indicates statistical significance at the 5% level.

In this section, we employ an asset-pricing model that accounts for higher co-moment factors in the spirit of Kostakis et al. (2012). In particular, we augment the CAPM with the coskewness and cokurtosis factors, leading to the following higher co-moments model:

$$R_{i,t}-R_t^f=\alpha_i+\beta_{i,MKT}\left(R_{m,t}-R_t^f\right)+\beta_{i,S^--S^+}\left(S^--S^+\right)_t+\beta_{i,K^+-K^-}\left(K^+-K^-\right)_t+\varepsilon_{i,t}$$

where $(S^- - S^+)$ stands for the coskewness factor and $(K^+ - K^-)$ for the cokurtosis factor. Following Kostakis et al. (2012) $(S^- - S^+)$ has been constructed as a zero-cost spread between the portfolio containing the 20% of the shares exhibiting the most negative coskewness with respect to the market portfolio (S^-) and the portfolio containing the 20% of the shares exhibiting the most positive coskewness (S^+). Similarly, the cokurtosis factor $(K^+ - K^-)$ has been constructed as a zero-cost spread between the portfolio containing the 20% of the shares exhibiting the most positive cokurtosis with respect to the market portfolio (K^+) and the portfolio containing the 20% of the shares exhibiting the most negative cokurtosis (K^-).

Table 6 reports the estimated alphas for portfolios of firms constructed on the basis of raw measures of incentive pay (Panel A) and industry- and sales-adjusted measures of incentive pay (Panel B).[20] The results presented in Table 6 confirm that low-incentive-pay firms outperform high-incentive-pay firms. In particular Portfolio_10% earns positive abnormal performance (10.27% p.a.) even after adjusting for coskewness and cokurtosis risks. Interestingly, Portfolio_90% earns abnormal performance of only 0.21% p.a. An investment strategy of buying firms in the lowest decile and selling short firms in the highest decile would have earned 10.06% p.a., which is statistically significant at the 10% level. The spread remains statistically significant once quintile portfolios are considered. Our results remain qualitatively similar when we use industry- and size-adjusted compensation measures for the portfolio construction. In particular, an investment strategy of buying firms in the lowest decile and selling short firms in the highest decile of adjusted CEO incentive pay would have earned 6.26% p.a. As expected, the spread declines in magnitude but remains significant when quintile portfolios are considered.

[20] In the interest of space, we do not report the results on the performance of portfolios sorted on the basis of CEO cash pay and CEO total pay.

Table 6
Higher co-moment alphas for portfolios sorted on the basis of CEO incentive pay.
This table reports the estimated annualized alphas for different portfolios of firms as constructed using raw measures of CEO incentive pay (Panel A) and industry- and size-adjusted measures of CEO incentive pay (Panel B). Higher co-moment alpha stands for the annualized alpha estimate derived from the higher co-moments asset-pricing model (see Section 5.1 for details). (1), (2) and (3) present the results for firms that lie on the left tail of the incentive pay distribution (i.e. lowest 2% or Portfolio_2%, lowest 10% or Portfolio_10% and lowest 20% or Portfolio_20%). (4), (5) and (6) present the results for firms that lie on the right tail of the incentive pay distribution (i.e. highest 2% or Portfolio_98%, highest 90% or Portfolio_90% and highest 20% or Portfolio_80%). The table also reports the average return (spread) of the strategy of buying firms with low CEO incentive pay and selling short firms with high CEO incentive pay, along with the corresponding t-statistic (in parentheses) under the null hypothesis of equal returns for each pair of portfolios. All t-statistics are constructed using Newey–West standard errors corrected for heteroscedasticity and serial correlation.

Panel A: CEO-incentive-pay-based portfolios			
	Lowest-pay firms		
	(1)	(2)	(3)
	Portfolio_2%	Portfolio_10%	Portfolio_20%
Higher co-moment alpha (% p.a.)	6.72	10.27	8.74
	(1.25)	(1.51)	(1.58)
	Highest-pay firms		
	(4)	(5)	(6)
	Portfolio_98%	Portfolio_90%	Portfolio_80%
Higher co-moment alpha (% p.a.)	−1.30	0.21	−0.06
	(−0.26)	(0.07)	(−0.02)
	Spread: Lowest pay–highest pay		
	(1)–(4)	(2)–(5)	(3)–(6)
Higher co-moment alpha (% p.a.)	8.02	10.06*	8.80**
	(1.55)	(1.77)	(2.05)

Panel B: Adjusted CEO-incentive-pay-based portfolios			
	Lowest-pay firms		
	(1)	(2)	(3)
	Portfolio_2%	Portfolio_10%	Portfolio_20%
Higher co-moment alpha (% p.a.)	9.93	8.18*	4.21
	(1.09)	(1.75)	(1.09)
	Highest-pay firms		
	(4)	(5)	(6)
	Portfolio_98%	Portfolio_90%	Portfolio_80%
Higher co-moment alpha (% p.a.)	−1.85	1.92	0.25
	(−0.36)	(0.56)	(0.08)
	Spread: Lowest pay–highest pay		
	(1)–(4)	(2)–(5)	(3)–(6)
Higher co-moment alpha (% p.a.)	11.78	6.26*	3.96**
	(1.50)	(1.75)	(2.06)

* Indicates statistical significance at the 10% level.
** Indicates statistical significance at the 5% level.

In Fig. 2, we report the exposure of all portfolios considered to coskewness and cokurtosis risk factors. Portfolios with high incentive pay tend to be more exposed to coskewness risk while portfolios with low incentive pay tend to be more exposed to cokurtosis risk. However, the differential in exposures does not seem to be large enough to explain the disparity in the performance across these portfolios.[21] In conclusion, the results in this section suggest that the outperformance of low-incentive-pay firms compared to high-incentive-pay firms declines but remains, in most cases, statistically significant even after utilizing a higher co-moment asset-pricing model.

5.2. Exposure to idiosyncratic risk

We also study whether our results are due to the high exposure of low-incentive pay firms to idiosyncratic risk. The fundamental principle of modern portfolio theory suggests that all investors hold the market portfolio (in equilibrium). However, investors in reality may not hold perfectly diversified portfolios. Under-diversified investors demand a premium for bearing idiosyncratic risk (see Goyal and Santa-Clara, 2003; Merton, 1987). In the context of our analysis, low-incentive-pay and high-incentive-pay are likely to have different exposures to idiosyncratic risk. Armstrong and Vashishtha (2012) argue that incentive-based compensation induces (risk-averse) CEOs to alter their firms' systematic and idiosyncratic risks. In particular, CEOs with high levels of options and LTIPs (i.e. high-incentive-pay firms) usually hold under-diversified portfolios because they invest both human capital and large proportions of their personal wealth in their firms. One way to hedge their positions is to

[21] For completeness, we also add coskewness and cokurtosis to a four-factor model, which also controls for market, SMB, HML and MOM factors. The results of the resulting six-factor model do not conflict with our key finding of a negative relationship between CEO pay and future shareholder returns. Specifically, we find that Portfolio_10% earns a statistically significant six-factor alpha of 8.91% ($t = 2.41$) while Portfolio_90% earns a much lower and insignificant six-factor alpha (1.31%, $t = 0.50$). This leads into a spread of 7.6%, which is statistically significant at the 10% level ($t = 1.80$). Analytical results are available upon request.

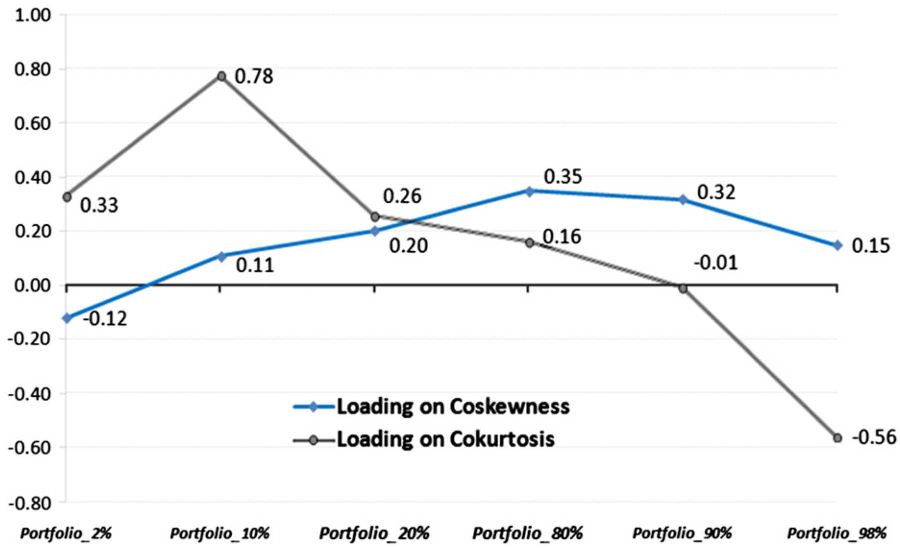


Fig. 2. Loadings of low and high incentive pay portfolios on coskewness and cokurtosis factors. This figure reports the exposure of low-incentive-pay portfolios (i.e. Portfolio_2%, Portfolio_10% and Portfolio_20%) and high-incentive-pay portfolios (i.e. Portfolio_80%, Portfolio_90% and Portfolio_98%) to coskewness and cokurtosis risks. Factor loadings are obtained from the following asset pricing model $R_{i,t}-R_t^f = \alpha_i + \beta_{i,MKT}\left(R_{m,t}-R_t^f\right) + \beta_{i,S^- -S^+}\left(S^- - S^+\right)_t + \beta_{i,K^+ -K^-}\left(K^+ - K^-\right)_t + \varepsilon_{i,t}$ where $(S^- - S^+)$ stands for the coskewness factor and $(K^+ - K^-)$ for the cokurtosis factor. Section 5.1 provides more details about this model and the way in which coskewness and cokurtosis factors are constructed.

engage in "risk-substitution" — that is, pass up innovative projects with high idiosyncratic (firm-specific) risk in favor of standard projects that have greater aggregate (systematic) risk, which is hedgeable (see Acharya and Bisin, 2009).[22] This leads into a higher exposure to aggregate rather than idiosyncratic risk (see also Meulbroek, 2001). Conversely, CEOs with low levels of options and LTIPs (i.e. low-incentive-pay firms) are less likely to hold under-diversified portfolios and, as a result, less willing to substitute firm-specific risk for aggregate market risk. This suggests that low-incentive-pay firms may be more exposed to idiosyncratic rather than aggregate risk.[23] A potentially high exposure of low-incentive-pay firms to idiosyncratic risk may drive their outperformance.

To check the validity of this argument, we proceed as follows: first, following Goyal and Santa-Clara (2003), we construct a measure of idiosyncratic risk, defined as the standard deviation of the residuals derived by the CAPM. For this measure to be consistent with our data on CEO pay (yearly frequency), the estimation of our proxy for idiosyncratic risk is performed on an annual basis using weekly observations. Firms that exhibit a high (low) standard deviation in the residual term are classified as high- (low-) idiosyncratic-risk firms.[24] Using this measure, we then test for differences in the average idiosyncratic risk between low-incentive-pay and high-incentive-pay firms. Furthermore, we split the sample into low-idiosyncratic-risk and high-idiosyncratic-risk firms and test whether the outperformance of low-incentive-pay firms is observed in both samples. If outperformance is, in fact, due to a high exposure to idiosyncratic risk, the return differential between portfolios consisting of the lowest-incentive-pay firms and portfolios consisting of the highest-incentive-pay firms should be more pronounced in the sample of high-idiosyncratic-risk firms. Also, there should be no spread in the sample of low-idiosyncratic-risk firms. For completeness, we also construct a monthly idiosyncratic-risk factor that is based on the idiosyncratic volatility of each stock. In particular, we estimate the CAPM model for each stock/month using 60-month rolling windows. For each month, we split stocks into 5 quintile portfolios according to idiosyncratic risk and calculate each portfolio's equal-weighted return. Our idiosyncratic-risk factor is defined as the return of the 5th quintile portfolio (i.e. q5, which contains stocks with high idiosyncratic risk) minus the return of the 1st quintile portfolio (i.e. q1, which contains stocks with low idiosyncratic risk). We then augment the asset-pricing models (CAPM, Fama/French and Carhart) with the idiosyncratic-risk factor and consider alphas relative to the resulting two/four/five-factor model. If outperformance is linked to idiosyncratic risk, the return differential between Portfolio_10% and Portfolio_90% should evaporate and become statistically significant when estimated using the augmented models.

The results of these tests suggest that Portfolio_10% is indeed exposed to a higher level of idiosyncratic risk. As shown in Panel A of Table 7, the average idiosyncratic risk in Portfolio_10% is 0.056 while the average idiosyncratic risk in Portfolio_90% is 0.051. The difference is statistically significant at the 1% level (i.e. p-value = 0.00). We then assess the relative performance of

[22] CEOs could also potentially hedge their portfolio positions by selling short their own firm's stock, but such an action is costly or even prohibited due to regulatory and reputational issues associated with insider trading (see Leland, 1992).

[23] There is a debate regarding the direction of causality between CEO pay and firm risk (see Low, 2009). In the present study, we conjecture that the causality runs from CEO pay to firm risk. Two recent studies by Gormley et al. (2013) and Low (2009), which exploit natural experiments/exogenous shocks to overcome the causality issue, strongly support this view. Still, we acknowledge that more research is required to fully address the reverse causality issue, which should involve the use of systems of simultaneous equations (similar to Palia, 2001) and natural experiments (similar to Gormley et al., 2013; Low, 2009).

[24] In order to classify firms into low-idiosyncratic-risk and high-idiosyncratic-risk groups we use the median value as a cut-off point.

Table 7
CEO incentive pay, stock returns and idiosyncratic risk.
This table reports the exposure of low- and high-CEO-incentive-pay firms to idiosyncratic risk (Panel A). It also reports, in Panels B and C, the estimated annualized alphas for firms that lie on the left decile of the CEO-incentive-pay distribution (Portfolio_10%) and firms that lie on the right decile of the CEO incentive pay distribution (Portfolio_90%). Alphas, which are estimated using three asset-pricing models, namely the CAPM, the Fama and French (1993) three-factor model and the Carhart (1997) four-factor model (see Section 4.3 for details), are reported separately for high-idiosyncratic-risk firms (Panel B) and low-idiosyncratic-risk firms (Panel C). Idiosyncratic risk is defined as the standard deviation of the residuals derived by the CAPM (see Section 5.2 for details). Firms that exhibit a high-above-median (low-below-median) standard deviation in the residual term are classified as high- (low-) idiosyncratic-risk firms. In Panel D, we augment the asset-pricing models (CAPM, Fama/French and Carhart) with the idiosyncratic-risk factor (IVOL) and consider alphas relative to the resulting two/four/five-factor model. Details on the construction of the IVOL (monthly) factor are provided in Section 5.2. All *t*-statistics are constructed using Newey–West standard errors corrected for heteroscedasticity and serial correlation.

Panel A: Exposure to idiosyncratic risk			
	Portfolio_10% Low CEO incentive pay firms	Portfolio_90% High CEO incentive pay firms	Difference (p-value)
Average idiosyncratic risk	0.056	0.051	0.005 (0.00)
Panel B: High-idiosyncratic-risk firms			
	(1)	(2)	(1)–(2)
	Portfolio_10%	Portfolio_90%	
CAPM alpha (% p.a.)	8.81	−6.14	14.95**
	(0.94)	(−0.85)	(2.50)
Fama–French alpha (% p.a.)	3.34	−10.97**	14.31**
	(0.59)	(−2.47)	(2.44)
Carhart alpha (% p.a.)	4.65	−6.67	11.32*
	(0.82)	(−1.57)	(1.90)
Panel C: Low-idiosyncratic-risk firms			
	(1)	(2)	(1)–(2)
	Portfolio_10%	Portfolio_90%	
CAPM alpha (% p.a.)	9.20**	6.67***	2.53
	(2.37)	(2.98)	(1.00)
Fama–French alpha (% p.a.)	7.20**	5.99***	1.21
	(2.24)	(3.10)	(0.52)
Carhart alpha (% p.a.)	6.97**	7.28***	−0.31
	(2.18)	(3.80)	(−0.12)
Panel D: IVOL–augmented asset-pricing models (All firms)			
	(1)	(2)	(1)–(2)
	Portfolio_10%	Portfolio_90%	
CAPM & IVOL alpha (% p.a.)	5.64	0.26	5.38
	(0.91)	(0.10)	(1.46)
Fama–French & IVOL alpha (% p.a.)	5.42	0.01	5.41
	(1.29)	(0.01)	(1.56)
Carhart & IVOL alpha (% p.a.)	5.71	2.61	3.10
	(1.40)	(1.06)	(0.86)

* Indicates statistical significance at the 10% level.
** Indicates statistical significance at the 5% level.
*** Indicates statistical significance at the 1% level.

Portfolio_10% and Portfolio_90% in the sub-groups of high-idiosyncratic-risk firms (Panel B of Table 7) and low-idiosyncratic-risk firms (Panel C of Table 7). We find evidence of a high and statistically significant spread in the sample of high-idiosyncratic-risk firms. This ranges from 11.32% under the Carhart model to 14.95% under the CAPM model. Interestingly, the spread appears to be very small and not statistically different from zero in the sample of low-idiosyncratic-risk firms. These results go through when different cut-off points are used for classifying firms into high- and low-idiosyncratic-risk groups (e.g. 25% and 75% percentiles; results are available upon request).

The results in Panel D of Table 7 also suggest that the outperformance of low-incentive-pay firms can, to a large extent, be explained by their exposure to idiosyncratic risk. Specifically, firms in the lowest incentive-pay decile earn an abnormal return of 5.64% ($t = 0.91$) once the idiosyncratic risk factor (IVOL) is added to the CAPM model. The corresponding abnormal return implied by the CAPM itself is much higher at 10.37% ($t = 1.96$) (see Table 5). This pattern is also observed when comparing the alphas from the Fama–French and Carhart models with those from the IVOL–augmented Fama–French and Carhart models. Importantly, the spread between low-incentive-pay and high-incentive pay firms decreases and becomes statistically insignificant once the idiosyncratic-risk factor is added to the CAPM, Fama/French and Carhart models. Taken together, the results in this section support the view that the outperformance of low-incentive-pay firms can be largely explained by their exposure to a higher level of idiosyncratic risk.

5.3. Portfolio returns at lower frequencies

In this section we examine whether the performance differences between low-incentive-pay and high-incentive-pay firms are driven by the frequency over which returns are calculated. We present results that are based on cumulative abnormal returns in the year before and up to three years after the portfolio construction, referring to firms that are in the bottom and top deciles of CEO compensation. We restrict our attention to portfolios ranked on the basis of CEO incentive pay, which were previously reported to differ substantially in terms of their performance according to monthly returns. Firms are sorted each year on the basis of their raw and industry- and size-adjusted incentive pay.[25] Panels A and B of Table 8 report equally-weighted raw and risk-adjusted portfolio returns for Portfolio_10% and Portfolio_90%, respectively. We construct cumulative returns over the following frequencies: one month (+1 m), three months (+3 m), 6 months (+6 m), one year (+12 m), two years (+24 m) and three years (+36 m). While calculating cumulative returns, we still allow for a 6-month gap between the financial year-end and the calculation of the first portfolio returns.

Similar to the results based on 1-month returns (see Tables 3–5), we observe some differences in the performance of the extreme decile portfolios, though they are not so pronounced. In particular, Portfolio_10% earns a statistically significant CAPM (Carhart) alpha of 11.09% (7.00%) p.a., while Portfolio_90% earns an insignificant CAPM (Carhart) alpha of 3.60% (4.33%) p.a. when a 3-month frequency is considered. The performance differences between Portfolio_10% and Portfolio_90% are also less clear-cut in the analysis based on a 6-month frequency. Specifically, Portfolio_10% earns a Carhart alpha of 7.26% p.a., while Portfolio_90% earns a Carhart alpha of 4.72% p.a. The findings also suggest that the outperformance of the lowest-incentive-pay firms completely diminishes for frequencies of 1 year or more (e.g. 12, 24 and 36 months).

Before drawing any conclusions from these results, a caveat must be noted. A common issue associated with the analysis of long-term abnormal returns following an event (in our case the classification of a firm into the top and bottom CEO pay deciles) relates to the difficulty to appropriately adjust for risk. As Kothari and Warner (2007) point out, even a small error in risk adjustment can make an economically large difference in the calculation of abnormal returns. Thus, our results based on lower frequencies must be interpreted with caution, and ideally evaluated jointly with the ones from returns at a monthly frequency.

When combined with the analysis at a monthly frequency, it is clear that Portfolio_10% and Portfolio_90% exhibit differences with respect to their stock market performance. Firms in the lowest incentive-pay decile exhibit higher post-ranking returns than firms in the highest incentive-pay decile. This suggests an almost complete reversal of the situation in the year leading to the compensation grant year, where firms with high incentive compensation also had significantly higher risk-adjusted returns. This performance reversal highlights the important role that information on CEO compensation plays in the determination of stock prices. The latter finding is also in line with Cooper et al. (2013) for US firms, who found that firms whose CEOs received the highest incentive pay also had significantly higher risk-adjusted returns in the year before portfolio formation.

5.4. Other explanations

We next investigate whether the negative link between CEO incentive pay and future stock returns is attributable to new CEO years. Firms may take the opportunity to adopt certain incentive-based compensation schemes at the inception of a new CEO's tenure. Such schemes may significantly affect future stock performance and, as a consequence, the interpretation of our results. To test for this possibility, we identify in our sample all CEO turnovers that have occurred each year over the period 1999–2010. We then exclude new-CEO years and re-estimate our main models. Our findings suggest that CEO turnover does not influence our findings. Specifically, we find that the spread between Portfolio_10% and Portfolio_90% is positive (at 7.79% under CAPM, 6.57% under the Fama–French model and 4.74% under the Carhart model) and remains statistically significant for most cases considered.[26]

Another explanation, which is used by Cooper et al. (2013) for their US-based findings, relates to CEO overconfidence. According to the overconfidence hypothesis, overconfident CEOs accept high levels of incentive pay and subsequently underperform both in terms of stock and operating performance. However, such hypothesis cannot be consistent with our findings. This is because the negative link between CEO incentive pay and stock returns is not driven by high-incentive-pay firms underperforming, but rather by low-incentive-pay firms outperforming.

6. Panel regressions of CEO pay on operating performance

Thus far, we have examined the link between CEO compensation and future shareholder returns. In this section we use panel-data methods to investigate the link between CEO pay and future operating performance. Following Cooper et al. (2013) we regress year-ahead return on assets (ROA) on lagged excess compensation and a set of firm, director and board characteristics that have been previously suggested as important drivers of performance. These characteristics include firm size, leverage, CEO tenure, CEO duality, board size, proportion of non-executive directors on the board, executive director ownership and ownership concentration, among others. For robustness purposes, we also estimate our panel-data models using return on capital employed (ROCE) as an alternative proxy of operating performance.[27] The main explanatory variables are the lagged (industry- and size-adjusted) measures of cash and incentive pay. The use of lagged regressors helps mitigate the causality problem, which may

[25] For the sake of brevity, we only report the results based on size- and industry-adjusted compensation measures. The results are similar when raw measures of compensation are used (available upon request).
[26] Analytical results are available upon request.
[27] ROCE-based regressions allow a comparison with other UK studies that focus on the determinants of firm profitability (see Zalewska, 2013).

Table 8
Adjusted CEO incentive compensation and shareholder returns: Different return frequencies.
This table reports annualized cumulative returns for firms in the top and bottom deciles of CEO-incentive-pay during the period 1999–2010. For the portfolio construction, industry- and size-adjusted measures of CEO-incentive-pay are used. Panel A reports equally-weighted (EW) raw and risk-adjusted returns (CAPM alpha, Fama–French alpha and Carhart alpha) for firms in the bottom decile of incentive pay (Portfolio_10%). Panel B reports the results for firms in the top decile of incentive pay (Portfolio_90%). We calculate the cumulative returns for Portfolio_10% and Portfolio_90% over the following frequencies: 12 months before (−12 m), one month (+1 m), three months (+3 m), 6 months (+6 m), one year (+12 m), two years (+24 m) and three years (+36 m) after the portfolio construction. While calculating cumulative returns after the portfolio formation, we allow for a 6-month gap between financial year-end and the calculation of the first portfolio returns. *t*-statistics (in parentheses) are constructed using Newey–West standard errors corrected for heteroscedasticity and serial correlation.

	Frequency in months (m)						
	−12 m	+1 m	+3 m	+6 m	+12 m	+24 m	+36 m
Panel A: Firms in the lowest decile of CEO incentive pay (Portfolio_10%)							
EW returns (% p.a.)	12.12***	15.14**	16.25***	17.12***	12.54***	9.83***	8.93***
	(4.85)	(2.25)	(3.39)	(4.20)	(4.90)	(5.11)	(6.13)
CAPM alpha (% p.a.)	5.57***	10.37*	11.09**	11.78**	7.29***	4.91***	4.82***
	(2.72)	(1.96)	(2.15)	(2.37)	(2.94)	(3.12)	(3.17)
Fama–French alpha (% p.a.)	2.67*	6.58**	7.29***	7.59***	4.52***	1.81**	2.07***
	(1.66)	(2.34)	(2.84)	(4.03)	(4.75)	(2.41)	(3.36)
Carhart alpha (% p.a.)	3.52**	7.26**	7.00***	7.26***	3.49***	0.03	−0.50
	(2.11)	(2.55)	(2.75)	(3.68)	(3.18)	(0.04)	(−0.66)
Panel B: Firms in the highest decile of CEO incentive pay (Portfolio_90%)							
EW returns (% p.a.)	17.44***	7.77	8.59**	9.95**	9.63***	8.12***	5.78***
	(6.67)	(1.17)	(1.97)	(2.53)	(3.16)	(3.66)	(4.22)
CAPM alpha (% p.a.)	11.11***	2.78	3.60	3.96	3.55**	2.81***	1.51**
	(4.25)	(0.84)	(1.24)	(1.51)	(2.03)	(2.77)	(2.29)
Fama–French alpha (% p.a.)	8.73***	0.66	1.76	2.48	2.46**	1.27	0.83
	(5.96)	(0.25)	(0.74)	(1.22)	(2.27)	(1.38)	(1.24)
Carhart alpha (% p.a.)	8.99***	3.00	4.33	4.72**	3.29**	1.52	0.16
	(4.29)	(1.10)	(1.63)	(2.20)	(2.37)	(1.42)	(0.22)

* Indicates statistical significance at the 10% level.
** Indicates statistical significance at the 5% level.
*** Indicates statistical significance at the 1% level.

arise if boards design CEO pay (e.g. level of incentive pay) on the basis of past performance. Another reason why causality does not seem to be an important issue in our analysis is the high (time-series) variability in excess pay. We estimate the average autocorrelation of total pay, direct pay and incentive pay. In all cases, the average (1-year lag) autocorrelation is very low (at 0.17, 0.14 and 0.19, respectively). Such levels of autocorrelation suggest a high variability for all measures of excess pay.

Table 9 presents the results from three different fixed-effect estimators: i) the White (1980) estimator that corrects for heteroscedasticity, ii) the Rogers (1993) estimator that produces cluster-robust standard errors and iii) the Driscoll and Kraay (1998) estimator, which produces standard errors that are heteroskedasticity- and autocorrelation-consistent, and also robust to general forms of cross-sectional dependence.[28] An alternative estimator that simultaneously corrects standard errors for heteroscedasticity, autocorrelation and cross-sectional correlation is the one by Beck and Katz (1995).[29] However, given the nature of our panel (large cross-sectional dimension N compared to the time dimension T), we prefer the Driscoll and Kraay (1998) estimator to the one proposed by Beck and Katz (1995). This is because the latter estimator can be rather imprecise if the ratio T/N is small (Hoechle, 2007).

Panel A of Table 9 presents the results based on ROA while Panel B those based on ROCE.[30] The results are quite robust across the three estimators. We find strong evidence supporting the view that CEO incentive pay is significantly negatively related to forward one-year operating performance. This suggests that high CEO incentive pay leads not only to lower shareholder returns but also to lower operating performance. The latter finding is consistent with the evidence provided by Cooper et al. (2013) for US firms. Interestingly, we also find that CEO cash pay is positively associated with our two measures of future operating performance, which is also in line with Cooper et al. (2013). The positive link between cash pay and ROA/ROCE also supports Hayes and Schaefer's (2000) argument that boards reward top executives for value-maximizing actions with effects that have not materialized yet, but are likely to be observed in future performance (e.g. next year's earnings). Concerning our control variables, we find that most enter with the expected sign. For example, CEO tenure is positively associated with ROA/ROCE (and is statistically significant in 5 out of 8 estimated models), which possibly reflects the fact that good CEOs usually stay longer in their job (see Zalewska, 2013). The negative coefficient on board size confirms the evidence by Yermack (1996) that financial ratios related to profitability decline as board size grows. Moreover, the estimated coefficient on firm size is positive, which is also in line

[28] Hoechle (2007) provides an excellent discussion on the strengths and limitations of several panel data estimators, including those used in our study.
[29] It has been shown that this estimator performs well in relatively small panels (see Zalewska, 2013 for an application using UK panel data and also the simulated evidence by Hoechle, 2007).
[30] All variables, except for ROA, ROCE and leverage, are winsorized to the 1st/99th percentiles to moderate the influence of outliers on estimated coefficients. ROA and ROCE are winsorized to −200% and leverage to 100% for the same reason.

Table 9
Panel regressions of CEO compensation on operating performance.
This table presents results from panel regressions where one-year forward ROA (Panel A) and one-year forward ROCE (Panel B) are regressed on lagged industry- and size-adjusted cash/incentive pay, and other lagged control variables. For the estimation, we use three different fixed-effects estimators: i) the White (1980) estimator that corrects for heteroscedasticity (models 1 and 5), ii) the Rogers (1993) estimator that produces cluster-robust standard errors (models 2 and 6) and (iii) the Driscoll and Kraay (1998) estimator, which produces standard errors that are heteroskedasticity- and autocorrelation-consistent, and also robust to general forms of cross-sectional dependence (models 3, 4, 7 and 8). Detailed definitions for the industry/size-adjusted compensation measures are provided in Section 3. All other variables are defined in the note to Table 2.

Standard errors (S.E.)	Panel A: One-year forward ROA (models 1–4)				Panel B: One-year forward ROCE (models 5–8)			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	White	Rogers	Driscoll–Kraay	Driscoll–Kraay	White	Rogers	Driscoll–Kraay	Driscoll–Kraay
Leverage	0.250***	0.250***	0.250***	0.262***	0.366***	0.366***	0.366***	0.386***
	(5.05)	(5.45)	(3.70)	(2.80)	(4.56)	(4.94)	(5.79)	(4.07)
Firm size	0.608	0.608	0.608	0.170	1.116*	1.116**	1.116**	0.714
	(1.07)	(1.08)	(1.28)	(0.38)	(1.79)	(1.99)	(2.02)	(1.42)
CEO tenure	0.142	0.142	0.142**	0.148**	0.292*	0.292	0.292***	0.282***
	(1.18)	(0.87)	(2.27)	(2.19)	(1.66)	(1.43)	(2.85)	(2.59)
CEO duality	1.109	1.109	1.109	−2.662	−0.191	−0.191	−0.191	−4.066
	(0.44)	(0.55)	(0.62)	(−1.42)	(−0.05)	(−0.04)	(−0.07)	(−1.41)
Non-executive dirs	−0.057	−0.057	−0.057*	−0.074**	−0.104	−0.104	−0.104**	−0.117**
	(−1.10)	(−1.11)	(−1.72)	(−2.31)	(−1.37)	(−1.30)	(−2.04)	(−2.46)
Board size	−1.807***	−1.807***	−1.807***	−1.861***	−2.953***	−2.953***	−2.953***	−3.161***
	(−5.21)	(−4.56)	(−10.52)	(−6.54)	(−5.71)	(−5.48)	(−10.61)	(−12.51)
Executive ownership	−0.153**	−0.153***	−0.153**	−0.034	−0.173*	−0.173***	−0.173	−0.087
	(−2.22)	(−3.03)	(−2.53)	(−0.47)	(−1.88)	(−3.00)	(−1.64)	(−0.74)
Owner-concentration	0.042	0.042	0.042	−0.006	0.064	0.064	0.064	0.058
	(0.10)	(0.14)	(0.08)	(−0.13)	(1.01)	(1.17)	(0.90)	(0.85)
CEO incentive pay	−0.001**	−0.001***	−0.001**	0.0001	−0.001**	−0.001***	−0.001**	0.0003
	(−2.31)	(−3.17)	(−2.16)	(0.54)	(−2.48)	(−2.98)	(−2.10)	(1.22)
CEO cash pay	0.008***	0.008***	0.008***	0.005***	0.015***	0.015***	0.015***	0.013***
	(6.73)	(7.54)	(13.51)	(14.31)	(8.07)	(6.39)	(14.39)	(7.29)
ID_RISK_HIGH	–	–	–	−3.200**	–	–	–	−4.481***
				(−2.49)				(−3.74)
ID_RISK_HIGH × CEO incentive pay	–	–	–	−0.001***	–	–	–	−0.001***
				(−2.82)				(−2.67)
ID_RISK_HIGH × CEO cash pay	–	–	–	0.006***	–	–	–	0.006***
				(6.12)				(5.07)
Time dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry clusters	–	Yes	–	–	–	Yes	–	–
Number of obs	6418	6418	6418	5567	6418	6418	6418	5567
R-squared	0.06	0.06	0.06	0.08	0.09	0.09	0.09	0.11

* Indicates statistical significance at the 10% level.
** Indicates statistical significance at the 5% level.
*** Indicates statistical significance at the 1% level.

with Yermack's (1996) findings. However, the coefficient on firm size is only statistically significant in models 5–7. Finally, the positive coefficient on leverage is against the view that high leverage signals financial distress and hence may lead to underperformance (see Opler and Titman, 1994). A potential explanation of our finding stems from the monitoring/disciplinary role of debt. As Jensen (1986) notes, a relatively high leverage ratio increases performance by forcing managers to take difficult value-maximizing actions, which they would otherwise avoid.

We then test whether the relationship between CEO pay and operating performance varies across high- and low-idiosyncratic-risk firms. We introduce a dummy variable that takes the value of 1 for high-idiosyncratic-risk firms, as defined in Section 5.2, and 0 otherwise (*ID_RISK_HIGH*). We then construct two interaction terms, "*ID_RISK_HIGH* × *CEO_Incentive_Pay*" and "*ID_RISK_HIGH* × *CEO_Cash_Pay*", which are included in our model as additional explanatory variables. The results, which are presented in models 4 and 8, suggest that the negative association between CEO incentive pay and operating performance is driven by high-idiosyncratic-risk firms. Specifically, the coefficient on the interaction term "*ID_RISK_HIGH* × *CEO_Incentive_Pay*" is negative and statistically significant. Conversely, the coefficient on the variable "*CEO incentive pay*" is not statistically different from zero. Moreover, the results of these models suggest that the positive impact of CEO cash pay and ROA/ROCE is more pronounced in high-idiosyncratic-risk firms (i.e. the coefficient on the interaction term "*ID_RISK_HIGH* × *CEO_Cash_Pay*" is positive and statistically significant).

We conduct several tests to ensure the robustness of our results. First, we investigate whether our results are driven by family firms. This test is motivated by recent evidence showing that family firms differ from non-family firms in terms of compensation-design and profitability (see Li et al., 2012; Scholes et al., 2012).[31] In doing so, we eliminate from the sample all

[31] In our sample, it is likely that most family (listed) firms are concentrated at the lower part of the CEO-incentive-pay distribution. This is because family firms usually possess characteristics that are also observed in our low-incentive-pay group of firms e.g. *i*) they rely less on performance-based compensation and ii) they are more exposed to a higher level of idiosyncratic risk (see Li et al., 2012 for some recent evidence).

firms with ownership concentration exceeding 25%.[32] We choose this threshold because the European definition of a public family firm stipulates that 25% of the equity is owned by the family (Scholes et al., 2012). After imposing this restriction, which possibly rules out all family firms from the sample, we re-estimate our panel regressions. The results support a strong negative link between CEO incentive pay and future performance. For robustness purposes, we perform the same exercise using alternative definitions of ownership concentration (e.g. the sum of the stakes of a firm's shareholders with equity ownership greater than 5%) and different ownership concentration thresholds (e.g. 20%). Finally, we replace the variable "executive ownership" with the variable "CEO ownership" in models 1–9. The rationale behind the inclusion of CEO ownership in the model is that the percentage of equity ownership held by the CEO may work as a substitute for incentive pay. In all cases, our results remain qualitatively similar to those reported in Table 9 (all unreported results are available upon request). Taken together, the results in this section support the view that in addition to its negative relationship with returns, CEO incentive pay is also inversely associated with future operating performance. Furthermore, the negative link between CEO incentive pay and ROA/ROCE is more pronounced in firms with high idiosyncratic risk.

7. Conclusion

An important and highly debated topic in corporate finance is whether the level and structure of CEO pay in large companies serve the interests of both managers and shareholders. Existing research provides mixed evidence on this issue. The recent financial crisis has also revealed severe flaws in corporate compensation practices (e.g. a weak link between executive pay and corporate performance), which resulted into an intense debate about whether cross-sectional variations in CEO pay can be fully justified by economic fundamentals.

This study is designed to contribute to this debate by analyzing CEO pay from an *ex-post* perspective; we hypothesize that high compensation contracts induce senior managers to exert costly effort to increase their firms' future growth opportunities, eliminating in this way agency problems and improving future shareholder returns. This hypothesis is tested using a large sample of firms listed on the LSE over the period 1998–2010.

Our results indicate a strong negative relationship between CEO incentive pay and subsequent shareholder returns. Firms that pay their CEO excessive fees (in comparison to those of peer firms in the same industry and size group) earn significantly lower risk-adjusted returns. To illustrate the return differential, an investment strategy of buying firms in the lowest 2% of the incentive-pay distribution and selling short firms in the highest 2% of the incentive-pay distribution would have earned monthly abnormal returns of more than 11% p.a. during the sample period. Interestingly, this suggests a reversal of the situation in the year leading to the compensation grant year, where firms with high incentive compensation also had significantly higher risk adjusted returns. The latter result highlights the important role that information on CEO compensation plays in the determination of stock prices. Our results also suggest that the outperformance of low-incentive-pay firms can be largely explained by their exposure to a higher level of idiosyncratic risk. Finally, evidence from panel regressions suggests that, in addition to its negative relationship with returns, CEO incentive pay is inversely associated with future operating performance.

Our study can be extended in several directions. An obvious extension would be the investigation of the individual components of CEO-incentive-pay (e.g. options, LTIPs, other non-cash compensation) and their impact on future shareholder returns. This analysis would help determine the components of incentive pay that are responsible for the negative relationship between incentive pay and shareholder returns as documented in this paper. Exploring the drivers of the negative relationship between incentive pay and operating performance is also a natural subject for future research. Previous studies document that undiversified manager's optimal policies differ from the policies that would be chosen by a diversified shareholder (see Armstrong and Vashishtha, 2012; Panousi and Papanikolaou, 2012). It remains to be investigated whether, and to what extent, equity-based compensation leads to suboptimal corporate policies (e.g. underinvestment) and a subsequent deterioration in operating performance.

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[32] Ownership concentration is defined as the sum of the stakes of a firm's shareholders with equity ownership greater than 10%. For robustness, we also employ alternative definitions of this variable.

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