ISSN 2042-2695

CENTRE for ECONOMIC PERFORMANCE

CEP Discussion Paper No 1439

Revised August 2018
(Replaced July 2016 version)

CEO Pay and the Rise of Relative Performance Contracts: A Question of Governance?

Brian Bell
Simone Pedemonte
John Van Reenen

LSE THE LONDON SCHOOL OF ECONOMICS AND POLITICAL SCIENCE

E·S·R·C ECONOMIC & SOCIAL RESEARCH COUNCIL

Abstract
Would moving to relative performance contracts improve the alignment between CEO pay and performance? To address this, we exploit the large rise in relative performance awards and the share of equity pay in the UK over the last two decades. Using hand-collected data from annual reports on explicit contracts, we find that despite these changes: (1) CEO pay still responds more to *increases* in the firms' stock performance than to decreases. Moreover, this asymmetry is stronger when corporate governance is weak; (2) "pay-for-luck" persists as remuneration increases with random positive shocks, even when the CEO has equity awards that explicitly condition on firm performance relative to peer firms in the same sector. We show that a major reason why explicit relative performance contracts do not eliminate pay for luck is that CEOs who fail to meet the terms of their past performance awards are able to obtain more generous new equity rewards in the future. Moreover, this is stronger when the firm has weak corporate governance. These findings suggest that reforms to the formal structure of CEO pay contracts are unlikely to align incentives in the absence of strong shareholder governance.

Keywords: CEO pay, incentives, equity plans
JEL Classifications: J33; J31; G30

This paper was produced as part of the Centre's Growth Programme. The Centre for Economic Performance is financed by the Economic and Social Research Council.

Acknowledgements
We are grateful to Richard Belfield, Bob Gibbons, Bengt Holmstrom, Louis Kaplow, Kai Li, Bob Pindyck and participants in seminars at ECB, Harvard, the IZA/SOLE Conference, LSE, MIT, NIESR, Oxford, Sheffield, RES, Towers Watson and UBC Finance for helpful comments. This research was funded by the ESRC at the Centre for Economic Performance.

Brian Bell, King's Business School and Centre for Economic Performance, London School of Economics. Simone Pedemonte, Department of Economics, University of Oxford. John Van Reenen, Sloan School of Management & Department of Economics, MIT, Centre for Economic Performance, London School of Economics and NBER.

Published by
Centre for Economic Performance
London School of Economics and Political Science
Houghton Street
London WC2A 2AE

I. INTRODUCTION

CEO pay is rarely out of the news. The remuneration of CEOs and other senior executives has risen much faster than that of ordinary workers. For S&P500 firms, the average CEO made 31 times the wage of the average production worker in 1970 (26 times for the median CEO), 325 by 2008 and 347 in 2016.[1] Although pay levels are lower in the UK, the trends are similar. Figure 1 shows that in our data CEO pay was about 160% larger in real terms in 2014 than 1999 compared to a 10% rise for the median worker. This continues a longer-term trend: the ratio of median FTSE-100 CEO pay to median UK wages has risen from about 11 in 1980 to 96 in 2014.[2]

CEO pay could have risen purely because of competitive forces such as a stronger market for superstars caused by globalization and technological change (e.g. Edmans and Gabaix, 2016; Gabaix and Landier, 2008; Rosen, 1981). However, other factors may also play a role as attested by many corporate governance scandals. In this paper, we use UK publicly listed firms as a case study because since the late 1990s, there has been a major shift towards rewarding CEOs based on *relative* performance. [3] A typical plan is to grant executives equity conditional on improving shareholder returns relative to a peer group of large firms in the same sector (e.g. being among the top quartile of performers over a three-year period). These relative performance contracts contrast to more standard US-style stock option contracts that are based on general improvements in equity prices. Almost no equity awards are now made to UK CEOs that do not have a performance condition attached to them.

It has long surprised economists that such relative long-term incentive plans (LTIPs) are uncommon (Holmstrom, 1979, 1982).[4] Relative performance plans are designed to reduce the problem that CEO remuneration could increase merely because of positive shocks to the firm unrelated to executive effort or ability. Figure 2 shows that at the start of our sample around 20% of total pay was in the form of LTIPs, rising

[1] Conyon et al. (2011) and https://aflcio.org/paywatch

[2] Conyon, Gregg and Machin (1995) show that the median pay of the highest paid directors in FTSE-100 companies was £63,000 in 1980, compared to median wages of £5,400. By 2014, the median pay of this set of directors was £2.61m according to our data, while median wages had risen to £27,215.

[3] The move to relative performance plans arose from the recommendations of several high profile 1990s Commissions such as the 1995 Greenbury Report. http://en.wikipedia.org/wiki/Greenbury_Report. See also the 1992 Cadbury Report and 1998 Hampel Report.

[4] Using indirect methods relating relative firm to industry performance Gibbons and Murphy (1990) find some evidence for their use in large US firms in the 1970s and 1980s, but Aggarwal and Samwick (1999) find little evidence for them in the 1990s.

to 30% by the end of the sample. Of these awards, the share that used a sector comparator rose from a quarter to 40%, with the remainder using a general comparator e.g. the FTSE-100 companies. US corporations have also been moving towards these plans, but at a slower rate. De Angelis and Grinstein (2016) report that although the trend is upwards, by 2007 only 30% of S&P 500 firms used some form of relative performance evaluation in at least part of their CEO pay package (Gong et al, 2011, estimate the figure to be 25% for the wider group of S&P 1500 firms). As an early adopter, the UK experience can shed light on the efficacy of such plans.

We use original data on explicit CEO contracts covering just under 500 publicly listed firms accounting for almost 90% of UK stock market value between 1999 and 2015. First, we show that there is a strong relationship between CEO pay and performance but that it is asymmetric – pay responds more to *increases* in firm performance than to decreases.[5] Further, this protection on the downside occurs only when there is weak external control (as proxied by lower institutional ownership and an explicit measure of corporate governance). Second, there is substantial "pay for luck" with CEO pay increasing when the industry experiences a random positive shock even when the CEO is subject to relative *sector* LTIPs. An important reason for this surprising result is that CEOs in weakly governed firms who fail to meet the terms of their existing LTIPs are able to obtain deals that are more generous on their *future* LTIPs. We show that these future LTIPs are re-designed to the benefit of the CEO, by including multiple performance criteria, for example, which makes them more likely to vest.

One explanation for our findings is that CEO remuneration plans are sufficiently complex that shareholders have difficulty effectively monitoring the contracts. Our results suggest that reform of CEO pay is not achieved simply by altering the structure and terms of rewards. Governance matters more than formal contract structure, which implies that government policies to mandate contractual forms are likely to be gamed. More attention needs to be focused on how to improve governance than on formal contractual details.

Related Literature. Our paper is in the CEO pay-performance tradition (Baker, 1939; Jensen and Murphy, 1990). Surveys by Frydman and Jenter (2010) and Bertrand

[5] Garvey and Milbourne (2006) find some evidence of this in US data. Daniel et al (2016) claim to find no asymmetry when they use a wider definition of pay that includes all sources of shareholder wealth.

(2009) conclude that there is a positive, statistically significant relationship between CEO pay and shareholder returns (and accounting measures of performance such as profitability and sales growth). This link exists for most time periods and across most countries, and there appears to have been an increase in the sensitivity of pay to performance over time as CEO compensation has tilted toward a more incentive-based structure (see Hall and Liebman, 1998). The interpretation of this empirical pay-performance link is more controversial. It may be the outcome of an optimal contract between principal and agent or it could, at least partially, reflect the exercise of managerial power to extract rents (e.g. Bebchuk and Fried, 2004; Djankov et al, 2008).

Various pieces of evidence suggest that corporate governance and external control matters for CEO pay. Hartzell and Starks (2003) show that institutional ownership concentration is positively related to the pay-performance elasticity and negatively related to the level of pay, whilst Core et al. (1999) find that the proportion of non-executives on the Board is associated with lower levels of CEO pay.[6] Bertrand and Mullainathan (2001) find that their "pay for luck" effect is substantially attenuated when there is stronger external control – as measured by the number of large shareholders of the firm. This result has also been found in Garvey and Milbourn (2006). Some other papers have looked at the peer groups of firms used by corporations when they set CEO compensation. Faulkender and Yang (2013), for example, show that such peers are chosen strategically to drive up CEO pay, especially in the weakly governed firms (consistent with the results we will present below). However, these are generally not explicit contracts tied to relative performance, which is the focus of our paper.

The paper is structured as follows. Section II discusses data, Section III reports our main results, Section IV provides some extensions and robustness tests, while our conclusions are in Section V.

II. DATA

Our main data on pay comes from Boardex, which provides annual data from the Remuneration report of all listed UK companies. This database is essentially the UK equivalent of the US ExecuComp database. The data cover all Board executives within

[6] Ryan and Wiggins (2004) demonstrate that it is also associated with a stronger pay-performance link.

the firm and reports base salary, cash and share bonuses, and details of all equity awards - regular stock options and Long-Term Incentive Plan awards. We supplemented this data by hand-collecting from the Annual Reports more detail on each equity award (e.g. grant date, performance condition, performance comparator group) and we also track each award through to the vesting date to determine the outcome of the award. From these sources, we define three alternative measures of pay (further details in Appendix A):

1. **Cash Pay** = Salary + Bonus (Cash Bonus + Face Value of Deferred Bonus Shares)
2. **New Pay** = Cash Pay + Expected Value at Grant Date of New Equity Awards (regular stock options and LTIPs)
3. **Total Pay** = New Pay + Change in Expected Value of previously granted Equity Awards that have not yet been vested or exercised.

To give an idea of a typical LTIP award and how we value it *ex ante* consider the sector LTIP award made to the Vodafone CEO, Arun Sarin, on July 28th 2004 (see Figure 3). The CEO was awarded 2,016,806 shares in an LTIP share plan, with a face value of £2.4m (share price of 119p on the grant date). The 2005 annual report (which recorded the 2004 award) provides details of the vesting schedule and the set of firms that made up the comparison group (29 firms in the FTSE Global Telecom index). If the Total Shareholder Return (TSR) of Vodafone over the subsequent three years was below the median of the comparison group, no shares would vest. TSR performance in the top quintile would result in full vesting and a sliding (though not linear) scale operates between the median and 80th percentile. In the event, on July 28th 2007, 576,806 shares vested and 1,440,000 were forfeit (i.e. 28.6% of the award vested) as TSR performance was in the 53rd percentile. To value the award on grant date, we take the face value of the award and adjust downward for two effects. First, we use the history of all LTIP plans to determine the average vesting percentage – this gives us an approximate estimate of what probability the CEO should assign to actually obtaining the shares at vesting date[7]. Second, we adjust for the probability that the CEO will leave

[7] Alternative assumptions about vesting probabilities such as using rolling or recursive historical outcomes or industry-specific outcomes does not substantively change any of our results.

the firm during the performance evaluation period and thus lose the shares (or at best have them pro-rated). Appendix A discusses this in more detail and reports on various robustness tests. For regular stock options that have no performance conditions (which are rare in our data), we value using a standard Black-Scholes formula.

Our sample is comprised of the 300 largest publicly listed UK-domiciled firms each year from 1999 to 2015, representing on average 94% of the market capitalization of the UK stock market. This gives a total sample of 498 firms. We then match these 498 firms to the Boardex database and obtain 472 matches with pay data, representing around 85% of total market capitalization.[8] We have a final sample of 1,201 CEOs. For all these firms we also have annual company account data and stock price data merged in from Thompson Datastream. These relate to the worldwide-consolidated activity of the firm and enable us to construct standard measures of firm performance such as shareholders' return, profitability and revenues per worker. Table 1 reports some summary statistics for CEO pay and company-level data. The average total package for CEOs over the sample period was £1.64m (about $2.6m). As shown in Figure 1, this average masks a strong trend over the period with average pay rising from £0.9m to £1.9m. For the median CEO, base salary accounts for almost half of remuneration, with bonuses and new equity accounting broadly equally for the other half.

III. MAIN RESULTS

III.A. Firm-Level Pay-Performance Regressions

Our basic estimation equations are of the form:

$$ln(pay)_{ijt} = \alpha_{ij} + \sum_{k=0}^{K} \beta_k \mathrm{PERF}_{\mathrm{jt-k}} + \tau_t + \varepsilon_{ijt} \quad (1)$$

where $\ln(pay)_{\mathrm{ijt}}$ is the total remuneration of CEO *i* at firm *j* at time *t*, α_{ij} is a CEO-firm match-specific fixed effect (hence absorbing both the time invariant CEO and firm effect), τ_t are time dummies, ε_{ijt} is an error term and $PERF$ is the measure of firm performance – total shareholder returns (*TSR*) as a measure of firm value. We allow

[8] We fully match every firm to a Boardex identifier. The 26 firms without pay data are generally those that delisted at some point in 2001 or 2002 and appear not to have had their remuneration reports entered or archived by Boardex – see Appendix A for more details.

both for the contemporaneous association of pay and performance as well as lagged effects (our baseline specification is $K = 2$, but we also experimented with alternative dynamic forms). The model is estimated by within groups (i.e. including a full set of firm-by-CEO match effects) with standards errors clustered at the firm level (except when we use industry-level instrumental variables, where we cluster at the industry level). We also present specifications where we first-difference equation (1) instead of just including a full set of firm-CEO match effects which is useful when we want to explore asymmetries of pay related to positive and negative performance.

Table 2 contains OLS estimates of equation (1). To begin, the dependent variable is ln(New Pay), which measures the total flow compensation that the CEO receives in a given financial year. These results are therefore identical to the standard pay-performance regressions in the CEO literature. The pay-performance elasticity with respect to shareholder returns is estimated at 0.152 and is highly significant.[9] We next decompose New Pay into base salary, bonus and the expected value of new equity and estimate equation (1) separately for each component of pay. The results show that the pay-performance link is mainly driven by the responsiveness of bonuses and new equity awards to shareholder returns. There is no relationship between base salary and performance. In contrast, there is a sizeable link with bonuses and new equity – a 10% rise in shareholder returns is associated with a 7% rise in the level of these components.

III.B. Asymmetrical Response of Pay to Performance

Does the CEO pay-performance relationship purely reflect market forces or are there corporate governance issues? We investigate this in two ways. First, we look at asymmetric responses in the pay-performance relationship, and then in sub-section III.C we look at the evidence of "pay for luck".

The idea behind the examination of asymmetry is whether CEO pay increases with positive firm performance but decreases by far less when performance declines. Furthermore, we are interested in whether this asymmetry is particularly strong when governance is weak. Our main proxy for governance is the impact of external shareholder control. Numerous studies have argued that pay in the boardroom is related to measures of corporate governance such as the proportion of independent directors or

[9] This is somewhat higher than other UK estimates. Conyon et al. (2011) have an estimate of 0.096 over the period 2003-08 and Ozkan (2009) reports an estimate of 0.093 over the period 1999-2005.

the existence of an independent remuneration committee. Aghion, Van Reenen and Zingales (2013) argue that institutional ownership is associated with better governance (as measured for example by the Gompers et al. (2003) IRRC index), because activist institutions such as pension funds typically have the ability and incentive to monitor CEOs more than dispersed owners. Our data on institutional ownership comes from Thomson Reuters Global Ownership files. The data we use relates to December of each year from 1997 and records the percentage of outstanding shares owned by all those with a shareholding larger than 0.015%. We calculate for each year the percentage of outstanding shares held by institutional investors. Across the sample as a whole, institutional investors account for 60% of share ownership – roughly the same as observed for the U.S. in the 2000s (Aghion et al., 2013). There is however significant variation across companies, with a standard deviation of 19%. We split the sample into quartiles based on average institutional ownership and focus on the difference between the lowest quartile of ownership (less than 48%) and the other three quartiles.[10]

First, we examine whether the estimated pay-performance link differs depending on institutional ownership. Column (1) of Table 3 repeats the basic CEO fixed-effect TSR regression from Table 2 for the slightly reduced sample for which we also have institutional ownership data. It shows an almost identical coefficient to the within group estimate of Table 2 (0.149 compared to 0.147). In column (2) we switch to a first-difference specification since we will subsequently want to examine asymmetries in the pay-performance relationship depending on whether returns are positive or negative and this is more naturally specified in first-differences. The coefficient in the first-difference specification is very close to that in the fixed-effect model.

Column (3) of Table 3 allows for an interaction between returns and whether the firm has high or low institutional ownership.[11] The link between pay and performance is much larger (and significant) for the high institutional ownership firms (0.227) than the low institutional ownership firms (0.030). In the next column we allow

[10] Nothing hinges on using quartiles or combining the highest three quartiles into one category. Results available on request show that the remaining three quartiles have very similar estimated coefficients and one cannot reject equality. Table A2 shows that there is little evidence of economically substantial differences between the low and high institutional ownership groups across observables such as sales, employment, market capitalisation or executive pay levels or growth rates.

[11] All regressions with institutional ownership effects also include a full set of interactions between the ownership dummies and the time dummies. The measure of institutional ownership is always lagged one period.

different pay-performance elasticities between positive and negative shareholder returns, by including an interaction between returns and an indicator equal to 1 if the growth was positive (ΔlnTSR(+)) and zero otherwise. Column (4) shows that there appears to be a marginally significant (and economically substantial) propensity to reward positive returns more favourably than negative returns are penalized looking at all firms together.

Column (5) of Table 3 generalizes the column (4) specification to allow the asymmetry of pay and performance to depend on our proxies for corporate governance. We find evidence that there is a significant asymmetry for the more "weakly governed" firms but not the strongly governed firms. We find that firms with weak governance reward positive returns with significantly higher pay (an elasticity of 0.298 = 0.430 – 0.132) but require no pay penalty for negative returns (an insignificant -0.132). In other words, for such firms the coefficients imply that a 10% increase in TSR is associated with 3% higher pay, whereas a 10% decrease has no significant penalty (if anything, a 1.3% gain). By contrast, the firms with higher institutional ownership appear to reward performance symmetrically (as the coefficient of -0.037 on the interaction is insignificant).

Figure 4 uses the coefficients from column (5) of Table 3 to illustrate this asymmetry for the high and low institutional investor categories separately. There appears to be a clear symmetry for Panel A (high institutional ownership) compared to Panel B (low institutional ownership) where CEOs do not seem to be "punished" for poor performance.

All these results relate to New Pay (i.e. salary plus bonus plus expected value of new equity awards). The asymmetry result is driven by the new equity awards since regressions that use cash pay (i.e. salary plus bonus) as the dependent variable do not show this asymmetry.[12] This is important since our results below will also point to the use of new awards to circumvent the relative performance contracts.

Institutional ownership is not a perfect proxy for governance (e.g. Schain and Stiebale, 2016), so we also consider an alternative measure of governance by using data from the Institutional Voting Information Service (IVIS). IVIS provides a detailed analysis of UK-listed companies in relation to the level of compliance with corporate

[12] Although they do still show a stronger link between pay and performance for higher institutional ownership firms

governance "best practice" (see Selvaggi and Upton, 2008, for more details[13]). Its main purpose is to assist subscribers with their voting decisions at the annual general meeting (e.g. approving the accounts, dividends, elections and remuneration of directors). IVIS draws up a list of key issues for investors to consider and highlights their seriousness using a colour-coded system. A "red-top" is used to indicate the strongest concern that a proposal does not comply with best practice, an "amber-top" indicates concern and a "blue-top" indicates no area of major concern. We use IVIS data from 1998-2014 and code a red-top as a 2, an amber-top as a 1 and a blue-top as a 0.[14] We average this score for each firm and split firms into "well governed" if this score is above the median and "poorly governed" if the score is below the median. In column (6) of Table 3 we use the IVIS measure as our indicator of corporate governance. Again, we cannot reject symmetry of the CEO pay-performance relationship for well-governed firms (a coefficient of -0.093 with a standard error of 0.067), whereas we do reject it for the poorly governed firms (a coefficient of 0.249 with a standard error of 0.094).

To check that these results are driven by governance and not some other correlated effect (like firm size), we repeated the analysis of Table 3 looking at interactions with other observables. For example, we constructed dummy variables based on whether the firm is in the lowest quartile or below median based on market capitalization, total employment, shareholder returns and lagged levels of CEO pay. In no case do we observe significant evidence of asymmetry in pay with respect to performance on any of these alternative categorizations.

Overall, we conclude that there is an asymmetry in rewards, with more benefits on the upside than the downside, driven by those firms with weak governance.[15]

III.C. CEO Pay for Luck: Instrumental Variable (IV) strategies

Another way to investigate the issue of whether the pay-performance relationship is all due to market incentives is to consider the extent to which CEOs are rewarded for luck. Consider the pay of oil company CEOs. Their pay is related to their

[13] The authors also use a subset of this data to examine the link between corporate governance and shareholder returns (in the spirit of Gompers et al., 2003)). They find that the shares of the well-governed firms have higher shareholder returns.

[14] This captures the fact that red-tops are substantially less-likely than amber-tops and thus signify significantly more concern. In our data, 8% of our observations are red-topped, and 21% are amber-topped. Our results are robust to using a 1/0 categorization instead.

[15] This result is in the same spirit as Harford and Li (2007) who find evidence that CEOs pursue excessive mergers and acquisitions to disguise under-performance and hence help break the pay-performance link.

firm's shareholder returns, but this in turn is strongly correlated with the price of oil. Since the oil price is easily observed and outside the control of the CEO, the standard Holmstrom and Milgrom (1987) result would argue that the firm should ensure no link between pay and the oil price. But in practice, the link is strong suggesting that CEOs are being partly rewarded for luck. Bertrand and Mullainathan (2001) show that US CEOs receive the same payoff to a "lucky dollar" of shareholder returns as they do to a general dollar of shareholder returns. Formally, this is illustrated by showing that the OLS estimate of the pay-performance elasticity is the same as the IV estimate using industry performance to instrument for firm performance.[16] Since the CEO cannot control industry performance, we can interpret the IV estimate as identifying those returns that are common to the industry i.e. luck.[17]

We follow this idea by instrumenting shareholder returns with the returns in the global industry (the Datastream Industrial Sub-Sector Global-ex-UK Index) but dropping the UK firms from this index to avoid a mechanical relationship (i.e. we construct the leave-out mean). For our 471 firms we have 92 such sub-sectors (we lose one firm for which we cannot match a global industry index). Column (1) of Table 4 uses Cash Pay (equal to salary plus bonus) as the dependent variable, while column (2) uses New Pay, which is cash plus the expected value of new equity awards (the measure used in Tables (2) and (3)). The coefficient on TSR is significant in both specifications and interestingly, the OLS and IV estimates are similar regardless of which pay concept is used. We cannot reject that the IV and OLS estimates in every column of Table 4 are equal at the 5% significance level.

In column (3) of Table 4, we use Total Pay as the dependent variable, which adds to New Pay the change in value of unexercised and unvested equity awards granted in previous years. The longer a CEO remains in their job, the quantitative significance of these prior awards rises. For every equity-based award (deferred shares, regular stock

[16] Many other instruments have been suggested in the literature. Blanchflower et al. (1996) focus on using lag structures, but potential external instruments have included firm-specific technological innovation (Van Reenen, 1996), import/export price shocks (Abowd and Lemieux, 1993, and Bertrand, 2004) and oil price shocks (Bertrand and Mullainathan, 2001). Card et al. (2014) instrument the value-added per worker of each firm (their measure of rents) by the value-added per worker of all firms in the same four-digit industry outside the region of Italy on which their analysis is conducted. The identifying assumption is then that industry demand shocks affect firm-level profitability but have no direct effect on local labour supply.

[17] Subsequent work has examined whether the pay-for-luck effect is asymmetric. Garvey and Milbourn (2006) show that CEO pay rises when firm performance increases due to good luck but does not go down to the same extent when firm performance decreases due to bad luck. By contrast, Daniel et al (2016) argue that this apparent asymmetry is a result of not controlling for firm size.

options, LTIPs) we record the grant-date information and then follow the award across subsequent annual reports to determine the ultimate outcome of the award (whether the original award vests and if so how much, and whether the vested award has been exercised). We then compute the annual revaluation of all previous equity awards that have not yet reached their vesting date. Since the change in the value of past awards is, at least in part, mechanically related to shareholder returns, it is unsurprising that in column (3) the coefficient on TSR increases substantially. This indicates that the pay-performance link is tighter than would be suggested by less comprehensive pay measures (as Hall and Liebman, 1998, also found for the US). Again though, the IV estimate is similar to the OLS.[18]

Therefore, across all columns in Table 4, CEO "pay for luck" appears very prevalent, just as in Bertrand and Mullainathan (2001).[19]

III.D. Do Sector LTIPs eliminate Pay for Luck?

The evidence of substantial CEO pay hikes from rises in industry TSR may appear surprising. The substantial corporate reforms in the UK in the late 1990s were supposed to explicitly control for improvements in the firm position that were due to industry-wide shocks. So, is it simply that the reforms failed in this objective or is something more complex going on? An obvious starting point is to focus on those LTIPs with an explicit sector performance hurdle. At a minimum, we would expect such awards to exhibit much less sector pay-for-luck. Thus, for all LTIP awards, we identify those that have at *least some part of the award* that vest only on the performance of shareholder returns relative to a sector benchmark. We term these sector LTIPs (and their converse non-sector or general LTIPs) – these are the splits shown earlier in Figure 2.

We now conduct the OLS/IV comparison of the previous sub-section for two outcomes: (1) the percentage of the LTIP award that ultimately vests and (2) the change in value of the LTIP from grant date to vest date. We are interested in the extent to which these two outcomes for CEOs successfully condition out the sector pay-for-luck

[18] If we were to add in the shares held voluntarily in the CEO's portfolio as a measure of "pay" the relationship would strengthen even further of course.

19 We have also investigated whether the pay-for-luck effect is larger in less well-governed firms. If we take the estimates in Column (3) of Table 4 and instrument returns allowing for a differential effect between strong and weak governance, we do find that the pay-performance elasticities are much closer when instrumenting than in the OLS specification. This is consistent with such an interpretation, though the effect is not statistically significant.

(i.e. the OLS coefficient being significantly larger than the IV coefficient). Table 5 reports the results. In Panel A, the results show that the percentage of the LTIP that ultimately vests is strongly correlated with firm returns, as one would expect. When we instrument firm returns with sector returns in columns (2) and (4), the IV coefficient for sector LTIPs drops substantially and is no longer significant at the 5% level.[20] By contrast, the non-sector LTIP IV coefficient is indistinguishable from the OLS coefficient – so as we would expect given their design, these LTIPs fail to condition out sector luck. Turning to Panel B however, we find that when we focus instead on the change in value of the LTIP from grant date to vest date, the sector LTIPs continue to reward sector luck to a significant extent – though even here there is attenuation of the sector luck component for sector LTIPs (column (2)) whereas this is not the case for non-sector LTIPs (column (4)).

Why do sector LTIPs seem to successfully remove most pay-for-luck in the probability of vesting but seem to do so much less successfully for the more important issue of overall pay? One reason may be that other components of pay are used to offset any penalty for the CEO associated with LTIPs failing to meet their performance hurdles. To test this hypothesis, we focus on the LTIPs that reach their vesting date and see whether there is any reaction to these events. The actually vesting outcome is fully known at the time to the firm. Suppose in a given financial year *t* there are a set of LTIPs, S_V, that reach their vesting date. For each of the LTIPs in this set, we can calculate the percentage of originally granted shares that actually vest. This is bounded between zero and one. If we have more than one LTIP in the S_V set, we can calculate a weighted percentage using the expected value at grant date as weights. We can then define a dummy variable, *LTIP_Fail* equal to 1 if this vesting percentage is less than 1 (i.e. not full vesting). We use the one-year lag of this indicator since the firm may not know for certain what will happen to the LTIPs that are vesting this year (so will not be certain of the value of *LTIP_Fail*). However, they will definitely know the previous year's outcome.

[20] It would be surprising for the estimated IV coefficient to fall to zero even if the sector LTIP perfectly conditioned out sector luck. There are two key reasons for this. First, our sector instrument is not in general the exact sector comparator group used in the evaluation (this is because the benchmark firms are not always revealed in the company accounts). Second, we define a sector LTIP as one with *at least some* sector-return comparison. However, such an LTIP may have other comparators as well that will not completely condition out sector luck.

Table 6 reports the results of including such an indicator variable in the usual pay-performance regressions. We consider two of our measures of pay. First, using ln(New Pay) as the dependent variable allows for offsetting compensation across all components of pay. Second, we use the value of new equity awards only to test whether firms use new LTIP awards to offset any decline in the value of previously awarded LTIPs. Thus, we can compare the coefficients across the two measures of pay to determine whether *and where* any such compensation is occurring.

Column (1) of Table 6 reports the coefficient estimates where the dependent variable is *ln* (New Pay), showing that there is no obvious link between pay and whether LTIPs failed in the previous year. We then decompose this into cash pay (salary plus bonus) in column (2) and new equity awards in column (3). Like the first column, CEO cash does not respond to past failure of LTIPs, but in contrast, the coefficient on *Lagged_LTIP_Fail* is positive, though not significant, for New Equity Awards. Note that all our regressions include ln(TSR) on the right-hand side, so we control for the fact that declines in the value of previous awards usually occur in years that see declines in shareholder returns. Of course, the sign of the coefficient on *Lagged_LTIP_Fall* goes the wrong way for this to be an explanation - we would expect pay to be lower in poor performing years.

Does corporate governance matter here? To assess this, we interact the "failed LTIP" indicator with our main indicator of corporate governance (institutional ownership). Columns (4) to (6) replicate the previous columns but allow for this potential governance asymmetry. The key result can be seen in column (6). Echoing the results of Table 3, we find that firms with low institutional ownership provide significantly higher compensation (in the form of new equity awards) when previous LTIPs fail. This is not the case in firms with high institutional ownership. There is no pay offset for well-governed firms - implying that external control matters for CEO pay.

This evidence suggests that LTIPs are being undermined in some firms. In firms with poor governance, when LTIPs do not pay out, CEOs are able to obtain significantly better deals for their new LTIPs to compensate them for their failure to meet the terms of their existing relative performance contracts.

III.E. Further evidence on LTIP Manipulation

The previous sub-section demonstrated that poorly governed firms partially offset failing LTIPs by providing more generous – in terms of ex ante value – subsequent equity awards. A complementary strategy would also be to restructure the terms of the new equity awards to make them less likely to fail. In this sub-section, we present evidence on this strategic activity.

Over time, LTIPs across all firms have tended to become more complex. One measure of this is the number of performance scales that are used to judge success. In the LTIP example for Vodafone discussed in Section II, there is only one performance scale (TSR) which is measured against a global peer group. In the early part of our sample, most awards had a single performance scale – usually TSR or Earnings per Share (EPS) growth. In the latter part of the sample, most awards have adopted at least two performance scales – generally a combination of TSR and EPS growth. Figure 5 shows the trend over time.

What is the effect of such a change? There are two key effects. First, if we calculate the vesting percentage i.e. shares vesting as a proportion of originally granted, there is a decline (from 67% to 60%) when we switch from single to multiple performance scales. This is driven by that fact that full vesting now requires the achievement of multiple objectives, which is harder to achieve. Second, the probability of the award completely failing is reduced - from 26% to 20%. This is because there are now at least two chances to reach the minimum performance threshold. Therefore, the move towards multiple performance scales reduces the high-stakes nature of the LTIPs and has increased the likelihood that at least some payout will be achieved.

In Table 7 we explore whether the probability of switching the number of performance scales is related to the failure of prior LTIPs and to corporate governance. We can do this analysis only for the sub-set of firms that were constituents of the FTSE-100 at some point in our sample.[21] We run probit models that have a dependent variable equal to one if the LTIP has multiple performance scales and zero if it has a single scale. The regressions control for corporate governance, industry and time effects and ln(TSR). The coefficient on LTIP Fail in column (1) shows a strong positive link between prior LTIPs failing and the decision to increase the number of performance

[21] This is because we require additional detailed data on each award to determine the number and nature of each performance scale, and this information is not reported in Boardex.

scales used. However, one might argue that this reflects an efficient outcome. If the LTIP had been poorly designed in the past and had failed more frequently than was optimal, it makes sense for the firm to revise the structure of the LTIP in response. However, the interaction effect of LTIP Fail with our corporate governance measure (shown in column (2)) shows that well-managed firms do not respond to past failure. Only the weakly governed firms do so. This again suggests a gaming of the structure of LTIPs to compensate for past failure and complements the analysis in the previous sub-section.

IV. EXTENSIONS AND ROBUSTNESS

IV.A Are LTIPs large enough in magnitude?

One argument to counter our results is simply that the share of LTIPs in the pay that CEOs receive each year is not yet substantial enough to align CEO and shareholder incentives. It is certainly true that even by the end of our sample only around one-third of pay is accounted for by LTIPs, with the remainder reasonably evenly divided between salary and annual bonus. A key question is therefore whether our results that point to governance failures that allow LTIPs to be undermined are really just reflecting this fact. To examine this, we take two approaches. First, we exploit the fact that the share of LTIPs in pay has risen over the sample period (Figure 2). If the problems we identify were really one of magnitude, we would expect those problems to be stronger in the first half of the sample when LTIPs were less prevalent. Therefore, we can re-estimate the results allowing for interactions with a dummy for the second half of the sample and test whether there are significant changes in the coefficients. Second, we can exploit the fact that firms differ in their use of LTIPs. We obviously do not want to claim that this is exogenous, but we can divide our sample of firms into "High LTIP" and "Low LTIP" based on their average share of pay accounted for by LTIPs. Again, if we re-estimate with interactions for the "High LTIP" firms, we can test whether the same governance problems occur in both sets of firms. For our sample, the average LTIP share is 12% in the "Low LTIP" firms and 29% in the "High LTIP" firms. Table 8 reports both experiments. The first column again shows the key result from Table 6 – poorly governed firms compensate for failed LTIPs with more generous new awards. In column (2), we see that there is no evidence to suggest that this effect is removed as the share of LTIPs in total pay grows – in fact, the coefficient is the wrong sign, though

statistically insignificant. Similarly, this effect of poor governance has not weakened over time (column 3). Both of these results support our interpretation of the data.

IV.B. Firm Performance and Job Exit

Our estimates implicitly assume that the executive remains with the firm and so is in a position to have their pay respond to changes in firm performance. It is plausible however, that poor performance may lead not only to lower wages but also to an increased probability of a job separation (e.g. Huson et al, 2001; Jenter and Kanaan, 2010). Thus, we may be underestimating the impact of firm performance on CEO expected returns. To examine this issue, we estimate job-exit probabilities for executives. We define a job-exit as occurring subsequent to the last observed pay year for an individual with a particular firm, provided we observe the same firm in the following year but without the individual employed. Table A3 reports the marginal probabilities of job-exit for CEO's as a function of changes in shareholder returns. For CEOs, we find strong negative effects from shareholder returns. In other words, poor firm performance is associated with an increased risk of job-exit.[22]

This raises the issue of whether our results are biased due to dynamic selection (the static effects are controlled for by the match specific effects). Maybe the asymmetry of the coefficient on shareholder returns in the CEO pay equation in Table 3 could be due to attenuation as large negative shocks to shareholder returns are followed by dismissal rather than compensation cuts? To look at this issue we performed several tests. First, we re-ran Table 3 excluding the last year (or alternatively the last two or three years) of CEO tenure. The asymmetries we identify in Table 3 continue to hold for this sub-sample. Secondly, we allowed for an asymmetry in the job-exit probability with respect to shareholder returns. However, unlike CEO pay, we found no significant difference between the impact of positive or negative returns on job-exits. Thirdly, we allowed for both the level effect of shareholder return on exit and its asymmetry with positive and negative TSR realisations to vary with our corporate governance measures. Again, we could find no significant differences of these on job

[22] Although our data cannot distinguish between voluntary and involuntary job-exits, Gregory-Smith et al. (2009) show that for a broadly similar group of UK CEOs over the period 1996-2005, there is a strong effect on job-exits from shareholder returns. Furthermore, they conducted a news search of reasons for exit to identify exits due to dismissal. Unsurprisingly, the effect of poor shareholder returns is observed most strongly for those CEOs who are forced to leave.

exit. Hence, it seems unlikely that the findings on the CEO pay-performance relationships we describe in this paper are purely due to dynamic selection bias.

IV.C. Other reasons for pay for luck in sector LTIPs

In addition to poor governance, there is also a mechanical reason for the "pay for luck" aspect of sector LTIPs. Sector LTIPs explicitly rank on sector performance to determine vesting and thus *by definition* remove sector luck from this outcome. However, *conditional* on vesting, the change in value of a sector LTIP depends only on the firm return, which includes sector luck. An example makes this clear. Suppose a CEO is given a sector LTIP with an initial face value of £3m, (say 1m shares at a grant price of £3) and that the firm ultimately ranks in the top quartile against the sector comparators. Then the LTIP fully vests and the CEO gets the 1m shares. However, consider two possible ways that this happened. First, suppose the firm outperformed a strongly performing sector (the firm returns were 50% compared to a sector average of 40%) and in the second, the firm outperforms a poorly performing sector (firm returns of -30% against a sector average of -40%). In the first case, the vested LTIP has an ex-post value of £4.5m while in the second it has a value of £2.1m. Therefore, although the relative performance against the sector is the same in both cases, the change in value is much higher in the strongly performing sector example. Thus, pay-for-luck remains an integral part of the sector LTIP structure and helps explain the results of Table 4. An alternative structure for such awards would be to grant the CEO a notional award of £3m and on successful vesting adjust the amount paid by the *excess* return of the firm relative to the sector return. This would remove the entire pay-for-luck element. We suggest that moving to such an LTIP structure would be preferable from an incentives perspective than the current state of affairs.

V. CONCLUSIONS

We examine the pay-performance relationship for CEOs over the last two decades using explicit measures of performance contracts. The UK has moved much more rapidly and aggressively than the US to eliminate all equity awards to executives that do not have performance conditions attached to them. Our analysis suggests that not all of the CEO pay-performance relationship is likely to be rationalized by efficiency considerations. First, CEO pay rises much more when the firm does well than it falls when the firm

does badly, and this asymmetry occurs only for firms with weaker governance. Second, there remains substantial pay-for-luck with pay responding to industry-wide improvements in performance. Third, even when CEO pay is explicitly tied to performance relative to sector averages, it seems to have little effect on reducing pay-for-luck. In part, this is because when CEOs fail their relative performance contracts, they are compensated by even more generous incentive pay deals, both in terms of the ex-ante value of new awards and the structure of such awards. Again, these rewards for failure are concentrated in those firms that have weaker governance.

In our view, the fundamental problem is that CEO remuneration packages are so opaque and complex it is hard for individual shareholders to gauge their true structure and generosity unless they are unusually assiduous and strongly motivated. Greater mandated transparency is unlikely to resolve this (e.g. Mas, 2016; Hermalin and Weisbach, 2012). Institutional owners, because they have greater resources and larger block-holdings, are more likely agents to have the ability and incentive to be active monitors. In the absence of such agents "stepping up to the plate", however, it is likely that calls for cruder and more direct intervention in CEO pay will become stronger over time.

REFERENCES

Abowd, J. M., and Lemieux, T. (1993) "The Effects of Product Market Competition on Collective Bargaining Agreements: The Case of Foreign Competition in Canada", *Quarterly Journal of Economics,* 108, 983-1014.

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

Aghion, P., Van Reenen, J., and Zingales, L. (2013) "Innovation and Institutional Ownership", *American Economic Review*, 103(1): 277–304.

Baker, J. (1939) "Executive Compensation Payments by Large and Small Industrial Firms" *Quarterly Journal of Economics*, 53(3), 404-434

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

Bell, B. and Van Reenen, J. (2014) "Bankers and their Bonuses", *Economic Journal* 124 (574) F1–21.

Bertrand, M. (2004) "From Invisible hand to the invisible handshake? How import competition changes the employment relationship" *Journal of Labor Economics,* 22(4), 723-765.

Bertrand, M. and Mullainathan, S. (2001) "Are CEOs rewarded for luck? The ones without principals are", *Quarterly Journal of Economics,* 116, 901-32.

Bertrand, M. (2009) "CEOs", *Annual Review of Economics,* 1, 121-50.

Blanchflower, D., Oswald, A., and Sanfey, P. (1996) "Wages, Profits and Rent Sharing", *Quarterly Journal of Economics*, 111, 227-52.

Card, D., Devicienti, F., and Maida, A. (2014) "Rent Sharing, Hold Up and Wages: Evidence from Matched Panel Data", *Review of Economic Studies*, 81(1), 84-111.

Conyon, M., Fernandes, N., Ferreira, M., Matos, P., and Murphy, K. (2011) "The Executive Compensation Controversy: A Transatlantic Analysis", in Tito Boeri, Claudio L. and K. Murphy (eds) *Executive Remuneration and employee Performance Related Pay*, Oxford: Oxford University Press, 116-122

Conyon, Martin, Gregg, Paul, and Machin, Stephen (1995) "Taking care of business: Executive Compensation in the United Kingdom", *Economic Journal*, 105(430), 229-47.

Core, John, Robert Holthausen, and David Larcker (1999) "Corporate governance, chief executive officer compensation, and firm performance", *Journal of Financial Economics,* 51, 371-406.

Daniel, Naveen, Yuanzhi Li, and Lalitha Naveen (2016) "Asymmetry in Pay for Luck: A Size Effect?" mimeo, Drexel University.

De Angelis, David and Yaniv Grinstein (2016) "Relative Performance Evaluation in CEO Compensation: A Non-Agency Explanation" mimeo, Cornell

Djankov, S., R. La Porta, F. Lopez-de-Silanes and A. Shleifer (2008) "The Law and Economics of Self-dealing" *Journal of Financial Economics*, 88(3), 430-465

Edmans, Alex and Xavier Gabaix (2016) "Executive Compensation: A Modern Primer" *Journal of Economic Literature*, 54(4), 1232-87

Faulkender, M. and J. Yang (2013) "Is disclosure an effective cleaning mechanism? The Dynamics of Compensation Peer Benchmarking" *Review of Financial Studies*, 26(3), 806-839

Frydman, C., and Jenter, D. (2010) "CEO Compensation", *Annual Review of Financial Economics*, 2, 75-102.

Gabaix, X. and A. Landier (2008) "Why Has CEO Pay increased so much?" *Quarterly Journal of Economics*, 123: 49-100.

Garvey, Gerald and Todd Milbourne (2006) "Asymmetric benchmarking in compensation: Executives are rewarded for good luck but not penalized for bad", *Journal of Financial Economics*, 82, 197-225

Gibbons, Robert and Kevin Murphy (1990) "Relative Performance Evaluation for chief executive officers" *Industrial and Labor Relations Review* 43, 30-51

Gompers, Paul, Ishi, Joy and Metrick, Andrew (2003), "Corporate Governance and Equity Prices" *Quarterly Journal of Economics*, 118, 107-155

Gong, Guojin, Li, Laura Yue, and Shin, Jae Yong (2011) "Relative performance evaluation and related peer groups in executive compensation contracts", *Accounting Review*, 86, 1007-44.

Gregory-Smith, I., Thompson, S., and Wright, P. W. (2009) "Fired or Retired? A Competing Risks Analysis of Chief Executive Turnover", *Economic Journal*, 119, 463-81.

Guiso, L., Pistaferri, L., and Schivardi, F. (2005) "Insurance within the Firm", *Journal of Political Economy*, 113(5), 1054-87.

Hall, B. J., and Liebman, J. B. (1998) "Are CEOs Really Paid like Bureaucrats?" *Quarterly Journal of Economics*, 113(3), 653-91.

Harford, Jarrad and Kai Li (2007) "Decoupling CEO Wealth and Firm Performance: The case of Acquiring CEOs" *Journal of Finance* LXII (2) 917-947

Hartzell, Jay and Laura Starks (2003) "Institutional Investors and Executive Compensation", *Journal of Finance*, 58(6), 2351-74.

Helpman, E., Itskhoki, O., and Redding, S. (2010) "Inequality and Unemployment in a Global Economy", *Econometrica*, 78(4), 1239-84.

Hermalin, B. and M. Weisbach (2012) "Information Disclosure and Corporate Governance" *Journal of Finance*, 67(1), 195-233

Holmstrom, Bengt, (1979), Moral hazard and observability, *Bell Journal of Economics* 10, 74-91.

Holmstrom, Bengt (1982) Moral Hazard in Teams, *Bell Journal of Economics* 13, 324-340.

Holmstrom, Bengt and Paul Milgrom (1987) "Aggregation and linearity in the provision of inter-temporal incentives" *Econometrica*, 55, 303-328

Huson, M., Parrino, R. and LT. Starks (2001) "Internal Monitoring mechanisms and CEO turnover: a long-term perspective", *Journal of Finance* 55, 2265-97.

Jensen, M. C., and Murphy, K. J. (1990) "Performance Pay and Top-Management Incentives", *Journal of Political Economy*, 98, 225-64.

Jenter, Dirk and Fadi Kanaan (2010) "CEO Turnover and Relative Performance Evaluation" Stanford mimeo

Main, B., O'Reilly, C., and Wade, J. (1993) "Top Executive Pay: Tournament or Teamwork?" *Journal of Labor Economics*, 11(4), 606-28.

Mas, A. (2016) "Does Disclosure affect CEO Pay setting? Evidence from the passage of the 1934 Securities and Exchange Act", Princeton mimeo

Murphy, Kevin (1999) "Executive Compensation" in Orley Ashenfelter and David Card (eds) *Handbook of Labor Economics Volume 3b*, Amsterdam: North Holland

Office for National Statistics, *Annual Survey of Hours and Earnings, 1997-2009: Secure Data Service Access* Colchester

Ozkan, N. (2009) "CEO Compensation and Firm Performance: An Empirical Investigation of UK Panel Data", *European Financial Management*

Rosen, Sherwin (1974) “Hedonic Prices and Implicit Markets: Product Differentiation in Pure Competition”, *Journal of Political Economy* 82 (1), 34–55

Rosen, Sherwin, (1981) “The Economics of Superstars” *American Economic Review*, 71(5), 845-58.

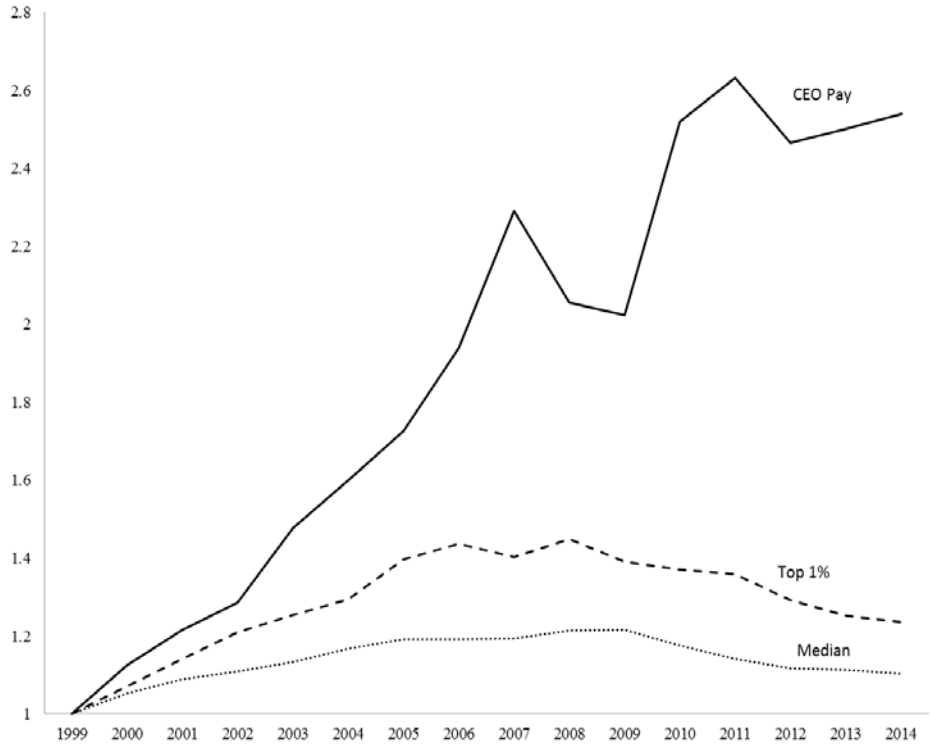
Ryan, Harley, and Roy Wiggins (2004) “Who is in whose pocket? Director Compensation, board independence, and barriers to effective monitoring”, *Journal of Financial Economics*, 73(3), 497-524.

Schain, Jan and Joel Stiebale (2016) “Innovation and Institutional Ownership: Comment” University of Dusseldorf, mimeo

Selvaggi, M., and Upton, J. (2008) “Governance and Performance in Corporate Britain”, Association of British Insurers Research Paper No.7.

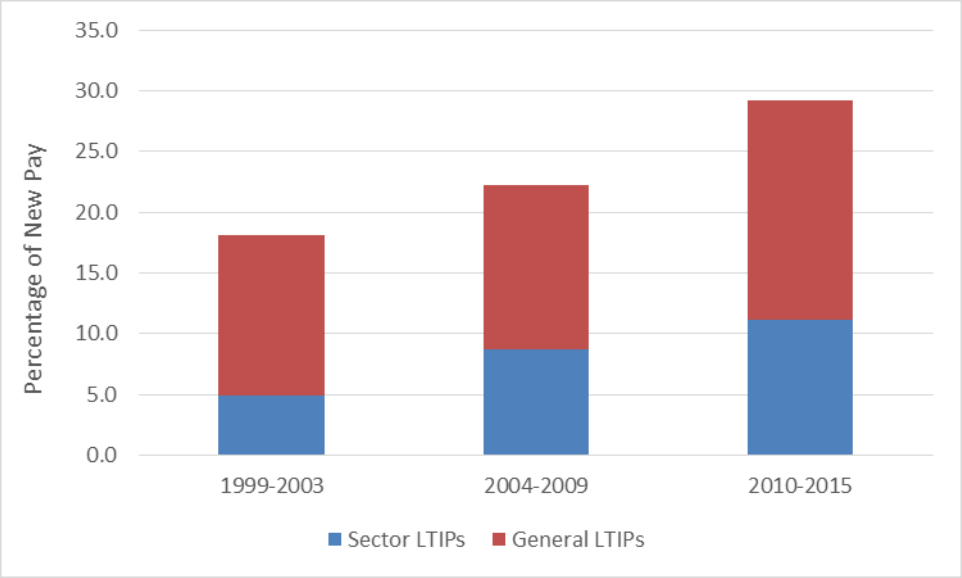
Van Reenen, J. (1996) “The Creation and Capture of Rents: Wages and Innovation in a Panel of U.K. Companies”, *Quarterly Journal of Economics*, 111, 195-226.

FIGURE 1: CEO MEDIAN REAL PAY GROWTH COMPARED TO TOP 1% AND MEDIAN PAY GROWTH FOR ALL WORKERS



Notes: CEO real median pay is taken from our data (see text); percentiles of pay are from the Annual Survey of Hours and Earnings (ASHE). 2014 prices. Pay rates normalized to one in 1999.

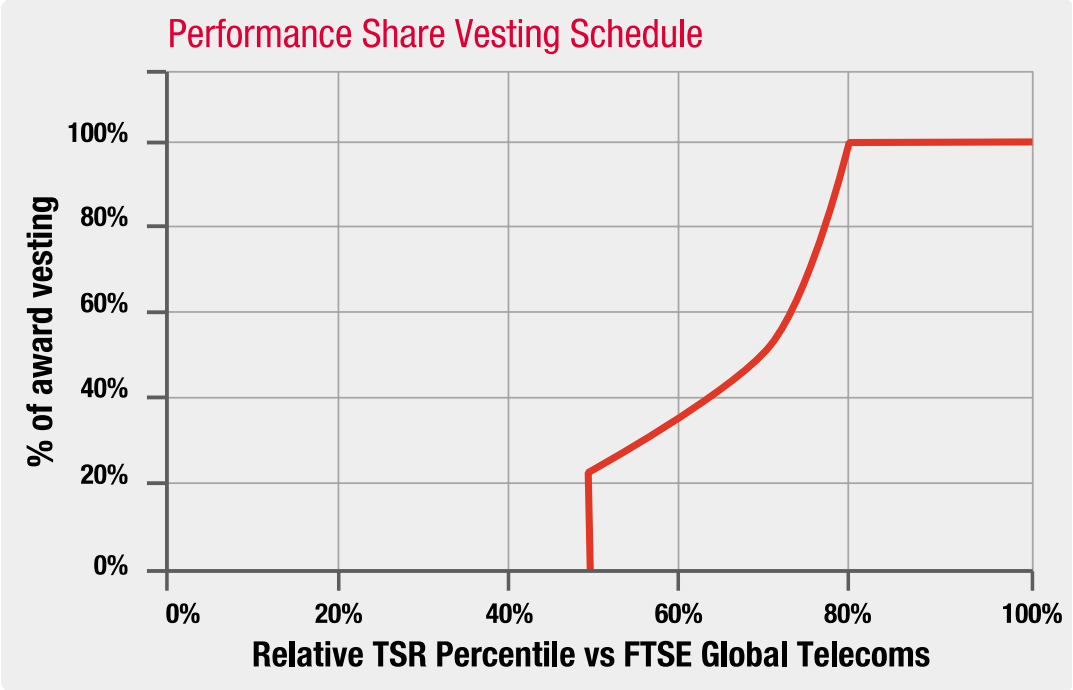
FIGURE 2: SHARE OF CEO PAY IN LTIPS AND SHARE OF ALL LTIPS THAT HAVE A SECTOR COMPONENT



Notes: LTIP share is the estimated proportion of new pay in the form of LTIPs, all of which are performance conditional. Sector LTIPs show the percentage that have a sector component in the performance evaluation (i.e. are benchmarked against an industry peer average), whilst General LTIPs are those with a non-sector comparator.

Source: Authors' calculations based on Boardex data

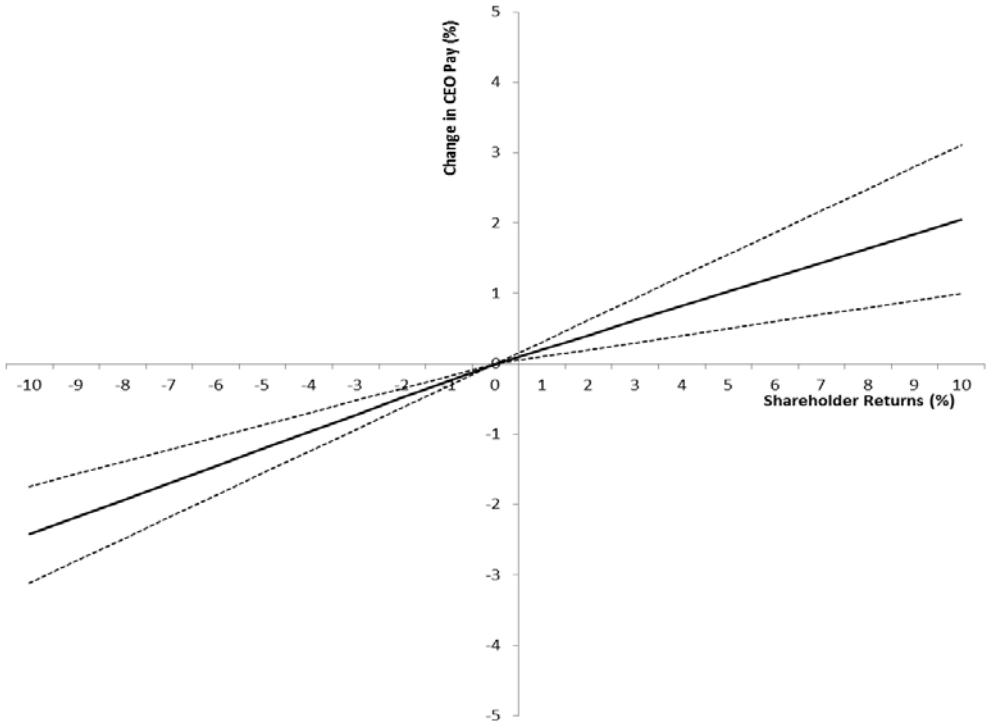
FIGURE 3. VODAFONE LTIP VESTING SCHEDULE



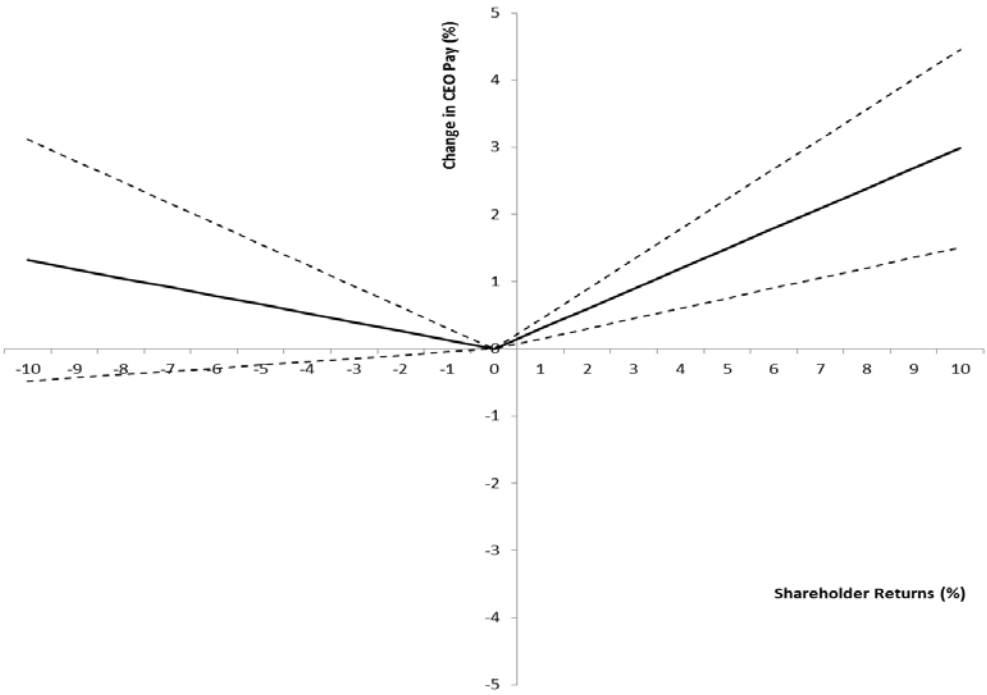
Notes: Taken from Vodafone's 2005 accounts relating to a 2004 LTIP award. Figure indicates the proportion of shares (2 million) that will be granted to CEO depending on the performance of Total shareholder Return relative to basket of 28 "peer" telecom companies in the July 28th 2004 to July 28th 2007 period.

FIGURE 4. ASYMMETRIC PAY-PERFORMANCE ESTIMATES

Panel A: Firms with strong governance (High share of Institutional Owners)

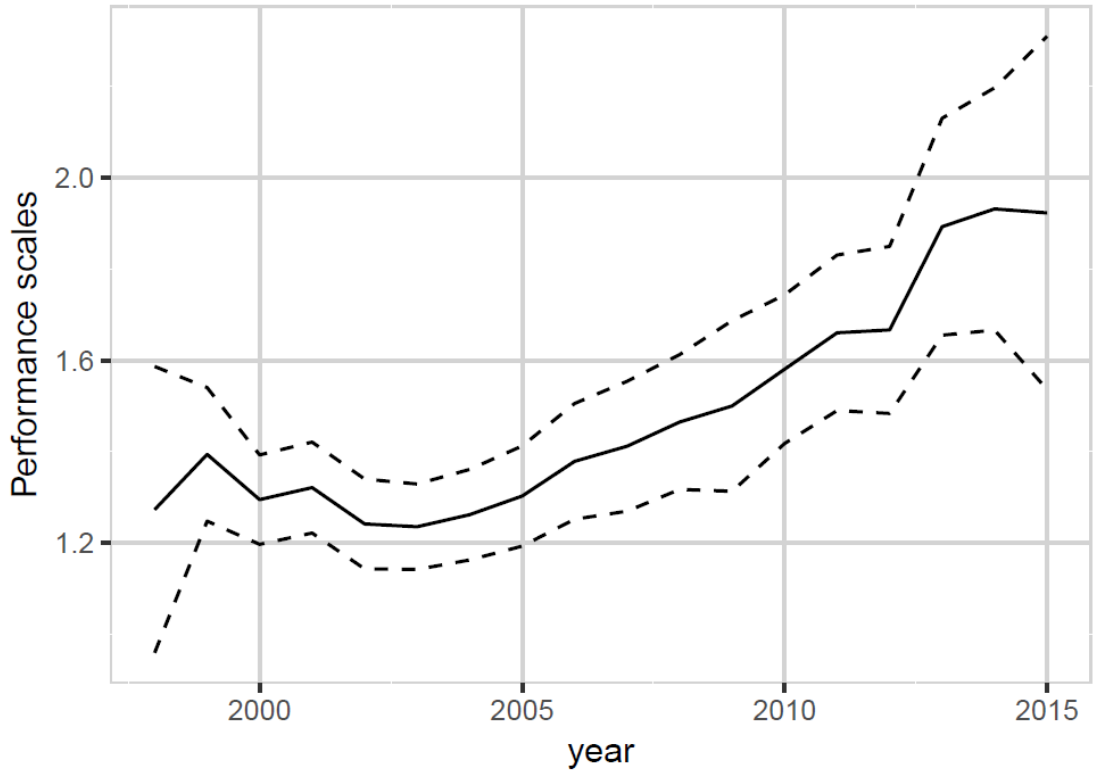


Panel B: Firms with weak governance (Low share of Institutional Owners)



Notes: Theses figures represent the implied effect of a percentage change in TSR (shareholder returns) on the percentage increase in CEO pay. The coefficients are from the specification in column (5) of Table 3. 95% confidence intervals shown.

FIGURE 5. NUMBER OF PERFORMANCE SCALES PER LTIP



Notes: This is the average number of performance scales per LTIP CEO contract (e.g. EPS and TSR).

TABLE 1: SUMMARY STATISTICS

	Mean	Median	10th Percentile	90th Percentile
Panel A: Pay Data				
Total Compensation	1,638	1,039	366	3,277
Salary	539	482	233	931
Bonus	501	262	0	1,185
New Equity	598	214	0	1,251
LTIP Share (%)	22.6	21.9	0	49.8
Panel B: Company Data				
Market Capitalization (£m)	4,298	791	149	7,972
Total Employment	19,253	4,900	276	46,600
Shareholder Returns (%)	18.9	13.3	-37.7	70.2
Institutional Ownership (%)	58.2	62.3	21.4	86.7

Notes: All pay data figures in Panel A are in real (2014) £1000s. Data are for 1999-2015. New Equity is the expected value at grant date of new equity awards. Total Compensation is New Pay (the sum of salary, bonus and new equity).

TABLE 2: PAY AND FIRM PERFORMANCE

	Impact	Long-Run	#obs	#CEOs	#Firms
Dependent variable:					
ln(New Pay)	0.147 (0.020)	0.152 (0.023)	6,087	1,201	472
ln(Salary)	0.003 (0.012)	-0.004 (0.018)			
ln(Bonus)	1.718 (0.157)	0.682 (0.212)			
ln(New Equity)	0.375 (0.159)	0.702 (0.226)			

Notes: Each cell reports the results from a separate regression where the dependent variable is regressed on ln(TSR=Total Shareholder Returns) as the measure of firm performance used and includes CEO-firm match fixed-effects, ln(employment) and time dummies. The first column is the "impact" effect that includes only contemporaneously dated performance. Column (2) reports the long-run effect from a regression with both contemporaneous and two lags of performance. We report the OLS coefficient and standard error clustered by firm in parentheses underneath.

TABLE 3: ASYMMETRIES IN THE CEO PAY-PERFORMANCE RELATIONSHIP AND GOVERNANCE

	(1)	(2)	(3)	(4)	(5)	(6)
	Dependent Variable = ln(New Pay)					
Method:	**Within Groups**	**First Differences**	**First Differences**	**First Differences**	**First Differences**	**First Differences**
Corporate Governance Measure:			**Lagged II**		**Lagged II**	**IVIS**
*ln*TSR	0.149					
	(0.020)					
Δ*ln*TSR		0.162		0.107		
		(0.028)		(0.048)		
Δ*ln*TSR *Strong Governance			0.227		0.242	0.239
			(0.027)		(0.035)	(0.034)
Δ*ln*TSR * Weak Governance			0.030		-0.132	0.103
			(0.056)		(0.092)	(0.056)
Δ*ln*TSR(+)				0.135		
				(0.077)		
Δ*ln*TSR(+) * Strong Gov					-0.037	-0.093
					(0.071)	(0.067)
Δ*ln*TSR(+) * Weak Gov					0.430	0.249
					(0.141)	(0.094)
Observations	5,038	5,038	5,038	5,038	5,038	4,959
Firms	449	449	449	449	449	466

Notes: All results use Boardex Data. Column (1) is a fixed-effect model with the ln(New Pay) as the dependent variable. The subsequent columns report first-difference models. Strong governance is measured by high institutional investor share ownership in columns (3)-(5) and IVIS (Institutional Voting Information Services) score in column (6). Low II firms are those with one-year (or more) lagged institutional investor share ownership in the bottom quartile of the distribution (and High II are all others). IVIS is whether the firm is above or below median in the IVIS index of corporate governance. The index ranges between 2 and 0 depending on the number of "red" (= 2 points), "amber" (=1 point) or blue (=0 points). All regressions include CEO-firm match fixed-effects and time dummies (time dummies interacted with the High II dummy in columns (3) and (5) and interacted with low and high IVIS measures in column (6)). Standard errors are clustered at the firm-level. TSR = Total Shareholder Return and Δ*ln*TSR(+) is when the change in TSR is positive.

TABLE 4: PAY FOR LUCK? OLS VS. IV PAY-PERFORMANCE ELASTICITIES

Dependent Variable:	(1) ln(Cash Pay)	(2) ln(New Pay)	(3) ln(Total Pay)
Panel A: OLS Estimates			
*ln*TSR	0.132	0.146	0.886
	(0.017)	(0.020)	(0.071)
Panel B: IV Estimates			
*ln*TSR	0.139	0.207	1.070
	(0.041)	(0.043)	(0.120)
# firms	471	471	471
# CEOs	1,199	1,199	1,182
# Observations	6,070	6,070	5,342
First Stage F-stat	167	167	129

Notes: Cash Pay is salary plus cash bonus, New Pay is Cash Pay plus the expected value of newly awarded equity, and Total Pay is New Pay plus the estimated change in the value of previously awarded but still held equity awards. TSR is total shareholder returns. All regressions include employee-firm match fixed-effects, ln(employment) and time dummies. In Panel B, TSR is instrumented by the ICB Industrial Sub-Sector Global ex-UK index TSR. Standard errors are clustered at the industry level (92 clusters).

TABLE 5: OLS AND IV ESTIMATES OF LTIP VESTING AND VALUE

	(1) Sector LTIP OLS	(2) Sector LTIP IV	(3) Non-Sector LTIP OLS	(4) Non-Sector LTIP IV
Panel A: Dependent Variable is Vesting Percentage (mean = 0.626)				
ΔTSR	0.233	0.077	0.160	0.169
	(0.023)	(0.041)	(0.018)	(0.040)
Panel B: Dependent Variable: Change in Value of LTIP in £s (mean = 107,871)				
ΔTSR	535,980	388,293	449,452	493,023
	(27,070)	(64,716)	(36,246)	(102,713)
# Obs	2,054	2,054	3,780	3,780
First Stage F-stat		59		36

Notes: Panel A has vesting percentage of the relevant LTIP (Long-Term Incentive Plan) as the dependent variable while Panel B has the ex-post change in value of LTIP (in £'000s) as the dependent variable. Sector LTIP are all performance-related equity plants that have at least some sector TSR comparison component while non-Sector LTIP are all other equity plants. ΔTSR is the percentage change in total shareholder returns over the performance evaluation period. Results reported are OLS and IV regressions with time dummies. ΔTSR is instrumented by the ICB Industrial Sub-Sector Global ex-UK index TSR. Standard errors are clustered at the industry level (92 clusters).
.

TABLE 6: HOW SOME CEOS GET COMPENSATED FOR FAILING LTIPS

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent Variable:	**ln(New Pay)**	**ln(Cash Pay)**	**New Equity Awards**	**ln(New Pay)**	**ln(Cash Pay)**	**New Equity Awards**
Lagged_LTIP_Fail	-0.004	0.003	40,490	-0.022	-0.006	9,363
	(0.015)	(0.013)	(29,972)	(0.016)	(0.016)	(34,944)
Lagged_LTIP_Fail * *Low II*				0.092	0.057	134,123
				(0.038)	(0.030)	(67,312)
*Lagged ln*TSR	0.185	0.138	116,948	0.187	0.144	116,625
	(0.018)	(0.014)	(51,535)	(0.021)	(0.015)	(62,363)
# Obs	5,070	5,070	5,070	5,070	5,070	5,070
# CEOs	1,049	1,049	1,049	1,049	1,049	1,049
# Firms	449	449	449	449	449	449

Notes: New Pay is Cash Pay plus the expected value of newly awarded equity and New Equity Awards is the expected £-value of new equity awards on grant date. *Lagged_LTIP_Fail* equals one if the LTIPs that vested in the previous financial year did not fully vest, and zero otherwise. TSR is total shareholder returns and is included in all columns. *Low II* is equal to one if the firm's lagged institutional ownership share is in the bottom quartile across all firms in a given year. Columns (4) - (6) also includes *Low II* interactions with both lnTSR and time dummies. Regressions also include time dummies and a lagged dependent variable. All regressions are panel regressions with match fixed-effects. Standard errors are clustered at the firm level.

TABLE 7: FAILING LTIPS ARE ASSOCIATED WITH INCREASING THE NUMBER OF PERFORMANCE SCALES IN FUTURE CONTRACTS (AND SO MAKING IT MORE LIKELY THEY WILL VEST)

	Dependent variable: **=1 if number of performance scales >1**	
	(mean =0.444)	**(mean =0.457)**
TSR	0.255 (0.037)	0.257 (0.037)
Lagged_LTIP_Fail	0.178 (0.045)	0.031 (0.073)
Lagged_LTIP_Fail**Low II*		0.200 (0.080)
# obs	577	545
Log Likelihood	-242.348	-219.840
Akaike Inf. Crit.	602.700	559.680

Note: Control variables are year dummies, industry dummies, market capitalization, lagged TSR, indicators for whether the LTIP has a TSR component, and full interactions with Low II. Estimates reported are marginal effects from a probit ML regression.

TABLE 8: REWARDS FOR FAILURE ARE NOT DUE TO QUANTITATIVE UNIMPORTANCE OF LTIPS

Dependent variable:	ln(New Pay)		
	(1)	**(2)**	**(3)**
	Baseline	**High v Low LTIP Share**	**First v Second Half of Sample**
Lagged_LTIP_Fail	-0.022	-0.046	-0.008
	(0.016)	(0.031)	(0.023)
Lagged_LTIP_Fail * *Low II*	0.092	0.100	0.079
	(0.038)	(0.054)	(0.069)
Lagged_LTIP_Fail * *Low II* * High Share		0.051	
		(0.063)	
Lagged_LTIP_Fail * *Low II* * Second Half			0.015
			(0.073)
# Obs	5,070	5,070	5,070
# CEOs	1,049	1,049	1,049
# Firms	449	449	449

Notes: Column (1) baseline is the same specification as column (4) of Table 6.

APPENDIX A: DATA

Sampling Frame
The sample of firms is constructed by ranking all UK-domiciled and UK primary-listed companies by market capitalisation at end-December every year from 1999 to 2010. We exclude investment trusts. The top 300 firms are selected and over the whole period this produces a sample of 498 firms. On average, the top 300 firms each year represent 94% of total market capitalization. These firms are then matched to share-price and annual accounts data in Datastream. We are able to match 486 of the firms.

The Boardex Sample
The 486 firms with share-price and accounts data are then matched to executive-level compensation data from Boardex. We have a flat-file from Boardex containing all executives of UK companies over the period 1999-2014. We are able to match all 486 firms, but only 472 have pay data in Boardex. The Boardex coverage increased substantially from around 2002 and has subsequently covered almost all listed UK companies. Across all matched companies, we have 1,201 CEOs with at least two years of pay data.

Firm Performance Measures
Total Shareholder Return (TSR) is a return index. It includes the change in the share price but also incorporates dividends, share buy-backs, M&A activity, etc. Since it is an index, we also control for firm effects in one way or another to track changes in the index. Source: *Datastream.*

Other measures
Employment is the firm's global employment.

Construction of the CEO Pay Variable
For the main Boardex CEO data, we construct three measures of CEO pay that reflect increasingly broad concepts, with successive measures adding to the previous measure. When discounting the value of new awards that have a vesting period to evaluate in present value terms, we discount by 5% pa. This figure captures both the probability that the CEO will leave the company prior to the vesting date (and not be entitled to the vesting of the award) and the time value of money.

(i) Cash Pay
The cash parts of CEO compensation are simply the salary plus the annual bonus. The annual bonus can comprise both a cash bonus and a deferred bonus. A deferred bonus is the promise of shares (or cash) at a point in the future, with no future performance conditions. These are valued at the grant date share price and discounted to be in present value terms, but are otherwise the same as cash. Restricted stock is included in this category – stock that is given to the CEO but cannot be sold for a period of time (this is rare in the UK). We do not account for pensions and other non-pay benefits, due both to complexity and a lack of uniform reporting across firms.

(ii) New Pay

New Pay measures the flow of new compensation to the CEO in a given year. It therefore combines *Cash Pay* with the expected value on grant date of any new equity awards. New Equity awards can be further divided into regular stock options and LTIPs (which themselves can be either share-based or option-based). Regular stock options are valued according to Black-Scholes in the standard way, and we can denote their value as *V_OPT*. We use a 5% interest rate and the trailing 36-month standard deviation of returns in the option calculation. The LTIP aspect is more complicated to calculate. Suppose a CEO receives a set of LTIP awards in the current financial year. We need to construct an expected value for these awards. Consider the following:

$$E_t \left\{ \sum_k \phi(t,\tau)\omega_{k\tau}\, \mathrm{v}_{k\tau} \right\}$$

where E_t is the expectations operator at time *t*. There are a number of plans that the CEO is awarded at time *t* which potentially vest at different times in the future τ, τ > t. Denote the set of different plans as *k* which will be (potentially) received by the CEO. The value at time τ of these plans is $\mathrm{v}_{k\tau}$ if the CEO receives it (so for LTIP options this is just *V_OPT* evaluated at date τ), while for LTIP shares this will be a number of shares, $S_{k\tau}$ multiplied by the expected share price, $p_{k\tau}$. We have to form a probability of the CEO receiving each LTIP, which we denote $\omega_{k\tau}$. The plans have to be discounted to period *t* by the factor $\phi(t,\tau)$ to convert to present value terms. So a typical share-based LTIP will be valued at:

$$E_t \left\{ \sum_k \phi(t,\tau)\omega_{k\tau} S_{k\tau} p_{k\tau} \right\}$$

We know $S_{k\tau}$ from the plans themselves and we assume share prices follow a random walk so that $E_t p_\tau = p_t$. The discount rate is based on the real interest rate. The probability of the plan vesting ($\omega_{k\tau}$) is harder to calculate, so we will discuss this in more detail below.

A typical LTIP will be a number of shares granted in three years' time if the TSR of the firm is in the top quartile of a company portfolio of a firm's "peers" (say other large oil and gas firms for a company like BP or even the FTSE-100 index as a whole). There will be a smaller fraction of shares awarded if the company is above the median but below the lower quartile (usually a linear schedule) and usually no shares if the company is below median performance. Other LTIP plans include:

- Stock options given conditional on performance (instead of shares or granted unconditionally like standard options).
- Cash granted conditional on performance (much rarer as the bonus is usually based on subjective performance evaluation)
- Relative performance based on a market index like the FTSE-100

- An absolute performance target (usually some improvement in the firm's own TSR irrespective of other firms' TSR)
- A target specified in accounting terms instead of TSR (e.g. earnings per share, EPS)

One strategy would be to estimate the expected vesting probability based on detailed knowledge of the plan's structure and analyst forecasts of the firm's expected performance. For the Boardex data this is infeasible as each scheme is sufficiently complicated to prevent the construction of a database that could generate such predictions. We therefore follow a second simpler strategy, which is to use the empirical proportion of success for all firms in the sample. To achieve this, we have taken every equity award given to a CEO in our sample and followed the award through to vesting outcome (firms are required to report this in the remuneration report). This then allows us to calculate the average percentage of shares that vest. Table A1 reports the realised outcome of awards across the complete sample.

In effect, we assume that the firm has full information about the future state of the market, but not the firm's own idiosyncratic success. We therefore assume that on grant date, all awards are expected to vest in the same percentage as all such awards of that type have done historically. So for example, if a CEO is awarded an LTIP Share award, we assume that the ex-ante vesting percentage is 52.5%. We also look at other probabilities such as considering only past information on vesting probabilities and not future information, using industry-specific probabilities, etc. The results are robust to these alternatives.

Note that we do not explicitly account for the possibility that the CEO exits over the lifetime of the LTIP. The provisions over what the CEO would obtain if he left are very complex (Golden Parachutes, etc.) and depend on whether the departure is voluntary or not ("good leaver" or not). However, the fact that we build in forfeiture from the empirical vesting probabilities across the whole sample (which includes exits), helps to mitigate this issue.

(iii) Total Pay

Since LTIPs are usually granted every year, the CEO will generally have a portfolio which are due to vest at different times. One can therefore argue that the total remuneration that a CEO receives in a given year is equal to the *New Pay* received plus the change in the value of all LTIPs received in previous years that have not yet vested and been exercised. In terms of the expected value of LTIPs presented above, we need to calculate the *change* in expected value from one period to the next:

$$E_{t+1}\left\{\sum_k \phi(t+1,\tau)\omega_{k\tau}S_{k\tau}p_\tau\right\} - E_t\left\{\sum_k \phi(t,\tau)\omega_{k\tau}S_{k\tau}p_\tau\right\}$$

So for any award that has still not reached its vesting date τ at time $t + 1$, we need to evaluate the above expression. The number of shares $S_{k\tau}$ does not change (this is set at the grant date) and the market price of the shares is observed at t and $t + 1$. The discount factor will simply adjust for the fact that the award is one year closer to vesting and

therefore valuable in present value terms. The key difficulty is that the expected vesting probability will have changed i.e. $E_{t+1}\omega_{k\tau} \neq E_t\omega_{k\tau}$

We take the following approach to this problem. Since we know what happens to the LTIP eventually (our sample period ends in 2015 so we do not know what happens to recently granted awards), we construct expectations of the vesting probability from the date of grant (when they are set according to Table A1) to the date of vesting such that the expected probability moves smoothly from the initial expected value to the realised outcome. Suppose for example that an LTIP share award is given that ultimately vests with only 30% of shares awarded after three years. We start with a vesting probability of 0.525, after year one this is reduced to 0.45, after year two it is reduced to 0.375 and reaches the actual vesting outcome of 0.3 at the end of year three. This then provides all the data we need to calculate the change in expected value of previous LTIPs.[23]

[23] Note that this is different from the "ex ante" compensation used in the ExecuComp TDC1 commonly used by researchers in the CEO pay literature. TDC1 uses an *ex ante* evaluation of stock option grants using the Black Scholes formula (unlike TDC2 which is the *ex post* exercise price of stock options) and adds this to all forms of cash compensation. We follow this procedure too. However, TDC2 uses the ex post realisation of all other forms of LTIPs, implicitly valuing all LTIPs at zero until their pay-out. By contrast, we try to treat all other LTIPs symmetrically with stock option and give them a value after they are granted as they are valuable to CEOs and potentially a way of aligning incentives. The reason for the asymmetry in ExecuComp is presumably because US firms were not obliged to disclose their non-stock option LTIPs prior to a change in SEC rules in 2006 (see De Angelis and Grinstein, 2016).

TABLE A1: REALISED OUTCOME OF EQUITY AWARDS, 1999-2015

	Number of Awards	% Fully Vesting	% Partially Vesting	% Forfeit	% of award obtained ex-post
Deferred Bonus	1,329	84.4	6.4	9.2	91.0
LTIP Share	3,682	31.3	35.2	33.5	52.5
LTIP Option	2,702	70.1	7.5	22.4	74.7
Share Option	314	80.6	2.2	17.2	82.0
Other	1,159	60.7	8.9	30.4	67.4

Notes: A unit of observation is a plan (Boardex plus own data collection efforts). Forfeited plans are a mixture of CEOs completely failing to meet the performance criteria and leaving the firm.

TABLE A2: COMPARISONS BETWEEN LOW AND HIGH INSTITUTIONAL INVESTOR FIRMS

	Mean (Median)	Low II Mean (Median)	High II Mean (Median)	T-Test of Means
Market Capitalization (£m)	4,411 (764)	5,318 (611)	4,122 (798)	2.96
Sales (£m)	3,996 (690)	4,850 (487)	3,721 (775)	2.43
Employment	18,640 (5,183)	17,633 (3,101)	18,964 (5,815)	0.98
2-yr Sales Growth (%)	20.5 (17.8)	26.0 (19.4)	18.8 (17.4)	3.90
1-yr Lagged Return (%)	6.5 (11.2)	5.8 (10.1)	6.7 (11.4)	0.54
2-yr Lagged Return (%)	15.7 (16.5)	17.7 (15.6)	15.1 (16.7)	1.11
CEO Pay (£m)	1,388	1,293	1,419	1.77
CEO Lagged Pay Growth (%)	11.8	12.1	11.8	0.18

Notes*:* Comparison of means (and medians) between low institutional ownership (lowest quartile) observations and high institutional ownership (other three quartiles). All values are nominal.

TABLE A3: JOB-EXIT MARGINAL PROBABILITIES

	Boardex CEO
Δ*ln*TSR	-0.055 (0.009)
Obs	5,581
#Firms	470
#CEOs	1,114

Notes: The coefficient is the marginal effect from a probit model of job-exit with time dummies. Standard errors are clustered at the firm level.

CENTRE FOR ECONOMIC PERFORMANCE
Recent Discussion Papers

1438	Fadi Hassan Paolo Lucchino	Powering Education
1437	Evangelia Leda Pateli	Local and Sectoral Import Spillovers in Sweden
1436	Laura Kudrna Georgios Kavetsos Chloe Foy Paul Dolan	Without My Medal on My Mind: Counterfactual Thinking and Other Determinants of Athlete Emotions
1435	Andrew B. Bernard Andreas Moxnes Yukiko U. Saito	Production Networks, Geography and Firm Performance
1434	Zack Cooper Stephen Gibbons Matthew Skellern	Does Competition from Private Surgical Centres Improve Public Hospitals' Performance? Evidence from the English National Health Service
1433	Nicholas Bloom Raffaella Sadun John Van Reenen	Management as a Technology?
1432	Andrew B. Bernard Toshihiro Okubo	Product Switching and the Business Cycle
1431	Fabrice Defever Alejandro Riaño	Protectionism through Exporting: Subsidies with Export Share Requirements in China
1430	Andrew B. Bernard Renzo Massari Jose-Daniel Reyes Daria Taglioni	Exporter Dynamics and Partial-Year Effects
1429	Cletus C. Coughlin Dennis Novy	Estimating Border Effects: The Impact of Spatial Aggregation
1428	Alan Manning	The Elusive Employment Effect of the Minimum Wage

1427	Decio Coviello Andrea Guglielmo Giancarlo Spagnolo	The Effect of Discretion on Procurement Performance
1426	Andrew B. Bernard Andreas Moxnes and Karen Helene Ulltveit-Moe	Two-sided Heterogeneity and Trade
1425	Stephen Machin Sandra McNally Martina Viarengo	"Teaching to Teach" Literacy
1424	Yatang Lin	Where does the Wind Blow? Green Preferences and Spatial Misallocation in the Renewable Energy Sector
1423	Andrew B. Bernard Valerie Smeets Frederic Warzynski	Rethinking Deindustrialization
1422	Stefano Gagliarducci Marco Manacorda	Politics in the Family: Nepotism and the Hiring Decisions of Italian Firms
1421	Jordi Blanes i Vidal Marc Möller	Team Adaptation
1420	Andrew B. Bernard J. Bradford Jensen Stephen J. Redding Peter K. Schott	Global Firms
1419	Marco Manacorda Andrea Tesei	Liberation Technology: Mobile Phones and Political Mobilization in Africa
1418	Jeremiah Dittmar Ralf R. Meisenzahl	State Capacity and Public Goods: Institutional Change, Human Capital and Growth in Early Modern Germany

The Centre for Economic Performance Publications Unit
Tel 020 7955 7673 Fax 020 7404 0612
Email info@cep.lse.ac.uk Web site http://cep.lse.ac.uk