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Executive Pay and Investment in the UK

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Executive Summary

This study explores the relationships between CEO performance targets, the pay incentives associated with those targets, and firm investment for companies listed on the FTSE All-Share index (as of April 2020) during the period 2013-2019. It assesses the strength of the incentives provided by performance targets, and whether these targets incentivise CEOs to make investment decisions in order to improve their achieved performance. This is a key channel through which executive pay practices could drive short-termism and impair long-term innovation and resilience in UK corporations.

To achieve these objectives, the study has three specific aims:

1. To explore the prevalence of different performance targets in UK executive pay contracts, with a view to better understanding the use of different target types and whether they are calibrated effectively to incentivise target achievement.
2. To examine the evidence for whether CEOs influence firm investment decisions to improve performance against specific targets in their pay contracts.
3. To examine the evidence for whether there is a systematic relationship between the presence and size of specific performance targets and firm investment.

Context

UK productivity growth since the 2007/08 Global Financial Crisis has been slow, and this challenge is unlikely to be resolved without significant investment. Furthermore, the UK faces additional challenges that will require long-term investment, such as infrastructure development, digital transformation, and climate change. However, reviews of the UK economic environment have raised concerns that investment decision-making in the UK tends to prioritise short-term financial returns rather than long-term growth and value creation, particularly amongst public firms.[1]

Recent historical data does suggest that UK investment is relatively weak compared to other advanced economies. For example, the UK lags European comparators on research and development (R&D) expenditure relative to gross domestic product (GDP), and also on firm investment as a share of GDP. Furthermore, the UK also lags the US, particularly on R&D, despite the similarities in their corporate governance structures.

There are many potential causes of short-termism, such as quarterly reporting and fragmented share ownership. One potential cause that has received significant attention is the structure of

[1] For example, see The Purposeful Company (2016). ‘The Purposeful Company - Interim report’.

executive pay contracts. Specifically, performance-based incentives might lead executives to prioritise short-term returns at the expense of long-run growth by cutting investment.

A previous study, published by the Department for Business, Energy and Industrial Strategy (BEIS) in 2019, investigated whether the UK's largest firms use share repurchases to meet CEO performance targets, and whether the use of share repurchases has a detrimental impact on firm investment.[2] The study found no evidence that share repurchases are systematically used to meet CEO performance targets nor that they crowd out investment. However, the study did find some evidence that the presence of earnings per share (EPS) targets in executive pay contracts was associated with lower capital expenditure (capex). This result suggested there could be broader relationships between executive performance targets and investment decisions.

These broader relationships between executive performance targets, the pay incentives associated with performance targets, and firms' investment decisions are the focus of this study.

Executive pay and investment

Executive pay packages are generally split into fixed compensation and performance-based rewards. This study focuses on the incentives created by the performance-based components, in particular annual bonus and long-term incentive plan (LTIP) schemes. These performance-based rewards can be important determinants of total executive pay. For example, amongst CEOs of FTSE All-Share firms in 2018, the average maximum potential value of the annual bonus and LTIP was 1.33 and 1.81 times the value of fixed compensation.[3]

The annual bonus and LTIP compensation that executives receive is contingent on conditions set by remuneration committees (RemCos). As well as setting the pay attached to each condition, RemCos will also set performance targets for each condition which determine the level of pay that the executive receives at different levels of performance. Upon achieving the 'threshold' performance target associated with a condition, the executive begins to receive a payout from the annual bonus or LTIP. This payout increases as performance improves, up until the 'maximum' performance target is achieved. The aim is to align the executive's incentives with shareholder interests while capping the maximum potential pay.

Often performance targets are set based on metrics such as profit or EPS, which measure firms' short-term financial health. Executives may be able to control their performance against these targets through their decisions on firm investment. For example, reducing R&D increases both profit and EPS. While this may boost the firm's short-term financial performance, it may harm long-term value creation.[4]

[2] BEIS (2019). 'Share repurchases, executive pay and investment'.

[3] PwC analysis.

[4] This is not to say that reductions in investment necessarily harm long-term firm performance: as noted in our literature review (Appendix A), they may help to curb overinvestment (and therefore improve future performance)

Approach

This study builds on existing academic literature that investigates the relationship between executive performance targets and investment. It expands the evidence base with UK-specific data using statistical and econometric techniques to analyse potential links between executive performance targets and investment. The analysis focuses on broad categories of performance targets within annual bonus and LTIP schemes. We focus our analysis on CEOs because they are the executives with overall authority over firm investment decisions, and also because their status and responsibilities are relatively consistent across major listed firms. The existence of other executive roles and associated responsibilities may differ across firms, depending on their governance structure and industry focus.

Our research dataset consists of UK firms in the FTSE All-Share index as of April 2020. These firms are tracked over the 2013-2019 period, which allows us to analyse their behaviour over time. To build the dataset, we combined firm-level financial data from CapitalIQ with a proprietary executive pay database covering CEO performance targets and incentives.

Our analysis seeks to study whether investment decisions taken by executives are significantly influenced by their remuneration targets, which could be detrimental to long-term firm performance. This could include, for example, cutting investment to increase earnings to meet a threshold target or to improve performance within a payout range. Alternatively, it could include, for example, an increase to investment to decrease short-term earnings, with the objective of not over-shooting a maximum target that was already likely to be achieved (i.e. to set a lower baseline for future performance discussions).

We employ three broad approaches to analyse our data:

1. Statistical analyses, which seek to understand the prevalence and calibration of different performance targets in executive pay contracts. The aim is to identify what incentives could be associated with executive performance targets and where CEOs could be incentivised to increase their current and future payout.
2. Threshold econometric analyses, which seek to understand whether performance targets affect CEOs' decisions on investment. More specifically, these analyses assess whether CEOs change firm investment to influence their performance against targets and therefore their pay.
    a. These analyses consider only a sample of firms that lie within a threshold of target performance. They focus only on executives who either just hit or just missed threshold or maximum payout levels.[5] Since whether the executive just

rather than causing myopic behaviour. For this reason, further research is needed to establish whether payout enhancing investment reductions improve or hinder future firm performance.

[5] Note that throughout this report we discuss CEOs 'just hitting' or 'just missing' different payout levels, this refers to CEOs hitting or missing the relevant payout level by a small margin. These two phrases do not have a temporal meaning.

hit or just missed the threshold should be essentially random, this allows us to study the causal effect of performance targets.

b. We approach this analysis from an (i) ex-post and (ii) ex-ante perspective. The former investigates whether CEOs *successfully* influenced their performance against targets through affecting firms' investment decisions, while the latter investigates whether CEOs *attempted* to use investment to influence their performance, whether successful or not. This econometric analysis is also supported by empirical assessment of the feasibility of using changes in investment to influence performance against targets.

3. General econometric analyses, which apply a large-scale approach to identify whether the presence and size of different performance targets is associated with more or less investment in aggregate. The aim is to assess whether the use of executive performance targets is correlated with more or less investment.[6]

We combine insights from these analyses to draw our conclusions.

Key findings

Our key findings are set out by research area below:

Literature review

1. The existing academic literature is primarily based on US evidence rather than UK evidence. It finds that executives change firm investment to influence their performance against targets, but that the actions taken vary depending on the type of target involved. Similarly, the impact of other executive pay incentives on firm behaviour varies by the type of incentive used.

2. There is additional evidence to suggest that executives take actions to beat other strategically important milestones such as zero earnings and last year's earnings. Studies have found that CEOs engage in myopic behaviour to beat these milestones, through their firms either generating unsustainable sales or overproducing to reduce the cost of goods sold.

3. CEOs may also take actions to beat analyst forecasts, as missing these can cause a significantly negative market reaction. Evidence suggests that firms increase accruals and cut R&D and advertising to pass these milestones, despite such actions being potentially detrimental to long-term value.

[6] We have also completed large scale econometric analysis to explore whether fixed executive compensation is adjusted to account for the expected value of performance-based compensation. The aim of this analysis is to assess to what extent annual bonuses and LTIPs act as de-facto base pay.

Statistical analysis of executive pay targets

4. Most CEOs' annual bonus and LTIP targets are concentrated within a relatively small number of target categories, and the relative prevalence of these categories has remained largely stable over the 2013-2019 sample period we consider. Specifically, we find that many annual bonus targets fall into the profit, personal and strategic measures categories, and we find that a clear majority of LTIP targets fall into the relative total shareholder return (TSR), EPS and other financial categories. This harmonisation of target types across firms makes it easier to identify the key target categories and analyse their relationships with investment.

5. A large proportion of CEOs (sometimes greater than 80%) achieve the threshold payout performance level across prevalent target categories, and this finding holds for both annual bonus and LTIP data. By contrast, achievement rates for the maximum payout performance level are more varied, ranging from 19% to 51% across target categories.

6. We can therefore say that achieved CEO performance often falls within the incentivised range (i.e. between the threshold and maximum payout levels), which suggests that targets could plausibly influence CEO behaviour and incentivise performance improvements. However, the high achievement rates for threshold payouts suggest that the CEOs of high-performing firms are unlikely to face significant challenges in meeting them. This finding implies that threshold payout targets may not affect CEO behaviour for some firms due to being highly achievable in any event.

7. Our analysis of the achieved CEO performance distribution for *annual bonuses* (specifically around the threshold and maximum payout levels) finds that performance tends to cluster asymmetrically around these levels, with many CEOs just hitting their threshold payout (relative to those just missing) and many others narrowly missing their maximum payout (relative to those just hitting). These patterns are consistent with CEOs' incentives to increase their current and future payout, because as we discuss in Chapter 3, CEOs start to receive payouts when performance exceeds the threshold payout level and they stop receiving additional payout once performance exceeds the maximum payout level.[7] The asymmetries in observed performance suggest that targets do have an influence on CEO decision making. However, we cannot rule out the possibility that targets have the desired effect of simply incentivising effort. The fact that more CEOs just meet rather than just miss the threshold payout is also consistent with CEOs working hard to hit it.[8]

[7] We refer the reader to Figure 3.2.1 (in Chapter 3) for a detailed explanation of how CEOs' incentive payout is affected by target performance.

[8] On the other hand, the fact that more CEOs just miss rather than just exceed the maximum payout suggests that maximum targets may encourage coasting close to the maximum payout. Still, even if incentives do lead to coasting behaviour once the maximum payout is reached, this may not necessarily be socially suboptimal if more stretching targets would lead to excessive focus on short-term performance at the expense of long-term value.

8. By contrast, our analysis of the observed CEO performance distribution for *LTIPs* produces much less evidence of asymmetries around the threshold and maximum payout levels, and there is less consistency across target types in the overall shape of the performance distribution. The differences between the annual bonus and LTIP distributions may reflect the relative difficulty that CEOs face in achieving the desired LTIP performance outcome, given that LTIPs tend to measure performance over a 3-year period, often against high-profile financial measures which capture success relative to competitor firms. By contrast, it is arguably easier for CEOs to influence their performance against annual bonus targets, given their short-term and often absolute (rather than relative) nature.

9. Taken collectively, our statistical findings support the hypothesis that performance targets affect CEO behaviour, and that CEOs influence their achieved performance in a manner consistent with increasing their current and future incentive payout (although we cannot definitively establish that payout motivations drive CEOs' observed behaviour, as opposed to other motivations). Importantly, it appears that CEOs are better able to influence their performance and achieve the desired outcomes when they have greater control over their performance, which is associated with less influence from external market conditions and shorter time horizons. Still, it should not be assumed from these findings that CEO performance targets (and their effects on CEO behaviour) are damaging to FTSE All-Share firms and wider society, as well-designed targets may guide CEOs towards better and mutually beneficial decisions.

Threshold econometric analysis

Statistical analysis of ex-ante and ex-post performance outcomes

10. Our analysis distinguishes between ex-post CEO performance, which captures actual CEO performance outcomes, and ex-ante CEO performance, which captures our estimates of how CEOs would have performed had investment remained at the previous year's level.[9] We find evidence that whilst CEOs' ex-post performance (i.e. whether a specific target is achieved or not) usually aligns with their ex-ante performance outcome, **there are numerous cases where investment changes are powerful enough to materially change the performance outcome**.[10] In other words, there are investment changes large enough to make the difference between CEOs missing a payout target and hitting that target.

11. As an illustration, we find 28 cases where CEOs hit their threshold payout targets when they would have otherwise missed them, because investment fell compared to the previous year's level. This represents 17.7% of the 158 cases where CEOs were set to

[9] In Chapters 2 and 4 of this report, we provide further detail on how we have estimated ex-ante performance based on certain assumptions about default investment growth.

[10] It should be noted that just because investment changes are powerful enough to materially change performance outcomes, this does not always mean that the direction of the change (and its effect on performance) aligns with CEOs' incentives to increase their payout. In this study, we find that investment changes run in both directions.

miss their threshold targets based on the previous year's investment level. On the other hand, this also means that investment did not fall materially (i.e. substantially enough to change the target achievement outcome) in 82.3% of cases.

12. We also find 46 cases where CEOs missed their maximum payout targets when they would have otherwise hit them, because investment grew compared to the previous year's level. This represents 16.2% of the 284 cases where CEOs were set to hit their threshold targets based on the previous year's investment level.

13. These discoveries contrast with the 2019 BEIS study mentioned above, which found that no firms successfully used share repurchases to meet EPS targets because their effect on EPS performance is too weak. This suggests that changing investment is **a significantly more powerful way of maximising performance-based payouts than share repurchases**. One reason for this could be that share repurchases are a fairly irregular and high-profile event which affect only a subset of FTSE companies each year, whereas investment decisions are regular and material for any major business.

14. Moreover, we find noticeable asymmetries in how investment changes alter target performance outcomes at different points of the payout distribution. At the threshold payout level, it is more common for investment to fall and CEO performance to improve, whereas at the maximum payout level, it is more common for investment to rise and CEO performance to fall. These patterns are consistent with CEOs' incentives to increase their current and future payout.

15. In those cases where year-on-year investment changes are material enough to alter CEOs' target achievement outcome (either positively or negatively), we find that the year-on-year changes to investment (and the resulting changes in performance against targets) are often large. This finding implies that it may be easier for those CEOs whose firms have (i) high investment intensity and (ii) potential for year-on-year volatility in investment spend to successfully enhance their payout using investment decisions. Those CEOs whose firms do not meet these requirements may find it harder - although certainly not impossible - to enhance their payout in this way.

16. Overall, whilst there is some evidence to suggest that CEO performance may influence firms' investment decisions, it is important to note that most of the time ex-ante and ex-post performance outcomes are similar or identical. Across the two target and investment relationships we study, we find that the ex-ante and ex-post performance outcomes align in 1612 of 1706 cases (94.5%) when threshold and maximum payout results are combined.[11] In other words, it is relatively rare for investment to change substantially enough (either positively or negatively) to affect target achievement status.

[11] To calculate this result, we consider all observations (where both an ex-ante and ex-post outcome is available) around both the threshold payout and maximum payout. This includes the 158 cases where the ex-ante outcome is target non-achievement at the threshold (as cited in paragraph 11) and the 284 cases where the ex-ante outcome is target achievement at the maximum (as cited in paragraph 12), but also 685 cases where the ex-ante outcome is target achievement at the threshold and 579 cases where the ex-ante outcome is target non-achievement at the maximum. In total, this gives 1706 cases. For further detail on our statistical analysis of ex-ante and ex-post performance outcomes, we refer the reader to Chapter 4.

This indicates that, while greater than for repurchases, the scope for CEOs to materially change performance outcomes using investment levers is likely to be limited.

Econometric analysis of ex-post and ex-ante performance outcomes

17. Our econometric analysis of ex-post outcomes produces mixed findings. There is some evidence across several of the target measure and investment combinations that firms whose CEOs just hit their maximum payout target undertake greater investment growth than firms whose CEOs just miss their maximum target.

    a. This evidence is consistent with the hypothesis that CEOs who are already on track to exceed the maximum target increase firm investment to avoid significantly outperforming against the target. Doing so might lead to the maximum ratcheting up next year. In addition, increasing investment gives the CEO greater latitude to cut investment to hit future targets.

    b. However, this finding is not consistently replicated across the suite of econometric regressions run for these variable relationships.

18. Our analysis also finds some evidence of negative relationships between CEOs just hitting their maximum payout for LTIP EPS targets and measures of accruals.[12] This provides potential evidence of managing accounting earnings to influence performance against targets.

    a. This evidence is consistent with the hypothesis that CEOs who are already on track to exceed the maximum target reduce firm accruals to avoid significantly outperforming against the target. Doing so might lead to the maximum ratcheting up next year. In addition, reducing accruals gives the CEO greater latitude to increase them to hit future targets.

    b. However, this finding is not consistently replicated across the suite of econometric regressions run for these variable relationships.

19. However, the broader finding across our ex-post econometric analysis is that there are relatively few strong relationships between target performance and investment, with most relationships being weak or non-existent. This contrasts somewhat with the finding of asymmetric investment changes in our statistical analysis, and may indicate that this behaviour is targeted among particular firms in specific circumstances - for example, those with high investment intensity and thus greater latitude to cut investment - rather than being widespread.

20. Our econometric ex-ante analysis produces relatively similar findings to our ex-post analysis. For one of the two target measure and investment relationships studied, there

[12] Accruals is not an investment measure: instead it is an additional dependent variable which we investigate in this study. The difference between investment measures and accruals is explained in Chapter 2. We measure accruals as the change in net operating assets, that is, net income not covered by cash.

is some evidence to suggest that firms whose CEOs are on track to hit their maximum payout target undertake greater investment growth than firms whose CEOs are on track to miss their target.

   a. This finding is consistent with the hypothesis that CEOs who are on track to exceed the maximum payout target have an incentive to increase firm investment and reduce performance, to avoid outperforming the target by too much.

   b. However, this finding is not fully replicated across all of the econometric regressions run, including the baseline specification.

21. As with the ex-post analysis, the broader finding is that most of the relationships between CEO performance and investment are weak or non-existent. As noted above, CEOs may only have latitude to increase or decrease investment to achieve desired performance outcomes in firms with high investment intensity.

22. Across our threshold econometric analyses, we generally find less evidence of investment being used to influence performance around the threshold payout target than the maximum. This may reflect how a large proportion of CEOs meet or exceed their threshold payout targets (as discovered in our statistical analysis of executive pay data) and so there is less need to change investment to achieve these targets.

General econometric analysis

23. Our general econometric analysis, which explores relationships between the presence and size of performance targets and measures of investment growth and accruals, finds relatively limited evidence of strong relationships. For most target measure and investment combinations studied, we find weak or non-existent relationships.

   a. The few significant relationships are positive, implying that the presence or increased size of particular targets leads to higher investment growth or higher accruals. The investment growth result contradicts the hypothesis that CEOs will reduce firm investment to hit targets. However, the accruals result is consistent with the hypothesis that CEOs will increase firm accruals to hit targets.

   b. Unlike the 2019 study, we do not find a significant negative relationship between the size of LTIP EPS targets and capex due to differences in the sample and specification. This study has a larger sample, and so the results are likely to be more representative.

24. The lack of a consistent relationship between performance targets and investment may arise for two reasons:

   a. First, omitted variables distort the observed relationship. One such omitted variable could be the CEO's latitude to influence investment. It may be that boards only put certain types of performance targets in place when this latitude is low, e.g. due to the firm having low investment intensity or the board closely

monitoring investment. These omitted variables are also why we do not make causal claims with the general regression analysis.

b. Second, it is *a priori* unclear whether targets will incentivise CEOs to increase or decrease investment. They have incentives to decrease investment if they are near the threshold, but increase it if they are near the maximum. This is another reason why the more targeted analyses, that differentiate between the threshold and maximum, are more reliable.

25. Many of the intricacies around incentive effects, such as those highlighted in our threshold analysis, may be lost in our general econometric analysis. Evidence of such behaviour, which would be of concern, could occur and yet not be reflected in our general econometric analysis.

Next steps and avenues for further research

This study has conducted detailed investigation into how CEOs typically perform against their annual bonus and LTIP targets, and it has also considered a broad range of relationships between executive pay targets and investment decisions. Whilst there is good evidence to suggest that CEO performance targets do influence firm performance in a manner consistent with increasing CEO payout, it is much less clear that CEOs are influencing firm performance (and therefore their pay) by changing investment. There is some evidence of such investment decisions amongst certain firms, but less clear evidence of this behaviour across the wider FTSE All-Share group.

We note that the latter finding does not necessarily mean that CEO pay is correctly set in most large firms. Indeed, one reason why there is little need for CEOs to reduce investment to hit the threshold payout could be that threshold targets are too easy to hit. Still, the evidence does not suggest a systematic problem with executive pay causing underinvestment.

We consider that this study provides useful insights into executive pay and its relationships with investment, particularly in terms of building the UK evidence base. We believe that there is scope for further research to shed greater light on the overall value of CEO performance targets, and how they may lead to CEOs acting in their own self-interest (whilst also potentially having some positive consequences). The following research topics would benefit from additional study:

1. One limitation of this study is that it considers evidence from all firms across the FTSE All-Share, without a detailed assessment of how investment conditions vary significantly across these firms, and how this might affect CEOs' ability to influence investment in their own favour. Further analysis could seek to stratify companies and test whether relationships between investment and CEO performance are stronger within particular sectors compared to others. A key challenge would be gathering sufficient data to perform a robust analysis, given the sample size constraints we identified when conducting this study.

2. Further studies may seek to build on the ex-post and ex-ante performance framework developed in this study. Our ex-ante analysis assumes that investment would have stayed at the prior year's level. A more complex analysis could consider changes in firm performance, economic uncertainty and other determinants of investment, which would lead to the 'neutral' level of investment being different from last year's level.

3. Further research could also explore whether UK CEOs use other channels beyond investment to influence short-term target performance, such as opex reductions or employee redundancies. An added challenge with these alternative channels is that there might be a wide range of reasons why opex or employee headcount could fluctuate under 'business as usual' conditions, irrespective of CEO decisions. Opex is heavily influenced by routine business activities, and research into potential decision-making would need to identify its most discretionary elements, such as marketing expenditure.

4. Additionally, further research could consider whether the use of particular CEO performance targets drives improved firm performance in subsequent years. There has been some research published on this topic, but much of it focuses on the US rather than UK context. As our literature review (in Appendix A) indicates, it is possible that positive effects of performance-based pay targets on future firm performance may help to mitigate any negative long-term impacts arising from CEOs responding to financial incentives to influence their payout. However, it is very difficult to demonstrate causality in either direction. Whether a firm is just above or just below a target is essentially random, but whether a firm has a performance target is not random - boards choose to implement performance targets. Thus, as mentioned earlier, a positive link between targets and performance would not imply that the former caused the latter, as it could be that an attentive board caused both.

1. Introduction

This chapter first explores the context to this report, including the public interest in executive pay practices and perceived corporate short-termism amongst UK firms. The focus then turns to the specific purpose of this research and how it relates to a previous study on share repurchases, executive pay and investment, which was published by BEIS in 2019. The chapter concludes by outlining the structure of this report.

Context

Public discussion on executive pay

There has been ongoing public discussion on the disparity between the pay of CEOs and ordinary workers for many years, beginning in the mid-1990s. In 2016, polling evidence showed that there was significant public concern in relation to executive pay, with two thirds of the UK population believing that executive pay is generally too high.[13] Concerns about levels of CEO pay led to the requirement for UK listed companies with more than 250 employees to disclose, from 2019, the ratios between the pay of the CEO and the quartiles of pay in the UK workforce. For FTSE-100 companies with financial year ends between 31 December 2019 and 30 June 2020, the median disclosed ratio between CEO pay and the company's median UK employee was 73:1.[14]

Concern has extended beyond the level of pay to its structure. There have been concerns over whether executive pay is properly linked to performance and whether it may even incentivise short-term behaviour at the long-term expense of both firms themselves and society. This has resulted in executive pay structures playing a prominent role in parliamentary investigations of the banking crisis and cases of firm failures, e.g. Carillion in 2018.[15]

The regulatory response to the banking crisis included wide-reaching provisions to lengthen the timeframe of pay schemes, to enhance governance and disclosure relating to pay, and to change the way in which performance is measured. Across all sectors, UK investors, the government and the Financial Reporting Council (FRC) have made efforts to reform executive pay design and disclosure. Some of the measures include:

- Introduction of a binding vote on executive pay policy for UK listed companies in 2013, coupled with enhanced disclosure requirements, including mandated disclosure of the

[13] PwC (2016). 'Time to listen'.

[14] PwC analysis of 82 FTSE-100 companies with financial year ends between 31 December 2019 and 30 June 2020.

[15] Business, Energy and Industrial Strategy and Work and Pensions Committees (2018). 'Carillion: Government response'.

details of executive pay targets relating to the variable elements of the 'Single Figure' of each directors' total pay;

- Revisions to the Investment Association Guidelines in 2016 to reflect recommendations of greater alignment of pay structures with company strategy, greater flexibility in shareholder guidelines to enable a lesser emphasis on target-based LTIPs, and greater focus on deferred share awards;[16]
- Revisions to the UK Corporate Governance Code in 2018 to: encourage higher quality reporting; lengthening of vesting and holding periods for LTIPs from three to five years; an obligation on the RemCo to engage with the wider workforce on how executive pay aligns with wider company pay policy; alignment of executive pension arrangements with the wider workforce; and encouraging the RemCo to apply judgement and discretion when determining executive pay outcomes, particularly where '*formulaic outcomes*' lead to unjustified payouts from incentive plans;[17] and
- Introduction of a new UK regulation in 2018 requiring large[18] publicly listed UK firms to disclose and explain each year the ratio of their CEO's total pay to both the median pay and the lower and upper quartile pay points of their UK employees. Mandatory reporting has been required since the beginning of 2020.

These measures, as well as ongoing public concern, have contributed to an environment of relatively static executive pay levels amongst FTSE 100 firms over the last decade. Indeed, median CEO pay in June 2019 reached its lowest level since 2011, at £3.61 million. This represents a reduction of 0.5% compared to 2018 and followed a fall of 8.6% in the previous year.[19] For context, the estimated growth in UK median gross annual earnings have only recently returned to pre-2008 levels (around an average of 3.8% annual growth), with 3.9% growth and 3.4% growth in 2019 and 2020 respectively. In comparison, estimated median gross annual earnings increased by 'only' 1.7% on average between 2011-2018, suggesting pay levels have been relatively static for all UK employees.[20]

Public discussion on investment and short-termism

The UK economy is facing a series of challenges, including ongoing low productivity and the recovery from COVID-19. Addressing these challenges is likely to require long-term investment.

The UK has experienced an ongoing, extended lull in productivity growth with a particularly slow recovery following the 2007/08 Global Financial Crisis, as shown in Figure 1.1.1. Moreover, the UK's performance lags many of its comparator countries – including Germany,

[16] Executive Remuneration Working Group (2016). 'Interim report'.

[17] FRC (2018). 'The UK Corporate Governance Code'.

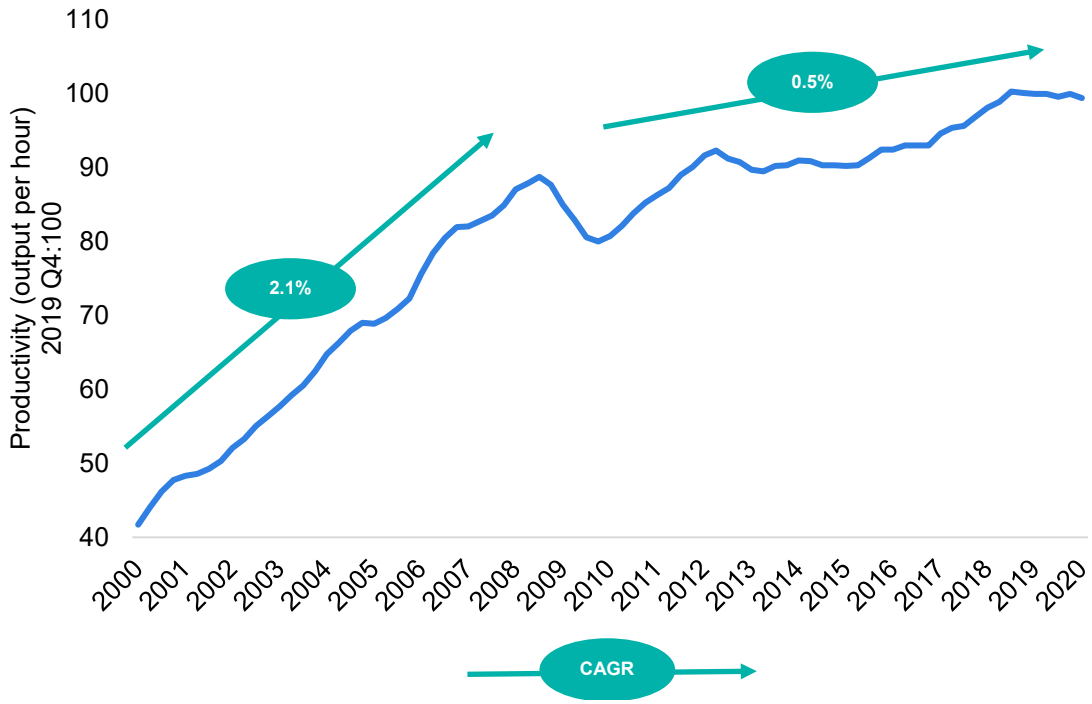
[18] Over 250 employees.

[19] CIPD (2020). 'FTSE 100 CEO pay in 2019 and during the pandemic', p.4.

[20] ONS (2020). Annual Survey of Hours and Earnings time series of selected estimates, Table 1.

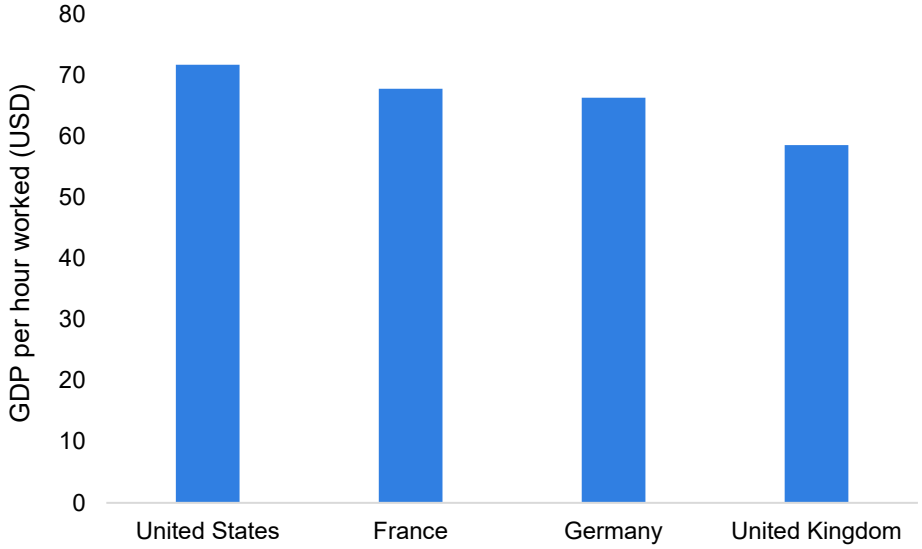
France and the United States – as shown in Figure 1.2.2. PwC analysis suggests the UK's productivity shortfalls reflect "*slower productivity growth since the financial crisis…but also long-term structural challenges facing the UK economy related to factors like infrastructure and skills*".[21]

Figure 1.1.1: UK productivity and compound annual growth rate (CAGR), 2000-2020



Sources: PwC analysis of ONS and OBR data

Figure 1.1.2: UK and comparator country productivity in 2019



Note: Productivity is measured here by GDP per hour worked, expressed in US dollars.

[21] PwC (2019). 'UK Economic Outlook', p.3.

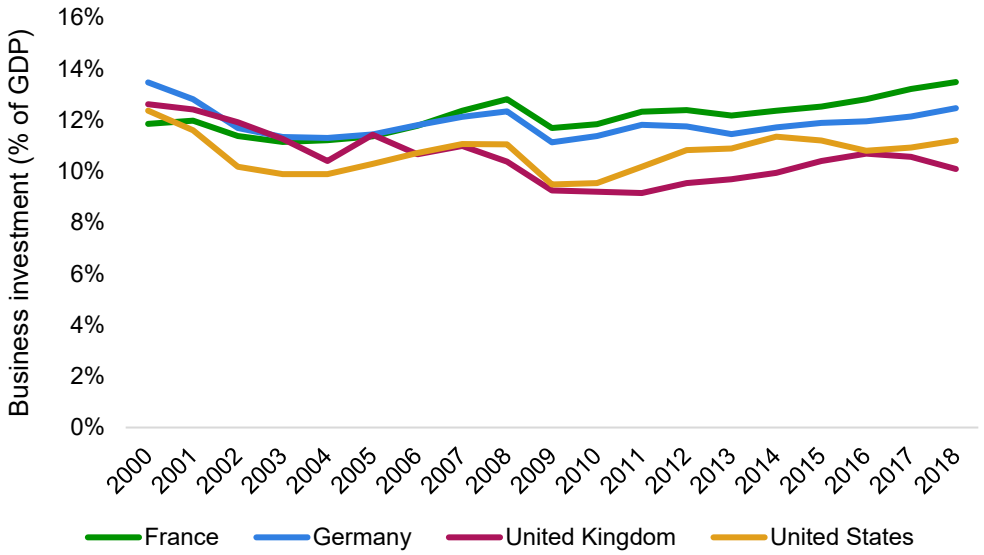
Source: PwC analysis of OECD data

Significant long-term investment is needed to address the UK's productivity challenge. Some argue that particular investment in infrastructure, digital transformation and upskilling could help the UK reduce its productivity gap with other advanced economies.[22]

However, UK firm investment has been weak in recent years, partly due to a challenging macroeconomic environment. Prolonged uncertainty about the future trading relationship between the UK and the EU has likely contributed to lower firm investment than would have otherwise been the case.[23]

Figure 1.1.3 demonstrates how the UK lags behind its counterparts on firm investment as a share of GDP, with firm investment at 10.1% of GDP in 2018, compared to 11.2%, 12.5% and 13.5% in the United States, France and Germany respectively.

Figure 1.1.3: Corporate investment in UK and comparator countries[24]



Source: OECD

More recently, the COVID-19 crisis has put further pressure on the UK economy, with the OECD forecasting an 11.5% decline in UK GDP in 2020.[25] Disruption and uncertainty caused by the crisis has also contributed to businesses delaying or forgoing investment programmes, which could lead to long-term economic scarring. In particular, the OBR November 2020

[22] PwC (2019). 'UK Economic Outlook', p.32.

[23] For example: Bank of England (2019). 'The impact of Brexit on UK firms'. Staff Working Paper No. 818.

[24] As defined by the System of National Accounts (2008).

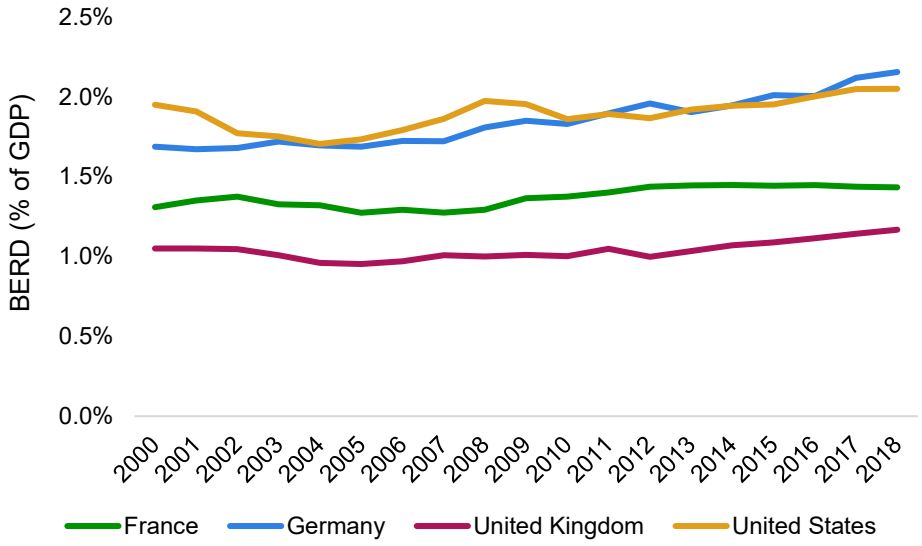
[25] OECD (2020). Real GDP forecast; Single-hit scenario, Annual growth rate (%), 2020.

central scenario forecasts 9% less cumulative firm investment between 2024 and 2020 compared to the OBR's March 2020 forecast.[26]

UK investment to aid the recovery from COVID-19 should look to the long-term to address these structural challenges.[27] However, there has long been a debate as to whether UK investment is particularly short-termist relative to other advanced economies.

As an example, the UK's record on research and development (R&D) expenditure demonstrates a potential tendency for short-termism. R&D is vital for innovation and drives long-term productivity improvements, yet can come with a higher risk as the outcomes are less certain. UK expenditure on R&D as a proportion of GDP has remained consistently below that of most of its comparator countries in Europe (as shown in Figure 1.1.4 below). Between 2000 and 2018, UK R&D expenditure has remained below 1.75% of GDP, whereas in Germany, France and Sweden average R&D expenditure has been at least 2.00% of GDP.

Figure 1.1.4: Business enterprise R&D (BERD) expenditure in UK and comparator countries



Source: OECD

Furthermore, businesses will increasingly need to invest in new technologies to remain competitive. Identifying the causes of potential short-termism will be key to addressing the barriers to long-term investment. As we explain further below, this research aims to understand whether the design of executive pay contracts could create incentives for short-term behaviour.

[26] OBR (2020). 'Economic and fiscal outlook'.

[27] Centre for Economic Performance (2020). 'Strategy, investment and policy for a strong and sustainable recovery: An action plan'.

Potential for executive pay to incentivise short-termism

In theory, executive pay should perfectly align the CEO with shareholders to prevent the CEO taking short-term actions that benefit them but not shareholders.[28] In practice, this is not possible for a number of reasons. First, perfect alignment would involve the CEO owning the entire company, so that they would be fully accountable for changes in firm value, but this would not be practical. In practice UK CEOs own less than 0.1% of their firm, which means that they lose less than £1,000 when firm value falls by £1,000,000.[29] Second, certain CEO actions take a very long time to affect performance, such as developing a new drug. Perfect alignment would pay the CEO according to performance in 15-20 years' time, but this is impractical as CEO tenures are much shorter. Similarly, even within the CEO's tenure, the CEO needs a basic salary. Market forces therefore lead to a balance of fixed and variable pay elements to attract a CEO. To achieve alignment subject to these constraints, CEO pay packages have evolved with the following three features:

- A mix of fixed pay elements (like salary and pension) and variable elements (like bonus and LTIPs).
- Performance targets attached to bonuses and LTIPs that attempt to incentivise CEOs to take actions that will lead to long-term performance.
- A significant proportion of the package being delivered in company shares to make the CEO sensitive to changes in the share price during, and for a period beyond, their tenure.

Although these aim to make CEO pay dependent on performance, this dependence in turn may give the CEO an incentive to take short-term actions to influence assessed performance for pay purposes, for example through:

- Taking actions to hit the threshold payout targets where bonuses or LTIPs start to be paid, or to increase performance within the payout range; or
- Taking actions to avoid exceeding maximum payout targets which may lead to them being increased in future.

This first problem is the principal reason why there are widespread concerns that executive pay leads to short-termism. However, these concerns need to be evaluated systematically with evidence, and are the focus of this study.

[28] Edmans, A. and Gabaix, X. (2016). 'Executive compensation: A modern primer' *Journal of Economic Literature*, 54, pp.1232-1287.

[29] The Purposeful Company (2017). 'Executive remuneration report'.

Purpose of the study

This research was commissioned by BEIS in March 2020. It follows on from a previous study, published by BEIS in July 2019, which investigated whether the UK's largest firms use share repurchases in order to meet CEO performance targets, and whether the use of share repurchases therefore has a detrimental impact on firm investment.

The 2019 study used a range of research methodologies to investigate these research questions and found no evidence that share repurchases are systematically used to either meet CEO performance targets or crowd out investment. Notably, the study found that share repurchases were not material enough to make the difference between a CEO missing or meeting their performance targets. However, the study did find some evidence of a direct negative relationship between the presence of EPS targets in executive contracts and capital expenditure (capex). This finding indicated the potential for a broader relationship between CEO performance targets and investment decisions, regardless of whether share repurchases are undertaken.

The findings of the 2019 study, together with significant public interest in the links between executive pay practices and corporate short-termism (as noted above), motivated this research into direct relationships between CEO performance targets, the pay incentives associated with those targets, and firm investment. The overall objective of this research is to assess whether CEO pay incentives linked to target performance exert influence on achieved performance, and if so, whether there is evidence that CEOs respond to these incentives in a manner which enhances their current and future payout. The scope of this research is limited to companies listed on the FTSE All Share index as of April 2020.

Specifically, the study has three core aims. These are:

1. To explore the prevalence of different performance targets in UK executive pay contracts, with a view to better understanding the use of different target types and whether they are calibrated effectively to incentivise target achievement.
2. To examine the evidence for whether CEOs influence firm investment decisions to improve performance against specific targets in their pay contracts.
3. To examine the evidence for whether there is a systematic relationship between the presence and size of specific performance targets and firm investment.

This study does not address the separate question of whether certain executive performance targets and incentives drive better subsequent firm outcomes (such as higher profit, revenue or employment). Although CEO performance targets often include firm-level performance indicators themselves, this question is not the focus of the research, and this study does not consider whether the use of performance targets in one year can influence performance in future years. Doing so is also very difficult, because correlation does not imply causation. Even if targets were positively associated with future performance, it may not be that the targets

caused the performance improvement; instead, it may be that an effective board both implemented the targets and improved performance.

Our research approach focuses on statistical and econometric analysis of UK investment data and UK executive pay data for 2013-2019, with our sample being restricted to firms listed in the FTSE All-Share index as of April 2020. To build the dataset, we combined firm-level financial data from Capital IQ with a proprietary executive pay database covering CEO performance targets and incentives.

Report structure

The rest of this report is structured as follows:

- Chapter 2: "**Approach**" provides an explanation of the methodological approach used to undertake this analysis, including: our data sources, statistical analysis of investment and executive performance targets, and econometric analysis of the relationships between CEO performance and investment.
- Chapter 3: "**Statistical trends in investment and executive performance targets**" explores key concepts associated with investment and executive performance targets, and examines statistical trends in these variables, including the typical distribution of investment variables and the success rates, performance distribution and financial materiality associated with different CEO performance targets.
- Chapter 4: "**Econometric analysis**" explores the findings of our econometric analysis looking at relationships between CEO performance and firm investment and accruals. This chapter first assesses the evidence for CEOs using investment to influence their achieved performance, before then analysing the broader influence of the presence and size of CEO performance targets on investment.
- Chapter 5: "**Conclusion**" summarises our overall findings and identifies possible areas for future research.
- Appendix A contains a literature review which we draw upon at relevant points in the report.
- Appendix B summarises the data sources used for our analysis in this report.
- Appendix C presents further statistical analysis of investment and executive pay, not detailed in the main body of this report.
- Appendix D contains the full details of our econometric analysis, including methodology and results.
- Appendix E details the bibliography drawn on in this report.

2. Approach

This chapter begins with an overview of the data sources used in our analysis before providing a high-level summary of the statistical and econometric approaches used for this research. This chapter introduces the key concepts, measures and methodologies that will be referred to throughout the analysis. More detail on the approaches we have used, including for the econometric analysis, can be found in Appendix D.

Data sources

We created a bespoke dataset by merging financial variables from Capital IQ with PwC's executive pay database. We summarise the PwC executive pay database at the end of this section. Our sample consists of firms in the FTSE All-Share as of April 2020. These firms are tracked back to 2013, which allows us to analyse their behaviour over time.[30] 2013 was also chosen as the start of the dataset as it is the first year in which new disclosure requirements applied, mandating the disclosure of annual bonus performance targets. This disclosure is required for some dimensions of our analysis. The key characteristics of the dataset are outlined in Table 2.1.1 below:

Table 2.1.1: Summary of financial and executive pay variables included in our study[31]

	Financial variables	Executive pay variables
Source	Capital IQ	PwC executive remuneration database
Number of variables	30+	240+
Years covered	2010-2019	2013-2019

[30] One might wonder if there is a concern with survivorship bias, since firms that dropped out of the FTSE All-Share prior to 2020 may have behaved differently than those that survived. It may be that those firms invested less, and failed to survive as a result (or invested too much and overextended themselves). However, our focus is not the level of investment, but the link between investment and performance targets. It is not clear why this link will be different between firms that survived and firms that dropped out.

[31] Note that all charts and data are drawn from this dataset unless otherwise stated.

	Financial variables	Executive pay variables
Key types of variables used	Measures of investment, our variables of interest Firm characteristics, e.g. firm age, or full-time employees Measures of financial performance, e.g. market capitalisation or stock returns	CEO characteristics Package composition details Annual bonus details, including target ranges and performance against targets LTIP details, including target ranges and performance against targets

PwC executive pay database

The PwC executive pay database reports on executive pay for FTSE All-Share firms from 2009-2019. It includes a broad coverage of pay, including executive characteristics and their pay packages. All CEO pay data, the focus of this study, is sourced from publicly available documents such as firm annual reports.

Executive pay data is collected through desk-based research and updated on a rolling basis as firms publish their annual reports. It is collected using standardised forms to maintain consistency which are reviewed by the PwC Executive Remuneration team. The database is then updated and checked using automated processes. Data maintenance is continual, and any errors are reported, fixed and updated within the database.

We have undertaken additional data cleaning and checking in preparation for this analysis. For example, this includes converting non-GBP currency units to GBP using historical exchange rate data from Capital IQ, and selecting the newer CEO when two observations are available for one year due to a change in CEO.

Statistical analysis of investment and executive performance targets

The aim of our statistical analysis is to introduce key concepts associated with investment and executive performance targets and understand how these variables have moved over time. This section is divided into two subsections explaining the different types of statistical analysis relating to (i) investment, and (ii) executive performance targets.

Investment

Investment is the primary dependent variable for our econometric analysis. Statistical analysis of the chosen investment measures enables us to understand key trends and informs our choice of econometric methodology.[32]

Our analysis focuses on the following types of investment, which are scaled by total assets, lagged by one year, to control for the effect of firm size on investment:

- Capex
- Net investment (capex minus depreciation)
- R&D expenditure

We study R&D because it is typically expensed and so reduces profit by the full amount of the investment. Capex is not expensed, but profit still falls by one year's worth of depreciation. In addition, if the capex is financed by raising debt, interest expense will rise; if it is financed with cash, interest income will fall.

Real earnings management is where the company makes decisions on real firm activities, e.g. investment, to achieve performance-based pay targets. However, our literature review also highlighted the potential for accounting earnings management to be used to achieve these targets. This refers to accounting policies, which do not change the firm's actual actions, but merely how its financial results are reported. More detail on the findings of our literature review can be found in Appendix A.

Therefore, we expand our focus to include the following types of accounting measures, which are also scaled by lagged total assets:

- Total accruals (change in net operating assets, i.e. net income not covered by cash)
- Discretionary accruals (the component of total accruals that is most likely at the manager's discretion)

An increase in accruals increases reported earnings. Further explanation of these different measures of investment and accruals is provided alongside the results of the statistical analysis in Chapter 3.

The statistical analysis of firm investment and accruals covers the 619 constituent firms of the FTSE All-Share in April 2020 over the period 2010-2019, although the exact sample for each measure varies depending on data availability. The analysis examines the level of investment and accruals at the 10th, 30th, 50th, 70th and 90th percentile in each year, as well as the average level of investment and accruals across the sample.

This analysis allows us to see how the distribution of each investment and accruals variable has changed over time.

[32] More detail on the choice of econometric methodology is provided in Appendix D.

Executive performance targets

Executive pay packages typically contain both a fixed base salary and performance-based rewards, such as an annual bonus or LTIP scheme. The achieved payout associated with performance-based rewards is determined by the executive or the firm's performance against several targets. It is these performance-based targets that are the focus of our study.

Performance-based targets are assigned a threshold and a maximum payout level: the threshold level marks the point where the executive will begin to receive additional pay through the annual bonus or LTIP. This pay increases as performance improves up until the maximum level, beyond which point the executive will receive no further pay for improved performance. We explain the relationship between target performance and achieved payout more comprehensively in Chapter 3.

For our statistical analysis, we have constructed five empirical measures to assess trends in CEO target performance. We first calculate each of these measures for each of our CEO-year performance observations, and we then aggregate the results across our sample, which allows us to study the distribution of CEO performance and identify key patterns or trends in the data.

At the aggregate level, we focus our analysis on descriptive statistics such as the average, count and frequency distribution of our empirical measures. Unless otherwise stated, our analysis applies to both annual bonus and LTIP targets. Our empirical measures, and the analysis relating to each one, are set out in Table 2.2.1 below. We refer the reader to Table 3.2.2 for a more detailed explanation of each measure and the purpose it serves.

Table 2.2.1: Measures constructed to analyse executive performance targets

Measure	Definition	Analysis undertaken
M1: Target prevalence	The total number of targets set under each target category, and the number of firms using each target category.	Analysis of the number of targets set under each target category (and relative share by category). Analysis of the percentage of firms in our sample using each target category.
M2: Target hit rate	An indicator variable that takes the value 1 when a target was hit or exceeded, or 0 otherwise (examined separately for 'threshold' and 'maximum' targets). When aggregated, this gives the target hit rate.	Analysis of hit rates across targets, and whether significant differences exist between hit rates for threshold and maximum targets.

Measure	Definition	Analysis undertaken
M3: Target deviation	The percentage deviation of achieved performance from the target (examined separately for 'threshold' and 'maximum' targets). When aggregated, this gives a target deviation distribution.	Analysis of the distribution of target deviations for key financial targets.
M4: Achieved package share	The percentage of a CEO's total potential pay (or total potential pay package) achieved through performance against a specific target.	Analysis of whether there are significant differences in mean achieved package share across different target categories.
M5: Mean vesting share	The percentage of the total available award for a specific performance target which is earned through achieved performance on average.	Analysis of whether there are significant differences in mean achieved vesting share across different target categories.

For all of the analysis conducted, we only draw inferences for cases with a sufficient sample size. In general, we consider 100 observations to be sufficient, because this allows for robust statistical inference. Although a greater sample size is needed to establish very precise estimates, our interest here is less in establishing exact point estimates and more in identifying key patterns from the data and comparing results across the most prevalent target categories (for which sample size varies).

Econometric analysis of investment and executive performance targets

Our econometric analysis aims to identify the relationship between executive performance targets and investment. We examine the evidence for two hypotheses:

1. CEOs will cut investment to improve their performance against targets until the maximum performance level is achieved, so that they can maximise their pay.
2. Once the maximum payout level is achieved, CEOs will increase investment to reduce their performance, so that they do not outperform their targets when there is no associated financial gain.[33]

We deploy three types of econometric analysis to test these hypotheses:

[33] Further discussion of how incentives vary along the payout profile is provided in Chapter 3.

1. **Ex-post threshold analysis** investigates whether firms whose CEOs just hit targets undertook different investment growth compared to those whose CEOs just missed targets. If so, this might indicate that those executives made investment decisions based on their performance against targets.
2. **Ex-ante threshold analysis** investigates whether firms whose CEOs were on track to just miss targets (based on previous investment levels) undertook different investment growth compared to those whose CEOs were on track to just hit their targets. This might indicate that during the year executives who were on track to just hit or just miss targets made investment decisions in an attempt to alter their performance against targets.
3. **General regression analysis** of the link between the size and presence of different executive performance targets and different measures of investment. This is to test a more general hypothesis that executive pay design creates incentives that influence investment.

For all pieces of analysis, we use a pooled ordinary least squares (OLS) estimator, using a pairs-bootstrap to draw inference. We use time, industry and firm financial controls to remove such effects that may be correlated with our dependent and independent variables of interest. See Appendix D for more detail on the econometric methodology and choice of estimator.

The remainder of this section sets out the motivation for each of these pieces of analysis, the approach taken and the interpretation of results. The results of our econometric analysis are presented in Chapter 4.

Ex-post threshold analysis

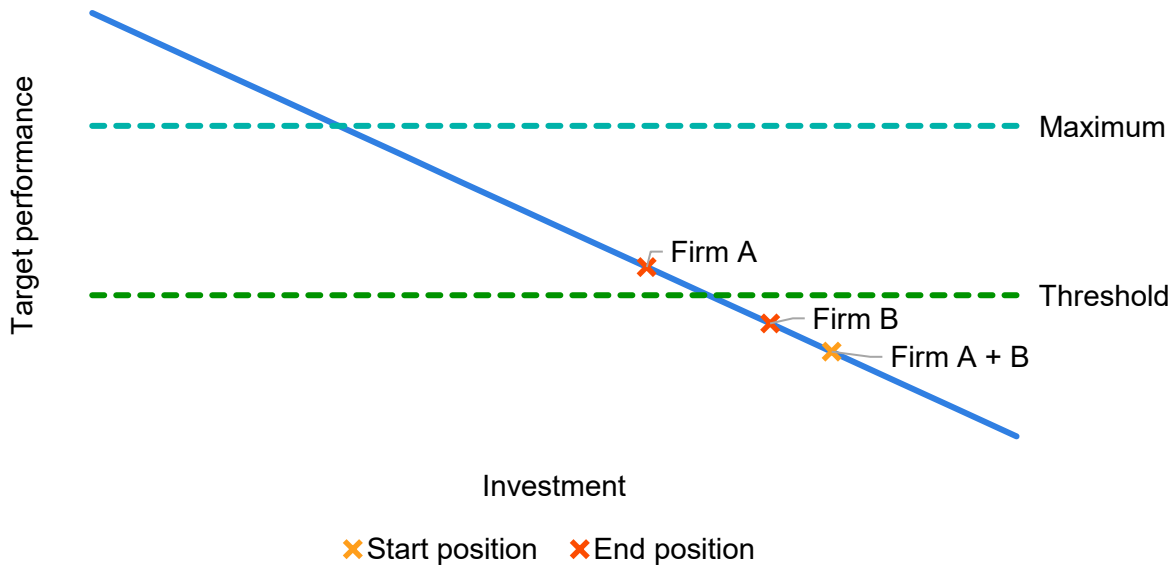
Ex-post threshold analysis takes the sub-sample of firms whose performance was very close to a target and investigates whether firms whose CEOs just hit a target undertook different investment growth compared to firms whose CEOs just missed a target. We examine performance around both the threshold payout and the maximum payout targets for this analysis.

The intuition behind this analysis is that whether a firm is just above or just below a target should be essentially random. Thus, any bunching either below or above the target is likely to be caused by CEOs responding to the incentives associated with targets. Also due to the randomness, whether a firm is just above or just below a target is unlikely to be driven by omitted variables that also affect investment. Any effect on investment can thus be attributed to CEOs responding to incentives in their own self-interest rather than omitted variables, allowing us to have a causal interpretation of the results.

Figure 2.3.1 below sets this framework out diagrammatically. When all other things are held constant, firms face a trade-off between target performance and investment, presented here as the blue line. The CEO is set a threshold and maximum performance level for their target. If Firm A and Firm B start with the same investment level, their CEOs are both on track to miss the threshold payout target. However, by reducing investment they can improve their performance. In this scenario, Firm A reduces investment by more than Firm B and its CEO

can meet the threshold payout target. Firm A's CEO is classed as hitting the target ex-post, while the Firm B's CEO is classed as missing the target ex-post.

Figure 2.3.1: Relationship between investment and ex-post target performance



We select a sample of firms deemed to have either *just hit* or *just missed* the target that gives a reasonable sample size for the analysis. We explain this step in more detail within Chapter 4. We face a trade-off whereby we want to take only the firms whose performance was closest to the relevant target but need a large enough sample size to be able to draw inference robustly.

The aim is to identify whether CEOs who *just hit* their performance targets increase or decrease investment significantly more than those CEOs who *just missed* their performance targets. Such a result would imply that firms changed their investment to meet CEO performance targets. We also look whether the shape of the payout profile influences investment. For example, we explore whether a sudden large increase in payout at the threshold payout level affects CEOs' incentives to reduce investment and thereby increase their annual bonus or LTIP payout. We may expect that executives who face a sudden increase in payout at the threshold payout level have a stronger incentive to cut investment when they are close to the threshold performance target than those who face only a gradual increase in payout at the threshold payout level, as the financial gain from achieving the threshold target is much greater.

For investment measures such as capex, net investment and R&D we use the annual *change* as the dependent variable. This is because last year's investment level is the baseline starting point, and any change in investment is relative to this baseline. In contrast, we take the *level* of total and discretionary accruals each year as the dependent variable because the natural baseline is zero. Therefore, the level is the change from zero. We regress the dependent variable on an indicator of whether the firm hit or missed a target (see Table 2.3.2).

Our baseline results also include a broad range of time, industry and firm financial controls to remove the effects of variables that may be correlated with the independent and dependent variables but are not of interest. The aim of including such controls is to remove effects that may otherwise bias our results.

We apply a series of sensitivity tests by expanding the allowed sample deviation window to increase the sample size, as we explain further in Chapter 4.

Table 2.3.2: Dependent and independent variables included in ex-post analysis

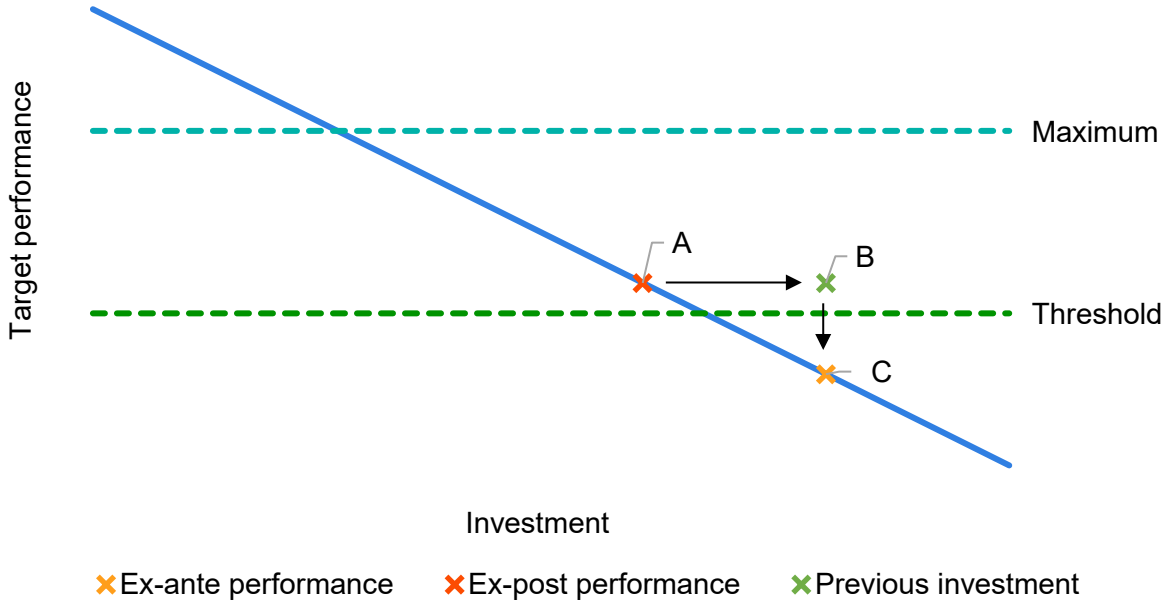
Dependent variables - investment measures scaled by lagged total assets	Independent variables - indicator of whether the target was hit or missed	Independent variables - controls
Capex (annual change) Net investment (annual change) R&D (annual change) Total accruals (level) Discretionary accruals (level)	Annual bonus: profit targets LTIP: EPS targets	Time effects Industry effects Firm financial effects

Ex-ante threshold analysis

Our ex-ante analysis aims to identify whether firms whose CEOs were on track to just hit their performance targets (based on previous investment levels) undertook significantly different investment growth compared to firms whose CEOs would have just missed them. This allows us to identify whether CEOs *attempted* to influence their performance against targets by changing investment, rather than whether CEOs *succeeded* in influencing their performance against targets by changing firm investment. The difference between *attempting* and *succeeding* is that even if a CEO tried to use investment to influence target performance, the change might not be sufficiently large to achieve the desired performance level.

Figure 2.3.3 below demonstrates how ex-ante performance is calculated. We know a CEO's actual performance and actual investment in one year (point A). We also know a firm's level of investment in the previous year (point B). If we know the relationship between investment and target performance, we can therefore calculate what the CEO's performance would have been had investment stayed at the previous year's level (point C). In the example below, we see that the CEO ex-ante would have just missed the threshold payout performance level had investment remained unchanged.

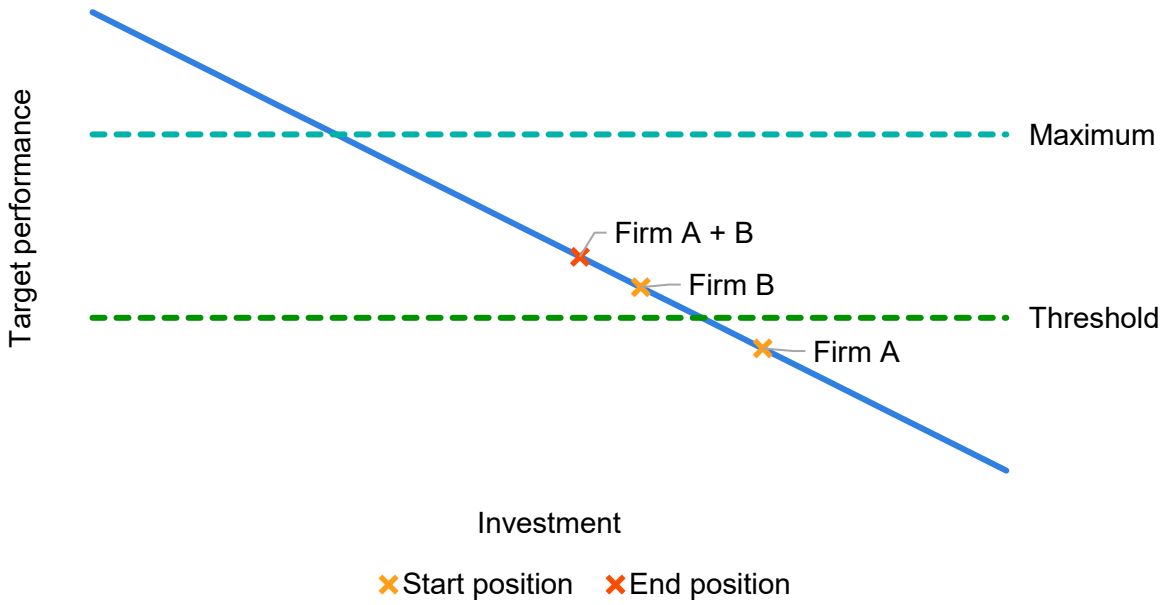
Figure 2.3.3: Computation of ex-ante target performance



As such, we can therefore compare whether CEOs who were on track to *just miss* a performance target changed firm investment by more than CEOs who were on track to *just hit* a performance target, to influence their performance against the target in their own self-interest. For example, in Figure 2.3.4 below the CEOs of Firm A and Firm B both achieve the same ex-post end position along the investment/target performance frontier. However, the start positions show that Firm A's CEO is ex-ante on track to just miss the threshold payout performance level while Firm B's CEO is ex-ante on track to just hit it. To achieve the same end position, Firm A cut investment by more than Firm B.

Regardless of ex-post performance, the finding that Firm A cut investment by more than Firm B would therefore suggest that CEOs *attempt* to use investment to hit performance payout targets.

Figure 2.3.4: Relationship between investment and ex-ante target performance



Given how ex-ante performance is calculated, this analysis focuses on relationships where there is a direct mechanical link between investment and target performance, for example where an increase in R&D expenditure directly reduces profits and so affects profit target performance. Using annual bonus data, we focus on two relationships where there is a strong direct trade-off between investment and target performance:

- The relationship between profit targets for annual bonuses and the change in R&D expenditure
- The relationship between cashflow targets for annual bonuses and the change in capex

Before we carry out the econometric analysis, we undertake statistical analysis to assess the potential for CEOs to use investment to achieve performance targets. We investigate:

- The number of cases where changes in investment led to a change in target achievement status (i.e. the ex-post target achievement outcome is different to the ex-ante outcome), and the number of cases where there was no change in target achievement status (i.e. the ex-post target achievement outcome is identical to the ex-ante outcome).
- In those cases where there was a change in target achievement status, the magnitude of the changes in investment and CEO performance.

For our econometric analysis, we then select the subsample of firms whose CEOs were on track to just hit or just miss the target using the same approach applied for the ex-post analysis, only this time relating to ex-ante target deviation data.

The aim of our econometric analysis is to identify whether CEOs who were on track to *just miss* their performance targets increase or decrease investment significantly more than those CEOs who were on track to *just hit* their performance targets. Such a result would imply that CEOs tried to influence firm investment decisions in order to affect their performance against their targets. As done in our ex-post econometric analysis, we also look whether the shape of the payout profile influences investment. For example, we explore whether a sudden large increase in payout at the threshold payout level affects CEOs' incentives to reduce investment to increase their annual bonus payout.

In this analysis we regress the dependent variable, which is the change in investment since the previous year scaled by lagged total assets, on an indicator of whether the firm's CEO would have hit or missed a target if investment had not changed since the previous year (see Table 2.3.5).

As with the ex-post analysis, we include a broad range of time, industry and firm financial controls in our baseline results.

We apply a range of sensitivity tests to our analysis, such as altering the allowed sample deviation window to change the sample size. We also test the sensitivity of our results to the default investment growth assumption. The core analysis assumes that investment remains at the same level as the previous year, whereas our sensitivity analysis assumes that investment increases in line with UK CPIH inflation.

Table 2.3.5: Dependent and independent variables included in ex-ante analysis

Dependent variables - investment measures scaled by lagged total assets	Independent variables - indicator of whether the target was hit or missed	Independent variables - controls
Capex (annual change) R&D (annual change)	Annual bonus: profit and cashflow targets	Time effects Industry effects Firm financial effects

General regression analysis

Our general regression analysis is designed to test whether the size and presence of different executive performance targets in the CEO contract affect the levels of investment undertaken by firms once all other determinants of investment have been controlled for (see Table 2.3.6).

Note that this analysis is distinct from the ex-post and ex-ante analysis in the following ways:

- This analysis focuses on the presence and size of targets, rather than the executive's performance against targets.

- This analysis considers the full data sample, not just executives whose performance was close to either threshold or maximum payout levels.
- The threshold analysis allows a causal interpretation since it compares firms just above and just below a threshold. Whether a firm is just above or just below is essentially random. The general regression analysis does not allow a causal interpretation since it compares firms with and without specific target types. Whether a firm has a specific target is not random, leading to bias in the observed relationship between performance targets and investment. The regression would be biased towards finding no relationship if boards only put in specific performance targets if they believe they can prevent short-termist behaviour. Alternatively, it would be biased towards finding a relationship if troubled companies that must cut investment also put in specific targets to try to improve performance.
- The direction of the hypothesis is unclear. For the threshold analysis, incentives should lead CEOs to improve performance when close to the threshold and reduce performance when close to the maximum. Since the general regression analysis combines both of these cases together, it is not clear whether targets will incentivise the CEO to increase or decrease performance.

We estimate models focusing on the effect of target presence and target size separately, due to the substantial correlations between the two measures within each target category.

The aim is to identify the incentive effects of executive performance targets in aggregate. A significant relationship suggests that CEO investment decisions are affected by the presence or the size of targets in the executive pay contract.

Table 2.3.6: Dependent and independent variables included in general regression analysis

Dependent variables - investment measures scaled by lagged total assets	Independent variables - presence and size of target	Independent variables - controls
Capex (annual change) Net investment (annual change) R&D (annual change) Total accruals (level) Discretionary accruals (level)	Annual bonus: profit, EPS, cashflow and revenue targets LTIP: absolute TSR, relative TSR, EPS and cashflow targets	Time effects Industry effects Firm financial effects CEO characteristics

De-facto base pay analysis

We have also undertaken supplementary general regression analysis to investigate whether executives' overall pay awards are adjusted to reflect the difficulty of the performance targets

in their pay contracts. This de-facto base pay analysis tests the hypothesis that performance-based financial awards are effectively an addition to base pay, as opposed to CEOs' base pay being adjusted to account for the relative difficulty of their performance targets. Our approach and the results of this analysis are described in detail within Appendix D.

3. Statistical trends in investment and executive performance targets

This chapter sets out the trends in different measures of firm investment and executive performance targets that are the focus of this study. It also provides an overview of the key concepts associated with both investment and executive performance targets.

Statistical trends analysis of investment

This section presents summary statistics for key investment measures amongst FTSE All-Share firms. This study explores the impact of executive performance targets on firm investment, therefore understanding the underlying trends in investment helps to provide the context for this work. More detail on the trends not presented in this section is provided in Appendix C.

Note that throughout our analysis we review investment scaled by lagged total assets. Focusing on investment intensity removes the impact of firm size on investment.

Concepts of investment

In the UK, data on investment is measured at a national level by the Office of National Statistics and at the level of individual businesses in their company accounts.

1. The national data on investment includes 'gross domestic fixed capital formation',[34] and 'business investment'. The ONS also reports aggregate expenditure on R&D.
2. Individual businesses report on capital expenditure in their accounts and may separately report expenditure for R&D. Intangible investments and training are not always captured in company accounts. Unlike national data, consolidated company accounts also include investment by the company across all global operations.

Businesses make investment decisions based on a range of commercial considerations. Chief of these is the cost of investment compared to the expected return through increased profits, which can be compared to the return from alternative uses of capital.

Different types of investment are categorised differently for accounting purposes which can determine their direct relationship with the performance measures used in executive pay

[34] Gross domestic fixed capital formation (GDFCF) is a macroeconomic concept used in official national accounts. GDFCF is a component of the expenditure on GDP, and represents how much of the new value added in the economy is invested in fixed assets and other capital. Business investment does not include investment by central or local government, investment in dwellings, or the costs associated with the transfer of non-produced assets (such as land).

contracts. This study focuses on several types of investment to capture a range of these interactions.

The measures of investment included in this study are:

- Capex
- Net investment
- R&D expenditure

Capex is investment used to acquire, upgrade and maintain physical assets such as property, technology or equipment. It is recorded as an asset on the balance sheet under property, plant and equipment.

Net investment is the difference between capex and depreciation each year. Depreciation is the decline in the value of an asset over the course of its life.

Expenditure on **R&D** is investment in innovation and the development or improvement of products, processes or services. For tax purposes in the UK, R&D is defined as investment in activities which directly contribute to achieving an advance in science or technology through the resolution of scientific or technological uncertainty.[35] Certain indirect activities related to the project can also be counted as R&D. R&D is generally recognised as an intangible asset on the balance sheet in UK company accounts.

This study also investigates the possibility of accounting earnings management to achieve performance-based pay using accruals. The measures of accruals included in this study are:

- Total accruals
- Discretionary accruals

Total accruals are the change in net operating assets each year. Accruals arise when a good or service is delivered in one period but paid for in a different period. For example, this can occur when customers purchase goods on credit. Accrual-based accounting means a company records revenue when the transaction takes place and records the funds owed to the company as assets to the balance sheet under accounts receivable. The aim is to match revenue earned with its related expenses on the balance sheet, but it also enables firms to report earnings before the cash has actually been received.

Often it is clear when accruals should be reported. However, **discretionary accruals** occur when the firm has a choice of when and how assets and liabilities are reported, i.e. it is not mandatory to report the asset or liability.

The division of accruals into discretionary and non-discretionary is not reported separately on the balance sheet and therefore must be estimated. We use the Jones (1991) model to

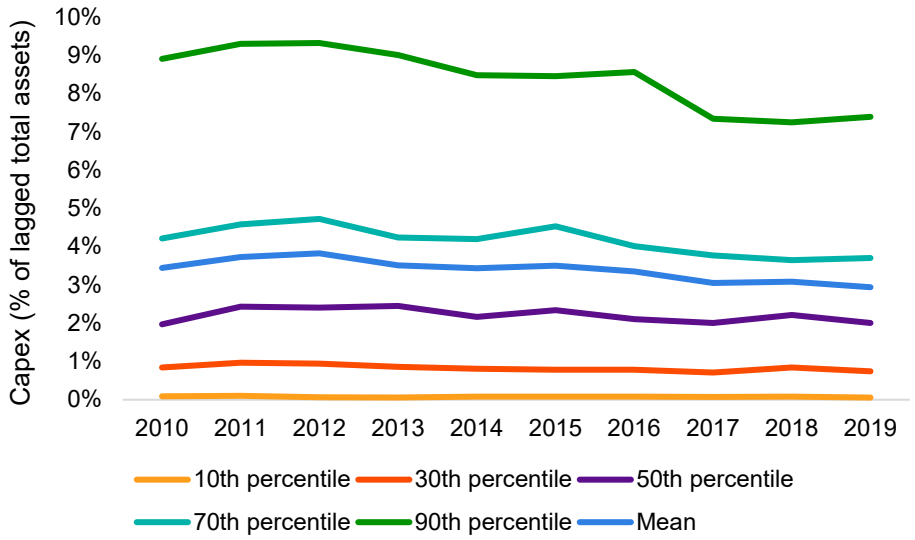
[35] Department for Business, Innovation and Skills (2010). 'Guidelines on the meaning of research and development for tax purposes'.

estimate non-discretionary accruals and take discretionary accruals as the difference between total accruals and non-discretionary accruals.[36]

Trends in investment

Capex amongst the FTSE All-Share has declined slightly since 2010. However, there is significant variation across the sample and the decline has largely been driven by capex reduction amongst firms that carried out the most capex investment relative to lagged total assets, as shown by the fall in the 90th percentile (Figure 3.1.1).

Figure 3.1.1: Percentiles of the distribution of capex (% of lagged total assets)



Net investment as a percentage of lagged total assets has been largely concentrated around zero. Like capex, mean net investment has declined slightly over the period studied. However, unlike capex, this fall has occurred for firms across the distribution. As such, the decline in the 90th percentile has also been seen in the 10th percentile.

R&D expenditure has remained relatively constant over the period studied, with median expenditure around 1.1% of lagged total assets. However, like capex, the 90th percentile has shown much more volatility than other percentiles, meaning there has been greater variation amongst more R&D intensive firms.[37]

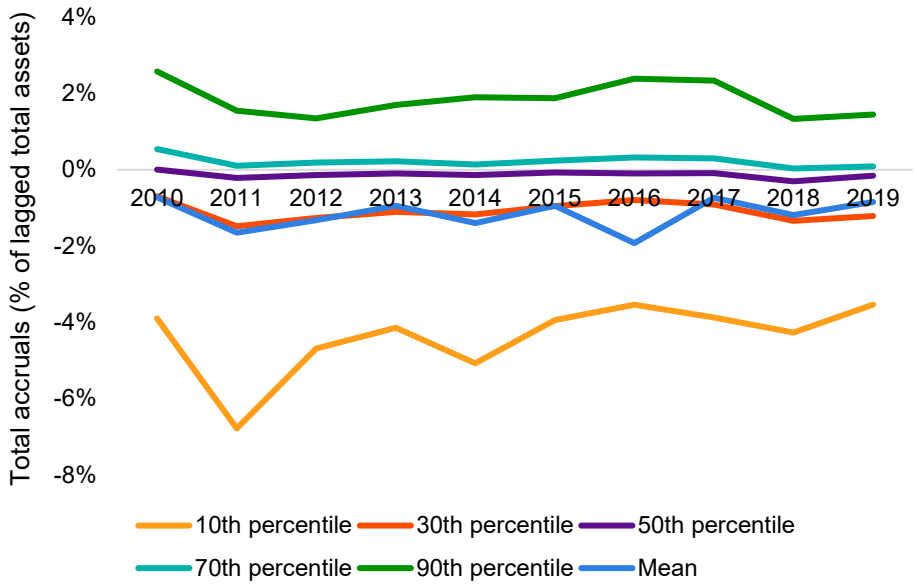
Trends in accruals

Total accruals have been relatively constant and clustered around zero. The mean has been more volatile since 2015 while most of the percentiles studied have remained flat, meaning that this volatility in the mean has most likely been driven by outliers.

[36] More information on the estimation of discretionary accruals can be found in Appendix B.

[37] Further detail and charts on net investment and R&D are available in Appendix C.

Figure 3.1.2: Percentiles of the distribution of total accruals (% of lagged total assets)



Discretionary accruals have followed a similar trend to total accruals throughout the period. More specifically, they tend to cluster around zero and have remained relatively constant. Similarly, since 2014 the mean has exhibited more variation while the percentiles have been more stable, suggesting that this volatility is also driven by a few outliers.[38]

Statistical trends analysis of executive performance targets

This section explores key trends in the use of performance targets in UK executive pay contracts. This analysis investigates the prevalence of different target types and whether targets are calibrated effectively to influence CEO behaviour and incentivise improvements in firm performance. We begin by defining key concepts related to executive performance and pay. The latter part of this section then explains how we used our data to construct a series of statistical measures relating to target prevalence and CEO performance, providing insight into how performance targets shape CEO behaviour.

Structure of UK executive pay packages

Executive compensation packages in the UK are typically split into some, or all, of the following components:

1. **Base salary, pension and benefits**[39] – this includes all benefits typical of most employee compensation schemes, including health insurance.

[38] Further detail and charts on discretionary accruals are available in Appendix C.

[39] These components sometimes collectively described as 'fixed pay' by executive pay analysts. We use this definition of the term 'fixed pay' in our de-facto base pay analysis, which is presented in Appendix D of this report.

2. **Bonus (annual and deferred)** – annual bonuses are typically included with performance measures applied over a single year, and typically based mainly on financial measures (such as profit, sales, or cashflow) but with a significant weighting to non-financial measures (such as customer satisfaction, employee engagement, or key strategic priorities).
3. **Long-term incentive plan (LTIP)** – these are multi-year pay plans (typically three-year plans) that vest[40] in the third year based on performance over the three-year period. LTIPs aim to reward executives' delivery of long-term shareholder value and are typically paid out in shares.
4. **Deferred matching award (DMA)** – some companies provide executives with the opportunity to invest part of their bonus into shares, which then is matched by an additional LTIP award known as a deferred matching award.
5. **Shares and share options** – shares and share options are typically granted within the awards above, although share options are now much less prevalent.

Evidence from recent years' pay awards suggests that performance-based pay typically represents a large share of UK CEOs' overall pay package. We find that on average 73% of maximum CEO pay amongst the FTSE All-Share in 2018 was linked to either annual bonuses (32%) or LTIPs (41%).[41] This split has remained broadly stable since 2013, with performance-based pay dominating overall pay. This underlines the importance of meeting performance targets for overall CEO pay.

In this study, we focus on the individual performance targets contained within the annual bonus and LTIP components of CEO pay packages, which determine how much of the available bonus or LTIP award a CEO ultimately earns.

Composition and incentive profile of annual bonus and LTIP schemes

As noted above, annual bonus and LTIP schemes are important features of CEO pay packages. Whilst the performance requirements for bonuses and LTIP awards to be paid out differ by firm, most annual bonus and LTIP schemes share several common characteristics. These are as follows:

- Schemes may contain just a single performance condition, but often there are multiple performance conditions within a bonus or LTIP scheme, each of which is linked to a separate performance target.
- Each performance condition is worth some specified fraction of the overall bonus or LTIP scheme.

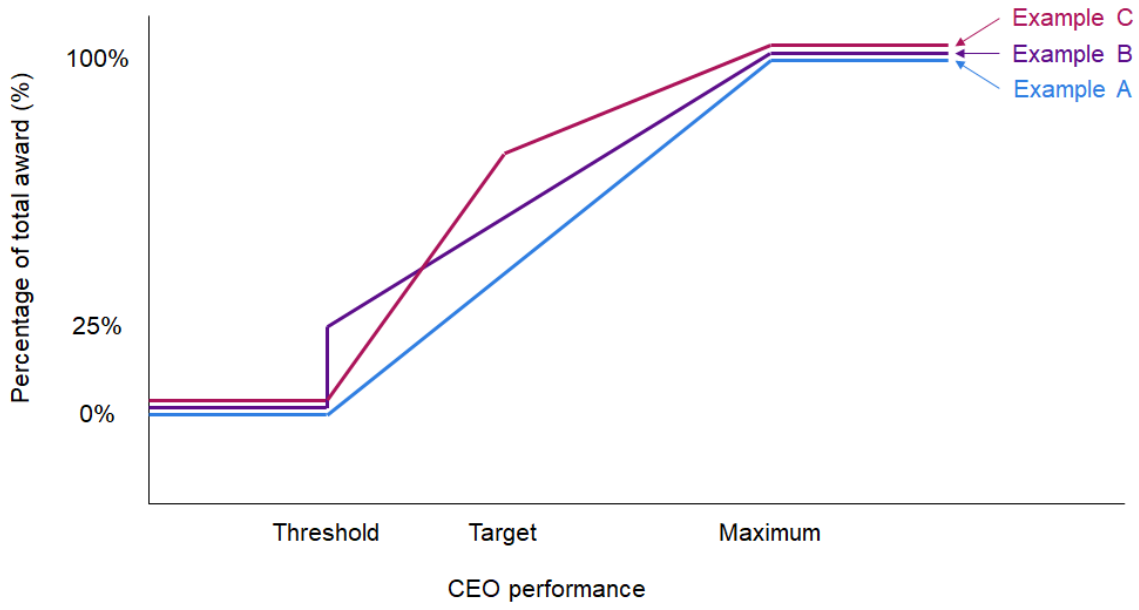
[40] Vesting is the process by which an employee becomes entitled to the benefits of the pay award.

[41] PwC analysis. Note that at the time of writing not all 2019 annual reports had been published, therefore 2018 data is presented here to prevent biasing the results.

- Each performance target within a bonus or LTIP is defined by several parameters. There is a total award potential, which specifies the financial award available for maximum performance, a 'threshold' payout level, which specifies the performance required to achieve the minimum incentive payout, and a 'maximum' payout level, which specifies the performance required to achieve the maximum incentive payout. There may also be a 'target' payout level, which falls between the threshold and maximum performance levels and is intended to set an expectation for outturn performance. We explain how these parameters jointly determine achieved bonus or LTIP payout in more detail below.

Figure 3.2.1 below captures how CEO performance against a particular target typically affects their achieved bonus or LTIP payout. Specifically, the figure shows the relationship between CEO performance and the percentage of the total award achieved.

Figure 3.2.1: Relationship between CEO performance and percentage of total award achieved (%)



As can be seen, CEO performance may fall into one of several categories:

- If CEO performance fails to meet the threshold payout level, the CEO does not earn a payout for that performance condition.
- If CEO performance meets the threshold payout level, the CEO earns the minimum incentive payout applicable to the performance condition. Importantly, this minimum payout can sometimes be a significant fraction of the total award, rather than starting at 0% of the total award. In cases like this, there is a discontinuity in the incentive profile, with performance *just below* the threshold target yielding zero payout and performance *just above* the threshold target yielding a substantial payout.
    - We have illustrated this through Examples A and B above. In Example A, the CEO earns 0% of the total award when performance reaches the threshold

target. This results in a smooth incentive profile with no discontinuity. By contrast, in Example B the CEO earns 25% of the total award when performance reaches the threshold. This creates a significant discontinuity in the CEO's incentive profile, which creates a strong incentive for the CEO to just beat the threshold level.

- If CEO performance falls between the threshold payout and maximum payout levels, then the CEO earns a payout which rises in line with achieved performance. In many cases, the payout increases linearly between the threshold payout and maximum payout levels, with linear interpolation used to calculate the exact award. If there is a 'target' performance level, then this may create a kink in the relationship between pay and performance, with different gradients between threshold and target performance, and target and maximum performance, respectively. This is captured through Example C above.
- If CEO performance meets the maximum payout level, then the CEO earns the maximum available payout for that performance condition.
- If CEO performance exceeds the maximum payout level, then no further reward is received beyond the maximum payout.

Despite the variety of performance-pay curves which CEOs may encounter, the financial incentives they face to improve performance are relatively simple. Until performance reaches the maximum payout level, CEOs have a financial incentive to improve their performance, although this incentive weakens significantly when performance is relatively close to the maximum payout level.[42] Once the maximum payout level is reached, the direct financial incentive to improve performance disappears altogether. Instead, there may be incentives to reduce performance for three reasons:

- First, significantly exceeding this year's maximum could lead to targets being ratcheted up next year, due to increased expectations.
- Second, reducing accruals gives the CEO greater scope to increase them to hit targets next year; similarly, increasing investment gives the CEO greater scope to reduce it to hit targets next year.
- Third, in cases where reducing performance aligns with increasing investment, then the CEO might expect increases in investment to improve future performance (making them more likely to hit their targets in future years, all else being equal).

[42] There may still be an incentive to inflate performance to achieve the maximum payout rather than ending up just below it. However, the incentives to improve performance when close to the maximum are lower than anywhere else between the threshold and maximum, since the CEO's gain from improving performance is capped.

Statistical analysis of CEO performance targets and pay

As part of this research, we conducted detailed statistical analysis of our executive pay data, in order to understand which types of performance target (or 'target categories') are most commonly applied within annual bonus and LTIP schemes, how CEOs typically perform against these targets, and how effective they are in incentivising performance.

The first step involved defining a series of statistical measures which could be analysed for each target category and would allow us to compare results across different target categories featured within annual bonus and LTIP schemes. Collectively, these measures aim to describe the importance of each target type and show how it contributes to achieved CEO pay. Table 3.2.2 below summarises the statistical measures we constructed and explains the definition and intended purpose of each measure.

Table 3.2.2: Summary of statistical measures constructed

Measure name	Definition and purpose
M1: Target prevalence	**Definition:** Frequency of usage for each target category within annual bonus and LTIP schemes. **Purpose:** Enable the identification of most commonly used target categories across annual bonus and LTIP schemes, and how the balance of target categories has changed over time. This enables us to focus our statistical and econometric analysis on the most prevalent target categories.
M2: Target hit rate	**Definition:** Indicator for whether a particular CEO met or exceeded their performance targets (we have calculated this separately for the threshold payout level and maximum payout level). The indicator takes value 1 if the relevant target was met or exceeded, and 0 otherwise. **Purpose:** When aggregated across all observations for a particular target category, this measure gives us the 'hit rate' for that category, which tells us how often CEOs hit or exceed the threshold payout or maximum payout level for that category. This enables us to compare the relative difficulty of meeting threshold and maximum targets across different categories.
M3: Target deviation	**Definition:** The percentage difference between achieved CEO performance and either the threshold payout or maximum payout level (we have calculated this separately with reference to the threshold payout and maximum payout respectively). **Purpose:** When aggregated across all observations for a particular target category, this measure gives us the distribution of CEO performance relative to threshold and maximum payout levels. This enables us to assess whether CEO performance appears to be

Measure name	Definition and purpose
	influenced by threshold and maximum payout levels, which could incentivise the CEO to either improve or cease improving performance (depending on the context).
M4: Achieved package share	**Definition:** This measure provides the approximate share of the CEO's overall pay award that was generated by performance against a particular target. This can be calculated for a specific performance condition by multiplying together three quantities: ● The percentage of the available award achieved through performance against that target (%) ● The weight allocated to that performance condition within the relevant annual bonus or LTIP scheme (%) ● The estimated share of the relevant annual bonus or LTIP within the CEO's overall pay award (%) **Purpose:** When aggregated across all observations for a particular target category, this measure can tell us the mean achieved share of CEOs' pay package achieved for that category. This provides an indication of the relative financial importance of different target categories, and the extent to which they guarantee pay. A high score on this measure may reflect either a high target hit rate or a high average weighting for the target category in question. *Note: This measure only includes cases for each target category where the target is present in the package, and so strips out the contribution to the mean package share achieved that comes from the prevalence of each target category.*
M5: Mean vesting share	**Definition:** This measure captures the mean achieved vesting share for different target categories (or equivalently, the percentage of the total award available for that particular target which is received), which is one sub-component of our achieved vesting share measure. **Purpose:** This measure allows us to investigate the returns which CEOs earn from their performance targets and analyse how CEOs typically perform against each target relative to the payout profile (taking account of discontinuities or non-linearities in the profile). This further strengthens our understanding of how strongly particular targets 'guarantee' CEO pay.

We now explain how we have applied each of these statistical measures to our CEO pay data, and we explore the results generated.

Measure 1: Target prevalence

As set out in Appendix B, a key aspect of compiling the PwC executive pay database involves allocating each studied CEO performance target to a specific target category, based on the aspect of firm performance which the target measures. For example, it is common for targets within annual bonus schemes to measure performance linked to cashflow, and therefore 'cashflow' is a target category in the database. For clarity, this does not mean that all targets allocated to a particular category are identically structured: the precise metrics they capture may be quite different. As an example, the 'other financial' category in our annual bonus data incorporates a number of financial performance metrics which are not otherwise captured through their own category, such as absolute return on equity and growth in net asset value.

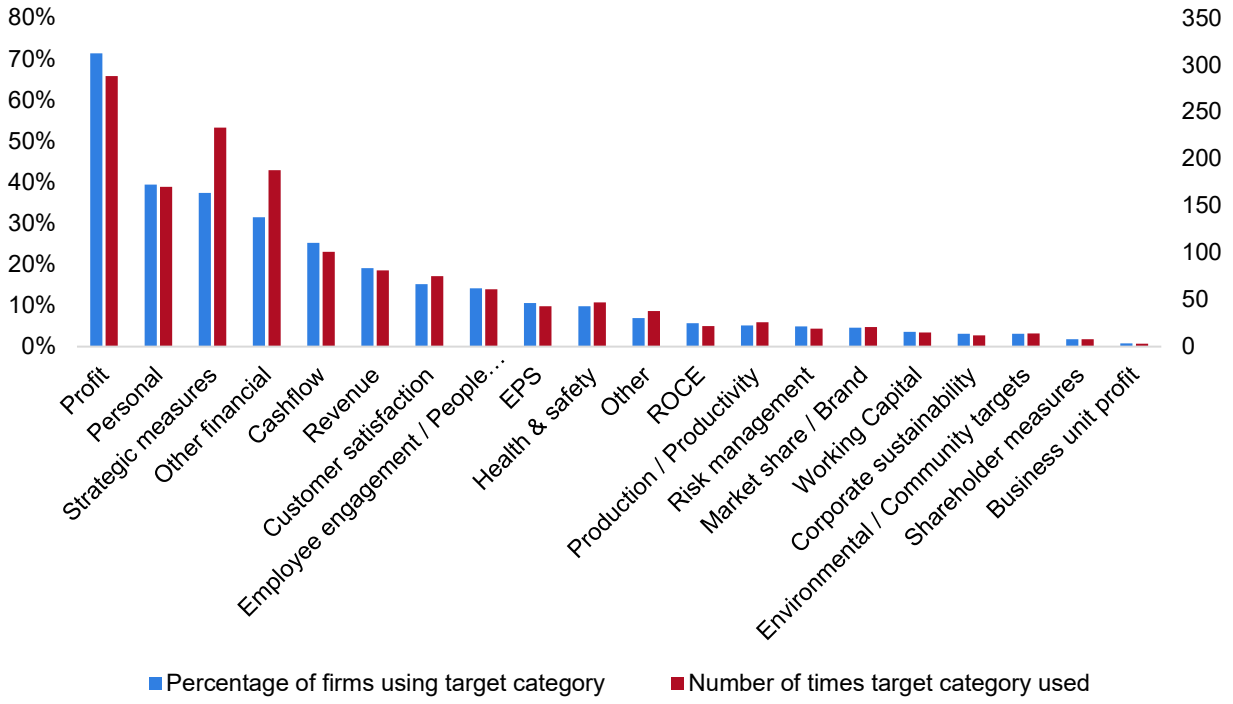
We assess the relative prevalence of different target categories within our data, by assessing their frequency of usage in our selected sample. We measure frequency of usage both in terms of the number of specific performance conditions which fall under a category (regardless of firm), and also by the percentage of firms in our sample which have either one or more targets belonging to that category. It should be noted that we analyse target prevalence separately for annual bonus and LTIP data.

Our chosen sample includes only current FTSE All-Share firms over the period 2013-2019. Further details on how we collected our data are provided in Appendix B.

We begin by examining the prevalence of different target categories within a given year for our annual bonus data. Figure 3.2.3 captures frequency of usage for each category in 2018, using both of the approaches outlined above.[43] The left-hand axis (and blue series) captures the percentage of firms in our sample with one or more targets in a particular category, whilst the right-hand axis (and burgundy series) captures the number of times each category is used by these firms (including multiple uses within the same bonus scheme).

[43] We study 2018 data because at the time of data collection, some companies had yet to report their year-end results for 2019 and therefore studying 2019 data could skew our results.

Figure 3.2.3: Prevalence of target categories within our annual bonus data (2018 only) - percentage of firms and number of uses



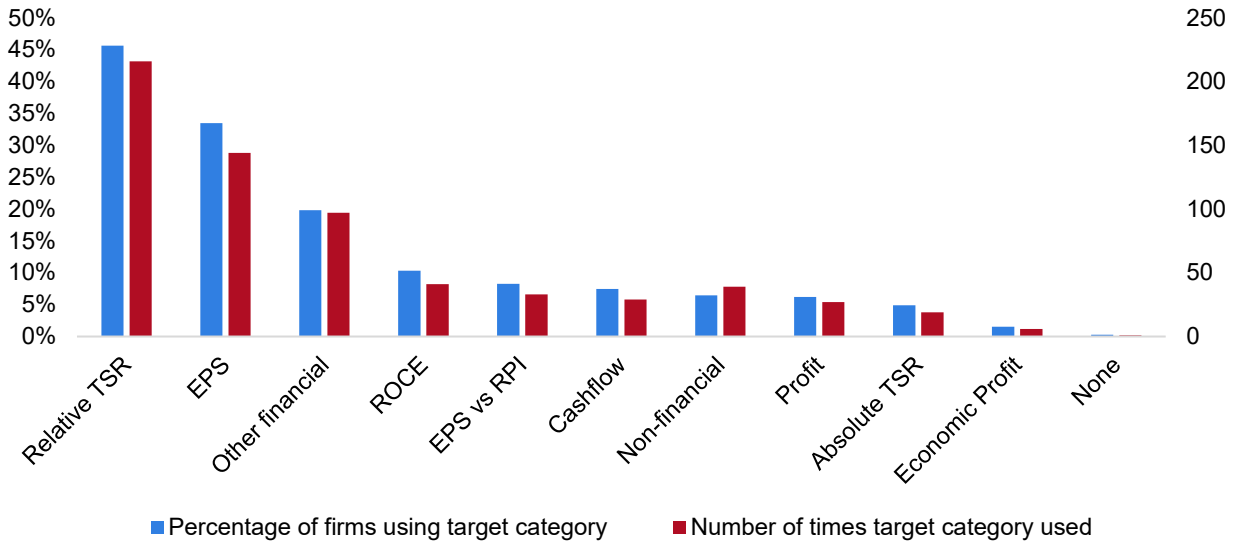
As the figure shows, profit, personal and strategic measures were the most prevalent categories for annual bonus targets and had the highest proportion of firms using such targets. These target categories, combined with cashflow, other financial, revenue and other, accounted for over 75% of annual bonus targets during this period.

Notably, EPS is used much less frequently within annual bonus schemes compared to LTIP schemes, where it is one of the most common target categories (as discussed below).

To understand whether the relative prevalence of target categories has changed significantly over time, we also investigate whether our findings are similar across the broader sample, which covers 2013-2019. We find that the results are very similar, with profit, personal and strategic measures being the dominant target categories. The proportion of targets classified as ‘other’ has fallen over time, and this may reflect a change in firm disclosure requirements in 2014 which required firms to make their executive pay policies more transparent.

We now examine the prevalence of different target categories within LTIP data, following the same approach. Figure 3.2.4 below captures our findings for the year 2018.

Figure 3.2.4: Prevalence of target categories within our LTIP data (2018 only) - percentage of firms and number of uses



This figure shows that compared to annual bonus targets, LTIP targets are relatively concentrated within a small number of common categories. Relative total shareholder return (TSR), EPS and other financial targets were the most prevalent LTIP targets, accounting for 70% of LTIP targets set during 2018.[44] This prevalence is mirrored by the percentage of firms using each type of target during this period, with 46%, 34% and 20% of firms setting relative TSR, EPS and other financial targets respectively.

Notably, many of the most common annual bonus categories are either infrequently used, or not used at all, within LTIP schemes. For instance, there is little use of profit, personal or cashflow targets. This reflects the fact that LTIP targets typically align with shareholder outcomes and incorporate high-profile financial return indicators (including TSR and EPS), whereas annual bonus targets are more likely to capture the achievement of personal or strategic objectives, or of financial targets that are considered to be milestones towards achieving the return indicators (including revenue and cashflow performance).

As for the annual bonus data, we extend our analysis to cover the broader 2013-2019 sample period, to show whether this materially changes the relative prevalence of different target categories. We find little difference overall, with relative TSR, EPS and other financial targets once again the dominant LTIP categories.

Notably in our wider 2013-2019 sample, the percentage of firms using targets is lower for all categories except EPS vs RPI, which is 3 percentage points more common. This indicates a decline in the use of EPS vs RPI targets, which has been countered by increased use of (absolute) EPS targets. This trend reflects how low inflation in recent years has increasingly

[44] For definitions of target category concepts such as relative TSR and EPS, we refer the reader to the Glossary.

led to EPS targets being set on an absolute basis, rather than EPS performance being evaluated against RPI inflation.

Key findings - Target prevalence (Measure 1)

Overall, these findings suggest that most annual bonus and LTIP targets fall into a relatively small number of categories, although the most prevalent annual bonus categories differ from the most prevalent LTIP categories.

The evidence shown here also suggests that the relative prevalence of different target categories has remained fairly stable over recent years.

Measure 2: Target hit rates

As mentioned in Table 3.2.2 above, the first stage of analysing target hit rates involves creating an indicator variable which measures whether a particular CEO met or exceeded their performance target. The indicator takes value 1 if the relevant target was met or exceeded, and 0 otherwise.

We created two versions of this variable for our dataset. The first version (known as the 'threshold success indicator') assesses whether achieved CEO performance met or exceeded the *threshold* payout level, whilst the second version (known as the 'maximum success indicator') assesses whether CEO performance met or exceeded the *maximum* payout level. By computing these variables for each performance observation and aggregating them by target category, we can calculate the overall hit rate for each category. This is done by calculating the proportion of observations for which the indicator variable takes value 1.

Having generated hit rates for each category, we can then compare the results. We begin by analysing the hit rates for annual bonus targets. Figure 3.2.5 displays hit rates associated with the threshold success indicator, whilst Figure 3.2.6 displays hit rates associated with the maximum success indicator.[45]

These charts cover the full 2013-2019 sample period, as is the case for all charts presented in the remainder of this chapter. However, they only feature those target categories which have over 50 success indicator observations, to ensure sufficient statistical confidence in the findings. Given the concentration of target categories identified through Measure 1, the most popular categories featured in the below charts have several hundred available observations. As well as the hit rates themselves (captured through the bars shown), these charts also

[45] All hit rate charts shown in this chapter capture absolute hit rates at the threshold and maximum payout levels, rather than conditional probabilities. In other words, the maximum hit rate charts show the proportion of all observations where the maximum payout is achieved (regardless of whether or not the threshold payout is achieved).

display 95% confidence intervals around the hit rate estimates, which allows us to examine whether hit rates differ to a statistically significant degree across target categories.[46]

Figure 3.2.5: Target hit rates for threshold payout (annual bonus)

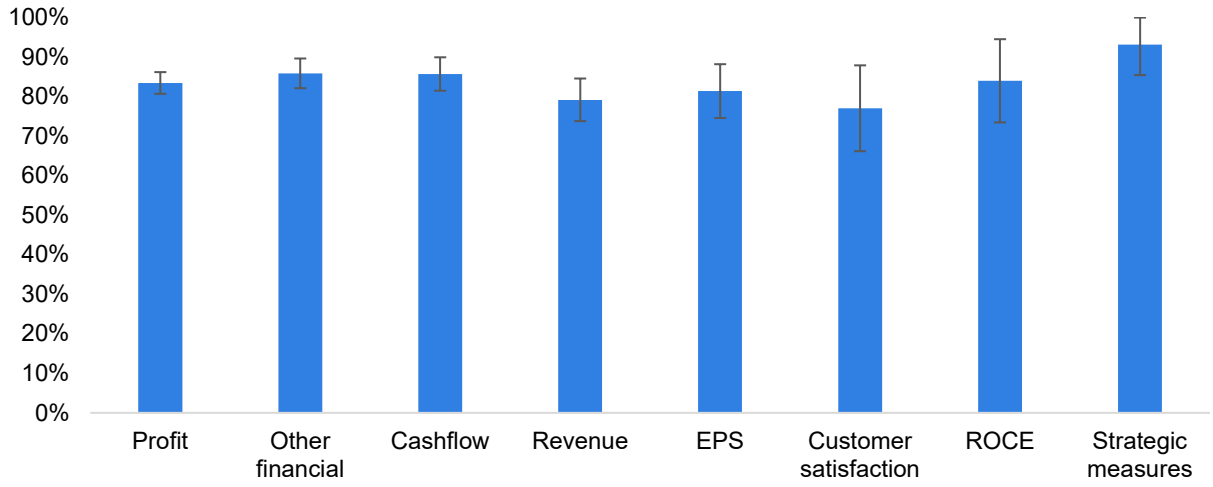
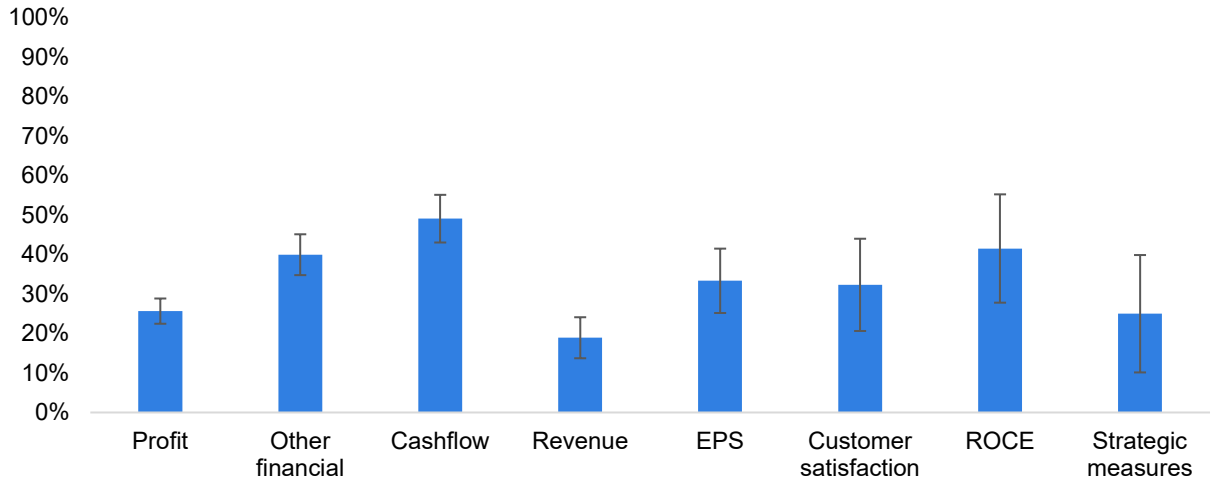


Figure 3.2.6: Target hit rates for maximum payout (annual bonus)



Our results show that threshold payout levels are met or exceeded in a clear majority of cases across all target categories. There is minor variation in threshold hit rates across targets, with some categories (such as group profit and other financial targets) having high hit rates in excess of 85%, whilst other targets such as revenue and customer satisfaction measures have hit rates below 80%. Notably, the 95% confidence intervals largely overlap for all target categories, indicating that the threshold hit rates are statistically indistinguishable from each other.

[46] The construction of 95% confidence intervals is based on the implicit assumption that target hit rates follow a normal (Gaussian) distribution.

Maximum bonus payout levels are met or exceeded much less frequently (less than 40% for most categories), which indicates that CEO performance often falls within the payout range for most categories.

In contrast to the threshold hit rates, there is much greater cross-category variation in maximum hit rates, with cashflow performance hitting the maximum payout in 49% of cases, whilst revenue performance hits the maximum payout in only 19% of cases. Some of the larger differences between target categories, including this one, are clearly statistically distinguishable. The scale of the hit rate for cashflow is particularly striking, given how it shows that almost 1 in 2 CEOs can earn the maximum payout. This raises a question of whether cashflow targets are not always stretching enough to incentivise performance improvements. Alternatively, this finding may reflect how some aspects of cashflow performance (such as working capital) are relatively controllable, and therefore it is arguably easier for CEOs to earn the maximum payout on these targets. It may additionally be in firms' interests to set relatively achievable cashflow targets, as setting more stretching targets could risk incentivising CEOs to focus excessively on short run cashflow performance at the expense of firms' long-term priorities. As we find below in our analysis of achieved package share (Measure 4), cashflow targets are usually given a relatively low weighting within CEOs' bonus packages, which makes it less expensive for firms to award CEOs the maximum payout.

We now apply the same hit rate analysis to LTIP target categories. We again show only those target categories with over 50 available observations. Figure 3.2.7 displays hit rates associated with the threshold success indicator, whilst Figure 3.2.8 displays hit rates associated with the maximum success indicator. We use a different colour to distinguish the relative TSR hit rates, which are estimated using a slightly different approach compared to the other categories.[47]

[47] Our standard approach to estimating hit rates involves analysing how CEOs performed relative to their threshold or maximum payout targets, where performance is expressed in the measured units. For example, a hypothetical CEO might achieve group profit of £500m, relative to a threshold payout target of £300m and a maximum payout target of £700m. In this case, using our standard approach we would determine that the threshold target was outperformed by £200m (and therefore met), whereas the maximum target was underperformed by £200m (and therefore missed). A key advantage of this approach is that it ensures hit rates are calculated using the same underlying data as our other statistical measures of executive pay, including target deviation distributions (see Measure 3).
For relative TSR targets specifically, we frequently find that achieved performance is not reported in quantitative terms but instead in qualitative terms, such as 'Median not met'. Observations like this are not picked up through our standard hit rate approach, yet excluding them risks creating bias in our hit rate estimates (particularly because many of the qualitative observations involve the threshold payout being missed). For this reason, we apply an alternative estimation approach which instead uses data on CEOs' achieved vesting share for relative TSR targets. This provides a more comprehensive view of hit rates, as almost all of this data is quantitative.

Figure 3.2.7: Target hit rates for threshold payout (LTIP)

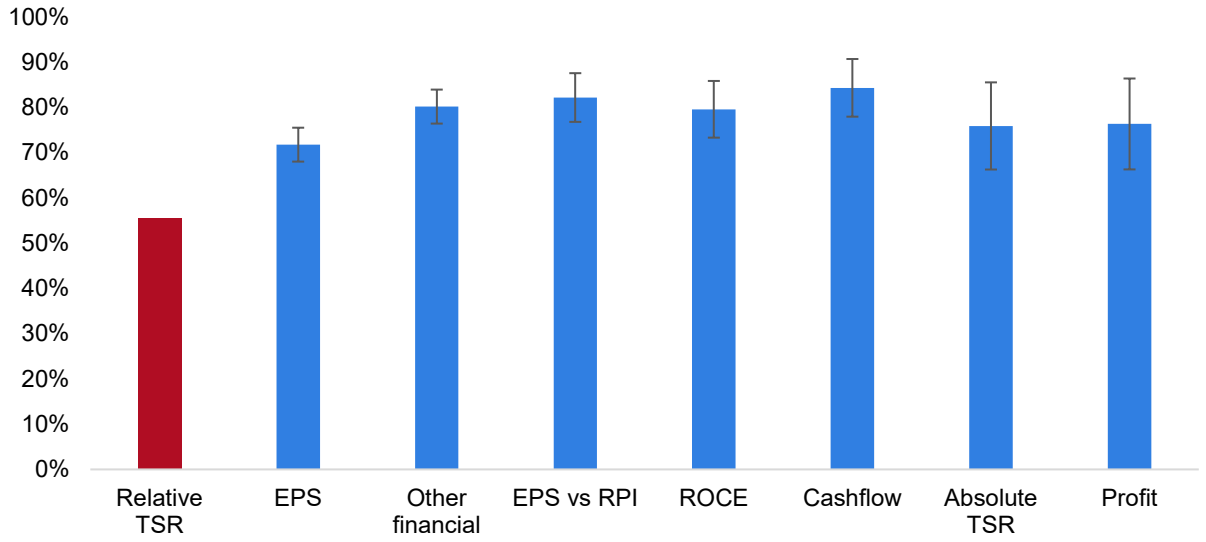
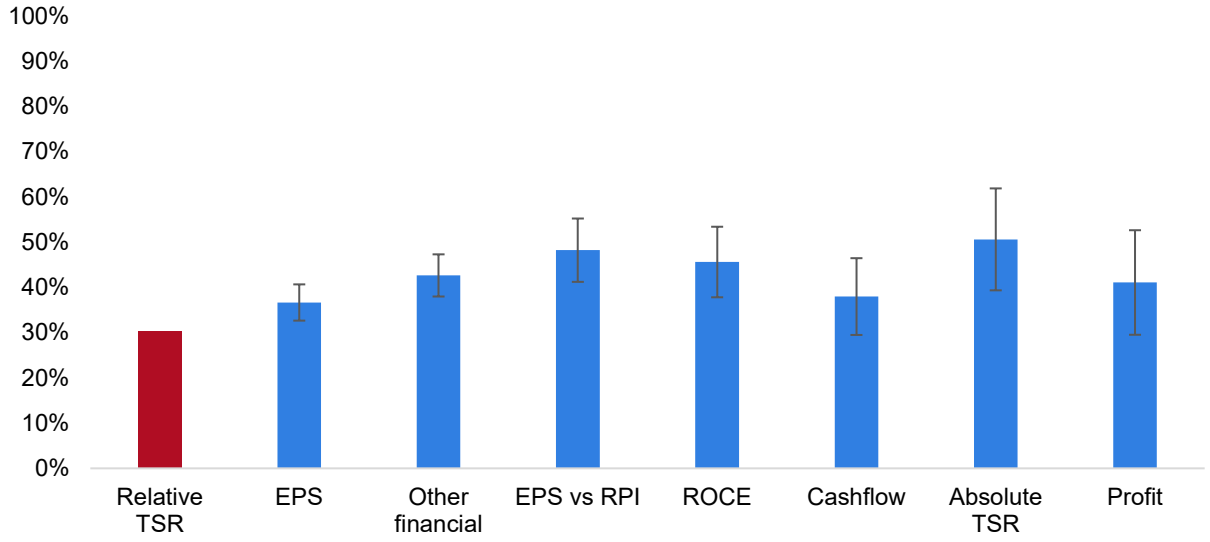


Figure 3.2.8: Target hit rates for maximum payout (LTIP)



Our results show that as for annual bonus data, threshold LTIP payout levels are met or exceeded in a clear majority of cases across all target categories. There is, however, some variation in threshold hit rates across categories, with some categories (such as cashflow and EPS vs. RPI) having high hit rates in excess of 80%, whilst relative TSR targets have a notably lower hit rate (56%). The 95% confidence intervals overlap for most categories, but the relative TSR hit rate is statistically distinguishable from other targets. This is a logical finding, and in fact we would expect relative TSR based measures to have a lower threshold hit rate of close to 50%, given that many relative TSR-based incentives only pay out when companies perform above the median TSR level relative to a defined comparator group of firms.

The 56% threshold hit rate observed for the relative TSR measure may reflect several factors. First, the observed hit rate may not fall at exactly 50% due to sampling uncertainty. Second, there may be reasons why over 50% of CEOs can exceed the median performance of their

TSR comparator groups. There is no set approach to defining these comparator groups, which may enable strategic selection of favourable comparators to increase the likelihood of above-median performance. Alternatively, RemCos may have some discretion to treat comparator group changes that occur within the LTIP period (such as takeovers) favourably, such that the CEO just exceeds median performance. These opportunities may be exercised in situations where committees are keen to retain a CEO who is perceived to be performing well. Both effects have limited power to influence performance, but they could plausibly raise average performance by 6 percentage points.

Maximum LTIP payout levels are met or exceeded less frequently, which indicates that like annual bonuses, LTIP performance regularly falls within the payout range. Still, compared to our annual bonus data we find that maximum payout hit rates are relatively high, consistently falling within the 30%-50% range. This suggests that around half of CEOs either miss their threshold payout or exceed their maximum payout on LTIP targets.

We find that the maximum hit rate for relative TSR targets is 30%. Like the 56% threshold hit rate, this result is somewhat above expectations given that the maximum payout for relative TSR-based incentives commonly requires upper quartile performance. We again find outperformance of around 5% relative to expectations, which may reflect the same factors mentioned above. An additional consideration when evaluating upper quartile performance is how achieved performance is evaluated, in particular whether a single firm is treated as the upper quartile or whether an average of two firms is taken. This offers possible additional opportunities for RemCos to make discretionary decisions in favour of CEO reward.

Key findings - Target hit rates (Measure 2) - absolute data

Overall, despite the differences in target category prevalence across annual bonus and LTIP schemes, our hit rate findings are broadly similar for annual bonus and LTIP data. In both cases, a clear majority of CEOs meet or exceed their threshold payout targets (typically around 80%), and significantly fewer CEOs meet or exceed their maximum payout targets (typically between 20% to 50%, depending on the target category). This implies that CEO performance regularly falls somewhere between the threshold payout and maximum payout levels, placing it within the payout range. This does suggest that targets are calibrated appropriately to incentivise performance improvement, although the relative ease of meeting the threshold payout implies that threshold targets may only incentivise improvement when prior performance is relatively poor. For some target categories, the relative ease of meeting the maximum payout also suggests that targets may fail to incentivise additional performance improvements among high-performing CEOs.

Another notable finding is that the difficulty of hitting threshold and maximum targets is relatively similar across target categories, particularly for LTIP schemes (where only threshold hit rates for relative TSR are significantly lower). For the annual bonus data, there is some evidence of variation in maximum hit rates, with cashflow measures having a notably higher hit rate than profit and revenue targets. This finding potentially reflects CEOs' greater

control over cashflow performance, which is heavily influenced by firms' internal expenditure and investment decisions. By contrast, revenue (and to some extent profit) performance is heavily determined by external market conditions as well as firms' ability to engage effectively with their customers and outperform their competitors. The fact that hit rates may be positively associated with the degree of CEO control over performance hints that CEOs may engage in behaviours that optimise their target performance and increase their incentive payout. We explore this hypothesis further in the rest of this report.

Measure 3: Target deviation

Having analysed target hit rates, we now assess the *extent* to which targets are exceeded or missed by calculating the percentage difference (or 'deviation') between achieved performance and the threshold or maximum payout level. When aggregated across all observations for a particular target category, this measure allows us to study the distribution of CEO performance relative to the threshold and maximum payout levels.

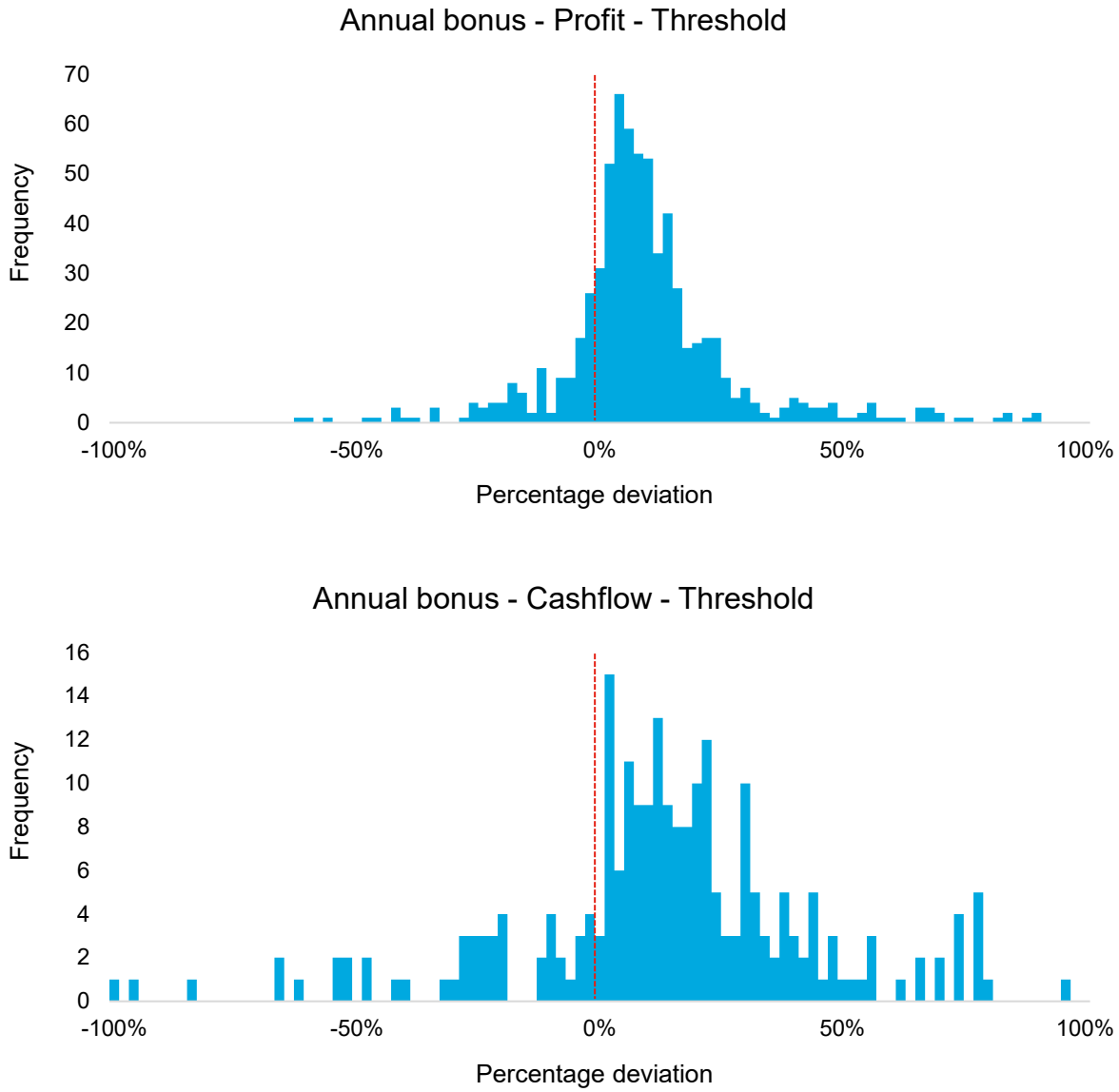
We have considered the percentage difference (%) between achieved performance and target levels, rather than using the absolute difference, because this provides a standardised measure of target deviation which allows for straightforward comparison both within and across target categories. Still, the distribution of target deviations will naturally differ somewhat across target categories, as some performance metrics are inherently more volatile than others.

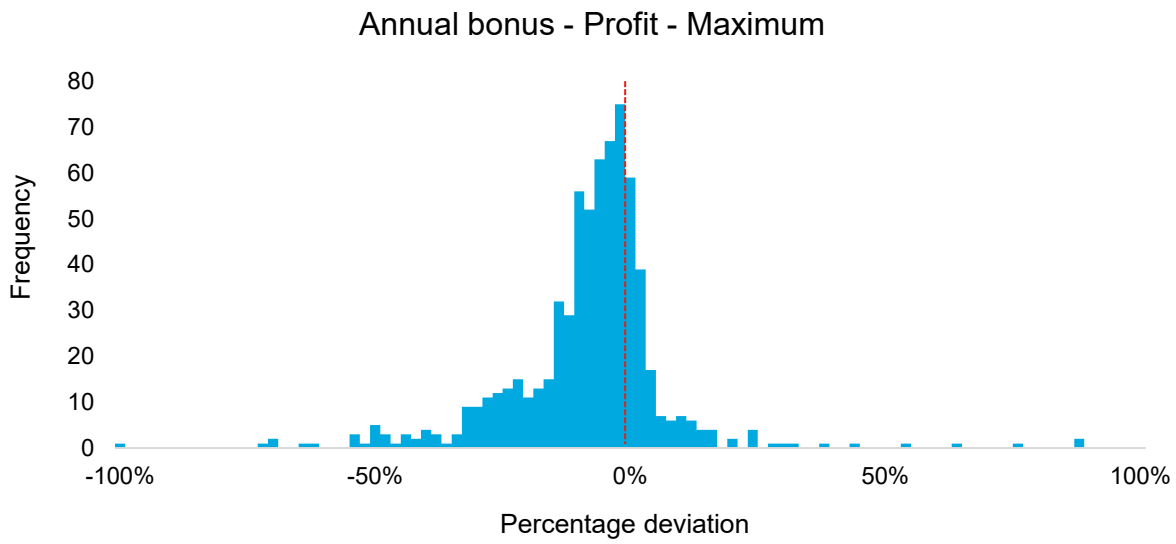
We begin by presenting the aggregated distribution of target deviations for two of the most prevalent annual bonus target categories. This is represented through a separate pair of histograms for each target category, which capture the distributions of achieved performance around the threshold and maximum payout levels. For reasons of brevity, we do not present all the target deviation distributions we have studied within this chapter: instead we refer the reader to Appendix C for the full set of distribution histograms.[48]

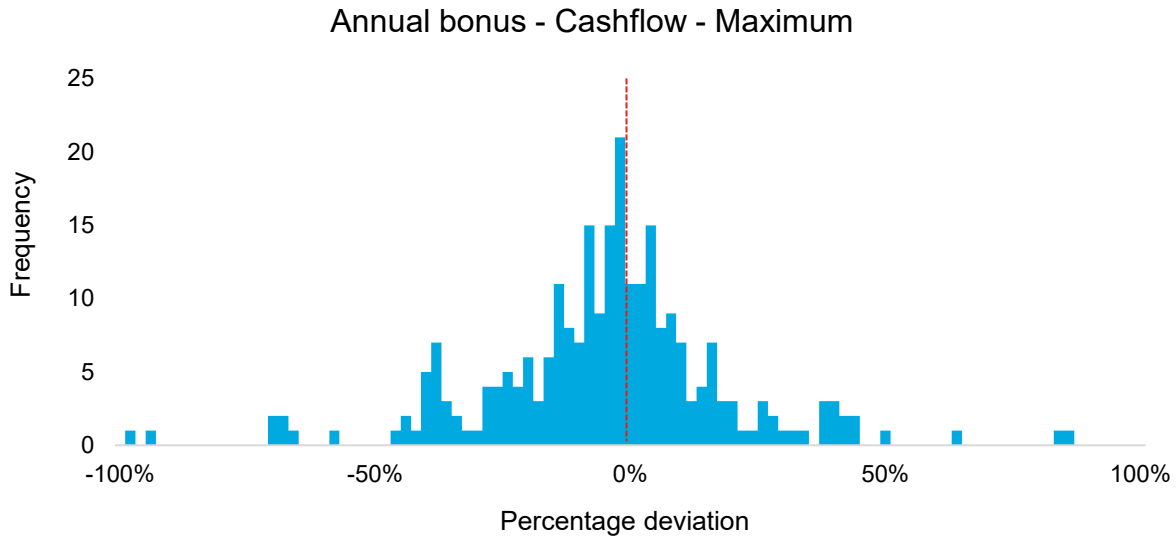
The analysis shown here focuses on profit and cashflow targets, with Figure 3.2.9 below capturing the target deviation histograms for these categories. In each of these histograms, a score of 0% means that the reference target (either threshold payout or maximum payout targets) has been exactly hit, with scores of -100% and +100% meaning that achieved performance is 100% lower or 100% higher than the reference target. We do not capture any observed deviations outside of the -100% to +100% range in these histograms.

[48] Across both this chapter and Appendix C, we only present those annual bonus and LTIP histograms built from over 100 target deviation observations, to ensure a reasonable degree of statistical robustness.

Figure 3.2.9: Target deviation distributions for selected prevalent annual bonus target categories (relative to threshold payout and maximum payout targets)







Target deviation distributions - important limitations

It is important to interpret these histograms with caution. Notably, these histograms do not tell us the percentage difference between the threshold and maximum payout levels themselves, which means that they also do not tell us where exactly achieved performance fell between the threshold and maximum payout levels. As a result, it should not be assumed that any clustering of observations around the threshold payout and maximum payout levels demonstrates that achieved performance often falls close to these reference points, and rarely falls halfway between them.

To illustrate this caveat with an example, consider a CEO's profit target where the maximum payout target is only 20% greater than the threshold payout target. If the CEO achieves profit 15% greater than the threshold payout target, then their performance would visually appear quite close to the threshold payout on the threshold deviation histogram. It would be a mistake to assume from this histogram that performance is far

from the maximum payout because the CEO's performance is actually closer to the maximum payout level than the threshold payout level.

In the absence of any incentive effects on CEO behaviour, we might expect there to be a broadly similar number of CEOs who just miss and just hit their threshold payout or maximum payout targets respectively. However, Figure 3.2.9 shows that performance is asymmetrically distributed around both the threshold payout and maximum payout levels. This is clear from visual inspection, but in Appendix C we also test formally for asymmetry using the McCrary (2008) test. This test finds that the distributional asymmetries are especially strong around the threshold payout, with clear evidence of discontinuities.

Notably, the direction of the asymmetry differs between the threshold and maximum targets. In the threshold deviation histograms, performance is asymmetrically tilted towards just *hitting* the threshold payout, whereas in the maximum deviation histograms, performance is asymmetrically tilted towards just *missing* the maximum payout. The extent of this asymmetry is striking, and importantly we find a similar pattern across other target categories whose histograms are shown in Appendix C (other financial, EPS and revenue), despite differences in sample size. This is an interesting finding, as it is **consistent with CEOs optimising their performance to increase their overall (current and future) payout**.

It is important to stress that, while the histograms suggest that targets alter CEO behaviour, it is not necessarily the case that these changes are socially suboptimal. One interpretation is indeed that the CEO engages in short-term actions (which may hinder long-term value) to hit the threshold, such as cutting R&D or increasing accruals, and undertakes the reverse to avoid exceeding the maximum too much. However, it could also be that targets have the desired effect – they may simply incentivise effort. The fact that more firms just meet rather than just miss the threshold is consistent with CEOs working hard to hit it. The fact that more firms just miss rather than just exceed the maximum suggests potential downsides to capping incentive payouts – it encourages coasting close to the maximum.[49]

The performance distribution for cashflow targets also shares some of the same features (including strong asymmetry around the threshold payout level), although a greater proportion of CEOs exceed both the threshold payout and maximum payout by a considerable margin. This is consistent with evidence from the target hit rate analysis, which suggests that cashflow targets are relatively easy to hit or exceed (particularly at the maximum payout) relative to other categories.

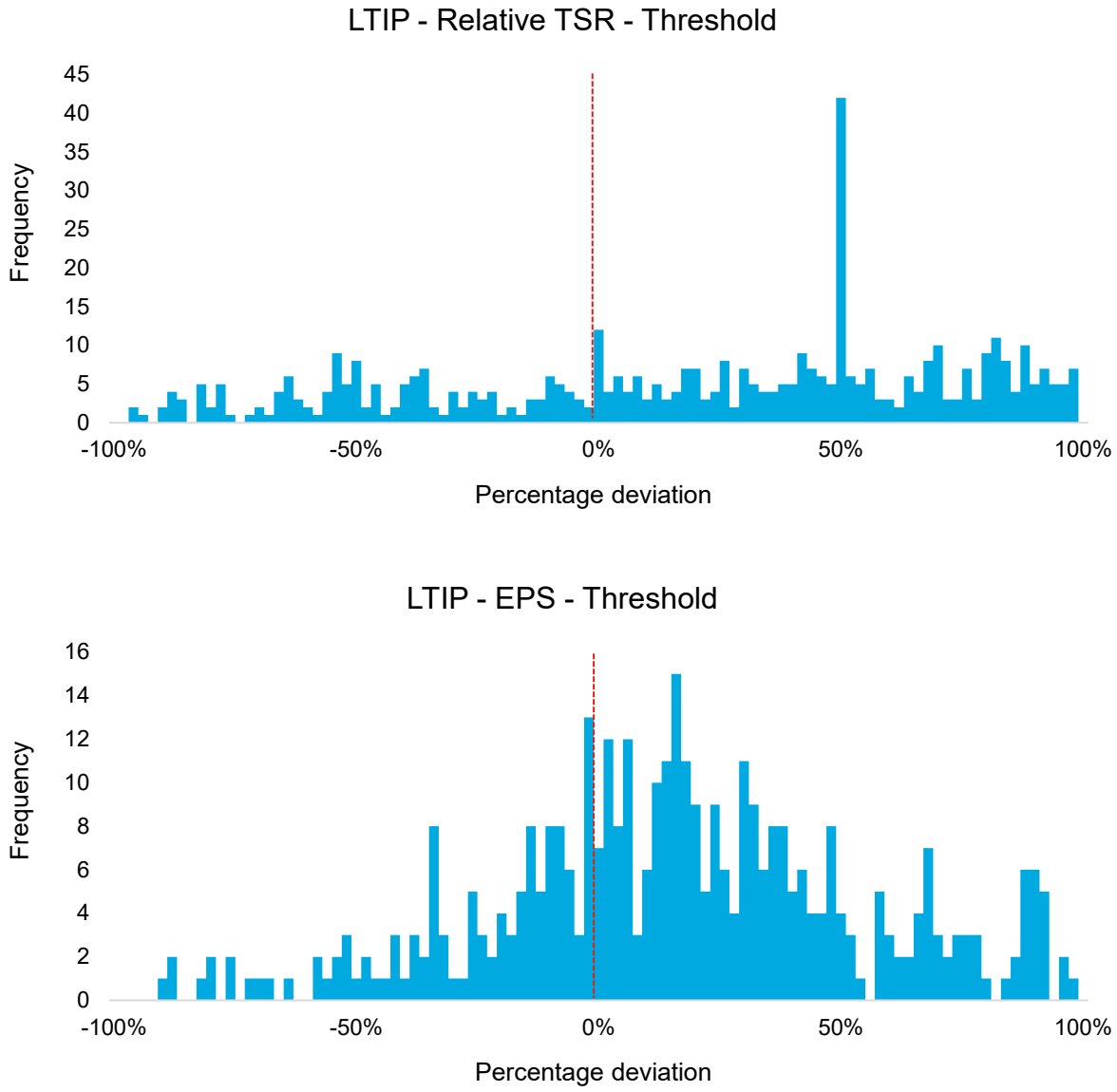
We now analyse the target deviation distributions for prevalent LTIP target categories, which allows us to assess whether the striking findings from our annual bonus data are replicated

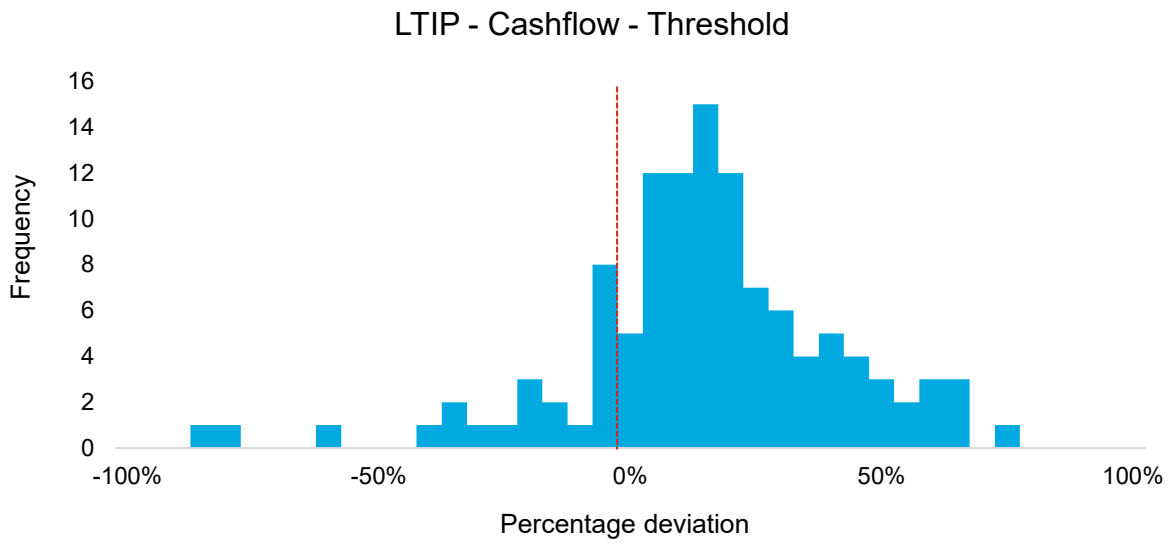
[49] Still, even if incentives do lead to coasting behaviour once the maximum payout is reached, this may not necessarily be socially suboptimal if more stretching targets would lead to excessive focus on short-term performance at the expense of long-term value.

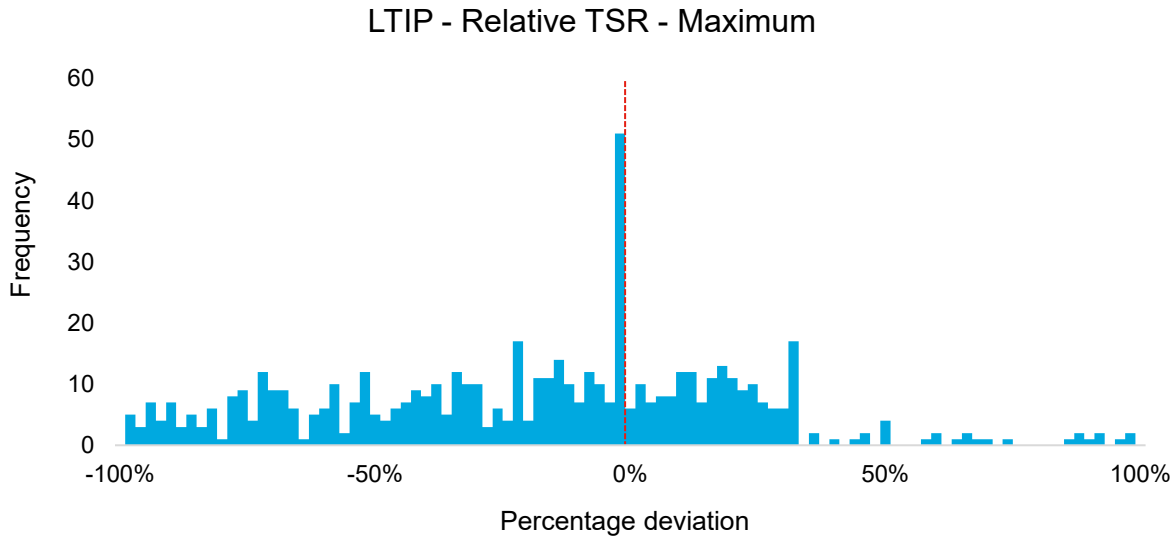
within LTIP data. We again use target deviation histograms, limited to the -100% to +100% deviation range, to present the distributions.

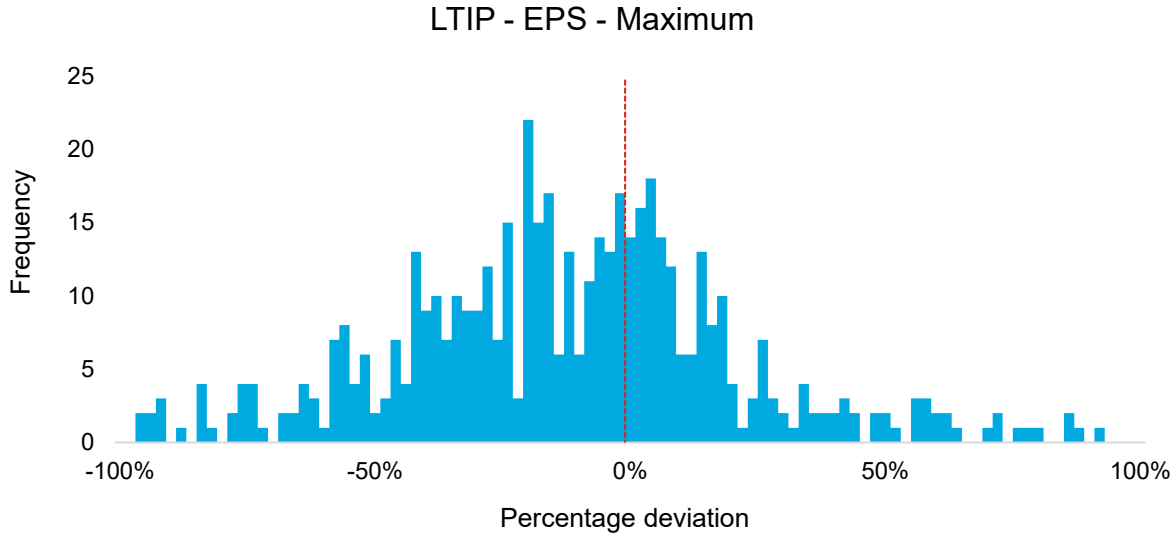
As for the annual bonus data, we do not present all of the target deviation distributions we have studied within this chapter: instead we present histograms for three of the most prevalent LTIP target categories, and we refer the reader to Appendix C for the full set of distribution histograms. The analysis shown here focuses on EPS, cashflow and relative TSR targets, with Figure 3.2.10 below capturing the target deviation histograms for these categories.

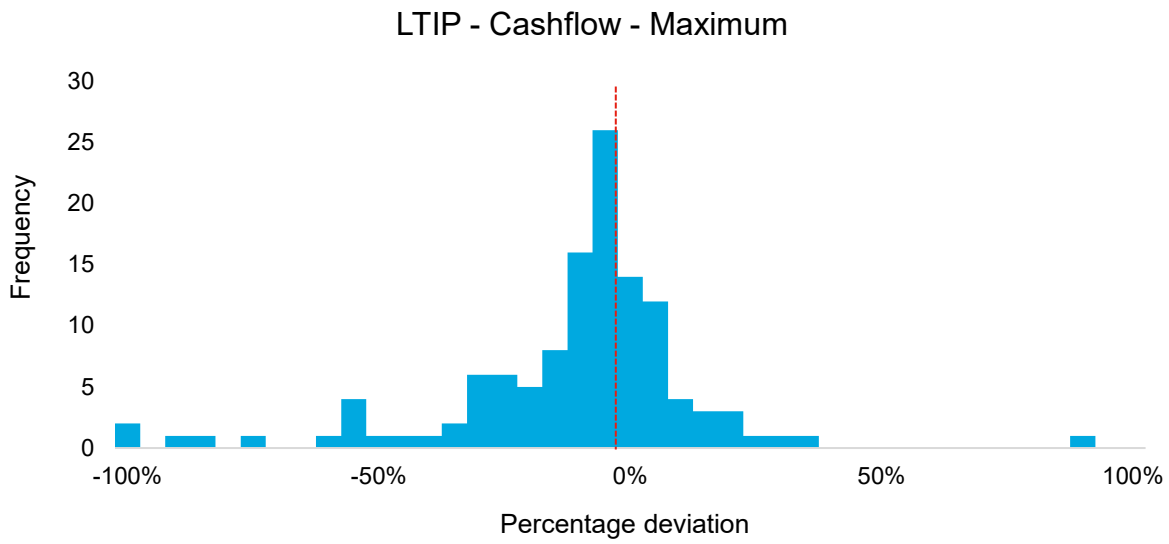
Figure 3.2.10: Target deviation distributions for selected prevalent LTIP target categories (relative to threshold payout and maximum payout targets)




LTIP - Cashflow - Threshold
Frequency
16
14
12
10
8
6
4
2
0
-100%
-50%
0%
50%
100%
Percentage deviation


LTIP - Relative TSR - Maximum
Frequency
60
50
40
30
20
10
0
-100%
-50%
0%
50%
100%
Percentage deviation


LTIP - EPS - Maximum
Frequency
25
20
15
10
5
0
-100%
-50%
0%
50%
100%
Percentage deviation



In contrast to the annual bonus histograms, these LTIP histograms show much greater symmetry and smoothness in target deviation distributions. This is particularly true for the maximum deviation distributions, which commonly have smooth performance distributions that peak at or close to the maximum payout level. We see this in the EPS histogram (and to some extent the relative TSR histogram) shown above, and also in the histograms for other prevalent target categories (ROCE, EPS vs RPI and other financial) which are captured in Appendix C. Relative to the annual bonus data, it is much more common for LTIP performance to exceed the maximum payout by some margin.

There is still some evidence of asymmetry around the threshold payout level in select cases (particularly for the cashflow histogram shown above), with many CEOs just hitting the threshold payout target, but this is less clear-cut and much less consistent across target categories than in the annual bonus data.

The deviation distributions for relative TSR are a notable outlier from other LTIP categories, as they are characterised by a relatively even distribution across the performance range which is punctuated by two notable spikes. In the maximum deviation histogram, we also find that the distribution tails off dramatically beyond the +33% deviation point. We explain in the limitations box below why we find these patterns, and why the relative TSR distributions should be interpreted with caution.

Additional limitations of the Relative TSR target deviation histograms

The relative TSR histograms shown above are heavily influenced by the measurement units and reporting conventions used to capture performance.

The primary explanation for this is that the reporting of relative TSR performance appears to be frequently truncated in our dataset. This arises because TSR targets often stipulate that to earn the threshold payout, a CEO must achieve a TSR score which exceeds the median (50th percentile) TSR among their firm's comparator group, and to earn the maximum payout, a CEO must achieve a TSR score which exceeds a higher

performance percentile among the same comparator group (often this is the 75th percentile). Results outside the 50th to 75th percentile range are frequently reported as 'below median' or 'above upper quartile' rather than giving the precise percentile.

The two spikes shown in the TSR threshold deviation histogram are at the 0% and +50% deviation points, which indicates that CEO performance either just hits the 50th percentile (reported as 0.5) or just hits the 75th percentile (reported as 0.75), with the latter implying a positive deviation of +50% compared to the threshold payout. Similarly, the two spikes shown in the TSR maximum deviation histogram are at the 0% and +33.3% deviation points, which indicates that CEO performance either just hits the 75th percentile (0.75), or comes top of the comparator group by reaching the 100 percentile (1.00), with the latter implying a positive deviation of +33.3% compared to the maximum payout.

Based on this evidence, we believe there is some truncation in the reporting of TSR performance, and therefore the TSR histograms should be interpreted with additional caution compared to the others. Ideally we could have analysed the underlying TSR scores themselves rather than the percentile positions firms achieved relative to their comparators, but this is challenging given that comparator firms' outturn performance is not known when targets are set (in other words, TSR performance and payout is determined on a relative basis).

Overall findings from our target deviation analysis

Comparing the histograms generated for annual bonus and LTIP data, there is a significant contrast in the deviation distributions which holds across almost all of the prevalent target categories considered. For the annual bonus data, we find evidence of clear asymmetries in the performance distribution, which favour just hitting threshold payout levels and just missing maximum payout levels. This is **consistent with CEOs' incentives to avoid missing the threshold payout level and also avoid exceeding the maximum payout level by a significant margin**. It is particularly striking that the same distributional shape and patterns apply to almost all the target categories considered (taking into account those histograms presented in Appendix C).

By contrast, our analysis of LTIP data produces much less evidence of distributional asymmetries, and there is less consistency between categories in the overall shape of the achieved performance distribution. The EPS distribution is particularly smooth, and this is perhaps most similar to a normal (Gaussian) statistical distribution across our annual bonus and LTIP data.

The explanation for these differences may stem partly from the purpose and structure of annual bonus and LTIP incentives. Given that annual bonus targets commonly measure firm-specific financial performance over a single-year time horizon, it is relatively straightforward for CEOs and RemCos to predict future performance and set challenging yet achievable benchmarks. By contrast, LTIP incentives typically measure CEO performance over a 3-year period, and there is a heavy emphasis on setting targets which reflect relative firm performance

against high-profile financial return indicators (such as TSR and EPS) which are of importance to shareholders. Given uncertainty over competitor performance and broader macroeconomic developments, it is therefore much harder for CEOs to forecast the outturn performance needed to meet their threshold payout and maximum payout targets. Moreover, it may be that LTIP targets are more frequently set by reference to absolute performance standards, regardless of the prospects of the company (for example requiring returns in excess of cost of capital, or minimum levels of EPS growth) whereas bonus targets may more commonly reflect a realistic short-term target.

Taken together, these factors are likely to make threshold payout and maximum payout targets a significantly more powerful incentive mechanism within annual bonus schemes than LTIP schemes. This may explain why LTIP schemes typically represent a greater share of CEOs' overall pay package (as noted earlier in this chapter), to ensure that they exert sufficient influence on performance. This is equally a plausible explanation for the contrast we find in target deviation distributions between annual bonus and LTIP schemes.

Overall, it does appear that CEOs' performance against their annual bonus incentives is influenced by knowledge of the threshold payout and maximum payout targets, with evidence of many CEOs just hitting the threshold payout and narrowly missing the maximum payout. However, these findings alone cannot tell us whether annual bonus incentives motivate CEOs to hit threshold payout targets through genuine firm productivity improvements, or whether they simply encourage CEO behaviour aimed at increasing short-run payout (potentially at the expense of long-term firm performance), using approaches such as reducing investment expenditure. Our econometric analysis in Chapter 4 aims to provide greater insight into this, by exploring whether there is evidence that CEOs alter investment to influence their performance against annual bonus and LTIP targets.

Key findings - Target deviation (Measure 3)

Our analysis explores the achieved CEO performance distribution across prevalent annual bonus and LTIP categories, considering how achieved performance compares to threshold and maximum payout targets. In the annual bonus data, we find evidence of striking asymmetries in the performance distribution around the threshold and maximum payout points, which are consistent with CEOs acting to increase their current and future bonus payouts. By contrast, in the LTIP data, we find that the achieved performance distribution is typically smoother, with much less pronounced asymmetries and a greater likelihood of performance exceeding the maximum payout by a wide margin.

The explanation for these differences may stem partly from the purpose and structure of annual bonus and LTIP incentives. Whereas annual bonus targets commonly measure firm-specific performance over a one-year time horizon, LTIP targets typically measure performance over a three-year period, and many of these targets evaluate performance relative to industry comparators or macroeconomic indicators. It is therefore easier for CEOs to control performance against their annual bonus targets, and this may encourage greater behavioural responses against bonus targets compared to LTIP targets.

However, these findings alone cannot tell us whether annual bonus incentives motivate CEOs to hit threshold payout targets through genuine firm productivity improvements, or whether they simply encourage CEO behaviour aimed at increasing short-run payout (potentially at the expense of long-term firm performance). Our econometric analysis in Chapter 4 considers whether there is evidence for CEO behaviour of this kind.

Measure 4: Achieved package share

The first three measures reported in this section capture the prevalence, difficulty and performance distribution associated with different target categories. This leads onto studying the achieved package share of each category, which combines elements of these three measures to identify the relative financial importance of different targets, expressed in terms of how much they contribute towards CEOs' overall pay awards.

As noted in Table 3.2.2 above, achieved package share can be calculated for a specific performance condition by multiplying together three quantities:

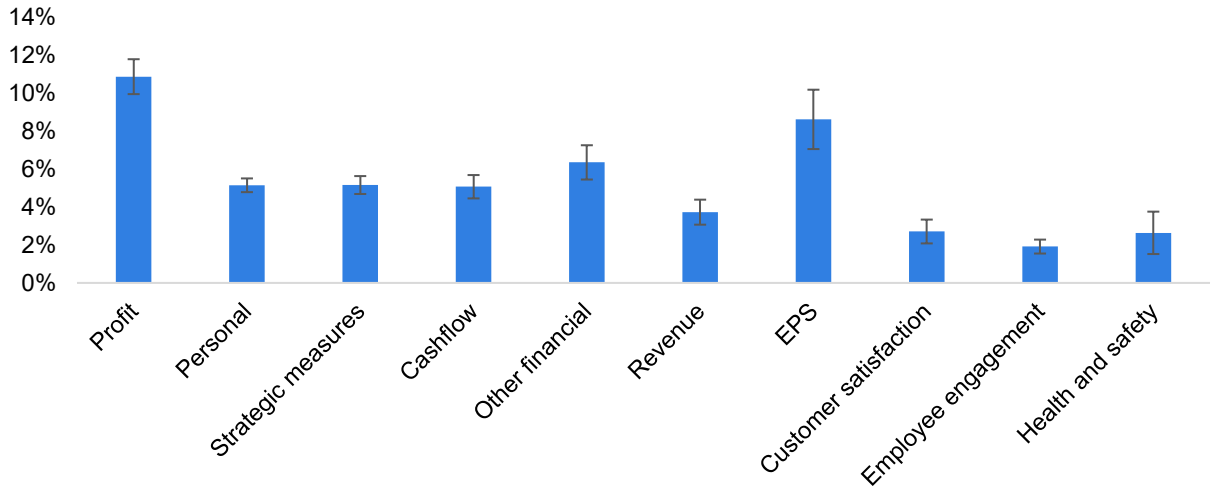
- The percentage of the available award achieved through performance against that target (%) - also known as the 'achieved vesting share'
- The weight allocated to that performance condition within the relevant annual bonus or LTIP scheme (%)
- The estimated share of the relevant annual bonus or LTIP within the CEO's overall pay award (%)

To estimate the latter quantity, we are not able to calculate the exact breakdown of CEOs' overall pay awards on an outturn performance basis, because a single year's total pay arises from fixed pay, annual bonus, and LTIP awards all made in different years and these may vary from year to year. Instead we draw on firms' estimated split of fixed pay awards, annual bonus schemes and LTIP schemes under a maximum performance scenario in their notes to the pay policy, as required by UK reporting guidance. As a result, one limitation of this analysis is that our results do not provide an exact estimate of how each target category contributed to CEOs' outturn pay awards. Another important (and related) caveat is that our results do not account for differences in the prevalence of different targets, as they focus only on cases where a given target category is present within the annual bonus or LTIP package.

Nonetheless, our results provide important insights into the relative financial materiality of different target types. Our analysis specifically focuses on the mean achieved package share across different target categories within both annual bonus and LTIP schemes.

We first analyse mean achieved package share for different annual bonus target categories. This is shown in Figure 3.2.11 below.

Figure 3.2.11: Mean achieved package share for prevalent annual bonus target categories

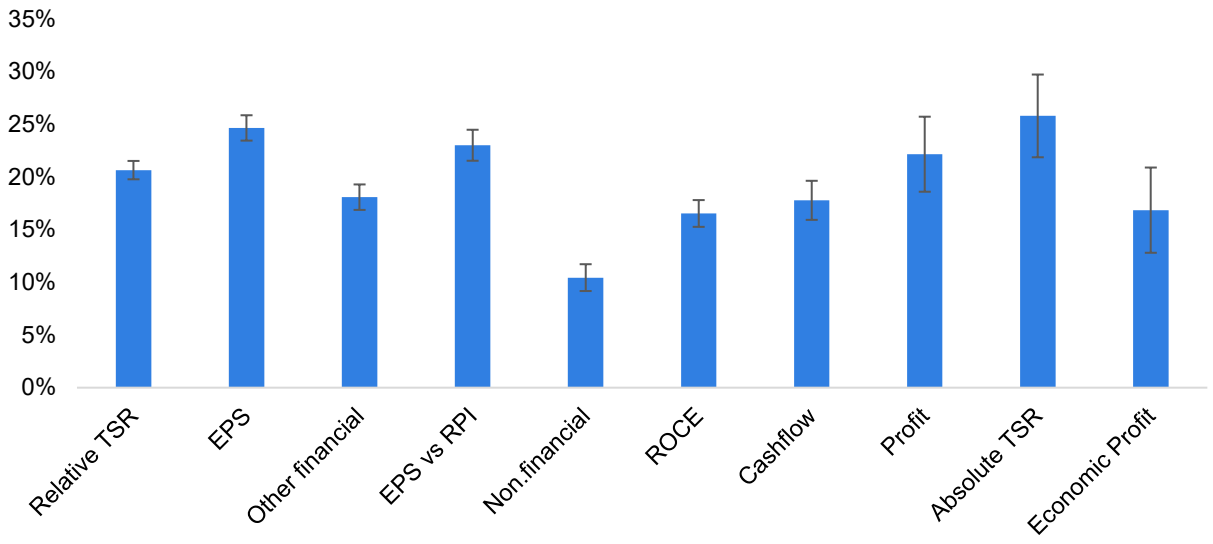


Reviewing the different target categories, we find substantial differences in mean achieved package share. Profit and EPS targets contribute a notably higher proportion of achieved package share than other target types, including those targets focused on personal or strategic objectives.
The primary drivers of the mean package share scores achieved by different target categories are the target hit rates associated with different categories (and the level of achieved performance more broadly), along with the average weights given to different target categories. Given that both target hit rates and the achieved performance distribution are very similar across target categories, these findings suggest that profit and EPS target measures are typically given a significantly higher weighting than other categories.

This finding is consistent with profit and EPS targets being mostly used as ‘Condition 1’ of the annual bonus, which is typically given a high weighting (often over 50%). By contrast, target categories like cashflow, personal and strategic objectives are very rarely the first condition, and these are more commonly the second, third, fourth or fifth conditions within the annual bonus package. This means that the weightings given to these targets is significantly lower, partly because they are almost never used as a sole condition (and therefore weightings of 100% are very rare).

We now perform a similar analysis for the most prevalent LTIP target categories, and the results are shown in Figure 3.2.12 below.

Figure 3.2.12: Mean achieved package share for prevalent LTIP target categories



In the LTIP data, we find somewhat less mean package share variation across most target categories compared to our annual bonus data. This indicates that the weightings given to different target categories are more comparable, which is perhaps unsurprising given that LTIP targets tend to largely capture high-profile financial outcomes, as opposed to personal or strategic outcomes. As a reminder, these results do not account for the relative prevalence of different target categories, which varies considerably (as found in our Measure 1 analysis). The mean achieved package share for each category is conditional on that category being present within the CEO's LTIP package.

Unlike in the annual bonus data, we find that all of the three most prevalent LTIP target categories are most often used as the first LTIP condition, which tends to have higher weightings. This is a key driver of the convergence between different target categories. Among the broader set of LTIP categories, ROCE, cashflow and non-financial targets are typically assigned second or third condition status. Notably, we find that the mean achieved package share for these three categories is relatively low, which is consistent with lower average weightings.

Our LTIP hit rate analysis (Measure 2) does find that relative TSR hit rates are notably lower than for other categories at the threshold payout level, leading to a higher incidence of zero payouts, which reduces its mean package share score relative to other target categories.

Given that the achieved performance distributions for LTIP categories show less uniformity than for annual bonus categories (as shown in Figure 3.2.10 above), these may also contribute to differences in achieved package share. For instance, the mean achieved package share for EPS is relatively high, and we see in Figure 3.2.8 that EPS has a relatively high proportion of cases where the maximum payout target is exceeded.

Comparing against the annual bonus results, another notable difference is that the mean

package share for LTIP categories is larger than for the annual bonus categories. There are two plausible reasons for this difference. Firstly, LTIP incentives are typically concentrated within a small number of target categories, whereas annual bonuses can contain many constituent targets (sometimes as many as 10 distinct targets are recorded per annual bonus scheme in the PwC database). This implies that average weightings for individual LTIP targets are generally higher than individual annual bonus targets. Secondly, LTIP schemes often (though not always) represent a higher share of a CEO's total pay award than annual bonuses. The first of these reasons is a particularly important driver of the mean package share differences.

Key findings - Achieved package share (Measure 4)

Our analysis finds significant variation in mean achieved package share across annual bonus target categories, with the profit and EPS categories both having a markedly higher average share than other target types. This implies that these categories are given relatively high weightings within annual bonus schemes, which is consistent with evidence that these categories are commonly used as the first condition within annual bonuses. By contrast, other prevalent categories are more commonly used as the second, third, fourth or fifth conditions, which are typically given lower weightings.

We do find some variation across LTIP target categories, although this is less pronounced than the annual bonus data, with more evidence of convergence. This is consistent with evidence that prevalent LTIP target categories are mostly used as the first condition within LTIPs, which reflects the relative concentration of LTIP incentives within a limited number of performance conditions.

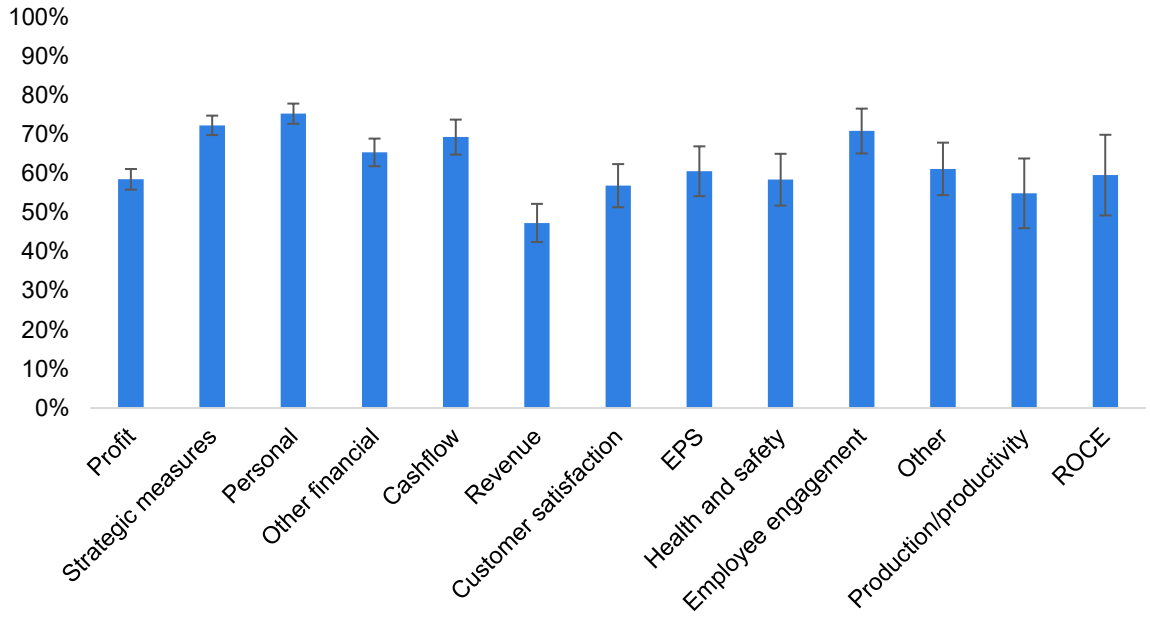
Measure 5: Mean vesting share

Our final measure focuses on the mean vesting share achieved by CEOs across different target categories. As explained under Measure 4 above, this statistic tells us the percentage of the available award achieved through performance against a particular target. Whilst we know how often CEOs meet (or exceed) their performance targets from Measure 2, and we also have some understanding of the performance distribution from Measure 3, this measure provides another way to assess where performance typically falls between the threshold payout and maximum payout levels, and therefore how challenging it is for CEOs to earn incentive payouts across different target categories.

Our analysis focuses on the mean achieved vesting share across target categories. This is influenced by several factors, including the vesting share available at the threshold payout and maximum payout levels, and also where achieved performance falls relative to these levels.

We first analyse the mean achieved vesting share across annual bonus target categories, which is captured in Figure 3.2.13 below.

Figure 3.2.13: Mean achieved vesting share for prevalent annual bonus target categories

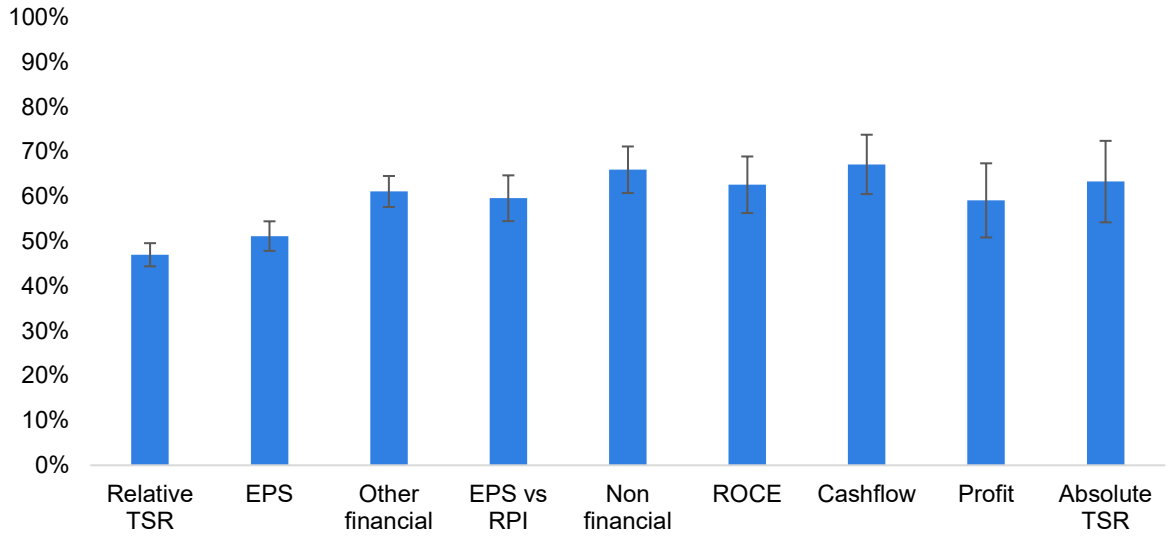


As Figure 3.2.13 shows, all prevalent target categories have more than 50% of their potential payout realised, except for revenue. Strategic measures and personal targets have the highest achieved vesting share on average, at c.72% and c.75% respectively, significantly higher than other categories like profit and revenue. This is consistent with anecdotal evidence that RemCos are reluctant to award CEOs the maximum possible score against more discretionary, subjective targets, but equally it is common for these scores to be high unless performance is particularly poor. We notably find that customer satisfaction targets (which can be more readily measured) have a lower mean vesting share, which suggests that it is the subjectivity of personal and strategic targets (more than their non-financial status) which influences mean vesting share.

We also find from Figure 3.2.13 that cashflow targets have a relatively high mean vesting share, which is consistent with the finding that maximum payout hit rates are very high for this category.

We now explore how mean vesting share varies across prevalent LTIP categories, which is captured in Figure 3.2.14 below.

Figure 3.2.14: Mean achieved vesting share for prevalent LTIP target categories



All target categories except relative TSR have more than 50% of their potential payout realised, which is broadly similar to the annual bonus data, although the mean vesting shares are slightly lower for LTIP categories (with most scores falling into the 50%-70% range). This may reflect the relative absence of subjective and non-financial targets within LTIP schemes. Relative TSR vesting shares are lower than 50% on average, which is partly due to the relatively low threshold payout hit rates for this category, and also the strong historical role which investors have played in ensuring that TSR targets are fairly benchmarked (i.e. based on outperforming comparator firms) and challenging for the CEO to meet. EPS targets also have a relatively low mean vesting share of approximately 50%.

As identified in the annual bonus data, cashflow targets have one of the highest mean vesting share scores at 67%. This partly reflects the high threshold payout hit rates (and to some extent maximum payout hit rates) associated with LTIP cashflow targets.

Key findings - Mean vesting share (Measure 5)

Our analysis finds that most of the prevalent target categories across both annual bonus and LTIP schemes have more than 50% of their potential payout realised on average. We find particularly high mean achieved vesting share for prevalent subjective target categories within annual bonuses, such as strategic measures and personal targets. This is consistent with anecdotal evidence that RemCos tend to award relatively high performance scores against these discretionary targets whilst rarely awarding maximum scores.

We also find reasonable alignment between these findings and the target hit rates identified through Measure 2, as we would expect. Cashflow targets across both annual bonus and LTIP data have relatively high mean vesting share, which is consistent with their high threshold and maximum payout hit rates, whilst relative TSR has the lowest

mean vesting share of LTIP categories, which is consistent with the low threshold payout rates for this category.

Overall, we find that measures that are more subjective or controllable achieve higher vesting shares in both annual bonuses and LTIPs.

De-facto base pay analysis

To supplement our statistical analysis, we have also undertaken econometric analysis that considers whether either the annual bonus or LTIP acts as de-facto base pay. We find a significant negative relationship between the ratio of fixed pay to LTIP pay at maximum payout and the expected vesting share of the LTIP.

- Such a finding suggests optimal contracting behaviour among FTSE All-Share firms as fixed CEO pay is lower when it is relatively easy for CEOs to earn rewards from their LTIP.
- However, if LTIPs become seen (even in part) as de-facto base pay (especially where relatively achievable LTIP-based awards displace fixed pay), they may have less power to incentivise the CEO to prioritise firm performance. As such, LTIPs may not be used to serve their intended purpose.

Overall, this evidence suggests that CEO pay contracts do tend to be set rationally with regards to the expected value of the LTIP. Optimal contracting practices of this kind suggest that firms hold some power in the market for CEOs. Nonetheless, these practices could create risk that easier LTIP targets are seen as de-facto base pay, potentially reducing CEOs' incentives to prioritise firm performance.

Such optimal contracting does not appear to occur with regards to annual bonuses (at least not systematically). This implies that easy performance targets within annual bonuses may be seen as a pay top-up, rather than a replacement for CEOs' base pay.

Further detail on the de-facto base pay analysis is provided in Appendix D.

Overall conclusions from our statistical trends analysis of executive performance targets

In this section, we have explored the prevalence of different target categories within CEOs' annual bonus and LTIP packages, and we have analysed how CEOs typically perform against them. We have specifically assessed the most common target categories against five statistical measures. Taken together, our findings across these five measures help us to understand the relative financial importance of different target categories and the extent to which they influence achieved CEO performance.

There are several key conclusions which can be drawn from our statistical analysis:

- Our target prevalence analysis (Measure 1) finds that a large proportion of CEO performance targets are concentrated within a small number of popular categories. This

is especially true for LTIP targets, 70% of which fall under the relative TSR, EPS or other financial categories. There is less concentration within annual bonus incentives, but we still find that seven categories (profit, personal, strategic measures, cashflow, other financial, revenue and other) account for over 75% of annual bonus targets. This helps us to identify the key target categories to analyse against our other statistical measures.

- Our target hit rate analysis (Measure 2) finds that more CEOs fall within the incentivised performance range for annual bonus schemes than LTIP schemes. In our annual bonus analysis we find that threshold hit rates are consistently high across target categories, but maximum hit rates are often lower than 30%, implying that it is relatively easy for CEOs to earn the threshold payout but much harder for them to earn the maximum payout. In our LTIP analysis we still find that threshold hit rates are consistently higher than maximum hit rates, but the gap is smaller, with CEOs earning the maximum payout at least 30% of the time. This implies that CEOs quite often fall outside of the incentivised performance range on their LTIPs. Overall, these findings are consistent with annual bonus targets being easier to calibrate than LTIP targets, because they are set over an annual time horizon (rather than a multi-year horizon) and they typically relate to firm-specific performance rather than relative performance compared to a peer group. When RemCos have better ability to forecast performance outcomes (due in part to shorter time horizons), this appears to result in better calibrated targets.

- Taken together, our target hit rate analysis (Measure 2) and mean vesting share analysis (Measure 5) suggest that CEOs generally (although not always) achieve stronger performance on targets which are more directly controllable. For example, the hit rates for cashflow targets are relatively high across both annual bonus and LTIP data, and CEOs' mean achieved vesting share is also high for this category. By contrast, CEOs' hit rates and mean achieved vesting share for the revenue (annual bonus) and relative TSR (LTIP) categories are significantly lower. Whilst some aspects of cashflow performance (such as working capital) are highly influenced by firms' internal decisions, CEOs' performance against revenue and relative TSR targets is heavily affected by the broader market environment including the decisions made by competitor firms. These findings suggest that CEOs' targets do exert some influence on their decisions and achieved performance.

- Our target deviation analysis (Measure 3) provides interesting insights into the distribution of achieved performance, particularly at the two ends of the incentivised performance range (i.e. the threshold payout and maximum payout). This analysis finds striking asymmetries in achieved performance on annual bonus targets, with many CEOs just exceeding their threshold payout target and just missing or exactly hitting their maximum payout target, as opposed to just missing the threshold or materially exceeding the maximum. These asymmetries are suggestive of non-random performance outcomes close to the inflexion points in CEOs' payout profiles, and they are consistent with CEOs' incentives to act in their financial self-interest by maximising their current and future payout. There is less evidence of such asymmetries in the LTIP

performance distributions, which may reflect CEOs' weaker control over achieved LTIP performance.

- Our econometric analysis of de-facto base pay suggests that CEO pay contracts tend to be set rationally with regards to the expected value of the LTIP, although not with regards to the expected value of the annual bonus. Optimal contracting practices of this kind suggest that firms hold some power in the market for CEOs.

Overall, our statistical analysis does suggest that CEOs' performance targets are generally calibrated effectively to incentivise target achievement, although threshold payout targets are met by a large proportion of CEOs and therefore it is unlikely that high-performing CEOs (or average CEOs from high-performing firms) face significant challenges in achieving them.

Our analysis also sheds light on the extent to which targets influence CEO decision making and achieved performance. Taken collectively, our findings support the hypothesis that performance targets influence CEO behaviour, and that CEOs manage their achieved performance in a manner consistent with enhancing their current and future incentive payout. Importantly, it appears that CEOs are better able to manage their performance and achieve the desired outcomes when they have greater control over their performance, which is associated with less influence from external market conditions and shorter time horizons.

These findings alone cannot tell us what actions CEOs take to optimise their performance (such as potentially reducing or increasing investment), nor can they tell us whether such actions are harmful (or alternatively helpful) to firms' long-term interests. It should not therefore be assumed that CEO performance targets (and their effects on CEO behaviour) are damaging to FTSE All-Share firms and wider society, as well-designed targets may guide CEOs towards optimal and mutually beneficial decisions. The fact that targets appear to influence achieved performance does at least suggest that they have some power to incentivise CEOs, as intended.

In the rest of this study, we explore how performance targets may influence CEOs' decision making. Specifically, we analyse whether CEOs make short-term investment decisions aimed at influencing their performance against targets (and thereby increasing their current and future payout). As noted earlier, this is a key channel through which executive pay practices could drive short-termism and impair long-term innovation and resilience in UK corporations.

4. Econometric analysis

This chapter presents our analysis of the link between executive performance targets and firm investment or accruals. The chapter begins with a statistical analysis of how ex-post performance compares to ex-ante performance within our annual bonus data, which captures how firm investment and CEO performance change at different points along the CEO payout profile. The chapter then explores our econometric analysis of relationships between CEO performance and investment, starting with our threshold (ex-post and ex-ante) econometric analysis and then moving onto our general econometric analysis.

For more detailed information on our econometric analysis and line-by-line results, we refer the reader to Appendix D.

Statistical analysis of ex-post and ex-ante performance

Introduction to our ex-post and ex-ante analysis

We define ex-post performance as the observed performance that CEOs realise against their annual bonus and LTIP targets. Our econometric ex-post analysis (presented later in this chapter) tests whether CEOs who hit their performance targets by a small margin undertook significantly different investment growth from those CEOs who missed their targets by a small margin. Such a finding could indicate that CEOs hit or missed performance targets due to their firms' investment decisions.

By contrast, our econometric ex-ante analysis (also presented later in this chapter) investigates the links between investment and expected target performance. Specifically, our ex-ante analysis aims to test whether firms whose CEOs were on track to just hit their performance targets (had investment remained at the previous year's level) undertook significantly different investment growth from firms whose CEOs would have just missed their performance targets. To this end, we define ex-ante performance as the performance CEOs would have achieved had investment remained at the previous year's level.

In effect, our ex-ante analysis allows us to identify whether CEOs attempted to enhance their payout because they anticipated falling just short of the threshold payout target (or exceeding the maximum payout), rather than whether CEOs succeeded in hitting the threshold payout target (or just missing the maximum payout target) through investment decisions that enhanced their payout.[50]

[50] We define 'payout enhancement' as an increase to CEOs' overall (current and future) payout. Importantly, this can include actions which reduce short-term payout in return for higher future payout, and we explain in Chapter 3 of this study why CEOs have incentives to reduce performance once they reach the maximum target. To avoid confusing the reader, we use the term 'enhancement' in recognition that the initial effect of payout enhancing actions may be to reduce short-term payout.

As well as helping us to better understand whether CEOs have tried (and potentially failed) to change firm investment in their self-interest, our ex-ante analysis can also provide insights relevant to the interpretation of our ex-post analysis, which often involves hypotheses or assumptions about firms' ex-ante performance. One way of doing this is to directly compare firms' ex-ante and ex-post performance, to see how strongly correlated these variables are (and how often they differ materially). Therefore, before presenting our econometric analysis of ex-post and ex-ante performance, we first explore statistically how CEOs' ex-post performance relates to their ex-ante performance.

Estimation of ex-ante performance

Since expected target performance cannot be directly observed (or known), it therefore must be estimated using a series of assumptions. The first step in constructing our ex-ante performance measures therefore involves defining and calibrating these assumptions. To estimate ex-ante performance, we assume that investment would have been at the same level as last year in the absence of any decisions taken to enhance payout. We also test the sensitivity of our results to an alternative assumption, that investment would have grown in line with the annualised rate of CPIH inflation in the absence of any decisions taken to enhance payout.

We then estimate what ex-ante target performance would have been (under our investment assumptions) by assuming a direct mechanical relationship between investment and target performance. Since our CEO performance measures are not always directly linked to investment measures, we focus our ex-ante analysis on two sets of CEO performance and investment measures where a strong direct and mechanical relationship does exist. Specifically, our analysis considers:

- The relationship between profit targets within annual bonuses and the change in R&D expenditure
- The relationship between cashflow targets within annual bonuses and the change in capex

Capex decisions do not affect operating cashflow or financing cashflow measures, but they do affect investing cashflow, free cashflow and total (overall) cashflow. For this reason, our ex-ante analysis only studies the last three measures. We calculate what cash flow (profit) would have been had capex (R&D) remained at the same level as last year, based on the fact that £1 of capex (R&D) reduces cash flow (profit) by £1.

We acknowledge that these are only two relationships through which investment may be used to influence performance against targets, and there is a much broader set of investment and target variable relationships incorporated within our econometric ex-post analysis (presented later in this chapter). In theory, there may be significant relationships between many of these variables. Our approach has been to focus on two relationships where the effect of investment on the performance measure can be estimated without requiring assumptions – as stated above, £1 of capex (R&D) reduces cash flow (profit) by £1. It is indeed true that capex also

reduces profit due to depreciation and either an increase in interest expense or a reduction in interest income. However, we would have to estimate the depreciation and interest rates, and such estimations would be highly sensitive to assumptions.

Comparison of ex-post and ex-ante performance

For those relationships we have considered, there are four different scenarios for how ex-ante performance might compare to ex-ante performance, as captured in Table 4.1.1 below:

Table 4.1.1: Possible scenarios for ex-ante and ex-post performance against target

	Ex-post: Target hit	Ex-post: Target missed
Ex-ante: Target hit	Scenario A	Scenario B
Ex-ante: Target missed	Scenario C	Scenario D

Scenarios A and D capture outcomes where ex-ante and ex-post performance are aligned (albeit not necessarily identical), whereas Scenarios B and C capture outcomes where the target is hit under one measure but missed under the other. Our statistical analysis studies the occurrence of the four scenarios outlined in Table 4.1.1, and investigates whether there are any patterns in this data which indicate potential payout enhancement by CEOs.

How often Scenarios B and C occur can tell us how often changes in investment make the difference between performance targets being hit or missed. The relative prevalence of Scenarios B and C themselves is especially significant, as this could indicate that investment decisions are affected by their impact on CEO payout. In the absence of such effects, and assuming that both increases and reductions in investment are reasonably common, then we might expect the prevalence of Scenarios B and C to be broadly similar at both the threshold payout and maximum payout levels. In other words, we would expect a similar number of cases where investment rises or decreases close to the threshold and maximum payout levels, causing changes in target performance status. We can think of Scenarios B and C as ‘crossover’ scenarios, where performance crosses over the target level in either a positive or negative direction.

Findings from our analysis

Using our broad sample (i.e. not just those observations which are closest to the threshold or maximum payout levels[51]), we perform statistical analysis of how commonly Scenarios B and C occur, and also assess whether there is a material difference in their prevalence. We perform this analysis for both investment-target relationships studied in this section. Tables

[51] This distinguishes our statistical analysis of ex-post and ex-ante performance from our econometric analysis, which only considers those observations where ex-post or ex-ante performance falls close enough to the relevant target level. For further detail on our econometric analysis and the sample selection process used, please refer to the econometric analysis sections later in this chapter.

4.1.2 to 4.1.5 capture the number of performance observations falling under each of the four scenarios within our sample (these tables follow the same structure as Table 4.1.1 above).

Table 4.1.2: Number of observations under each scenario for the profit/R&D relationship at the threshold payout level

	Ex-post: Target hit	Ex-post: Target missed
Ex-ante: Target hit	552 (80%)	1 (0%)
Ex-ante: Target missed	17 (3%)	117 (17%)

Table 4.1.3: Number of observations under each scenario for the profit/R&D relationship at the maximum payout level

	Ex-post: Target hit	Ex-post: Target missed
Ex-ante: Target hit	175 (25%)	29 (4%)
Ex-ante: Target missed	4 (1%)	498 (71%)

Table 4.1.4: Number of observations under each scenario for the cashflow/capex relationship at the threshold payout level

	Ex-post: Target hit	Ex-post: Target missed
Ex-ante: Target hit	128 (82%)	4 (3%)
Ex-ante: Target missed	11 (7%)	13 (8%)

Table 4.1.5: Number of observations under each scenario for the cashflow/capex relationship at the maximum payout level

	Ex-post: Target hit	Ex-post: Target missed
Ex-ante: Target hit	63 (40%)	17 (11%)
Ex-ante: Target missed	11 (7%)	66 (42%)

The above tables provide several notable findings. Firstly, we find that for both relationships studied, the number of ‘crossover’ observations under Scenarios B and C is relatively small

relative to Scenarios A and D. This indicates that when CEOs hit performance targets ex-ante, they tend to also hit them ex-post, and similarly when CEOs miss performance targets ex-ante, they tend to also miss them ex-post. By implication, it is relatively rare for investment to change substantially enough (either positively or negatively) to affect target achievement status. This indicates that the scope for CEOs to materially change performance outcomes using investment levers is likely to be limited.

Notably, the prevalence of Scenarios B and C is greater for the capex/cashflow relationship than the profit/R&D relationship. This aligns with expectations, since capex is much larger than R&D and thus has a greater effect on cash flow than R&D has on profit.

Across both sets of tables, there is also a striking asymmetry in the relative prevalence of Scenarios B and C. We find that at the threshold payout level, Scenario C is significantly more common than Scenario B, whereas at the maximum payout level, the reverse is true. In other words:

- At the threshold payout level, it is more common for CEOs to perform **better** ex-post compared to ex-ante (than the other way round)
- At the maximum payout level, it is more common for CEOs to perform **worse** ex-post compared to ex-ante (than the other way round)

This is a particularly interesting finding, as it implies that **firms are tending to reduce investment around the threshold payout (which improves target performance), whilst increasing investment around the maximum payout (which worsens target performance).**[52]

Of course, we cannot prove from this analysis that firms are reducing or increasing investment because of CEO payout considerations. Nonetheless, this firm investment behaviour is consistent with CEOs' incentives to maximise current and future payout by reaching the threshold payout and just hitting (or narrowly missing) the maximum payout.[53] Whilst raising investment may slightly reduce current payout, this disincentive effect is very small if ex-ante performance is significantly above the maximum payout. Moreover, as we note in Chapter 3,

[52] Technically speaking, we cannot tell from this analysis alone whether the average CEO performing close to the threshold or maximum payout is increasing or decreasing investment: it depends not just on the relative prevalence of Scenarios B and C, but also on whether CEOs in Scenarios A and D are tending to increase or decrease investment. However, we can draw inferences about those changes in investment which ultimately matter the most (i.e. those changes which affected firms' target achievement position).

[53] One alternative explanation for these results is that CEOs who perform close to the threshold payout tend to reduce investment because their firms are performing less well in general terms, whereas those firms who perform close to the maximum payout have more capacity to increase investment. This explanation is unlikely since a single discrete CEO performance target is uninformative about overall firm performance. For example, if the target is EPS of £1, achieving EPS of £1 rather than 99p is no more indicative of performance than achieving 99p rather than 98p.

there are several reasons why CEOs have incentives to raise investment when ex-ante performance exceeds the maximum.

When we test the sensitivity of these results to an alternative assumption about default investment growth, we obtain very similar findings. Further detail on our sensitivity testing can be found in Appendix D.

It is instructive to contrast these findings with those of our 2019 study into executive pay, share repurchases and investment. A key empirical finding of the 2019 study was that no CEOs had successfully used share repurchases in order to meet their EPS targets, because repurchases are too small to make the difference between missing and hitting EPS targets.[54] This finding suggested that the potential for strategic use of share repurchases is very limited.

By contrast, the Scenario B and C results presented above show that changes in firm investment are large enough to make the difference between CEOs missing and hitting their profit or cashflow performance targets. In other words, this enables some CEOs to reduce (or increase) firm investment in order to influence their current and future bonus payouts, if they so choose. The effect of investment on firm performance appears to be significantly stronger than the effect of repurchases on EPS performance.

Having assessed the prevalence of Scenarios B and C, we can also explore the *size* of the changes in investment and target performance required for CEOs to fall under Scenario B (for maximum payout) or Scenario C (for threshold payout). This allows us to better understand the degree of investment change and target performance needed for a CEO to successfully influence their payout (either through reducing or increasing investment, depending on its implications for the CEO's current and future pay). From this, we can better assess how feasible it is for the average CEO to execute the necessary investment changes.

We first quantify the improvement in target performance achieved for each of our Scenario C observations at the threshold payout (and the decline in performance for each of our Scenario B observations at the maximum payout).[55] Figures 4.1.6 and 4.1.7 below capture the Net Performance Improvement (NPI) for each observation, which is defined as the percentage difference between ex-post and ex-ante target performance:

$$Net\ Performance\ Improvement\ (\%) = \frac{(Expost - Exante)}{Exante}$$

[54] BEIS (2019). 'Share repurchases, executive pay and investment', pp.65-66.

[55] There are 28 observations which fall under Scenario C from our threshold payout analysis (17 for profit/R&D; 11 for cashflow/capex) and 46 observations which fall under Scenario B from our maximum payout analysis (29 for profit/R&D; 17 for cashflow/capex). This explains the number of observations shown in Figures 4.1.6 to 4.1.14 below.

Figure 4.1.6: Net Performance Improvement for Scenario C observations (threshold payout analysis)

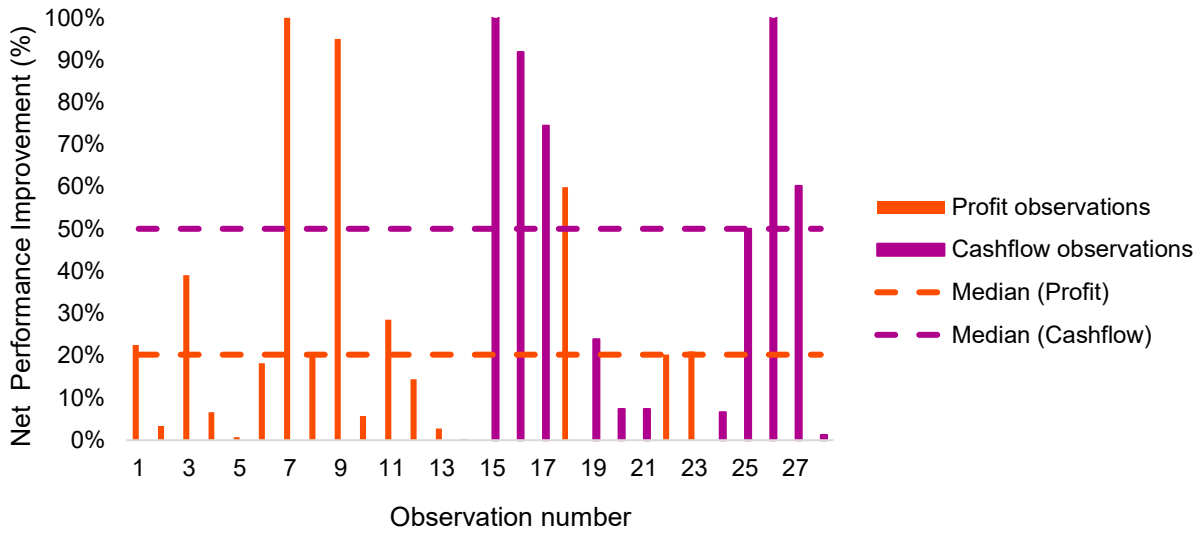


Figure 4.1.7: Net Performance Improvement for Scenario B observations (maximum payout analysis)

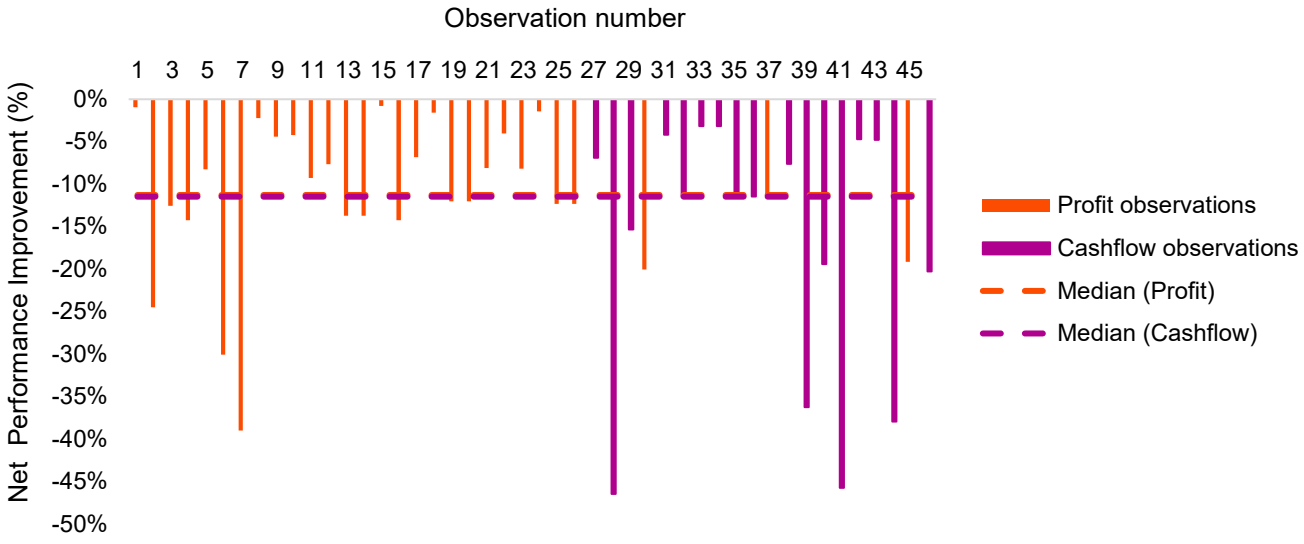


Figure 4.1.6 shows that NPI scores vary widely across observations - some of the percentage differences captured here are under 10%, whereas others are close to 100% or even larger. This demonstrates that observations may fall in Scenario C despite either ex-ante or ex-post target performance being substantially different from the relevant target level.

Figure 4.1.7 similarly shows that the extent of performance decline varies across observations in Scenario B. Many CEOs' ex-post performance is under 10% worse than their ex-ante performance, which is consistent with CEOs making targeted increases to investment such that they move closer to the maximum payout. Nonetheless, there are some notably large declines in CEO performance.

The large scale of some CEO performance changes (both positive and negative) is similarly reflected in the corresponding changes to investment, which are captured in Figures 4.1.8 and 4.1.9 below.

Figure 4.1.8: Investment changes for Scenario C observations (threshold payout analysis) - percentage of lagged total assets (%)

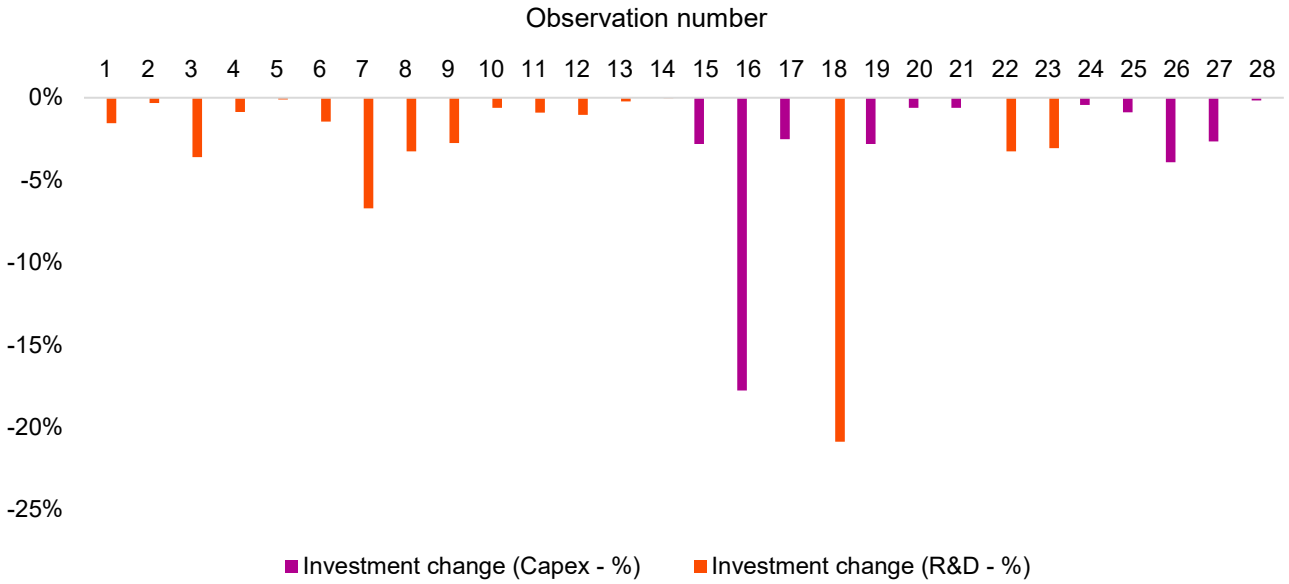
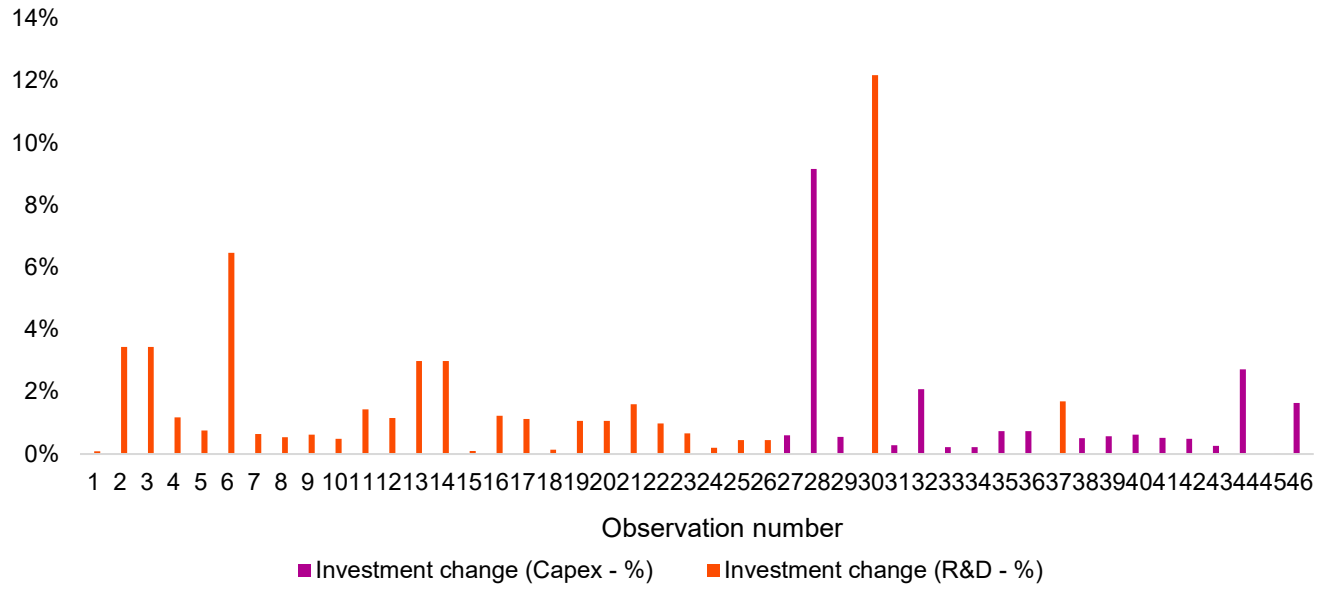


Figure 4.1.9: Investment changes for Scenario B observations (maximum payout analysis) - percentage of lagged total assets (%)



The investment changes involved in Scenario B and C observations are a significant proportion of lagged total assets. Despite there being some particularly large investment changes across the Scenario B and C samples (over 10% of lagged total assets) which appear to be outliers, the median absolute change in investment is also large, as shown in Table 4.1.10.

Table 4.1.10: Median absolute change in investment for Scenario B and C observations

	Threshold pay-out (£m) *Scenario C*	Maximum pay-out (£m) *Scenario B*
R&D/Profit	-£11.0m	+£9.6m
Capex/Cashflow	-£24.0m	+£33.6m

We find that the median absolute changes are larger for the capex-based relationship than the R&D-based relationship, which aligns with capex spend typically being larger than R&D spend in absolute terms.

The scale of these investment changes suggests that opportunities for payout enhancement may be restricted to CEOs of firms which experience both high average capex or R&D intensity and significant year-on-year investment volatility. This could provide some explanation for why Scenarios B and C are relatively rare across our sample, with ex-post performance tending to align closely with ex-ante performance. We can shed further light on this by analysing investment changes from another perspective, namely the percentage change in investment relative to the previous year. Figures 4.1.11 and 4.1.12 below capture this for our Scenario B and C observations respectively.

Figure 4.1.11: Investment changes for Scenario C observations (threshold payout analysis) - percentage change versus previous year's investment (%)

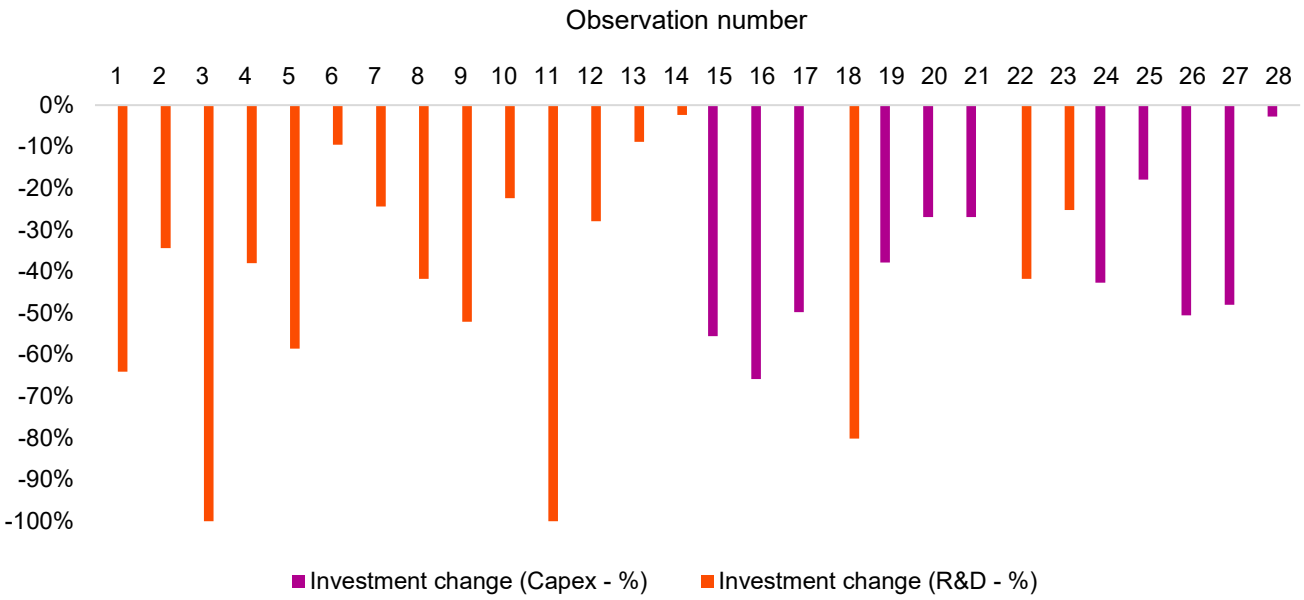
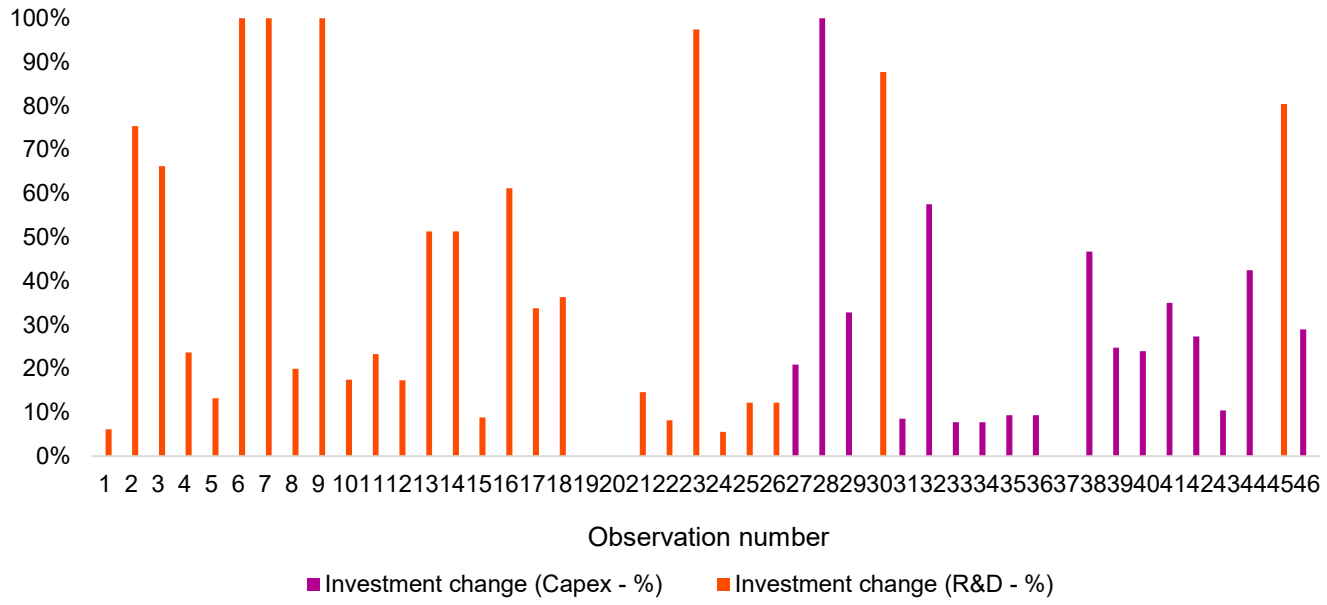


Figure 4.1.12: Investment changes for Scenario B observations (maximum payout analysis) - percentage change versus previous year's investment (%)



As these figures show, the investment changes involved in 'crossover' cases (i.e. those observations in Scenarios B and C) are often substantial. A clear majority of observations in Scenario C involve year-on-year investment reductions of over 20%, and we find two reductions of 100% for R&D, meaning that R&D investment is halted altogether. By contrast, a significant proportion of investment increases for the Scenario B observations are below 20%. This relative difference in investment changes is consistent with CEOs' incentives to maximise their payout, as those CEOs reducing investment at the threshold payout have an incentive to perform as strongly as possible, whereas those CEOs increasing investment at the maximum payout have an incentive to be cautious and not increase investment by more than they need to. The evidence shown here weakly supports the notion that investment decisions are influenced by CEO performance considerations. Still, it is very important to stress that the magnitude of investment changes varies widely across Scenarios B and C alike, with some large changes under both scenarios. This evidence alone cannot tell us that firms are making investment decisions to increase CEOs' current and future payout.

To gain another perspective still, we can extend our net performance improvement analysis to explore how much of the observed improvement in CEO performance was actually required to meet the relevant target level (and how much additional improvement was achieved beyond this). Figures 4.1.13 and 4.1.14 below replicate Figures 4.1.6 and 4.1.7 above, but with the observed NPI scores (%) decomposed into required NPI (%) and additional NPI swing (%).

Figure 4.1.13: Net performance improvement for Scenario C observations (threshold payout analysis) - decomposed

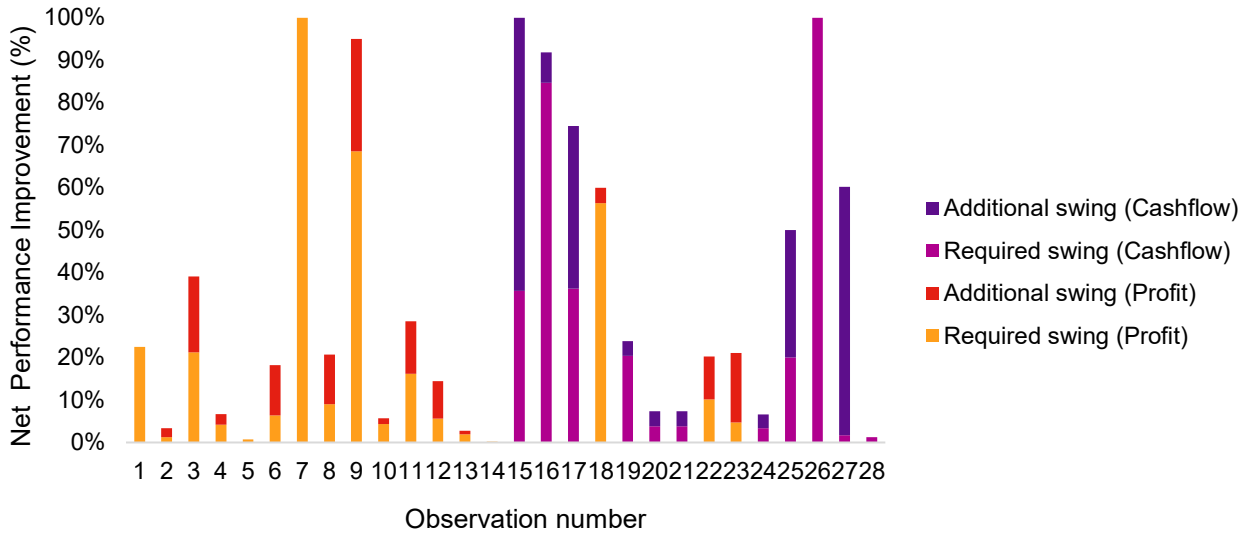
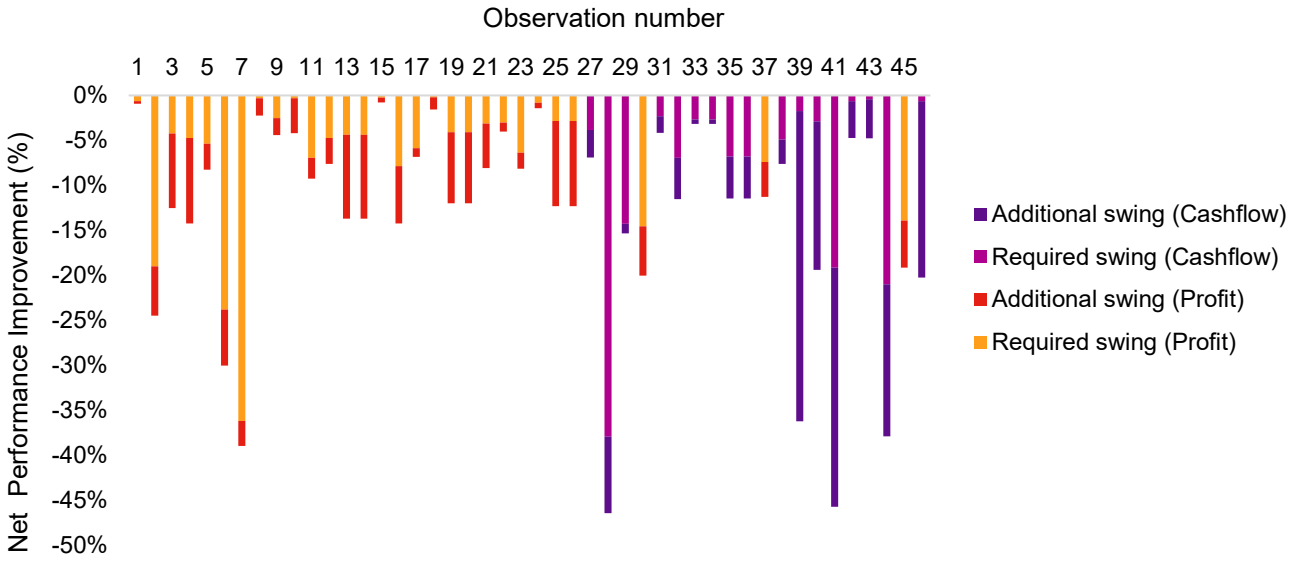


Figure 4.1.14: Net performance improvement for Scenario B observations (maximum payout analysis) - decomposed



These charts demonstrate that the required change in CEO performance (to enable the desired change in target achievement outcome) is commonly a large proportion of the total change achieved, with relatively little additional change beyond this, although this is not always the case.

The relative precision of some performance movements hints that CEOs may be altering firm investment with the aim of meeting their payout objectives, rather than simply altering firm investment for other reasons. However, we must also acknowledge that the movements in measured CEO performance are not always precise, particularly in relation to capex changes affecting cashflow performance. This suggests that payout motivations are far from the only

driver of firms' investment decisions, even when CEOs are able to influence their target achievement outcomes.

Taken together, an important implication from our analysis is that CEO performance can end up hitting threshold payout targets or missing maximum payout targets despite being some distance away from them in ex-ante terms. In short, the investment (and CEO performance) changes we observe in Scenarios B and C are often substantial rather than marginal. Consequently, econometric analyses which are restricted to those ex-ante observations closest to target levels, including the econometric ex-ante analysis presented below, are highly unlikely to capture all Scenario B and C observations (or 'crossovers') in our broader sample. Whilst this does not invalidate the case for targeted econometric analysis, it does emphasise the importance of analysing ex-ante performance from multiple perspectives.

Key findings from our statistical analysis of ex-post and ex-ante performance

Overall, our statistical analysis of ex-post and ex-ante performance provides some indicative evidence of investment decisions being influenced by their impact on performance, with asymmetries in favour of cutting investment at the threshold payout level and increasing investment at the maximum payout level. This behaviour is consistent with CEOs' incentives to maximise their current and future payout. Still, we cannot conclusively prove from this analysis that firms are reducing or increasing investment because of CEO payout considerations.

Although ex-post and ex-ante performance outcomes tend to align closely (with limited prevalence of crossovers), our results do demonstrate that firms have the power to change investment materially enough such that it affects CEO target achievement outcomes. This finding contrasts sharply with our 2019 study, which found that no CEOs had successfully used share repurchases to meet their EPS target.

In those cases where investment changes are large enough to affect the target achievement outcome, we find that the observed changes in investment and target performance are often substantial. This indicates that the necessary changes in investment may be more achievable for those CEOs whose firms have high capex or R&D intensity, together with the possibility of changing investment quite quickly. The need to secure substantial year-on-year changes to investment may prevent some CEOs from being able to use investment as a means of increasing their annual bonus payouts.

Econometric ex-post analysis

As a reminder, our econometric ex-post analysis tests whether firms whose CEOs hit their performance targets by a small margin undertook significantly different investment growth from firms whose CEOs missed their targets by a small margin. Such a finding could indicate that CEOs hit or missed performance targets by changing investment.

Design of our econometric ex-post analysis

We apply a simple econometric specification to test whether there are significant differences in firm investment and accruals between those firms whose CEOs just hit their target and those whose CEOs just missed their target. Investment or accruals, scaled as a percentage of lagged total assets, is the dependent variable. The key independent variable is a target achievement indicator which takes value 1 if ex-post performance was just above the target level, and 0 if it was just below. In our baseline econometric specification, we regress investment or accruals on this indicator along with a series of additional variables which control for industry fixed effects, time effects and firm-level characteristics.[56] A full list of these control variables is provided in Appendix D.

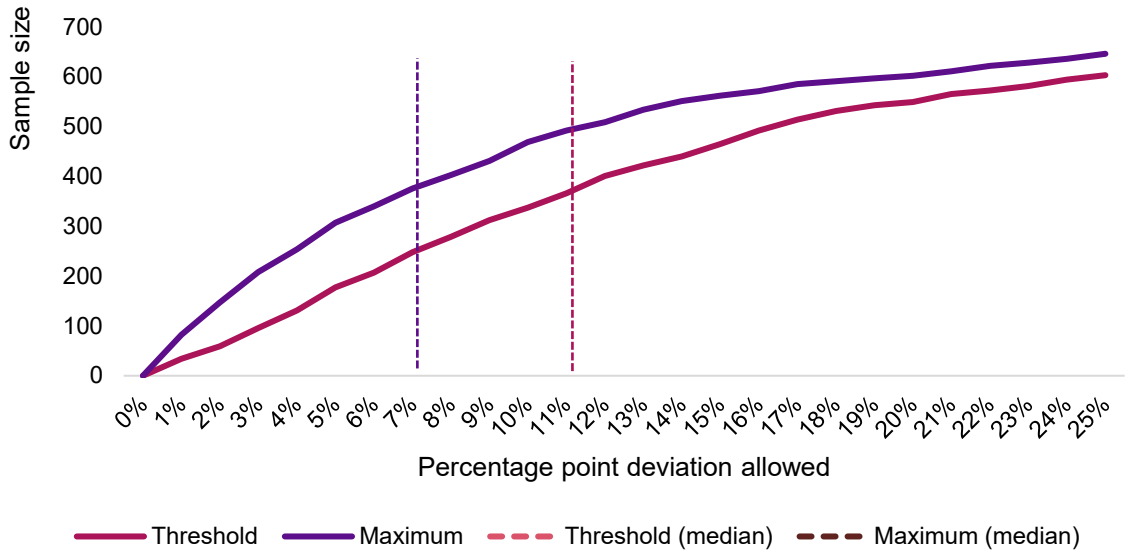
We also consider the effect of the shape of the payout profile on investment growth and accruals: in particular, whether a large and sudden increase in payout at the threshold performance level impacts CEO decisions by changing the effect of target performance on investment or accruals. For example, in Figure 3.2.1 we study whether Example B leads to different investment decisions to Example A. To do so, we include an indicator variable which takes the value 1 only when the target is hit *and* the vesting share of a target is greater than 10% at the threshold level, and 0 otherwise. As we discuss further in Appendix D, this enables us to compare the relative effects of target performance on investment and accruals when the threshold payout discontinuity is large, and when it is small or zero. The addition of this indicator variable gives us our augmented econometric specification.

We use the pooled OLS estimator to perform this regression, using a pairwise bootstrap procedure to construct confidence intervals and interpret the statistical significance of our findings. Further detail on this methodology can be found in Appendix D.

To select the appropriate subsample for ex-post econometric analysis, we face a trade-off between capturing only those observations closest to the threshold payout or maximum payout level, and ensuring that we have a sufficiently large sample size to conduct robust analysis and draw meaningful conclusions. Figure 4.2.1 below demonstrates the trade-off for annual bonus profit target data, showing how the available sample size increases as the allowed deviation from threshold and maximum payout targets is widened.

[56] Taking the subsample of firms that just hit or just missed the target is intended to result in little difference in sample characteristics between firms that just hit or just missed the target. However, we recognise that this assumption may not hold in practice as the allowed sample deviation window is widened. Therefore, our control variables are included in account for any variation in sample characteristics that may affect investment growth.

Figure 4.2.1: Available sample size versus allowed target deviation percentage for ex-post annual bonus profit performance



We set the allowed sample deviation windows just wide enough to give a sufficient sample size. Table 4.2.2 below captures the allowed sample deviation windows chosen for the two targets studied in our ex-post analysis. For annual bonus profit targets, the windows are expressed in terms of the maximum allowed percentage point deviation between ex-post performance and the target. For LTIP EPS targets, the windows are expressed in terms of the maximum allowed absolute deviation between ex-post performance and the target.

Table 4.2.2: Chosen sample deviation windows for ex-post econometric analysis

Target	Target type	Threshold payout: allowed deviation	Maximum payout: allowed deviation
Profit	Annual bonus	+/- 7.04% (65% of median deviation)	+/- 4.43% (65% of median deviation)
EPS	LTIP	+/- 0.05 (85% of median deviation)	+/- 0.05 (85% of median deviation)

In addition to running our baseline and augmented econometric regressions (using the sample deviation windows set out above), we also test the sensitivity of our econometric findings to different deviation windows. We set the allowed deviation window to (i) 100%, (ii) 150% and (iii) 200% of the median absolute target deviation to change the sample size.

Further detail on our sensitivity tests, and the econometric results they generate, can be found in Appendix D.

Findings from baseline econometric ex-post analysis

Our ex-post econometric analysis considered 20 different combinations of ex-post target performance and investment or accruals measures, plus an augmented specification and sensitivity tests for each one. Table 4.2.3 below sets out the breadth of relationships explored and compares the results across our baseline and augmented specifications, as well as the sensitivity tests.

Table 4.2.3 presents our findings through the following table rows:

- **Baseline** row captures the results of our baseline specification.
- **Augmented** row captures the results of our augmented specification, which separates the incentives for CEOs with a small and large threshold discontinuity in their payout profile.
- **Sensitivity tests** row captures the results of our sensitivity tests, which expand the allowed deviation window to (i) 100%, (ii) 150% and (iii) 200% of the median absolute target deviation.

Importantly, Table 4.2.3 does not show any quantitative results from our econometric analysis, focusing instead on capturing the qualitative findings which are of primary interest to the general reader. A tick indicates where a relationship yielded statistically significant results when time, industry and firm financial controls were included in the econometric specification. The level of statistical significance is indicated using asterisks, and plus and minus signs capture the direction of the estimated coefficients.

For our augmented specification and sensitivity tests, we also indicate whether we found a significant relationship for CEOs with a small or large threshold discontinuity in their payout profile. Again, asterisks indicate the significance of the different results. For the sensitivity tests, we use '/' between asterisks to show the level of significance across the three different windows. We use the following abbreviated terminology:

- *SD* means that a significant relationship is found for those CEOs with a zero or small threshold discontinuity in their payout profile.
- *LD* means that a significant relationship is found for those CEOs with a large discontinuity in their payout profile.

Detailed econometric results, including estimated coefficients and p-values, can be found in Appendix D.

Table 4.2.3: Summary of econometric ex-post analysis findings[57]

		Independent variable - target success indicator			
		Annual bonus - Profit		LTIP - EPS	
		Threshold	Maximum	Threshold	Maximum
Capex (change)	Baseline	-	-	✔* (+)	-
	Augmented	-	-	✔ (+) *LD***	-
	Sensitivity tests	-	-	✔ (+) *SD -/-/*** *LD -/-/**	✔ (+) *SD -/-/***
Net investment (change)	Baseline	-	-	-	-
	Augmented	-	-	-	-
	Sensitivity tests	-	✔ (+) *LD */*/***	-	-
R&D (change)	Baseline	-	✔** (+)	-	-
	Augmented	-	✔ (+) *SD* LD***	-	-
	Sensitivity tests	-	✔ (+) *SD */-/-*	-	-
Total accruals	Baseline	-	-	-	-
	Augmented	-	-	-	-
	Sensitivity	-	-	-	✔ (-)

[57] A tick is shown wherever we find an econometric relationship which is statistically significant at the 10% level, 5% level or 1% level. We use the following asterisk notation to represent the level of statistical significance: * (10% significance); ** (5% significance); *** (1% significance). The (+) symbol captures positive coefficients, whilst the (-) symbol captures negative coefficients. SD refers to CEOs with a small threshold discontinuity in their payout profile, while LD refers to CEOs with a large threshold discontinuity in their payout profile. For the sensitivity tests, the three results separated by '/' refer to the significance levels when the deviation window is set at 100%, 150% and 200% of the median absolute target deviation.

		Independent variable - target success indicator			
		Annual bonus - Profit		LTIP - EPS	
		Threshold	Maximum	Threshold	Maximum
	tests				*LD* **/***/***
Discretionary accruals	Baseline	-	-	-	-
	Augmented	-	-	-	✔ (+) *SD**
	Sensitivity tests	-	-	-	✔ (+) *SD -/*/-* ✔ (-) *LD ***/***/***

The sections below present and interpret the significant findings noted above. As such, we comment only on the five combinations of target and investment or accruals where a significant relationship was found.

Capex and LTIP EPS targets

Key findings

We find that firms whose CEOs just hit threshold payout for LTIP EPS targets increase capex by more than firms whose CEOs just missed threshold payout, which does not support our hypothesis that CEOs cut firm investment to improve performance against targets and increase their payout.

Overall, we find a significant positive relationship between performance at the threshold payout level for LTIP EPS targets and capex growth.

- We find that firms whose CEOs just hit threshold payout for LTIP EPS targets increase capex by more than firms whose CEOs just missed threshold payout, once time, industry and firm financial effects are controlled for.
- This does not support the hypothesis that CEOs cut capex to increase EPS and improve their LTIP payout. This may be because capex is not expensed, unlike R&D, and thus has a less detrimental effect on EPS.

Sensitivity analysis also finds some mixed evidence that firms whose CEOs just hit the maximum payout for LTIP EPS targets increase capex more than firms whose CEOs just missed.

- This finding suggests similar decision making as noted above for annual bonus profit targets and R&D expenditure growth.
- However, in contrast to the relationship between profit targets and R&D expenditure growth we find that this effect is only significant for CEOs facing a small threshold discontinuity in their payout profile (and hence a higher potential penalty for just missing out on maximum EPS targets).

Net investment and annual bonus profit targets

Key findings

For firms that have a large increase in payout at threshold performance level (and so a shallower gradient of payout curve) we find only weak evidence that firms whose CEOs just hit maximum payout for annual bonus profit targets increase net investment more than firms whose CEOs just missed maximum payout. This result is significant only for the sensitivity tests and not for our main specifications.

In our baseline analysis, we find no significant evidence of a relationship between net investment growth and achievement of maximum payout for annual bonus profit targets. The coefficients are positive but p-values too large to consider the results significant.

In our sensitivity tests, we find that firms whose CEOs just hit maximum payout and have a large increase in payout at threshold performance level increase net investment by more than firms whose CEOs just missed maximum payout.[58]

This suggests that discontinuities in the payout profile for annual bonus profit targets have a similar effect on net investment as on R&D. That is, only CEOs who know they are on track to achieve maximum payout for annual bonus profit targets and have a large increase in payout at threshold performance do not face a disincentive to invest. The fact that they receive a large increase in payout at threshold performance level means that the payout profile is less steep than if there were little increase in payout at threshold performance. Therefore, the impact on CEO payout if investment leads to them falling below maximum payout performance is less substantial.

R&D and annual bonus profit targets

Key findings

[58] Coefficients are similar across the three sensitivity tests, both with and without time, industry and firm financial controls.

We find that firms whose CEOs just hit maximum payout for annual bonus profit targets increase R&D significantly more than firms whose CEOs just missed maximum payout.

We find some evidence that a large threshold discontinuity strengthens CEOs' incentives. Of CEOs who just hit maximum performance payout, those who receive a large increase in payout at threshold performance level may increase firm R&D by more than those who receive only a small increase in payout at threshold.

In general, our analysis finds evidence that firms whose CEOs just hit maximum payout for annual bonus profit targets increase R&D significantly more than firms whose CEOs just missed maximum payout.

- More specifically, firms whose CEOs just hit maximum payout for annual bonus profit targets increase R&D by 0.6 percentage points of lagged total assets more than firms whose CEOs just missed the maximum payout. Given that the median firm expenditure on R&D is around 1.2% of lagged total assets, this is a notable difference.
- There are two possible interpretations of the findings. The first is that CEOs overinvest in R&D when they are on track to exceed the maximum. Doing so avoids significantly outperforming the maximum target, which risks it being ratcheted up next year. It also gives them latitude to cut R&D in future years to hit targets. The second is that CEOs underinvest in R&D between the threshold and maximum profit, since reducing R&D increases profit and thus pay outcomes. However, once performance exceeds the maximum, these disincentives are removed and so the CEO increases investment.

  Thus, the higher investment levels of firms that beat the maximum ex-post could either result from overinvestment, or the correct level of investment and instead firms below the maximum underinvesting.

Our augmented econometric specification reveals that this effect may be greater for CEOs facing a large increase in payout at threshold performance.

- There is greater incentive for CEOs facing a large increase in payout at threshold performance level to increase firm R&D when they are on track to ex-ante beat maximum payout. This is because a large increase in payout at threshold performance level means that the gradient of the payout profile between threshold and maximum is less steep, i.e. it could be increasing from 20% to 100% rather than from 0% to 100%. Therefore, CEOs who are on track to beat the maximum payout know that their payout will not be substantially affected if they increase firm R&D too much and end up just missing maximum payout. This finding suggests that discontinuities in the payout profile can potentially create incentives for CEOs which may be beneficial for investment growth.

These results become less significant as we increase the allowed deviation window for the subsample of firms. This may suggest that a wider allowed deviation window results in a less random selection of firms which is not adequately controlled for by the controls included in our

study. Additionally, as these samples include firms that are further away from their maximum payout performance level, they may face weaker incentives to use investment to influence target performance. For more detail on these sensitivity tests, see Appendix D.

Total accruals and LTIP EPS targets

Key findings

We find that firms whose CEOs just achieved maximum payout for LTIP EPS targets had lower total accruals than firms whose CEOs just missed maximum payout.

This suggests that CEOs may reduce firm accruals when they are already on track to achieve maximum payout so that greater profits can be reported in the following year. and also to avoid targets being ratcheted up in the future.

Despite finding no significant evidence in our baseline analysis, we find significant and consistent evidence of a negative relationship between achieving maximum payout for LTIP EPS targets and total accruals when the allowed sample deviation window is expanded in our sensitivity analysis.

- Positive accruals increase reported profit in the current year, therefore lower or negative accruals in one year enable the firm to report higher profits in the following year. If CEOs believe profits are adequate to ex-ante achieve maximum payout for LTIP EPS targets, then they have an incentive to forgo reporting profits beyond those needed to hit maximum payout in this year.
- In this scenario, CEOs could reduce accruals so that profits can be reported in the following year, making it easier for them to hit EPS targets in future without any change in firm performance. This also prevents CEOs from outperforming targets to the point where RemCos may make future targets harder to hit.

We find that this relationship is particularly significant for firms where CEOs face a large threshold discontinuity in their payout profile.

- The large increase in payout at threshold performance means that the gradient of payout between threshold and maximum is less steep than when there is a small increase in payout at threshold performance, and so the risk to the CEO of falling below the maximum payout is less pronounced.

Discretionary accruals and LTIP EPS targets

Key findings

We find that firms whose CEOs just achieved maximum payout for LTIP EPS targets had lower discretionary accruals than firms whose CEOs just missed maximum payout.

This provides further support for the possibility that CEOs could use accruals to influence target performance, by postponing profits when they are already on track to achieve maximum payout.

We find similar evidence for the relationship between discretionary accruals and LTIP EPS targets as between total accruals and LTIP EPS targets. That is, no significant results in our baseline analysis but a significant negative relationship in the sensitivity analysis.

- Firms where the CEO just achieved maximum payout for LTIP EPS targets had significantly lower discretionary accruals than firms where the CEO just missed maximum payout.
- This relationship is particularly significant for firms where the CEO faces a large threshold discontinuity in their payout profile.
- Such a relationship is expected given the results found for total accruals and LTIP EPS targets as discretionary accruals are a component of total accruals. They are the accruals that the firm or CEO has more ability to control and therefore can influence performance against a CEO's target.

Overall conclusions from our econometric ex-post analysis

Key findings

Overall, our ex-post econometric analysis provides some evidence that CEOs may make decisions about investment and accruals to influence their annual bonus or LTIP payouts.

We consider a wide range of relationships, and do not find support for the hypothesis that executives cut firm investment in order to achieve threshold payout performance levels.

Instead, we find some instances where exceeding the maximum is associated with higher investment growth. This ensures that the CEO does not significantly outperform the maximum target, which might lead to it being ratcheted up in the future, and also gives them latitude to cut investment to hit future targets. The results are stronger for R&D than capex, which is logical since R&D is expensed and thus has a much greater effect on profit and EPS than capex.

We find some consistent evidence of stronger ex-post target performance being associated with lower accruals at the maximum payout level. This may reflect CEOs choosing to forgo reporting profits when they are safely above maximum payout, so that higher profits can be reported in subsequent years, and also wishing to avoid targets being ratcheted up.

However, these results are not always consistently replicated across the suite of sensitivity tests we consider.

We do find some evidence that large threshold discontinuities in CEOs' payout profiles affect investment decisions in some cases.

We tend to find that where there is evidence of CEOs acting to enhance their payout, a large increase in payout at the threshold level strengthens the incentive to increase investment at the maximum. This is likely because CEOs stand to lose less payout from narrowly missing the maximum payout level, due to the shallower slope of the payout profile.

Our understanding of the results of our econometric ex-post analysis ultimately relies on certain assumptions about CEOs' ex-ante performance. This finding motivates our statistical comparison of ex-post and ex-ante performance (presented earlier in this chapter), but also our econometric ex-ante analysis which we present below.

Econometric ex-ante analysis

As a reminder, our econometric ex-ante analysis investigates the links between investment and expected target performance. Specifically, our analysis aims to test whether firms whose CEOs were on track to just hit their performance targets (had investment remained at the previous year's level) undertook significantly different investment growth from firms whose CEOs would have just missed their performance targets.

Design of our econometric ex-ante analysis

Our econometric ex-ante analysis follows a very similar design to our econometric ex-post analysis, with an almost identical econometric specification and estimation approach.

The key difference from our ex-post analysis lies in the independent variable used to capture target performance. Rather than considering ex-post outcomes, this is a target achievement indicator which takes value 1 if ex-ante performance is just above the target level, and 0 if ex-ante performance is just below the target level. This independent variable forms the core of our baseline econometric specification.[59]

As with our econometric ex-post analysis, we also consider the effect of the shape of the payout profile on investment growth. To do so, we add an indicator variable to our baseline specification which takes the value 1 only when the target is hit *and* the vesting share of a target is greater than 10% at the threshold level, and 0 otherwise. This gives us our augmented econometric specification.

We then select an appropriate sample for our ex-ante analysis which captures only those observations close to the reference target level whilst also ensuring that we have a sufficiently

[59] As in the econometric ex-post analysis section, all econometric results reported in this section (including our baseline and augmented specification results) reflect the inclusion of industry, time and firm-level financial controls. Further detail on our use of control variables is provided in Appendix D.

large sample size to allow for robust analysis. We again follow a baseline approach of setting allowed sample deviation windows just wide enough to allow for sufficient sample size. Table 4.3.1 below captures the allowed sample deviation windows chosen for each of the two ex-ante target and investment relationships we study. These windows are expressed in terms of maximum allowed percentage deviation between ex-ante performance and the relevant payout target.

Table 4.3.1: Chosen sample deviation windows for our ex-ante econometric analysis

Investment measure	Target measure	Threshold pay-out: allowed deviation	Maximum pay-out: allowed deviation
R&D	Profit	+/- 8.68% (75% of median sample deviation)	+/- 4.80% (65% of median sample deviation)
Capex	Cashflow	+/- 48.62% (180% of median sample deviation)	+/- 26.46% (165% of median sample deviation)

As Table 4.3.1 shows, our chosen deviation windows for cashflow performance are significantly larger than for profit performance. This is largely driven by the smaller number of available observations for cashflow performance, which means that a wider deviation window is required. Although this results in a window significantly wider than the median sample deviation, our use of multiple controls (including firm-level controls) within the econometric specification helps to prevent this from compromising the reliability of our findings.

In addition to running our core econometric regressions (using our chosen sample deviation windows), we also run a series of sensitivity tests on our augmented regression to examine whether this affects our results. These sensitivity tests incorporate the following changes:

1. We set the allowed sample deviation window to (i) 100%, (ii) 150% and (iii) 200% of the median sample deviation, which changes the size of our estimation sample. For the R&D-profit relationship, all three of these sensitivities widen the sample deviation window relative to our core regressions (which use 75% and 65% of the median sample deviation for threshold and maximum respectively). By contrast, for the capex-cashflow relationship, the 100% and 150% sensitivities narrow the sample deviation window relative to our core regressions (which use 180% and 165% of the median sample deviation for threshold and maximum respectively).
2. We change the counterfactual investment assumption used to calculate ex-ante performance, such that rather than remaining unchanged from the previous year's level, investment instead grows in line with the annualised rate of CPIH inflation.

Further detail on the specifics of our sensitivity tests, and the econometric results generated from them, can be found in Appendix D.

Findings from our econometric ex-ante analysis

Table 4.3.2 below captures the econometric results generated for both of the investment and target measure relationships studied in this section, showing how these results compare across our baseline and augmented specifications. Given the relatively small number of investment and target measure relationships explored in our ex-ante analysis (relative to our ex-post analysis), we are also able to capture the findings from each of our four sensitivity tests in the same table. Our six econometric regressions represented through the following table rows:

- **Baseline** row captures the results from our baseline specification.
- **Augmented** row captures the results from our augmented specification.
- **CPIH** row captures the results from our sensitivity test which uses CPIH inflation to derive ex-ante investment.
- **100% SDW**, **150% SDW** and **200% SDW** rows capture the results from our sensitivity tests based on setting the allowed sample deviation windows to 100%, 150% and 200% of the median sample deviation.

As for our econometric ex-post analysis, Table 4.3.2 does not show any quantitative results from our econometric analysis. Instead it captures the qualitative findings which are of primary interest to the general reader, with a tick shown where relationships yielded statistically significant results and a dash shown otherwise.[60]

For our augmented specification and sensitivity tests, we also indicate whether we found a significant relationship for CEOs with a small or large threshold discontinuity in their payout profile. We use the following abbreviated terminology:

- *SD* means that a significant relationship is found for those CEOs with a zero or small threshold discontinuity in their payout profile.
- *LD* means that a significant relationship is found for those CEOs with a large discontinuity in their payout profile.

We use the notation N/A to refer to those investment and target variable combinations not studied in our ex-ante analysis.

[60] A tick is shown wherever we find an econometric relationship which is statistically significant at the 10% level, 5% level or 1% level. We use the following asterisk notation to represent the level of statistical significance: * (10% significance); ** (5% significance); *** (1% significance). The (+) symbol captures positive coefficients, whilst the (-) symbol captures negative coefficients.

For a more detailed presentation of our econometric results, including coefficient estimates and their statistical significance levels, we refer the reader to Appendix D.

Table 4.3.2: Summary of econometric ex-ante analysis findings

		Independent variable - target success indicator			
		Annual bonus - Profit		Annual bonus - Cashflow	
		Threshold	Maximum	Threshold	Maximum
R&D (change)	Baseline	-	-	N/A	N/A
	Augmented	-	✔** (+) *LD*	N/A	N/A
	CPIH	-	✔* (+) *LD*	N/A	N/A
	100% SDW	-	-	N/A	N/A
	150% SDW	-	✔** (+) *SD*	N/A	N/A
	200% SDW	-	✔* (+) *SD*	N/A	N/A
Capex (change)	Baseline	N/A	N/A	-	-
	Augmented	N/A	N/A	-	-
	CPIH	N/A	N/A	✔* (+) *SD*	-
	100% SDW	N/A	N/A	-	-
	150% SDW	N/A	N/A	-	-
	200% SDW	N/A	N/A	-	-

R&D and annual bonus profit targets

Key findings

We find some evidence that firms whose CEOs were on track to achieve the maximum payout increased R&D by more than firms whose CEOs were on track to miss the maximum payout. This is consistent with CEOs' incentives to increase investment when the maximum payout level is exceeded. However, we do not find evidence of an effect on investment at the threshold payout level.

Some of our findings suggest that a sudden increase in payout at the threshold level strengthens CEOs' use of investment increases when they exceed the maximum payout, but this result is not consistent across specifications.

As Table 4.3.2 demonstrates, there are notable differences in the effects of target performance on investment at the threshold payout and maximum payout points of CEOs' incentive profile.

- At the threshold payout level, we find no statistically significant evidence of a relationship between ex-ante profit target performance and R&D, and this finding holds across all of the sensitivity tests we perform.
- By contrast, at the maximum payout level we do find some evidence that stronger CEO ex-ante performance (i.e. hitting or exceeding the maximum payout target) is associated with higher investment. This finding is consistent with CEOs' incentives to ensure they do not significantly outperform the maximum payout target.

The second result is broadly consistent with the statistical scenario analysis of ex-post and ex-ante performance presented earlier, which found that Scenario B (hitting the target ex-ante but missing it ex-post) is more common than Scenario C (the opposite) around the maximum. The first result appears inconsistent with the scenario analysis, which found that Scenario C is more common than Scenario B around the threshold. However, this is potentially explained by the fact that, while C is more common than B, Scenarios A and D (where ex-ante and ex-post performance line up) are much more common. Thus, while some CEOs may successfully cut firm investment to achieve the threshold payout, this only happens in limited cases.

Whilst our findings appear consistent with CEOs' incentives to maximise their payout, there is some inconsistency in our findings over how the shape of CEOs' incentive profile affects R&D investment.

- Our augmented regression and our counterfactual investment sensitivity test both suggest that a sudden large increase in payout around the threshold level (i.e. a payout discontinuity, as described in Chapter 3) drives CEOs to increase investment once they reach their maximum payout targets. This finding is notably consistent with our econometric ex-post analysis, which also finds evidence that CEOs who just hit their targets (and have a large discontinuity in their payout profile) tend to increase investment.

- To illustrate the magnitude of the estimated effect, our augmented specification results imply that investment growth (as a proportion of total lagged assets) is 0.8 percentage points higher among those CEOs who both (i) outperform against their maximum payout target ex-ante and (ii) have large threshold discontinuities in their payout profile. This difference is relative to those CEOs who underperform against their maximum payout target ex-ante. Given that the median firm expenditure on R&D is around 1.2% of lagged total assets, this is a material difference.
- However, when the estimation sample is widened significantly to include all observations within 150% or 200% of the median sample deviation, we find that it is only those CEOs with a small discontinuity in their threshold payout who increase investment when ex-ante performance exceeds the maximum payout target. This may be because the windows used in our sensitivity analysis are too large for the discontinuity to matter. The size of the discontinuity at the threshold affects how much pay the CEO might lose if she increases investment too much and performance ends up below the maximum. However, when the CEO is likely to outperform the maximum target by a large amount, it is very unlikely that performance will fall below the maximum and so there is no reason for the effects to be stronger where discontinuities are large.
- It is also important to note that our baseline and 100% median sample deviation specifications do not yield any results of clear statistical significance. Whilst these results are directionally consistent with our augmented and CPIH sensitivity specifications, the estimates are not strong enough to give statistical significance.

Overall, these variations in our findings suggest that our results should be treated with some caution, and we cannot definitively conclude whether and how the shape of CEOs' payout profile affects their propensity to influence investment decisions based on their impact on achieved performance (and payout).

One plausible explanation for the results could be that a large threshold discontinuity in the payout profile reduces payout risk for CEOs performing above the maximum payout level. Specifically, a large threshold discontinuity in the payout profile means that a CEO performing just below the maximum payout level will tend to earn a higher share of the total incentive award than otherwise. This is because a large threshold discontinuity reduces the slope of the incentive profile for those CEOs performing between the threshold and maximum payout levels (this is captured in Figure 3.2.1 above, where Example B's incentive profile has a shallower gradient than Example A). This implies that CEOs performing above the maximum payout on an ex-ante basis have less reason to worry about raising investment and narrowly missing their target, as this does not have a pronounced impact on their achieved payout.

This reasoning may encourage CEOs exceeding their maximum payout targets to increase investment, whilst those CEOs performing just below their maximum payout targets have relatively weak incentives to change investment. This may explain why in our augmented and CPIH sensitivity specifications, we find that large threshold discontinuities strengthen the positive relationship between ex-ante performance and investment around the maximum payout level.

However, the findings from our sample deviation sensitivity tests are harder to explain. As noted above, the disadvantage of widening the allowed sample deviation is that it weakens the precision of our analysis and risks capturing CEOs whose ex-ante performance is sufficiently distant from the threshold or maximum payout target for them not to consider changing investment. For this reason, we consider that greater weight should be applied to the results from our baseline, augmented and CPIH sensitivity analyses.

These considerations collectively point towards a need for caution in interpreting our findings and deriving potential explanations, especially when considering the results of our sample deviation sensitivity tests. Overall, the lack of clear consistency across our results suggests that CEOs are motivated by an intricate set of incentives, which may differ not only based on firm performance but also firm-specific characteristics. As indicated by our statistical analysis of ex-post and ex-ante performance, this implies that investment decisions influenced by their impact on performance may be concentrated within a subset of large firms operating under specific circumstances.

Capex and annual bonus cashflow targets

Key findings

In contrast to the R&D and profit targets relationship analysed above, we do not find any evidence that firms whose CEOs were on track to achieve the maximum payout increased capex by more than firms whose CEOs were on track to miss the maximum payout.

We do find limited evidence of a significant positive relationship between cashflow performance and capex investment at the threshold payout level. This aligns with CEOs' incentives to reduce investment if they are set to miss out on the threshold payout. However, this relationship is only significant across one of our six econometric specifications, and only for CEOs with small payout profile discontinuities at the threshold.

The results from our capex and cashflow analysis contrast with the R&D and profit analysis, in that we do not find any effects of statistical significance at the maximum payout level.

Instead, it is at the threshold payout level where there is greater evidence of a positive association between CEOs' ex-ante target performance and investment growth. Nonetheless, evidence of statistically significant effects is relatively limited.

- Whilst the coefficient estimates at the threshold payout level are consistently positive across the suite of econometric specifications we consider, they are only statistically significant in one of the six specifications, only at the 10% level, and only focusing on small threshold payout discontinuities (in contrast to our hypothesis that incentive effects are strongest where there are large threshold payout discontinuities).

- Overall, these results provide insufficient evidence to suggest that CEOs reduce firm capex when they expect to miss the threshold payout on their cashflow targets. As previously noted in this chapter, a drawback of our capex versus cashflow analysis (compared to our R&D versus profit analysis) is that the required sample deviation is significantly wider, due to sample size constraints. Although we have used multiple control variables to improve robustness, this means our analysis is less precise and has less power to capture behaviours that may exist among CEOs who just miss or just hit their cashflow targets. For these reasons, we consider that greater weight should be placed on the findings from our R&D versus profit analysis.

Key findings from our econometric ex-ante analysis

Overall, our ex-ante econometric analysis provides no evidence that CEOs systematically reduce firm investment when they expect to miss the threshold payout. However, in our R&D versus profit analysis we do find some evidence that CEOs increase firm investment when they expect to exceed the maximum payout. This result is consistent with our econometric ex-post analysis and with CEOs' incentives to maximise their current and future payouts, although it is not robust across all specifications studied.

There is some evidence that this effect is stronger among CEOs that face large threshold discontinuities in their payout profiles, and thus a smaller penalty for reducing performance below the maximum payout, although again this result is not consistent across all specifications.

We do not find any evidence that directly contradicts the payout maximisation hypothesis, such as investment growth being higher amongst those CEOs who are on track to miss the threshold payout or investment growth being lower among those CEOs who are on track to exceed the maximum payout.

Overall, these mixed findings point towards a need for caution in asserting that CEOs make investment decisions to enhance their current and future bonus payouts. Rather than being widespread and consistent across investment measures, it appears that investment decisions that are influenced by their impact on CEO performance are likely to be concentrated amongst particular CEO or firm groupings under specific circumstances. As noted in our statistical analysis of ex-post and ex-ante performance, CEO performance tends to reach the same target achievement outcome on both an ex-ante and ex-post basis, and major swings in investment are often required for payout enhancement to be successful. This suggests that such investment decisions may be feasible only for those CEOs with large investment budgets and the ability to make significant year-on-year investment changes.

General econometric analysis

This section sets out our general econometric analysis of the links between the presence and size of CEO performance targets and measures of investment and accruals. We first explain the design of our model, before presenting the results of the analysis.

It is important to stress that this analysis does not allow a causal interpretation since it compares firms with and without specific target types. Whether a firm has a specific target is not random, leading to bias in the observed relationship between performance targets and investment. The regression would be biased towards finding no relationship if boards only put in specific performance targets if they believe they can prevent short-termist behaviour. Alternatively, it would be biased towards finding a relationship if troubled companies that must cut investment also put in specific targets to try to improve performance.

Design of our general econometric analysis

Our general econometric analysis is designed to test whether the size and presence of different executive pay targets in the CEO contract affect investment and accruals decisions made by firms, once all other determinants have been controlled for. Investment growth or accruals, scaled as a percentage of lagged total assets, are the dependent variables.

Note that we test for the impact of target presence and target size separately due to the substantial correlations between the two measures within each target category. Further detail on this methodology can be found in Appendix D.

Findings from our general econometric analysis

Tables 4.4.1 and 4.4.2 below qualitatively set out the full breadth of relationships explored for changes in measures of investment growth and accruals and the presence and size of targets, with a tick shown where relationships yield significant results.[61] Asterisks are used to indicate the significance of the relationship and plus or minus signs capture the direction of the relationship.

Full quantitative results, including coefficients and p-values, can be found in Appendix D.

Table 4.4.1: Summary of results for relationships between investment growth and accruals and the presence and size of annual bonus targets

[61] A tick is shown wherever we find an econometric relationship which is statistically significant at the 10% level, 5% level or 1% level. We use the following asterisk notation to represent the level of statistical significance: * (10% significance); ** (5% significance); *** (1% significance). The (+) symbol captures positive coefficients, whilst the (-) symbol captures negative coefficients.

	Independent variable - presence and size of annual bonus targets							
	Profit		Cashflow		EPS		Revenue	
	Presence	Size	Presence	Size	Presence	Size	Presence	Size
Capex (change)	-	-	-	-	-	-	✔* (+)	✔* (+)
Net investment (change)	-	-	-	✔** (+)	-	-	-	-
R&D (change)	-	-	-	-	-	✔*** (+)	-	-
Total accruals	✔* (+)	✔* (+)	-	-	-	-	-	-
Discretionary accruals	-	-	-	-	-	-	-	-

Table 4.4.2: Summary of results for relationships between investment growth and accruals and the presence and size of LTIP targets

	Independent variable - presence and size of LTIP targets							
	Relative TSR		Absolute TSR		EPS		Cashflow	
	Presence	Size	Presence	Size	Presence	Size	Presence	Size
Capex (change)	✔** (+)	-	-	-	-	-	-	-
Net investment (change)	✔** (+)	✔** (+)	-	-	-	-	-	-
R&D (change)	-	-	-	-	-	-	-	-
Total accruals	-	-	-	-	-	✔* (+)	-	-

	Independent variable - presence and size of LTIP targets							
	Relative TSR		Absolute TSR		EPS		Cashflow	
	Presence	Size	Presence	Size	Presence	Size	Presence	Size
Discretionary accruals	-	-	-	-	-	-	-	-

Key findings

We find weak evidence of relationships between the presence or size of incentives and changes in investment and accruals. Most significant results are only significant at the 10% level.

All coefficients that are significant are also mildly positive, which does not support our hypothesis that targets incentivise executives to systematically reduce investment.

The lack of evidence may be because of omitted variables. Boards may be aware of the potential unintended consequences of performance targets, and only put them in place if they expect to be able to prevent short-termist behaviour. Alternatively, it could be that there is no reason to expect an overall relationship to begin with, since targets can provide incentives to either reduce investment (at the threshold) or increase it (at the maximum).

Unlike the 2019 study, we do not find evidence of a significant negative relationship between the size of LTIP EPS targets and capex due to differences in the sample and specification. This study has a larger sample, therefore the results are likely to be more representative.

Our general econometric analysis largely produces insignificant results. All of the significant coefficients are also mildly positive and most are only significant at 10%.

In contrast to our hypothesis, the slightly positive coefficients suggest that presence and size of certain targets may be associated with positive investment growth on average. However, the low statistical significance indicates that the presence and size of incentives alone have a limited impact on investment and accruals decisions on average.

Evidence of CEOs responding to financial incentives to maximise their payout that was identified by our threshold analysis is not reflected in our general analysis, when all firms are included in the regression. This is likely because targets can either encourage or discourage investment. As noted in Chapter 3, CEOs have financial incentives to decrease investment until their performance approaches the maximum payout level, but increase it once performance exceeds the maximum. Our threshold analysis does not find strong evidence of incentive effects around the threshold, however the incentive to reduce investment and

improve performance could continue between threshold and maximum payout performance level. The regression analysis combines all these cases, which may be why it finds no effect overall.

In interpreting these results, it is also important to consider how strongly target performance is influenced by particular investment and accruals measures, and, in particular, whether there are any mechanical relationships which give rise to direct trade-offs between investment or accruals and target performance. Such mechanical relationships may make it easier to identify a significant relationship even when all firms are considered in aggregate.

For example, profit has a strong mechanical link to accruals which may explain why we find a significant positive relationship between the both the presence and size of annual bonus profit targets and total accruals even when considering the relationship on average across all firms in our sample. This suggests that profit targets could be associated with accounting earnings management, although the lack of a relationship in our ex-post analysis suggests executives do not successfully achieve profit targets in this way.

In cases where the link is less mechanical, it may be harder to uncover a significant relationship through our general econometric analysis due to the many complex channels through which investment can affect target performance.

Unlike in our 2019 study, we do not find evidence of a significant negative relationship between the size of EPS targets in LTIPs and capex. However, there are several differences between this study and our 2019 study. When we restrict the firm sample to the FTSE 350, analyse the period 2009-2016 and take the level of capex scaled by lagged total assets as our dependent variable, in line with the design of the 2019 study, we do find a significant negative relationship between the size of LTIP EPS targets and capex. Further detail on the comparison of these results is available in Appendix D.

Therefore, the difference in findings between these studies is due to differences in the sample and econometric specification. This study has a larger sample due to covering a longer time series and more firms. We also consider the annual change in investment which more accurately captures firm decisions. As such, these findings are likely to be more representative.

Overall conclusions from our general econometric analysis

Overall, we find limited evidence that the presence and size of targets for annual bonus and LTIP pay is associated with reducing investment growth or lower accruals.

The limited significance of the results across our general econometric analysis reflects the complexity of CEO incentives, and may be unsurprising since targets can incentivise CEOs to either increase or decrease investment depending on whether they are close to the threshold or maximum.

Therefore, the contrasting and complex incentives associated with annual bonus and LTIP targets can lead to evidence of CEOs responding to financial incentives in their own self-

interest being obscured in our aggregate analysis. As such, many of the intricacies around incentive effects, such as those highlighted in our threshold analysis, may be lost. Evidence of such behaviour, which would be of concern, could occur and yet not be reflected in our general econometric analysis.

5. Conclusion

This report has investigated the performance targets in executive pay contracts and explored their impact on firm investment. The research presented above follows on from a previous study, published by BEIS in 2019, which found that UK FTSE-350 CEOs do not appear to use share repurchases (whilst forgoing capex) as a means of improving EPS performance and increasing their performance-based pay. However, the same study found limited evidence in favour of a direct negative relationship between investment and the presence of EPS targets in CEOs' pay contracts. The broader literature on this topic primarily studies US firms, but does provide further supporting evidence that CEOs may influence investment decisions to increase their performance-based pay.

This study therefore focused on direct relationships between firm investment and performance-based targets in CEOs' pay contracts. Its overall objectives were to assess whether CEO pay incentives linked to target performance exert influence on achieved performance, and if so, whether there is evidence that CEOs respond to financial incentives to increase their current and future payout in a way that could potentially harm long-term firm performance. This is a key channel through which executive pay practices may drive short-termism and a lack of long-term innovation and resilience in UK corporations.

To achieve these objectives, the study had several specific aims:

1. To explore the prevalence of different performance targets in UK executive pay contracts, with a view to better understanding the use of different target types and whether they are calibrated effectively to incentivise target achievement.
2. To examine the evidence for whether CEOs influence firm investment decisions to improve performance against specific targets in their pay contracts.
3. To examine the evidence for whether there is a systematic relationship between the presence and size of specific performance targets and firm investment.

Our research approach used a combination of statistical and econometric analysis, drawing on a bespoke dataset which combines detailed financial data with executive pay and performance data for FTSE All-Share firms (as of April 2020). We began by conducting separate statistical analysis on our investment and executive pay data, which provides insights into key trends in these variables such as how often CEOs meet their performance targets. We then conducted statistical and econometric analysis, which focused on specific key areas of the CEO performance distribution and explored whether there is evidence for CEOs changing firm investment decisions to influence their performance against targets. Finally, we used econometric analysis to look more broadly across the CEO performance distribution and assessed whether the presence and size of particular targets in CEO contracts is systematically associated with more or less investment.

Our key findings across each of these research areas are set out below:

Literature review

26. The existing academic literature is primarily based on US evidence rather than UK evidence. It finds that executives change firm investment to influence their performance against targets, but that the actions taken vary depending on the type of target involved. Similarly, the impact of other executive pay incentives on firm behaviour varies by the type of incentive used.

27. There is additional evidence to suggest that executives take actions to beat other strategically important milestones such as zero earnings and last year's earnings. Studies have found that CEOs engage in myopic behaviour to beat these milestones, through their firms either generating unsustainable sales or overproducing to reduce the cost of goods sold.

28. CEOs may also take actions to beat analyst forecasts, as missing these can cause a significantly negative market reaction. Evidence suggests that firms increase accruals and cut R&D and advertising to pass these milestones, despite such actions being potentially detrimental to long-term value.

Statistical analysis of executive pay targets

29. Most CEOs' annual bonus and LTIP targets are concentrated within a relatively small number of target categories, and the relative prevalence of these categories has remained largely stable over the 2013-2019 sample period we consider. Specifically, we find that many annual bonus targets fall into the profit, personal and strategic measures categories, and we find that a clear majority of LTIP targets fall into the relative total shareholder return (TSR), EPS and other financial categories. This harmonisation of target types across firms makes it easier to identify the key target categories and analyse their relationships with investment.

30. A large proportion of CEOs (sometimes greater than 80%) achieve the threshold payout performance level across prevalent target categories, and this finding holds for both annual bonus and LTIP data. By contrast, achievement rates for the maximum payout performance level are more varied, ranging from 19% to 51% across target categories.

31. We can therefore say that achieved CEO performance often falls within the incentivised range (i.e. between the threshold and maximum payout levels), which suggests that targets could plausibly influence CEO behaviour and incentivise performance improvements. However, the high achievement rates for threshold payouts suggest that the CEOs of high-performing firms are unlikely to face significant challenges in meeting them. This finding implies that threshold payout targets may not affect CEO behaviour for some firms due to being highly achievable in any event.

32. Our analysis of the achieved CEO performance distribution for *annual bonuses* (specifically around the threshold and maximum payout levels) finds that performance tends to cluster asymmetrically around these levels, with many CEOs just hitting their threshold payout (relative to those just missing) and many others narrowly missing their maximum payout (relative to those just hitting). These patterns are consistent with

CEOs' incentives to increase their current and future payout, because as we discuss in Chapter 3, CEOs start to receive payouts when performance exceeds the threshold payout level and they stop receiving additional payout once performance exceeds the maximum payout level.[62] The asymmetries in observed performance suggest that targets do have an influence on CEO decision making. However, we cannot rule out the possibility that targets have the desired effect of simply incentivising effort. The fact that more CEOs just meet rather than just miss the threshold payout is also consistent with CEOs working hard to hit it.[63]

33. By contrast, our analysis of the observed CEO performance distribution for *LTIPs* produces much less evidence of asymmetries around the threshold and maximum payout levels, and there is less consistency across target types in the overall shape of the performance distribution. The differences between the annual bonus and LTIP distributions may reflect the relative difficulty that CEOs face in achieving the desired LTIP performance outcome, given that LTIPs tend to measure performance over a 3-year period, often against high-profile financial measures which capture success relative to competitor firms. By contrast, it is arguably easier for CEOs to influence their performance against annual bonus targets, given their short-term and often absolute (rather than relative) nature.

34. Taken collectively, our statistical findings support the hypothesis that performance targets affect CEO behaviour, and that CEOs influence their achieved performance in a manner consistent with increasing their current and future incentive payout (although we cannot definitively establish that payout motivations drive CEOs' observed behaviour, as opposed to other motivations). Importantly, it appears that CEOs are better able to influence their performance and achieve the desired outcomes when they have greater control over their performance, which is associated with less influence from external market conditions and shorter time horizons. Still, it should not be assumed from these findings that CEO performance targets (and their effects on CEO behaviour) are damaging to FTSE All-Share firms and wider society, as well-designed targets may guide CEOs towards better and mutually beneficial decisions.

Threshold econometric analysis

Statistical analysis of ex-ante and ex-post performance outcomes

35. Our analysis distinguishes between ex-post CEO performance, which captures actual CEO performance outcomes, and ex-ante CEO performance, which captures our estimates of how CEOs would have performed had investment remained at the previous

[62] We refer the reader to Figure 3.2.1 (in Chapter 3) for a detailed explanation of how CEOs' incentive payout is affected by target performance.

[63] On the other hand, the fact that more CEOs just miss rather than just exceed the maximum payout suggests that maximum targets may encourage coasting close to the maximum payout. Still, even if incentives do lead to coasting behaviour once the maximum payout is reached, this may not necessarily be socially suboptimal if more stretching targets would lead to excessive focus on short-term performance at the expense of long-term value.

year's level.[64] We find evidence that whilst CEOs' ex-post performance (i.e. whether a specific target is achieved or not) usually aligns with their ex-ante performance outcome, **there are numerous cases where investment changes are powerful enough to materially change the performance outcome**.[65] In other words, there are investment changes large enough to make the difference between CEOs missing a payout target and hitting that target.

36. As an illustration, we find 28 cases where CEOs hit their threshold payout targets when they would have otherwise missed them, because investment fell compared to the previous year's level. This represents 17.7% of the 158 cases where CEOs were set to miss their threshold targets based on the previous year's investment level. On the other hand, this also means that investment did not fall materially (i.e. substantially enough to change the target achievement outcome) in 82.3% of cases.

37. We also find 46 cases where CEOs missed their maximum payout targets when they would have otherwise hit them, because investment grew compared to the previous year's level. This represents 16.2% of the 284 cases where CEOs were set to hit their threshold targets based on the previous year's investment level.

38. These discoveries contrast with the 2019 BEIS study mentioned above, which found that no firms successfully used share repurchases to meet EPS targets because their effect on EPS performance is too weak. This suggests that changing investment is **a significantly more powerful way of maximising performance-based payouts than share repurchases**. One reason for this could be that share repurchases are a fairly irregular and high-profile event which affect only a subset of FTSE companies each year, whereas investment decisions are regular and material for any major business.

39. Moreover, we find noticeable asymmetries in how investment changes alter target performance outcomes at different points of the payout distribution. At the threshold payout level, it is more common for investment to fall and CEO performance to improve, whereas at the maximum payout level, it is more common for investment to rise and CEO performance to fall. These patterns are consistent with CEOs' incentives to increase their current and future payout.

40. In those cases where year-on-year investment changes are material enough to alter CEOs' target achievement outcome (either positively or negatively), we find that the year-on-year changes to investment (and the resulting changes in performance against targets) are often large. This finding implies that it may be easier for those CEOs whose firms have (i) high investment intensity and (ii) potential for year-on-year volatility in investment spend to successfully enhance their payout using investment decisions.

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[64] In Chapters 2 and 4 of this report, we provide further detail on how we have estimated ex-ante performance based on certain assumptions about default investment growth.

[65] It should be noted that just because investment changes are powerful enough to materially change performance outcomes, this does not always mean that the direction of the change (and its effect on performance) aligns with CEOs' incentives to increase their payout. In this study, we find that investment changes run in both directions.

Those CEOs whose firms do not meet these requirements may find it harder - although certainly not impossible - to enhance their payout in this way.

41. Overall, whilst there is some evidence to suggest that CEO performance may influence firms' investment decisions, it is important to note that most of the time ex-ante and ex-post performance outcomes are similar or identical. Across the two target and investment relationships we study, we find that the ex-ante and ex-post performance outcomes align in 1612 of 1706 cases (94.5%) when threshold and maximum payout results are combined.[66] In other words, it is relatively rare for investment to change substantially enough (either positively or negatively) to affect target achievement status. This indicates that, while greater than for repurchases, the scope for CEOs to materially change performance outcomes using investment levers is likely to be limited.

Econometric analysis of ex-post and ex-ante performance outcomes

42. Our econometric analysis of ex-post outcomes produces mixed findings. There is some evidence across several of the target measure and investment combinations that firms whose CEOs just hit their maximum payout target undertake greater investment growth than firms whose CEOs just miss their maximum target.

    a. This evidence is consistent with the hypothesis that CEOs who are already on track to exceed the maximum target increase firm investment to avoid significantly outperforming against the target. Doing so might lead to the maximum ratcheting up next year. In addition, increasing investment gives the CEO greater latitude to cut investment to hit future targets.

    b. However, this finding is not consistently replicated across the suite of econometric regressions run for these variable relationships.

43. Our analysis also finds some evidence of negative relationships between CEOs just hitting their maximum payout for LTIP EPS targets and measures of accruals.[67] This provides potential evidence of managing accounting earnings to influence performance against targets.

    a. This evidence is consistent with the hypothesis that CEOs who are already on track to exceed the maximum target reduce firm accruals to avoid significantly outperforming against the target. Doing so might lead to the maximum ratcheting

[66] To calculate this result, we consider all observations (where both an ex-ante and ex-post outcome is available) around both the threshold payout and maximum payout. This includes the 158 cases where the ex-ante outcome is target non-achievement at the threshold (as cited in paragraph 11) and the 284 cases where the ex-ante outcome is target achievement at the maximum (as cited in paragraph 12), but also 685 cases where the ex-ante outcome is target achievement at the threshold and 579 cases where the ex-ante outcome is target non-achievement at the maximum. In total, this gives 1706 cases. For further detail on our statistical analysis of ex-ante and ex-post performance outcomes, we refer the reader to Chapter 4.

[67] Accruals is not an investment measure: instead it is an additional dependent variable which we investigate in this study. The difference between investment measures and accruals is explained in Chapter 2. We measure accruals as the change in net operating assets, that is, net income not covered by cash.

up next year. In addition, reducing accruals gives the CEO greater latitude to increase them to hit future targets.

b. However, this finding is not consistently replicated across the suite of econometric regressions run for these variable relationships.

44. However, the broader finding across our ex-post econometric analysis is that there are relatively few strong relationships between target performance and investment, with most relationships being weak or non-existent. This contrasts somewhat with the finding of asymmetric investment changes in our statistical analysis, and may indicate that this behaviour is targeted among particular firms in specific circumstances - for example, those with high investment intensity and thus greater latitude to cut investment - rather than being widespread.

45. Our econometric ex-ante analysis produces relatively similar findings to our ex-post analysis. For one of the two target measure and investment relationships studied, there is some evidence to suggest that firms whose CEOs are on track to hit their maximum payout target undertake greater investment growth than firms whose CEOs are on track to miss their target.

    a. This finding is consistent with the hypothesis that CEOs who are on track to exceed the maximum payout target have an incentive to increase firm investment and reduce performance, to avoid outperforming the target by too much.

    b. However, this finding is not fully replicated across all of the econometric regressions run, including the baseline specification.

46. As with the ex-post analysis, the broader finding is that most of the relationships between CEO performance and investment are weak or non-existent. As noted above, CEOs may only have latitude to increase or decrease investment to achieve desired performance outcomes in firms with high investment intensity.

47. Across our threshold econometric analyses, we generally find less evidence of investment being used to influence performance around the threshold payout target than the maximum. This may reflect how a large proportion of CEOs meet or exceed their threshold payout targets (as discovered in our statistical analysis of executive pay data) and so there is less need to change investment to achieve these targets.

General econometric analysis

48. Our general econometric analysis, which explores relationships between the presence and size of performance targets and measures of investment growth and accruals, finds relatively limited evidence of strong relationships. For most target measure and investment combinations studied, we find weak or non-existent relationships.

    a. The few significant relationships are positive, implying that the presence or increased size of particular targets leads to higher investment growth or higher accruals. The investment growth result contradicts the hypothesis that CEOs will

reduce firm investment to hit targets. However, the accruals result is consistent with the hypothesis that CEOs will increase firm accruals to hit targets.

b. Unlike the 2019 study, we do not find a significant negative relationship between the size of LTIP EPS targets and capex due to differences in the sample and specification. This study has a larger sample, and so the results are likely to be more representative.

49. The lack of a consistent relationship between performance targets and investment may arise for two reasons:

    a. First, omitted variables distort the observed relationship. One such omitted variable could be the CEO's latitude to influence investment. It may be that boards only put certain types of performance targets in place when this latitude is low, e.g. due to the firm having low investment intensity or the board closely monitoring investment. These omitted variables are also why we do not make causal claims with the general regression analysis.

    b. Second, it is *a priori* unclear whether targets will incentivise CEOs to increase or decrease investment. They have incentives to decrease investment if they are near the threshold, but increase it if they are near the maximum. This is another reason why the more targeted analyses, that differentiate between the threshold and maximum, are more reliable.

50. Many of the intricacies around incentive effects, such as those highlighted in our threshold analysis, may be lost in our general econometric analysis. Evidence of such behaviour, which would be of concern, could occur and yet not be reflected in our general econometric analysis.

Next steps and avenues for further research

This study has conducted detailed investigation into how CEOs typically perform against their annual bonus and LTIP targets, and it has also considered a broad range of relationships between executive pay targets and investment decisions. Whilst there is good evidence to suggest that CEO performance targets do influence firm performance in a manner consistent with increasing CEO payout, it is much less clear that CEOs are influencing firm performance (and therefore their pay) by changing investment. There is some evidence of such investment decisions amongst certain firms, but less clear evidence of this behaviour across the wider FTSE All-Share group.

We note that the latter finding does not necessarily mean that CEO pay is correctly set in most large firms. Indeed, one reason why there is little need for CEOs to reduce investment to hit the threshold payout could be that threshold targets are too easy to hit. Still, the evidence does not suggest a systematic problem with executive pay causing underinvestment.

We consider that this study provides useful insights into executive pay and its relationships with investment, particularly in terms of building the UK evidence base. We believe that there is scope for further research to shed greater light on the overall value of CEO performance targets, and how they may lead to CEOs acting in their own self-interest (whilst also potentially having some positive consequences). The following research topics would benefit from additional study:

5. One limitation of this study is that it considers evidence from all firms across the FTSE All-Share, without a detailed assessment of how investment conditions vary significantly across these firms, and how this might affect CEOs' ability to influence investment in their own favour. Further analysis could seek to stratify companies and test whether relationships between investment and CEO performance are stronger within particular sectors compared to others. A key challenge would be gathering sufficient data to perform a robust analysis, given the sample size constraints we identified when conducting this study.

6. Further studies may seek to build on the ex-post and ex-ante performance framework developed in this study. Our ex-ante analysis assumes that investment would have stayed at the prior year's level. A more complex analysis could consider changes in firm performance, economic uncertainty and other determinants of investment, which would lead to the 'neutral' level of investment being different from last year's level.

7. Further research could also explore whether UK CEOs use other channels beyond investment to influence short-term target performance, such as opex reductions or employee redundancies. An added challenge with these alternative channels is that there might be a wide range of reasons why opex or employee headcount could fluctuate under 'business as usual' conditions, irrespective of CEO decisions. Opex is heavily influenced by routine business activities, and research into potential decision-making would need to identify its most discretionary elements, such as marketing expenditure.

8. Additionally, further research could consider whether the use of particular CEO performance targets drives improved firm performance in subsequent years. There has been some research published on this topic, but much of it focuses on the US rather than UK context. As our literature review (in Appendix A) indicates, it is possible that positive effects of performance-based pay targets on future firm performance may help to mitigate any negative long-term impacts arising from CEOs responding to financial incentives to influence their payout. However, it is very difficult to demonstrate causality in either direction. Whether a firm is just above or just below a target is essentially random, but whether a firm has a performance target is not random - boards choose to implement performance targets. Thus, as mentioned earlier, a positive link between targets and performance would not imply that the former caused the latter, as it could be that an attentive board caused both.

Glossary

Term	Definition
EPS (Earnings per share)	Net company profit minus dividends, divided by average number of shares outstanding (i.e. owned by shareholders). This is a commonly used measure of company performance. Shares outstanding can be calculated either as shares outstanding at the end of period, or more typically as the weighted average of shares outstanding over the reporting term.
LTIP (Long-term incentive plans)	Pay package with various performance metrics (e.g. target EPS) and payout schedules (e.g. payment if the target is achieved).
Remuneration Committee (“RemCo”)	Appointed by the Board of Directors to oversee executive pay policy and set executive pay. It consists of at least two independent, non-executive directors in public companies. The corporate governance code sets out the principles and provisions that apply to RemCos in public companies on a “comply or explain” basis.
ROCE (Return on capital employed)	Profits before tax and interest, divided by working capital and fixed assets. This is a commonly used measure of company performance and efficiency.
TSR (Total shareholder return)	Change in share price and dividends during a period of time (usually one year) expressed as a percentage of the starting share price. This is a commonly used measure of company performance.

Appendix A: Literature review

Summary

This section summarises the findings of our survey of the academic literature on the relationship between executive incentives and firm behaviour. Unless otherwise stated, the studies are on the US. This is not so much due to an academic bias towards the US but because data availability is higher in the US. While one cannot automatically assume that findings from the US immediately translate to the UK, one can still learn a significant amount from US studies given the economic systems are similar (although far from identical) – just as one can apply the findings of most US medical studies to a UK context despite differences in diet, lifestyle, and healthcare systems. However, we did a particularly targeted search for UK papers.

The majority of the literature review focussed on leading academic finance and econometrics journals, however we also did an additional 'bottom up' sweep of the literature to ensure that our (quality and relevance focussed) targeted approach did not miss any residual literature that could inform our approach. The findings from the bottom up complementary review are documented in section A5.

Key findings from the literature review:

- **Firms appear to engage in real and accounting earnings management in order to achieve executive pay performance targets, but the actions taken vary depending on the type of target**.
    - CEOs use short-term earnings management in order to just meet financial target performance levels for cash stock and option grants. In particular, firms appear to use accruals and R&D cuts to meet EPS targets, and selling, general and administrative expenses (SG&A) cuts to meet profit targets. This results in firm performance clustering just above pay targets. Firms do not appear to engage in manipulation to achieve sales targets.
    - Performance-linked awards are associated with real earnings management, such as cutting R&D, advertising or SG&A, but not accounting earnings management, such as accruals and the likelihood of accounting restatements. Although, there is some UK evidence suggesting that accruals are positively associated with the value of performance-vesting stock options, and that this effect is stronger when there is a larger gap between target earnings and ex-ante earnings.
    - Correlational analysis suggests that the adoption of performance-linked awards, such as stock and option grants with performance-based vesting provisions, is associated with improvements in EBITDA.

    - In contrast to performance-linked awards, cash bonuses are associated with accounting earnings management but not real earnings management. Discretionary accruals are higher for firms between the threshold and maximum payout performance levels than those above the maximum.

- **Similarly, the impact of other executive pay incentives on firm behaviour varies by the type of incentive used.** Standard equity and long-term pay are associated with better firm performance, however vesting equity has been associated with declines in investment and increases in repurchases and M&A. While such actions could be efficient, evidence suggests this is not the case. However, the magnitude of the effects is small, suggesting that other types of incentives are a check on the myopic behaviour induced by vesting equity.
- **CEOs also have incentives to beat milestones such as zero earnings and last year's earnings**. Studies have found that CEOs engage in myopic behaviour in order to beat these milestones, such as generating unsustainable sales or overproducing to reduce the cost of goods sold.
- **CEOs may also take actions to beat analyst forecasts, as missing these can induce a significantly negative market reaction.** Evidence suggests that firms manipulate accruals, R&D and advertising to pass this milestone, despite such actions being detrimental to long-term value.

1. Introduction

That executive incentives may lead to short-termism has been a major concern for policymakers, boards, investors, and wider society. If executives have incentives to meet financial performance targets, they may take short-term actions (e.g. cutting investment) even if these actions harm long-term value. Moreover, this problem may extend far beyond performance targets in executive pay to other targets that executives have incentives to hit – for example, ensuring that earnings beat analyst forecasts, last year's earnings, or do not fall below zero.

However, even if we could document a robust empirical correlation between performance targets and certain CEO actions, this need not prove that the targets caused short-term behaviour. As Edmans, Gabaix, and Jenter (2017) note: "Identifying the causal effect of compensation contracts on any interesting outcome variable is extraordinarily difficult. These contracts are endogenous – executives, directors, and compensation consultants spend time and effort designing them, taking into account unobservable firm, industry, and executive characteristics. As a result, compensation contracts are inevitably correlated with these unobservable characteristics, which in turn affect firm behaviour, performance, and value".

In our specific context of the 'effect' of performance targets on CEO behaviour, there are several other alternative explanations:

1. Even if the correlation were causal – i.e. performance targets caused the CEO to take certain actions (e.g. investment cuts), it is very difficult to show that these actions destroy long-term value. For example, it could be that the CEO would otherwise deliberately overinvest because pay and prestige are linked to firm size. Or the CEO 'unintentionally' overinvests because she finds it difficult to abandon long-standing, but now unprofitable, projects due to lacking an objective outsider's viewpoint on their quality. Either way, performance targets encourage the CEO to 'get her act together' and cut wasteful projects. Doing so improves long-term as well as short-term value.

   In general, we can only observe the quantity of a firm's actions (e.g. the level of sales or investment) but this tells us little about their quality (e.g. whether investment is good or bad, or whether an increase in sales was due to effort or unsustainable sales policies).

2. The correlation may not be causal due to *reverse causality*. It may be that firm decisions cause changes in incentives, rather than incentives causing firm decisions. For example, if the CEO cuts investment (i.e. is now pursuing a margin rather than growth strategy), the remuneration committee may decide to give LTIPs based on EPS to hold her accountable for delivering on this new strategy.
3. The correlation may not be causal due to *omitted variables* that drive both incentives and actions. For example, it may be that a poor economic outlook both causes a firm to (rationally) cut investment and also causes a board to implement EPS targets to induce a turnaround.

Given the multiple potential explanations for a result, it is critical that an academic study addresses all potential explanations, to the extent possible, before drawing inferences. However, academic studies differ substantially in their quality and rigour. Many papers, even papers published in peer-reviewed journals, fail to measure variables (e.g. incentives or firm actions) correctly, have questionable hypotheses, or fail to distinguish between correlation and causation. That a result was 'shown' by an academic paper does not mean that it is reliable; one of the most dangerous phrases is "research has shown that…" because one can almost always find a paper to show what one would like to show. In particular, given confirmation bias, papers are more likely to attract attention if they claim to show executive misbehaviour. Thus, it is critical to ensure that the papers have been carefully scrutinised to verify that they actually show misbehaviour.

Wherever possible, we focus our literature review on papers published in the very top finance and accounting journals which reject nearly 90-95% of papers, given their high bar for rigour. However, we lowered the journal quality threshold for papers that use UK data, because we were unable to find any papers in the top journals that use such data. This in turn means that there is a need for a rigorous UK-specific study.

Since the peer-review process is not perfect, even papers published in top journals may not be fully watertight, and even papers in lower-tier journals may have interesting results. Thus, this literature review is deep, rather than broad. Rather than covering several papers superficially,

we cover the most relevant papers in depth, to be clear about what results they do and do not find, and potential concerns with the methodology that may affect the reliability of the results.

2. Link between executive pay performance targets and firm behaviour

This section reviews the literature on how performance targets in pay contracts may incentivise CEOs to take short-term actions.

The most relevant study is by **Bennett, Bettis, Gopalan, and Milbourn (2017)** who study financial targets that are included in CEO pay contracts. Due to its relevance, we describe it in the most detail.

The authors study 974 firms over 2006-12, which have contracts that link cash, stock, or option grants to various financial targets. They stratify these targets into three categories: EPS (EPS or earnings), Sales (sales), and Profit (EBIT, EBITDA, EBT, operating income, or FFO).

The main analyses start with the difference between the firm's *actual* EPS, Sales, or Profit and the *target* level in the bonus contract. Naturally, the difference is positive if the firm beat the target and negative if it missed it. They then combine these three differences into a single measure, by first normalising each difference by its standard deviation to put all three on the same scale.[68] The advantage of this measure is that it comprehensively captures the extent to which a firm met the targets in the contract. However, there is the potential for information to get lost in aggregation. For example, the aggregate measure might be just above zero, implying that a CEO engaged in manipulation to just hit her targets. However, it could be that two differences were very positive and one difference was extremely negative, so there was in fact no manipulation.

The paper finds that the aggregate measure clusters just above zero – i.e. there are far more observations just above zero, and far fewer just below zero, than would be the case if there were no strategic behaviour. Two formal statistical tests (the McCrary test and the bootstrap method) confirm that these differences are significant. This suggests that CEOs engaged in strategic behaviour to just hit the target. When they consider the difference in the three measures individually, they find that the EPS difference is clustered significantly above zero using both tests, but the Sales and Profit differences show significant clustering only under the bootstrap test.

The authors then do the same but for the *threshold* payout performance level of EPS, Sales, or Profit in the bonus contract rather than the target level. They show that the aggregate measure

[68] As a rough illustration of normalisation, assume you have two measures, A which ranges from 0 to 2, and B which ranges from 0 to 10. Simply adding them would be inappropriate as the sum would be driven more by B rather than A. Normalisation involves dividing measure B by 5 so that it ranges from 0 to 2. Then it has equal weight to A and so can be summed. More formally, normalisation involves scaling each measure by its 'spread'. In the above example, the 'spread' is captured by the difference between the maximum and minimum outcomes. In the authors' methodology, the 'spread' is captured by the standard deviation of a measure.

is clustered significantly above zero for the McCrary test. They do not report results for the bootstrap tests, nor the three individual measures.

The most germane analysis investigates the actions the firms may have taken to hit their performance targets. They compare firms that just met an EPS, Sales, or Profit target with those that just missed. This analysis is likely causal, since in the absence of strategic behaviour, whether a firm just meets or just misses a target should be random. In a simple comparison, without controls, firms that just met an EPS target (either threshold or target payout performance level) ex-post exhibited lower changes in R&D and lower repurchases than firms that just missed. In other words, firms met EPS targets by cutting R&D, but not by engaging in share buybacks. Firms that just met the Sales target exhibited higher sales growth than firms that just missed (as is expected). Firms that just met the Profit target exhibited lower SG&A than those that just missed. There was no difference in accruals for any of the three targets.

Finally, the authors used a regression framework to allow for control variables. Specifically, they focused only on firms that just met or just missed a performance target, excluding all others from the analysis. They regressed accruals, the change in R&D, or the change in SG&A, on a dummy variable that equals 1 if the EPS (or, in separate regressions, Profit, or Sales) target was just met and 0 if it was just missed. They controlled for the firm's size, market-to-book ratio, standard deviation of cash flow, and standard deviation of sales growth – other factors that may drive accruals and changes in R&D or SG&A. They found that accruals are higher and the change in R&D is lower for firms that just met the EPS performance target, and the change in SG&A is lower for firms that just met the profit target. All other regressions were insignificant.

Overall, the paper finds evidence that firms cluster just above targets for EPS, Profit, and Sales in pay contracts. There is more limited evidence for clustering just above thresholds, as some results are not reported. Firms appear to use accruals and R&D cuts to meet EPS (but not Profit) targets, and SG&A cuts to meet Profit (but not EPS) targets. There is no evidence that they engage in manipulation to achieve Sales performance targets, presumably because Sales appears at the top of the income statement and are thus unaffected by manipulation of items lower down the income statement.

Bizjak, Hayes, and Kalpathy (2015) is a related paper, started around the same time as Bennett et al. (2017) but unpublished. They use the same data set for incentive awards linked to performance targets. However, most of their analyses link firm behaviour to the amount of these performance-linked rewards that are expiring in the current year, rather than to the firm's proximity to financial performance target payout levels. This analysis is less precise, as such awards are particularly likely to affect firm behaviour if it is close to hitting the target.

The authors find no evidence that the existence of performance-linked awards causes earnings management. Specifically, accruals and the likelihood of accounting restatements are both either unrelated or *negatively* related to the value of expiring performance-linked awards. However, they do find that abnormal discretionary expenditure (the sum of R&D, advertising,

and SG&A) is negatively related to such awards.[69] (Note that they study the level of discretionary expenditure, whereas Bennett et al. study the change). This suggests that performance-linked awards are associated with *real* earnings management but not *accounting* earnings management.

These results are only correlations, not causations, for the reasons explained earlier. The authors attempt to obtain a causal interpretation by using two 'instruments' for the value of performance-linked awards.[70] Unfortunately, neither are likely to be valid. One is the average value of expiring performance-linked awards in the same zip code but not the same industry. The idea is that pay contracts may be shaped by regional peers. However, using peer group averages as instruments is nearly never valid since any endogeneity at the individual firm level is simply soaked up at the group level (see Gormley and Matsa (2013), Section 2.3.4). The second is the presence of a large compensation consultant, under the idea that compensation consultants advocate the use of performance-linked awards. However, compensation consultants advise on many other aspects of pay contracts, which could encourage or discourage earnings management.

The study does contain one table that related firm behaviour to proximity to performance targets – specifically, the threshold and the maximum payout performance levels (they do not study the target). Using regressions with controls, they find that firms just above the threshold payout performance level have significantly more accruals to firms far from performance targets. However, firms just below the threshold, and firms just above or just below the maximum, do not have significantly different accruals to firms far from performance targets. There are no significant differences for discretionary expenditure.

Bettis, Bizjak, Coles, and Kalpathy (2010) was the first academic paper to document the use of stock and option grants with performance-based vesting provisions. Much of their analysis describes the data, e.g. whether vesting is based on the stock price or accounting profits, or how difficult the performance targets are to hit. At the end, they study the performance of companies after they adopt performance-vesting equity. One measure of performance is EBITDA, where they compare each adopting company to a 'control' firm in the same industry with the closest EBITDA. They find that the adopting company enjoys a faster increase in EBITDA. However, discretionary accruals do not rise, suggesting that this is not the cause of the increase in reported EBITDA. The second performance measure is stock returns, where

[69] To calculate abnormal discretionary expenditure, they predict 'normal' discretionary expenditure given the year, firm's industry, and firm's revenues. Abnormal discretionary expenditure is actual discretionary expenditure minus the predicted level.

[70] A causal interpretation is not possible if the independent variable of interest (here, the value of performance-linked awards) might be driven by reverse causality or omitted variables. An 'instrument' is a variable that 'shocks' the independent variable of interest, and thus causes it to change for reasons other than reverse causality or omitted variables. For an instrument to be valid, it has to affect the dependent variable of interest (here, earnings management) only through affecting the independent variable of interest. For further details, see "A layman's guide to separating causation from correlation … And noticing when claims of causality are invalid" (www.alexedmans.com/correlation).

they compare each adopting company to a 'control' firm of similar size and book-to-market ratio. Here, they find no difference.

They authors stress that these results are only correlations, not causation. It could be that a board chooses to implement performance-vesting equity at the same time as it is becoming more attentive in general, and it is the latter that leads to the improvement in EBITDA. Alternatively, implementing standard equity might have had a similar effect.

While the three above papers study performance-contingent awards (which are often based on shares or options and have become popular in the US relatively recently), an older literature studies cash bonuses based on current-year performance, which have long been used. Most of these papers are in the accounting literature and thus focus on accounting earnings management rather than real earnings management.

A seminal study is by **Healy (1985)**. Prior to Healy, researchers had found inconsistent evidence that firms use accruals to hit bonus performance targets. Healy conjectures that this was because these studies assumed that bonuses would always encourage positive accruals. Instead, he pointed out that these incentives only exist between the threshold and maximum. If earnings are below the threshold, then the CEO will not be receiving a bonus anyway. Thus, she may want to report *negative* accruals, to hold back earnings that she can report next year to boost her bonus. Similarly, if earnings are above the maximum, the CEO has already maxed out her bonus. She may similarly wish to report negative accruals to hold back earnings for the future. Healy indeed finds that both the average level of accruals, and the frequency of positive accruals, is higher for firms between the threshold and maximum than firms above the maximum or below the threshold.

Holthausen, Larcker, and Sloan (1995) revisit Healy's results with a later dataset and a number of methodological changes – in particular, a different way of measuring accruals. They confirm Healy's results for the upper bound: discretionary accruals are more negative above the maximum than between the threshold and the maximum. However, they are unable to replicate his results for the lower bound: discretionary accruals are not more negative below the threshold. They conjecture that, even if a CEO is likely to receive no bonus, she will not decrease reported earnings for fear of being fired. They also study real earnings management, but they find no effects for either advertising, R&D, or capital expenditure.

Guidry, Leone, and Rock (1999) also revisit Healy's analysis, but using business unit rather than aggregate data. Their motivation is twofold. First, it is business unit managers that make decisions. Due to having different bonus plans, one may have incentives to increase accruals and another to decrease them. There is no aggregate effect, even though both business unit managers are engaging in earnings management. Second, business unit managers are paid only with cash and bonuses, not stock. For CEOs, stock may reduce their incentives to lower reported earnings even if above the maximum or below the threshold. Studying business unit managers removes the confounding effects of stock-based pay. Analysing a single large conglomerate but using business unit data, they find that accruals are higher for firms in

between the threshold and the maximum payout performance levels than those above or below.

Moving to studies based on UK data, **Kuang (2008)** studies the 240 largest non-financial firms from 1997-2004 with sufficient data on performance-vesting stock options (PVSOs); she does not consider performance shares. She divides PVSOs into three categories: those granted in the current year, those granted in prior years but where the performance period ends in the current year or later, and those that have already been vested (i.e. performance has already been evaluated) but not yet exercised. She argues that the second category of PVSOs will encourage earnings management. However, this prediction is unclear – PVSOs should only incentivise earnings management in the year in which performance conditions are tested, not before (as correctly assumed by Bizjak et al. (2005)).

She has two main results. The first is that accruals are increasing in the value of PVSOs. When she breaks PVSOs down into the three categories, the results are driven by the second type. However, her dependent variable is *absolute* accruals (i.e. both positive and negative accruals are counted as positive). The use of absolute accruals as the dependent variable is incorrect, since PVSOs should incentivise CEOs to increase rather than decrease reported earnings (unless one performs Healy's analysis of taking into account where firms are relative to performance targets, which Kuang does not do).

The second finds that the 'effect' of PVSOs on accruals is stronger when there is a larger gap between target earnings and *ex-ante* earnings, i.e. what earnings would have been without any earnings management. The rationale is that, the larger the gap, the more accruals will be needed to fill it. However, this hypothesis is again unclear. If the gap is too large, then the CEO is unlikely to bother trying to hit the target – the link between the gap and accruals is likely non-monotonic.

Moreover, both results are correlations with no causality. For example, it could be that high uncertainty leads the CEO to use more accruals (as the market likes smooth earnings) and also the board to give her more PVSOs (to incentivise her to navigate through the difficult conditions). The author attempts to address this by comparing firms pre- and post-PVSO adoption. However, this does not address the issue since firms endogenously choose to adopt PVSOs. They may choose to adopt them when uncertainty has risen.

Kuang and Qin (2009) also use UK data on PVSOs, but do not study any association with firm behaviour. Instead, they find that PVSOs lead to CEO pay being more sensitive to performance than time-vested stock options, which automatically will be the case by construction.

3. Link between executive pay incentives and firm behaviour

This section studies papers which show causal effects of executive pay incentives on firm behaviour, although the effects are caused by aspects of incentives other than performance targets.

Edmans, Fang and Lewellen (2017) study time-vesting, rather than performance-vesting equity. Their hypothesis is that, when equity is about to vest, the CEO has incentives to boost the stock price so that she can sell her equity at a higher price. The amount of equity that vests in a given year is determined by equity grants made several years prior, which permits a causal interpretation. The authors find that vesting equity (both stock and options) are associated with declines in investment (both R&D and capital expenditures). The results hold for both the level of investment and the change in investment. The magnitudes are not large – a one standard deviation increase in vesting equity is associated with an annualised $1.8 million fall in investment – suggesting that other incentives (e.g. the CEO's unvested equity, monitoring by the board or investors, or reputational concerns) are a check on myopic behaviour.

The reduction in investment may be either efficient (if the CEO tends to overinvest, and vesting equity causes her to scrap bad projects) or myopic. The authors rule out the 'efficiency' interpretation by showing that vesting equity is not associated with other increases in efficiency, such as a fall in cost of goods sold, a fall in operating expenses, or a rise in sales growth. They find further evidence in support of the 'myopia' interpretation by showing that the fall investment is lower when there are more blockholders (large shareholders) who are likely to see through earnings increases caused by investment cuts.

In a related paper, **Edmans, Fang and Huang (2020)** show that vesting equity is positively associated with repurchases and M&A. The advantage of studying repurchases and M&A, rather than investment, is that the authors can investigate the long-term returns to these actions in order to diagnose whether they are efficient or myopic. While repurchases are typically associated with positive long-term returns, they find that vesting equity is associated with lower long-term returns over the 2-3 years following repurchases and 4 years following M&A. Again the results are not substantial – a one standard deviation increase in vesting equity is associated with an annualised $6 million rise in shares repurchased.

Ladika and Sautner (2020) study the adoption of the FAS 123R accounting standard in the US, which required firms to expense the value of unvested options. This caused firms to accelerate option vesting to avoid the accounting charge. FAS 123R took effect for each firm in the first fiscal year starting after June 15, 2005. Thus, the authors compare firms with fiscal years ending between June and December (who were affected in 2005) with those with fiscal years ending between January and May (who were not affected until 2006), permitting a causal interpretation. The authors found that accelerated option vesting led firms to cut both R&D and capital expenditure. Thus, they find consistent results to Edmans, Fang, and Lewellen (2017) using an independent methodology.

Moving away from equity vesting, **Von Lilienfeld-Toal and Ruenzi (2014)** examine the effect of standard equity (that does not contain performance targets) on firm performance. They find that firms in which the CEO has a high level of voluntary stock ownership subsequently beat those in which she has a low level by 4-10% per year.

This relationship is only a correlation. One interpretation is that incentives work – high stock ownership today causes the CEO to improve the stock price tomorrow. However, causality might be the other way. When the CEO expects tomorrow's stock price to be high, she asks the board to pay them in stock rather than cash, or buys shares on the open market. Either way, she holds more stock today.

To provide further evidence for the first explanation, the authors studied whether the effect is greater where incentives are more likely to matter, because the CEO leader would otherwise be unaccountable for poor performance. These are cases in which few institutions own the company's shares, there are few industry competitors, takeover defences are strong, the CEO was originally the founder and recent sales growth is high. (The last two make it less likely that the board will fire the CEO.) In all five cases, the link between stock ownership and long-run returns is stronger, suggesting that the former causes the latter.

Flammer and Bansal (2017) investigate the effect of long-term pay, using a method that enables them to identify causation rather than just correlation. They do not simply study what happens to firm performance after the adoption of long-term pay schemes, since it may be that companies adopt long-term pay when the board becomes more effective. Instead, they study shareholder proposals to implement long-term pay. However, even this alone would not identify causality. It could be that shareholder proposals arise due to a large engaged blockholder, and it could be the blockholder - not long-term pay - that improves future performance.

The authors thus use a Regression Discontinuity Design. They compare proposals that narrowly pass (with 51% of the vote) to those that narrowly fail (with 49% of the vote). Whether you narrowly pass or narrowly fail is essentially random, and uncorrelated with other factors such as the presence of blockholders – if there were large blockholders, they would likely increase the vote from 49% to (say) 80%, not 51%.

They find that proposals to increase long-term pay improve long-term operating performance, regardless of whether you measure it using return on assets, net profit margin, or sales growth. There are also improvements in innovation (measured either by the number of patents or the quality of patents) and stakeholder value (the value the firm creates for its customers, the environment, society and employees – with the rise being particularly strong for employee welfare).

The authors define 'long-term pay' as restricted stock, restricted options, or LTIPs. Thus, the analysis does not allow us to distinguish between restricted equity and performance-vesting equity. However, it does allow us to see the effects of moving away from short-term bonuses.

4. Link between other executive milestones and firm behaviour

This section studies research on CEOs' incentives to beat milestones other than performance targets in pay contracts, and how they may affect firm behaviour.

One such milestone is *zero earnings*. **Hayn (1995)** finds that reported earnings are much more likely to be clustered just above zero than just below zero, suggesting that CEOs take actions to avoid reporting losses. **Burgstahler and Dichev (1997)** confirm these results and also find that another relevant milestone is *last year's earnings*, with firms being much more likely to report small earnings increases than small earnings decreases.

Burgstahler and Dichev also investigate what actions a CEO might be taking to avoid reporting losses or earnings decreases. They decompose earnings into three components: cash from operations (CFO), changes in working capital other than cash, and accruals. They hypothesise that a CEO will manipulate the first two components but not the third.[71] This hypothesis is questionable as it goes against the literature which argues the opposite - that accruals are easier to manipulate. The authors find that the first two components, but not the third, increase when a firm crosses from losses to gains. These results are shown using graphs with no statistical tests.

Dechow, Richardson, and Tuna (2003) formally test whether accruals are the reason for why small positive earnings are much more common than small negative earnings. They find that they are not – firms reporting small profits do not have higher accruals (nor a higher frequency of positive accruals) than those reporting small losses. They conjecture that the clustering may be due to managers taking real actions to avoid losses. These could be either efficient (e.g. working hard to avoid losses) or myopic (cutting investment).

Roychowdhury (2006) investigates this conjecture, by studying the real actions that firms may take to report small profits. He finds that firms that do so have higher abnormal production costs (the sum of costs of goods sold and increases in inventory), lower abnormal CFO, and lower discretionary expenditure (the sum of R&D, advertising, and SG&A).

The author interprets the first two findings as stemming from two actions. One is sales manipulation: firms accelerate the timing of sales or generate additional unsustainable sales through increased price discounts or more lenient credit terms. Such actions will lower CFO and increase production costs, compared to what would be expected given the level of sales. The second is overproduction to reduce the cost of goods sold by spreading fixed cost over a larger number of items. However, the firm incurs production and inventory holding costs on the over-produced items that are not sold in the same period, again reducing CFO and increasing production costs. Overall, the results suggest that companies engage in real activities manipulation to avoid reporting small losses.

A third milestone is *analyst forecasts*. There is a significantly negative market reaction to missing analyst forecasts (Bartov, Givoly, and Hayn (2002), Skinner and Sloan (2002)), which gives firms strong incentives to meet or beat them. Roychowdhury (2006) finds some evidence that firms engage in real earnings management to meet annual earnings forecasts, although the results depend on how he measures earnings forecasts.

[71] They write "The first two components, cashflow from operations and changes in working capital, are widely regarded in the literature as variables subject to management discretion".

Stronger evidence of taking actions to meet analyst forecasts is provided by **Bhojraj, Hribar, Picconi, and McInnis (2009)**. They divide firms into two categories. 'False Beaters' are firms that just beat earnings forecasts due to high accruals, low R&D, or low advertising. 'Honest Missers', in contrast, are firms that just missed forecasts due to low accruals, high R&D, or high advertising.[72] They find that False Beaters outperformed Honest Missers by 2-4% in the short-term, but underperformed by 15-41% over the next three years. This suggests that the market is fooled by actions taken to beat earnings forecasts, even though these actions are detrimental to long-term value.

Hribar, Jenkins, and Johnson (2006) find that firms use share buybacks to meet analyst forecasts. They find that firms whose *ex-ante* earnings (in the absence of buybacks) would have just fallen short of analyst forecasts engage in more buybacks than would be predicted given their characteristics. In contrast, firms whose *ex-ante* earnings would have just beaten analyst forecasts engage in fewer buybacks. They do not study whether these increases or decreases in buybacks are good or bad for firm value.

Turning to evidence from surveys of Chief Financial Officer behaviour, **Graham, Harvey, and Rajgopal** find that 80% admit that they would cut discretionary expenditure (on R&D, advertising, and maintenance) to meet an earnings milestone. When asked what the relevant earnings milestones are, 85.1% agreed or strongly agreed that earnings in the same quarter last year were important, 73.5% agreed with the analyst consensus forecast, 65.2% agreed with zero, and 54.2% agreed with the prior quarter's earnings.

Overall, the evidence suggests that vesting equity and EPS targets are associated with investment cuts, and that EPS targets are associated with accounting earnings management. However, even if pay incentives lead to investment cuts and earnings management, this must be weighed against the positive effects of incentives. For example, von Lilienfeld-Toal and Ruenzi (2014) find that CEOs with high equity incentives outperform those with low equity incentives by 4-10%/year. As Edmans, Gabaix, and Jenter (2017) write: "Any high-powered incentive contract creates incentives to manipulate the performance measure(s) it relies upon. However, finding that a pay practice, such as equity-linked pay, is associated with manipulation does not imply that incentive contracts are worse than no incentive contract." Any negative effect of incentives can be reduced by removing specific targets from the contract, rather than scrapping incentive pay entirely.

5. Wider findings on executive pay incentives

We also conducted a bottom up review of the wider literature to ensure no relevant papers were missed. This involved searching the JSTOR and Taylor & Francis databases using key terms such as 'executive pay', 'executive compensation' or 'equity vesting' and 'investment' or 'firm performance'. This search yielded a limited number of additional papers related to our study, the key findings of which are summarised here. These insights are not critically

[72] 'False Beaters' and 'Honest Missers' are our terminology, introduced for ease of exposition, not the authors'.

informative for our study, but provide useful additional context for those wishing to understand wider studies in the literature relevant to our area of focus.

Leonard (1990) found that the presence of LTIPs in executives' compensation packages was associated with a lower average return on equity, but a slower decline in return on equity over the period 1981-1985. In contrast, the presence of bonuses was associated with higher average return on equity, but had no significant effect on changes in return on equity.

Correlational analysis by Brown, Collins and Meade (1990) looked at how long-term and short-term compensation payments affected the CEO's decision-making horizon, measured through R&D expenditure. They found no link between total short-term compensation and R&D, but there was a significant positive association between long-term compensation and R&D.

Pissaris, Jeffus and Gleason (2020) focused on the impact of pay disparity and corporate governance on firm performance. They found that greater disparity between CEO and other executives' pay is significantly associated with higher return on assets. However amongst the firms with greater pay disparity, firms with better monitoring and transparency perform better than those without such corporate governance measures.

Cheng (2004) found that compensation committees establish a significant positive relationship between R&D expenditure and CEO compensation to prevent CEOs from making opportunistic cuts to R&D expenditure. The results indicate that the presence of horizon and earnings benchmarking myopia problems are not associated with reduced R&D expenditure, but that there is a significant positive relationship between changes in R&D expenditure and changes in CEO total compensation when these problems are present.

Appendix B: Data

Financial data

All financial data is either collected using Capital IQ, or otherwise calculated from data collected using Capital IQ.

Data collected from Capital IQ includes 30+ financial variables for the period 2010-2019. These variables can be divided into two types: (i) variables of interest, i.e. the dependent variables in our econometric analysis, and (ii) firm financial controls, i.e. variables used to control for characteristics that may affect investment other than executive performance targets. These variables are listed in Table A.B.1 below.

Table A.B.1: Financial variables

Type	Variables
(i) Variables of interest	• Capital expenditure • Net investment • Research & development expenditure • Total accruals • Discretionary accruals
(ii) Firm financial controls	• Firm age • Full time employees • Repurchases • Dividends • Market-to-book ratio • Market capitalisation • Stock returns • Revenue • Profit • Cashflow • Debt • Leverage • Industry

Discretionary accruals

Accruals can be discretionary or non-discretionary. As executives tend to have a greater ability to influence discretionary accruals, they are more likely to use discretionary rather than non-discretionary accruals as a means to increase their payout from performance targets. However, discretionary accruals cannot be observed and must be estimated using an

econometric model. We use the Jones (1991) model, as detailed in Dechow, Sloan and Sweeney (1995), which relaxes the assumption of many models that non-discretionary accruals are constant.[73]

In the Jones model, non-discretionary accruals in a given year are:

$$\frac{NDA_t}{A_{t-1}} = \alpha_1\left(\frac{1}{A_{t-1}}\right) + \alpha_2\left(\frac{\Delta REV_t}{A_{t-1}}\right) + \alpha_3\left(\frac{PPE_t}{A_{t-1}}\right)$$

where,

A_{t-1} =total assets in year t-1

ΔREV_t =revenues in year t less revenues in year t-1

PPE_t =gross property, plant and equipment in year t

$\alpha_1, \alpha_2, \alpha_3$ =firm-specific parameters

We estimate the firm-specific parameters for the estimation period using the following model for total accruals:

$$\frac{TA_t}{A_{t-1}} = \alpha_1\left(\frac{1}{A_{t-1}}\right) + \alpha_2\left(\frac{\Delta REV_t}{A_{t-1}}\right) + \alpha_3\left(\frac{PPE_t}{A_{t-1}}\right) + \gamma_t$$

We use a Bayesian ridge estimator to provide more stable estimates given the small sample size (10) per firm.[74] We then calculate non-discretionary accruals using the firm-specific parameters and take discretionary accruals as the residual between total accruals and non-discretionary accruals, such that:

$$TA_t = NDA_t + DA_t$$

Executive pay data

Our executive pay data is drawn from our proprietary PwC executive pay database. Further detail on this database and how it is compiled is set out in the focus box below.

PwC executive pay database
The PwC executive pay database reports on executive pay for FTSE All-Share firms from 2009-2019. It includes a broad coverage of pay, including executive characteristics and their pay packages. All CEO pay data, the focus of this study, is sourced from publicly available documents such as firm annual reports.

[73] Dechow, P. M., Sloan, R. G and Sweeney, A. P. (1995). 'Detecting earnings management' *The Accounting Review*, 70, pp.193-225.

[74] Copas, J. B. (1983). 'Regression, prediction and shrinkage' *Journal of the Royal Statistical Society: Series B (Methodological)*, 45, pp.311-335.

Executive pay data is collected through desk-based research and updated on a rolling basis as firms publish their annual reports. It is collected using standardised forms to maintain consistency which are reviewed by the Executive Remuneration team. The database is then updated and checked using automated processes. Data maintenance is ongoing, and any errors are reported, fixed and updated within the database.

We have undertaken additional data cleaning and checking in preparation for this analysis. For example, this includes converting non-GBP currency units to GBP using historical exchange rate data from Capital IQ, and selecting the newer CEO when two observations are available for one year due to a change in CEO.

We collect 240+ executive pay variables for the period 2013-2019, focusing only on CEOs rather than other executives.[75] These variables can be divided into two types: (i) variables of interest, i.e. the independent variables in all of our analyses and the dependent variables in our de-facto base pay analysis, and (ii) CEO controls, i.e. variables used to control for CEO characteristics that may affect investment aside from their executive performance targets. The full list of variables is detailed in Table A.B.2 below.

Table A.B.2: Executive pay variables

Type	Variables
(i) Variables of interest	● Annual bonus ○ Share of total remuneration package under maximum performance scenario that annual bonus accounts for (%) ○ 1-10 performance conditions, including target name and target category ○ Weight given to each performance condition within annual bonus ○ Share of the available award for each performance condition (i.e. vesting share) which is received under the following outcomes at the time of vesting: ■ Threshold pay-out performance ■ Target pay-out performance ■ Maximum pay-out performance ■ Achieved (i.e. outturn) performance ○ Performance required under each condition for: ■ Threshold pay-out ■ Target pay-out

[75] We use data from the 2013-2019 period because these are the years in which there is more comprehensive information available on CEOs' annual bonus and LTIP schemes, and the performance targets contained within them. This is the result of increased reporting requirements over recent years, particularly for annual bonus data.

Type	Variables
	■ Maximum pay-out ○ Achieved performance against each performance condition ● LTIP (up to four LTIP schemes recorded for each CEO-year combination in the database) ○ Share of total remuneration package under maximum performance scenario that LTIP schemes account for (%) ○ 1-5 performance conditions per LTIP scheme, including target name and target category ○ Weight given to each performance condition within LTIP scheme ○ Share of the available award for each performance condition (i.e. vesting share) which is received under the following outcomes at the time of vesting: ■ Threshold pay-out performance ■ Target pay-out performance ■ Maximum pay-out performance ■ Achieved (i.e. outturn) performance ○ Performance required under each condition for: ■ Threshold pay-out ■ Target pay-out ■ Maximum pay-out ○ Achieved performance against each performance condition ● Estimated value of overall remuneration package under threshold pay-out and maximum pay-out performance scenarios ● CEO salary at last review
(ii) CEO controls	● CEO tenure ● CEO age ● CEO shareholding

Target categories in the PwC executive pay database

Each CEO target performance observation in the PwC database is associated with a target name and target category. The target name typically captures the exact measure of performance (tied to a specific KPI), whereas the target category reflects the categorisation applied to that target by PwC as part of the data collection process. Target categorisations are used in order to group the thousands of performance observations into recognised categories, which allows for data aggregation and group comparison. An example of a target name and target category from the PwC database is shown below:

Table A.B.3: Example target name and target category

Target name	Target category
Free cash flow	Cashflow

The PwC database groups each target (i.e. each performance condition) within an annual bonus or LTIP into one of the categorisations shown in Table A.B.4 below. As this table captures, some of the PwC categorisations are used exclusively for either annual bonus or LTIP performance conditions (not both).

Table A.B.4: PwC target categories and their application to annual bonus / LTIP data

PwC target category	Use within PwC database
Absolute TSR	LTIP
Business unit profit	Annual bonus
Cashflow	Annual bonus / LTIP
Corporate sustainability	Annual bonus
Customer satisfaction	Annual bonus
Earnings before interest and tax (EBIT)	Annual bonus / LTIP
Earnings per share (EPS)	Annual bonus / LTIP
Economic profit	LTIP
Employee engagement	Annual bonus
Environmental/community targets	Annual bonus
EPS vs RPI	LTIP
Group profit	Annual bonus
Health and safety	Annual bonus
Market share	Annual bonus
Non-financial	Annual bonus / LTIP
Operational measures	Annual bonus
Other	Annual bonus

PwC target category	Use within PwC database
Other financial	Annual bonus / LTIP
Personal	Annual bonus
Production/productivity	Annual bonus
Project delivery	Annual bonus
Revenue	Annual bonus
Risk management	Annual bonus
Return on capital employed (ROCE)	Annual bonus / LTIP
Return on invested capital (ROIC)	Annual bonus / LTIP
Shareholder measures	Annual bonus
Strategic objectives	Annual bonus
Working capital	Annual bonus
Profit before tax (PBT)	LTIP
Total shareholder return (TSR)	LTIP
TSR vs index	LTIP

For the purposes of our statistical and econometric analysis of CEO target performance, which is presented in Chapters 3 and 4 of this report, we combine some of the PwC categories above into broader categories. We do this partly because there are strong similarities between some of the PwC categories, such as TSR and TSR vs Index, meaning that combination rationalises the data and assists cross-category comparison. The combination of similar categories also allows us to achieve greater sample size than would otherwise be possible.

Table A.B.5 below shows how we have combined selected PwC target categories to form broader categories for our statistical and econometric analysis.

Table A.B.5: Aggregation of PwC target categories

PwC database target categories	Aggregated target category
Earnings Before Interest and Tax (EBIT) Group profit	Profit (Annual Bonus)
Earnings Before Interest and Tax (EBIT)	Profit (LTIP)

PwC database target categories	Aggregated target category
Profit before Tax (PBT)	
Operational Measures Strategic Objectives Project Delivery Non-financial	Strategic Measures
Return on Capital Employed (ROCE) Return on Invested Capital (ROIC)	Return on Capital Employed (ROCE)

Data collection and merging process

Our sample consists of firms in the FTSE All-Share as of April 2020. These firms are tracked back to 2013, which allows us to analyse their behaviour over time.

This approach could in theory lead to different results if firms that dropped out of the FTSE All-Share during the sample period behave differently to those included in the index in 2020. However, any such effects are unlikely to be significant in practice. Even if the dropped firms systematically invest more or less compared to those in the 2020 index, this would not affect the results. They would have to differ specifically in the sensitivity of their investment behaviour to the presence of executive performance targets.

We merge the financial and executive pay datasets using a unique identifier for each observation, made up of the firm's ISIN and the year that the observation relates to. For each piece of analysis, we drop any observations which are missing necessary data.

Appendix C: Further statistical analysis of investment and executive pay

Chapter 3 presented the key findings of our statistical analysis of investment measures and executive performance targets. This appendix provides further detail on these trends for the interested reader.

Statistical trends in investment and accruals

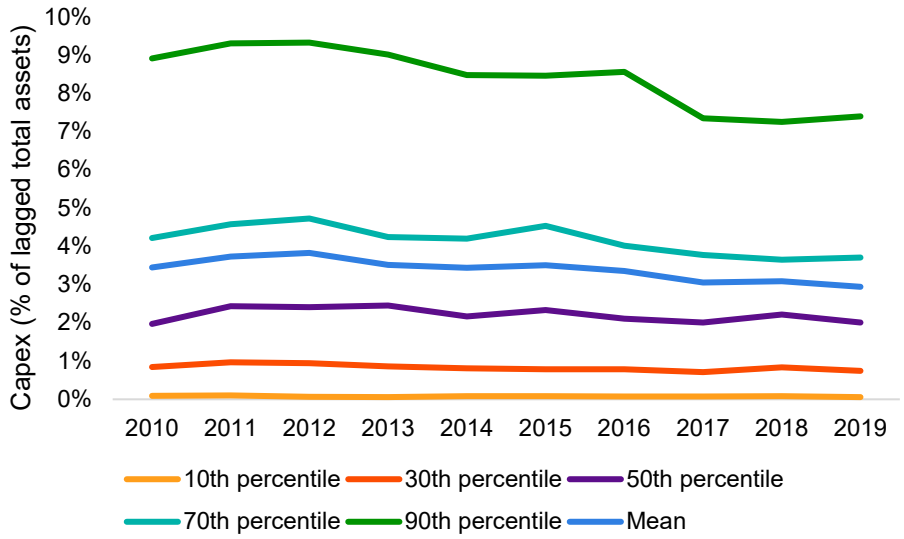
Capex

Capex intensity has been declining since 2010, however there is significant variation across the distribution.

Figure A.C.1 below shows that mean capex as a proportion of lagged total assets declined from 3.4% to 2.9% between 2010 and 2019. Median capex has remained relatively constant and, averaging 2.2% throughout the period, and below the mean. This demonstrates that the most firms cluster close to zero while some outlier firms have much higher capital intensity.

Notably, the 90th percentile of the data declined from 8.9% in 2010 to 7.4% in 2019, demonstrating that the fall in the intensity of capital expenditure has been driven by the positive tail of the distribution.

Figure A.C.1: Percentiles of the distribution of capex (% of lagged total assets)



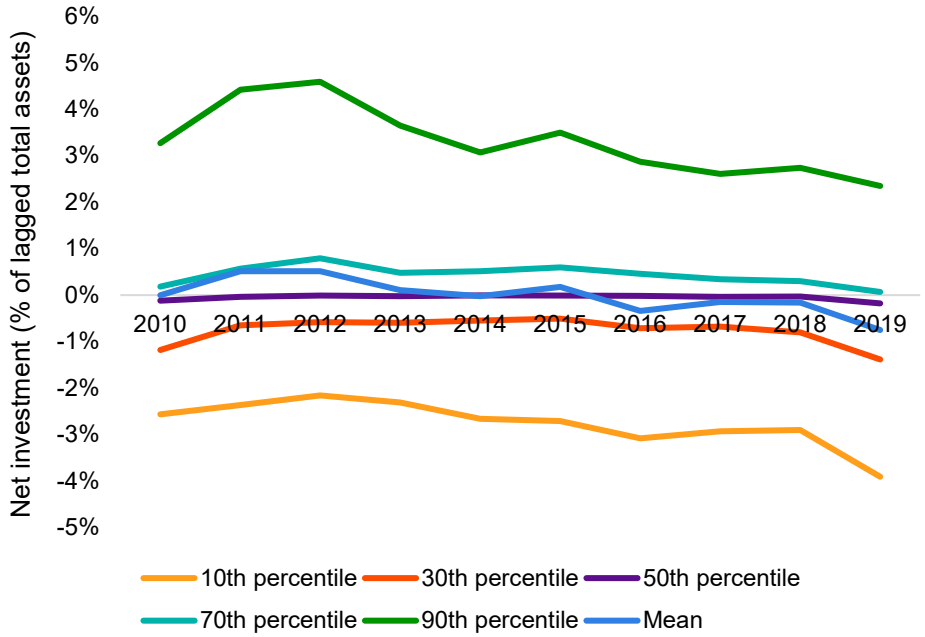
Net investment

Net investment intensity is largely concentrated around zero but the average level has fallen since 2010.

Figure A.C.2 below shows the fluctuation of mean net investment as a proportion of lagged total assets around zero, with a peak in 2012 at 0.5% which then declined through to 2019 with a value of minus 0.8%. The decline in the mean has been driven by a decline in both the 90th percentile and the 10th percentile. Similar to capex, the median has remained much flatter, between minus 0.2% and 0%, and is now higher than the mean.

The decline in the 90th percentile mirrors that of the 90th percentile for capex intensity however the decline in the 10th percentile is not seen in the 10th percentile for capex intensity. This suggests that depreciation intensity has remained relatively constant for the 90th percentile but increased for the 10th percentile.

Figure A.C.2: Percentiles of the distribution of net investment (% of lagged total assets)



R&D expenditure

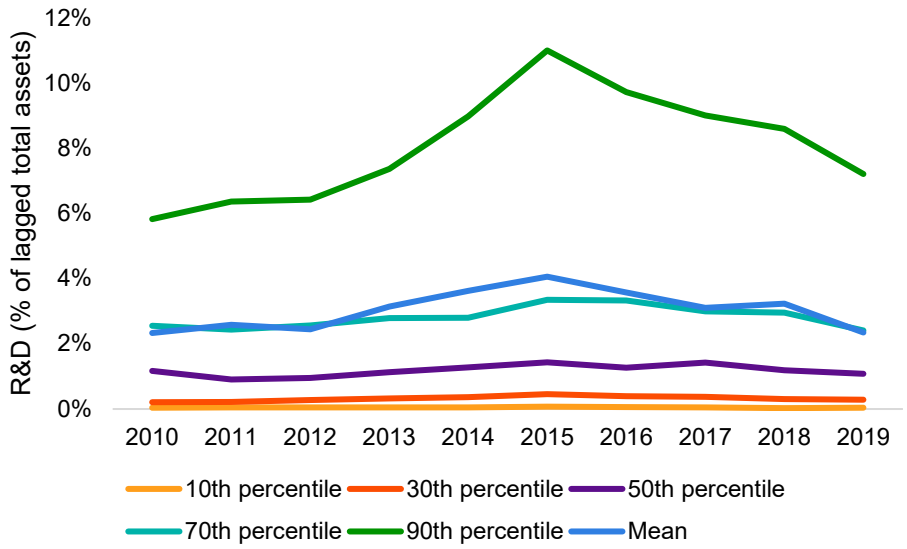
Median R&D expenditure intensity remained relatively constant between 2010 and 2019, while there has been significantly more variation in the mean and positive tails of the distribution.

Figure A.C.3 below shows the median level of R&D as a proportion of lagged total assets has only fallen from 1.2% in 2010 to 1.1% in 2019. The mean is much higher, demonstrating a positive skew, and has exhibited much more volatility. In particular, mean R&D intensity increased from 2.3% in 2010 to 4.1% in 2015, then declined to 2.4% in 2019.

The movement in the mean level of R&D has been driven by substantial variation in the 90th percentile, increasing from 5.8% in 2010 to 11.0% in 2015, then declining to 7.2% in 2019.

There has been much less variation in the lower percentiles of the distribution. There is a clustering of R&D intensity close to zero, while some firms undertake much more R&D relative to total assets.

Figure A.C.3: Percentiles of the distribution of R&D expenditure (% of lagged total assets)



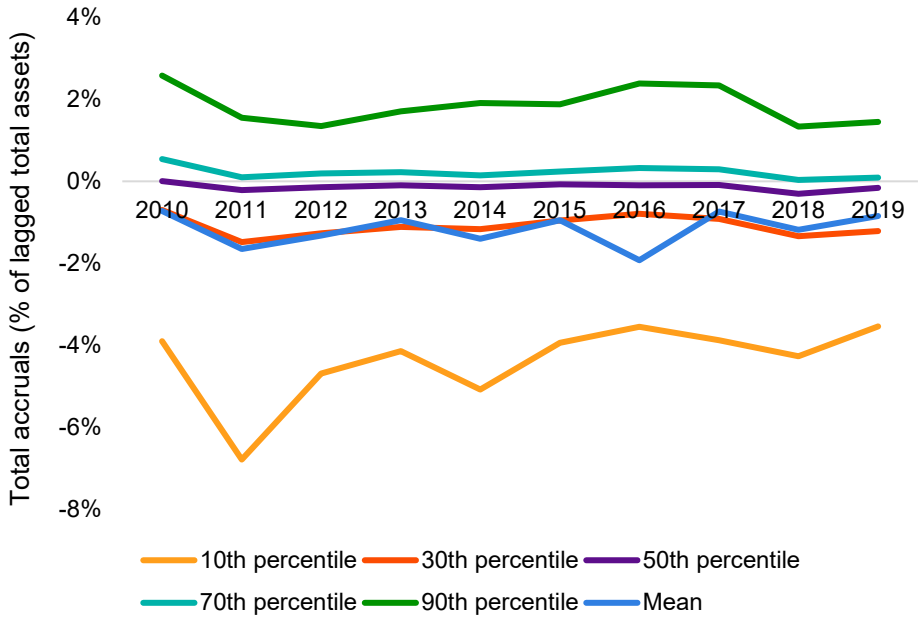
Total accruals

While not a measure of investment, our analysis also includes accruals as a mechanism for accounting earnings management.

Total accruals cluster around zero, with limited variation over the period studied. Figure A.C.4 below shows that the 30th, 50th and 70th percentiles have been relatively constant and close to zero. Meanwhile, the mean level of total accruals as a proportion of lagged total assets has fluctuated around minus 1.2% over time, close to the 30th percentile demonstrating a notable negative skew.

From 2015 onwards most of the percentiles studied remained relatively flat while the mean has exhibited more volatility, meaning that the variation in the mean has most likely been driven by outliers.

Figure A.C.4: Percentiles of the distribution of total accruals (% of lagged total assets)



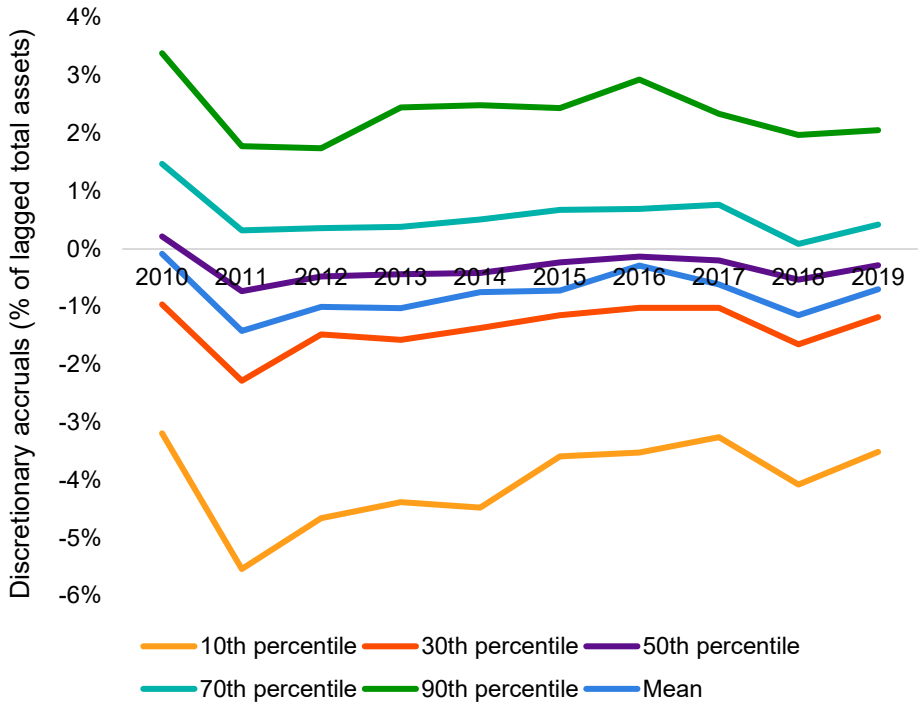
Discretionary accruals

Our analysis also considers discretionary accruals, a component of total accruals, and their potential for facilitating accounting earnings management to achieve executive performance targets.

Discretionary accruals have followed a similar trend to total accruals, clustering around zero with variation mostly driven by outliers.

Figure A.C.5 below shows that the mean value of discretionary accruals as a proportion of total accruals fell from minus 0.1% in 2010 to minus 1.4% in 2011 but has since risen to minus 0.7% in 2019. The median intensity of discretionary accruals has remained relatively flat and persistently at or below zero. Like total accruals, the percentiles have remained relatively stable since 2014, implying that the volatility in the mean is also driven by a few outliers.

Figure A.C.5: Percentiles of the distribution of discretionary accruals (% of lagged total assets)



Statistical trends in executive performance targets

Target deviation (Measure 3)

In this section, we provide further supporting information on our analysis of target deviation distributions (Measure 2), which is presented in Chapter 3. As a reminder, we construct this measure by calculating the percentage difference (or 'deviation') between achieved CEO performance and the threshold or maximum payout level. When aggregated across all observations for a particular target category, this measure allows us to study the distribution of CEO performance relative to the threshold and maximum payout levels.

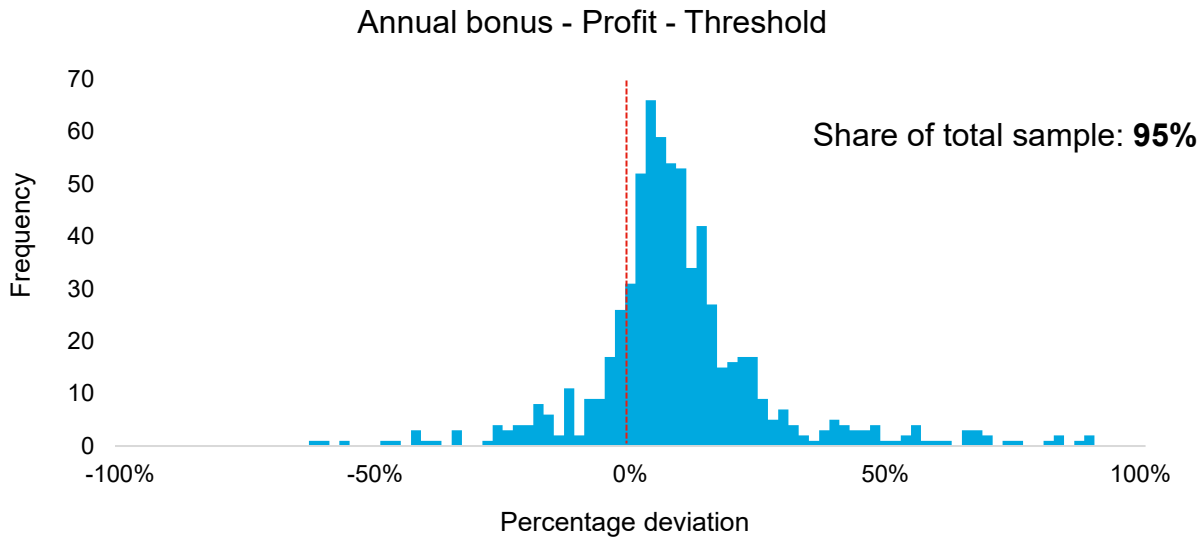
As part of our analysis, we calculated target deviations and modelled the target deviation distributions for five annual bonus target categories and six LTIP target categories. We focused on these categories because they have the most available data for this measure: specifically, we derived (and present) deviation histograms only where they are built from over 100 target deviation distributions, to ensure a reasonable degree of statistical robustness. In Chapter 3 of our report, we avoid presenting all of these histograms for reasons of brevity, and instead we only present a subset (2 target categories for annual bonus data, and 3 categories for LTIP data). This appendix therefore presents the full set of target deviation histograms, to allow for full comparison across target categories.

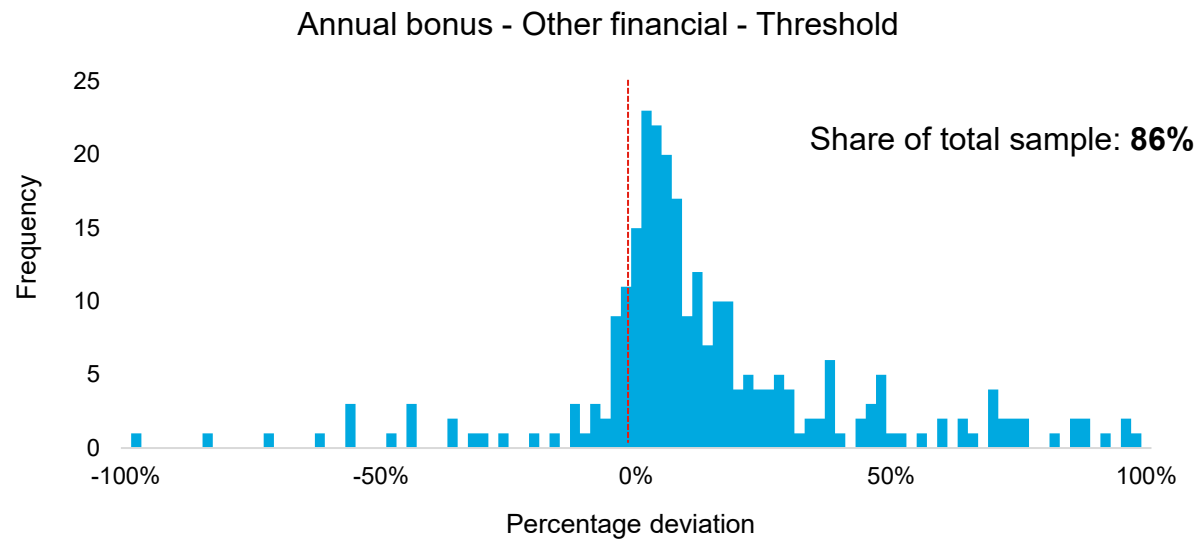
In Chapter 3, we also supplement the histograms with insights from the McCrary (2008) test. However, we avoid presenting the full results of the test in Chapter 3 due to the technical nature of the analysis. As such the results are set out in full in this appendix.

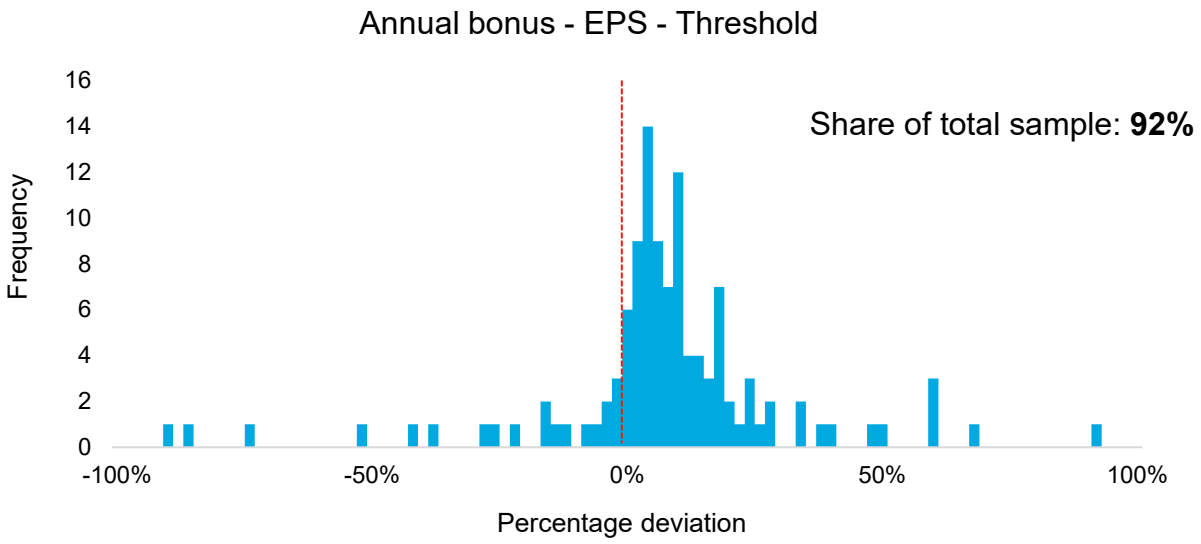
Figure A.C.6 below captures the target deviation histograms for our annual bonus target categories, whilst Figure A.C.7 captures the histograms for our LTIP categories.

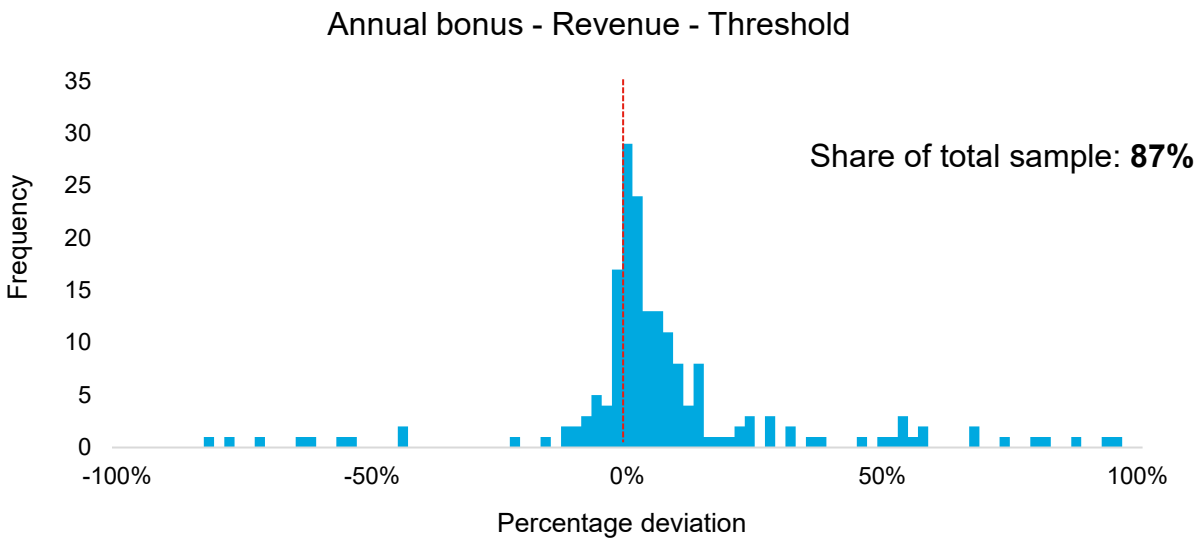
We do not provide detailed commentary on these histograms within this appendix, and we instead refer the reader to Chapter 3 for a discussion of how these histograms compare and what they imply for our broader analysis. However, we do capture the percentage of the total deviation sample that is captured in each of our histograms, bearing in mind that these histograms only cover those achieved performance observations within -100% to +100% of the reference target level (either threshold or maximum payout). For most of the histograms shown below, the vast majority of observations (often above 90%) are captured within this range. The most notable exceptions to this are the LTIP histograms relating to EPS vs RPI performance, which are discussed below the histograms.

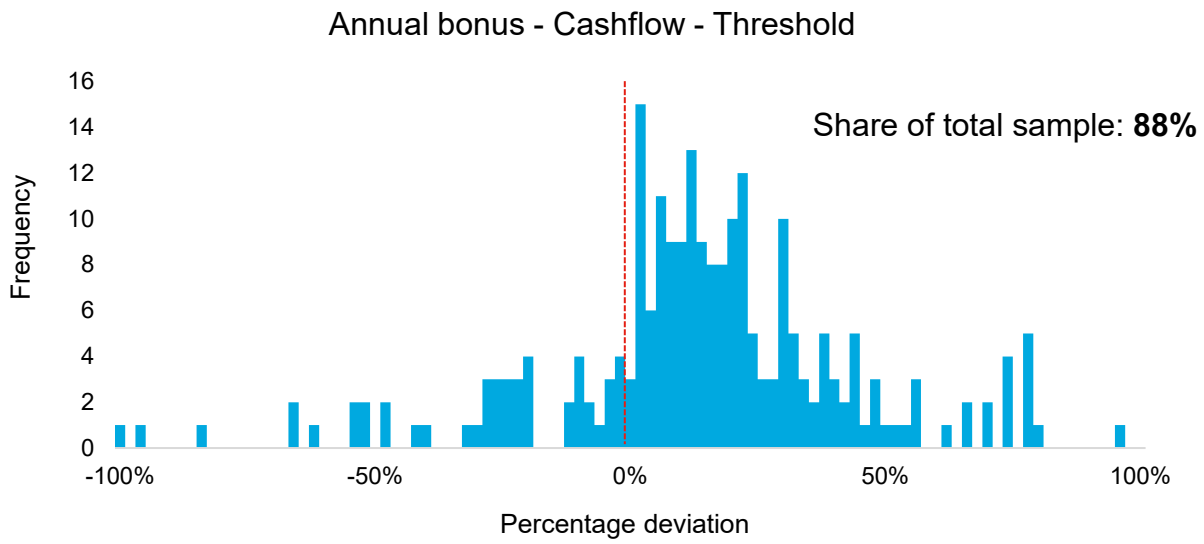
Figure A.C.6: Target deviation distributions for prevalent annual bonus target categories (relative to threshold payout and maximum payout targets)

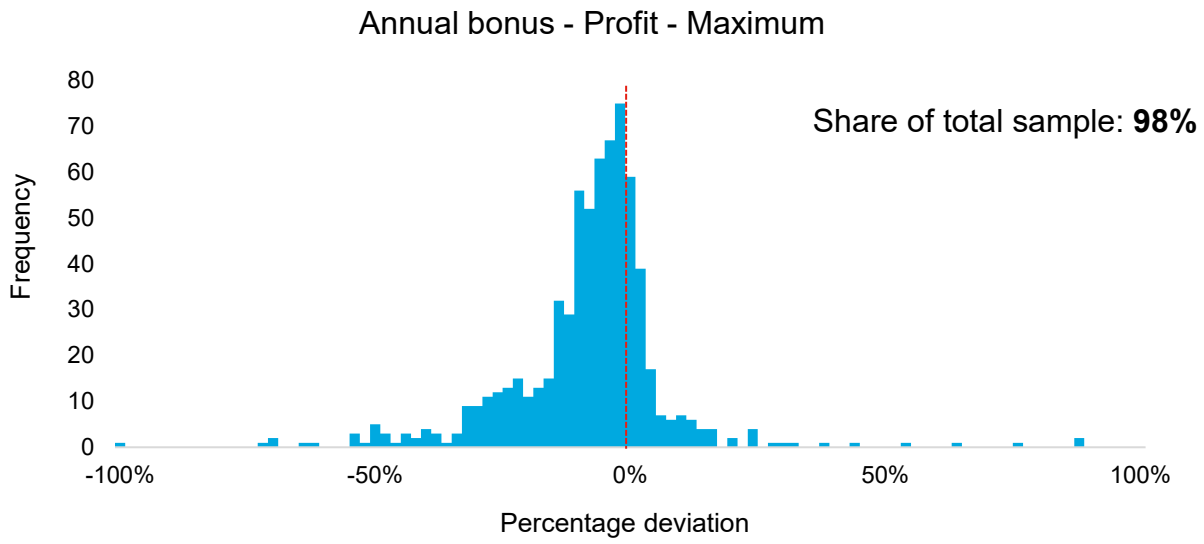


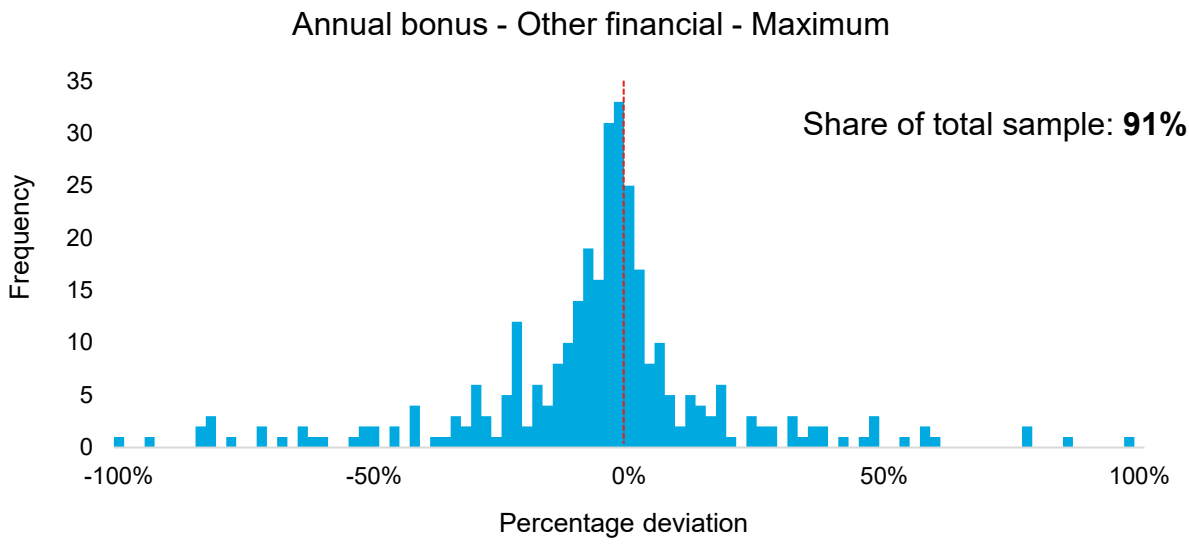

Annual bonus - Other financial - Threshold
Share of total sample: 86%
Frequency
25
20
15
10
5
0
-100%
-50%
0%
50%
100%
Percentage deviation

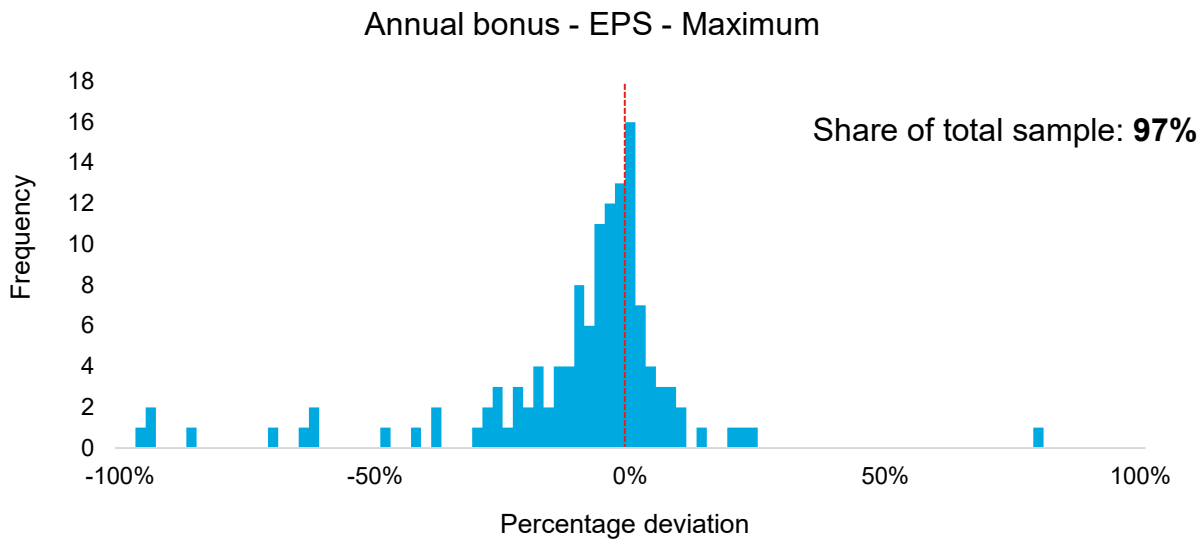

Annual bonus - EPS - Threshold
Share of total sample: 92%
Frequency
16
14
12
10
8
6
4
2
0
-100%
-50%
0%
50%
100%
Percentage deviation

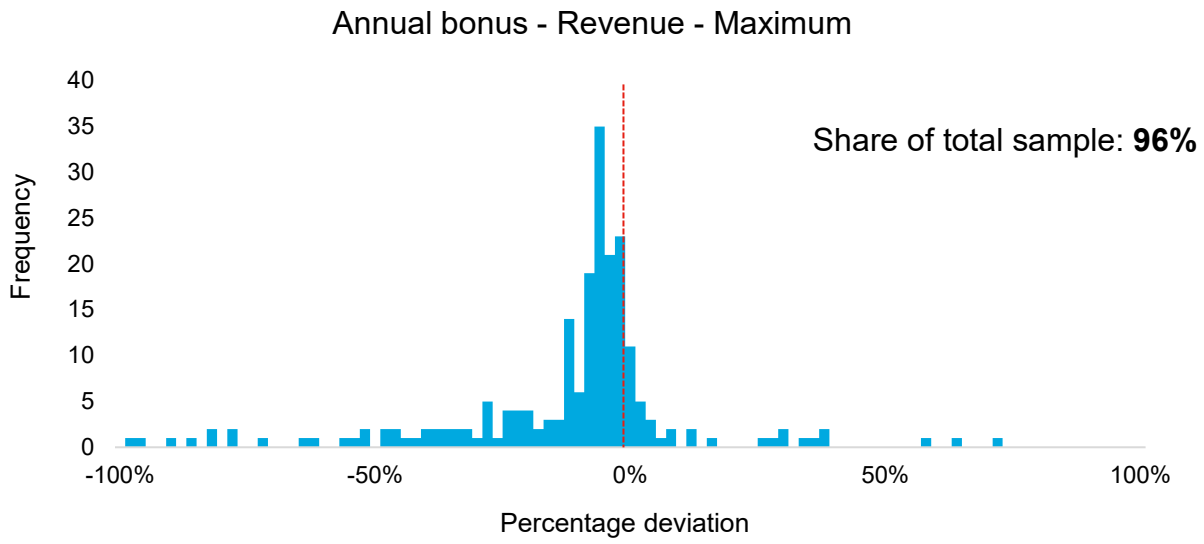

Annual bonus - Revenue - Threshold
Share of total sample: 87%
Frequency
35
30
25
20
15
10
5
0
-100%
-50%
0%
50%
100%
Percentage deviation


Annual bonus - Cashflow - Threshold
Share of total sample: 88%
Frequency
16
14
12
10
8
6
4
2
0
-100%
-50%
0%
50%
100%
Percentage deviation


Annual bonus - Profit - Maximum
Share of total sample: 98%
Frequency
80
70
60
50
40
30
20
10
0
-100%
-50%
0%
50%
100%
Percentage deviation


Annual bonus - Other financial - Maximum
Share of total sample: 91%
Frequency
35
30
25
20
15
10
5
0
-100%
-50%
0%
50%
100%
Percentage deviation


Annual bonus - EPS - Maximum
Share of total sample: 97%
Frequency
18
16
14
12
10
8
6
4
2
0
-100%
-50%
0%
50%
100%
Percentage deviation


Annual bonus - Revenue - Maximum
Share of total sample: 96%
Frequency
40
35
30
25
20
15
10
5
0
-100%
-50%
0%
50%
100%
Percentage deviation

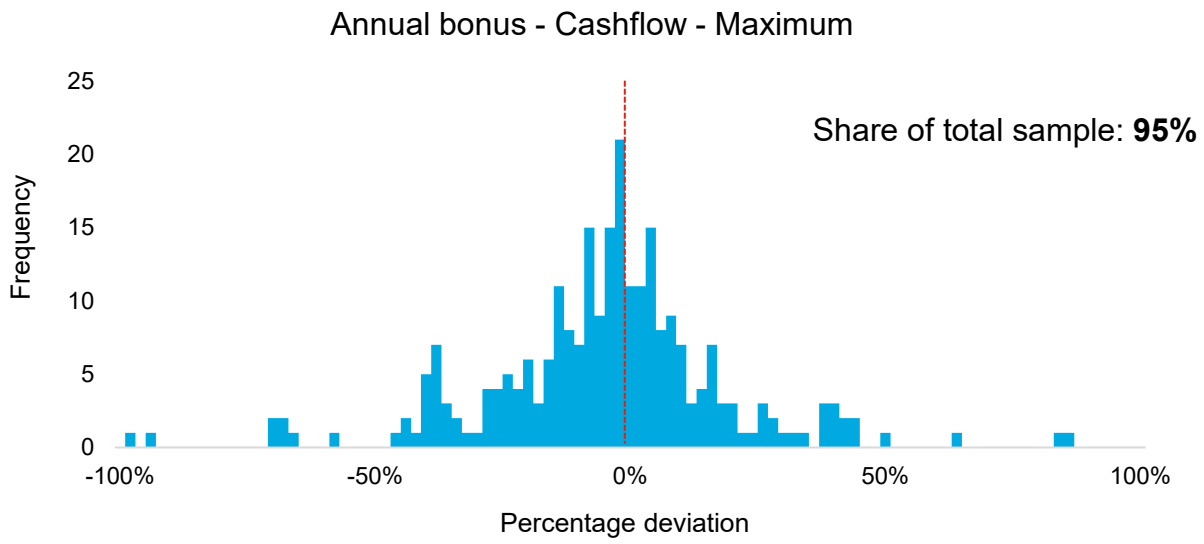
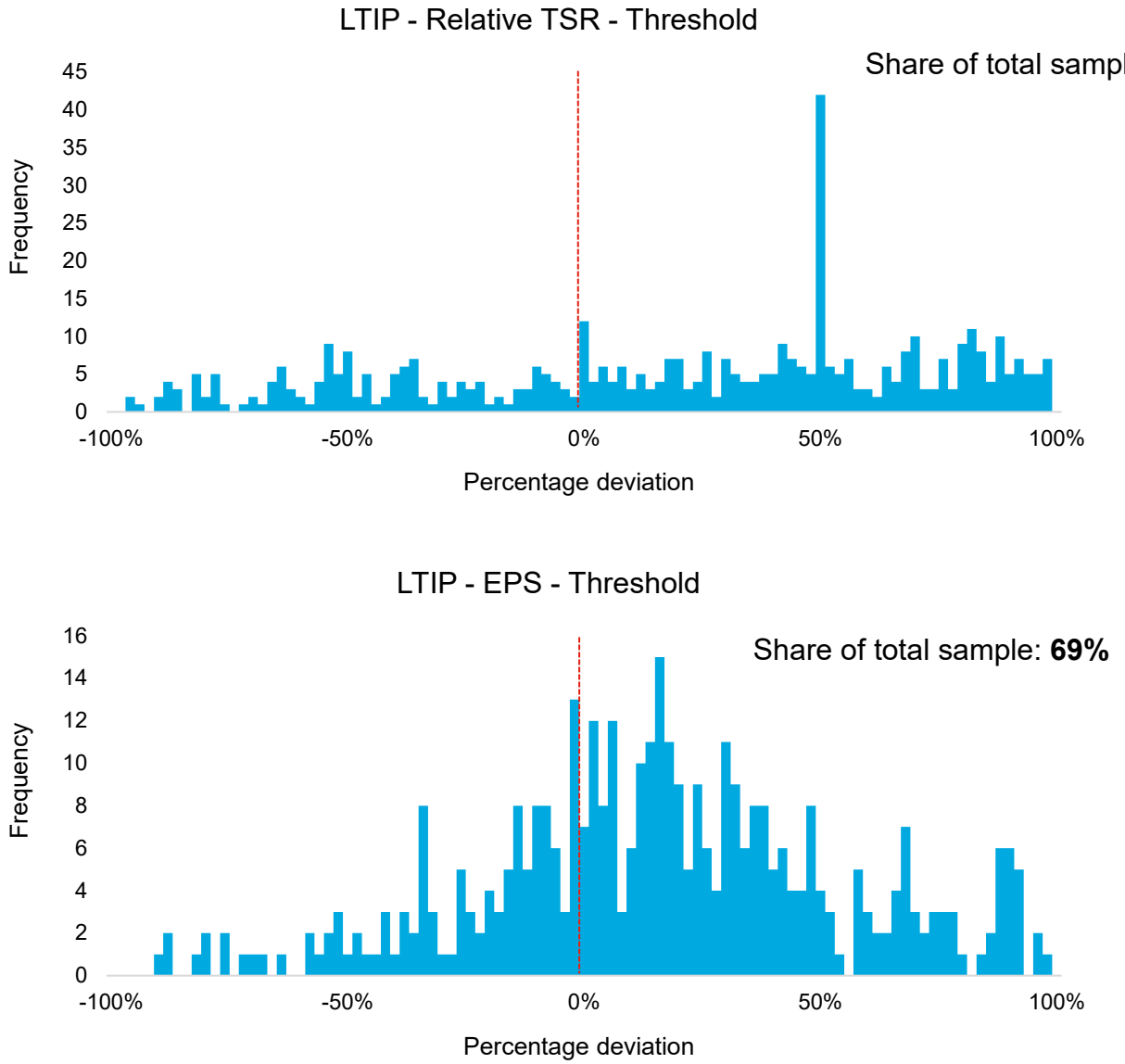
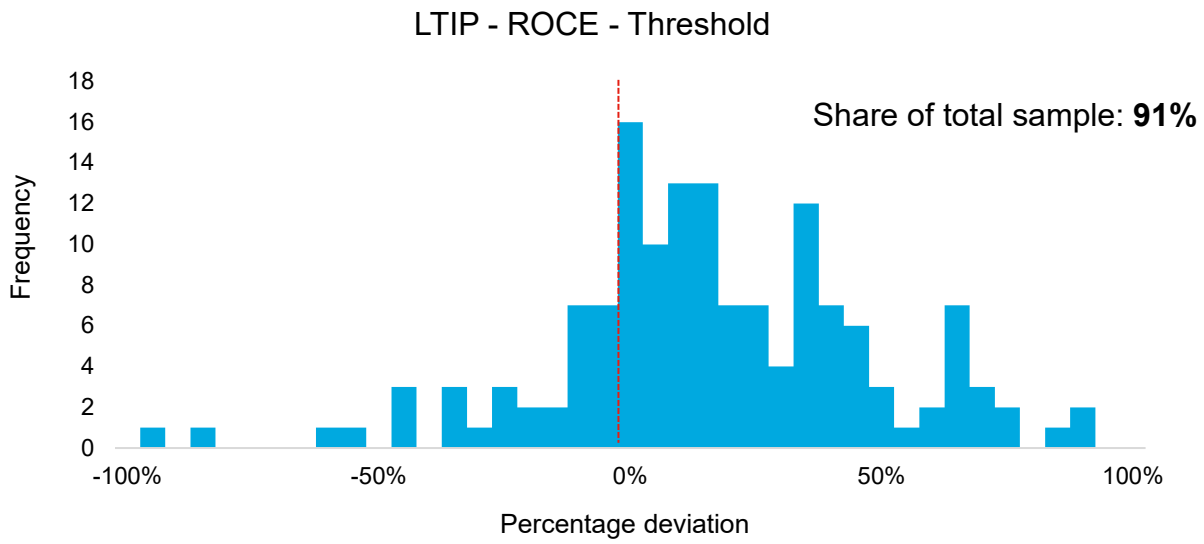
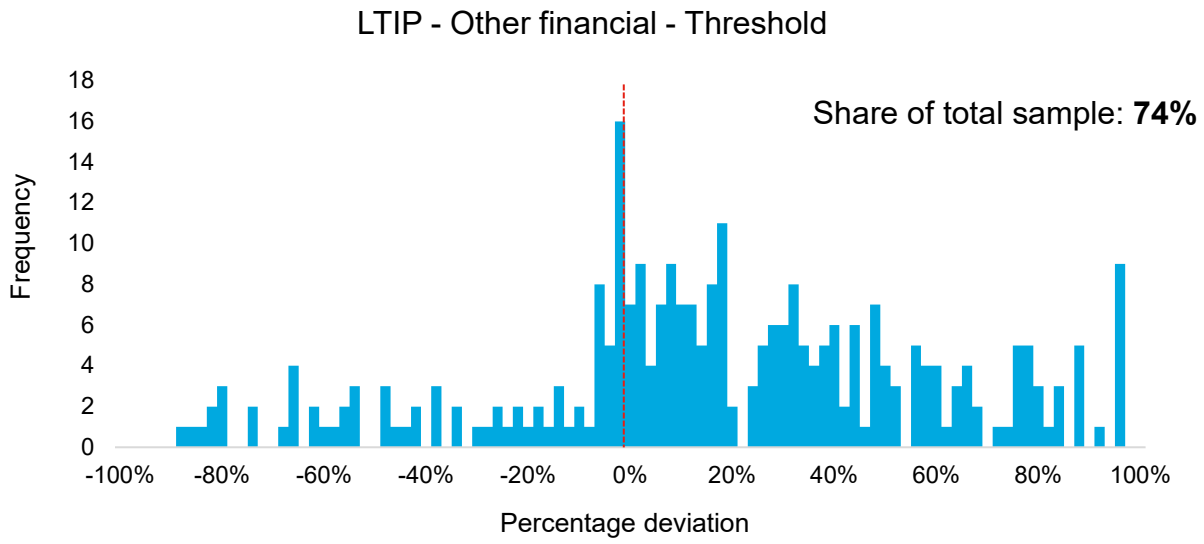
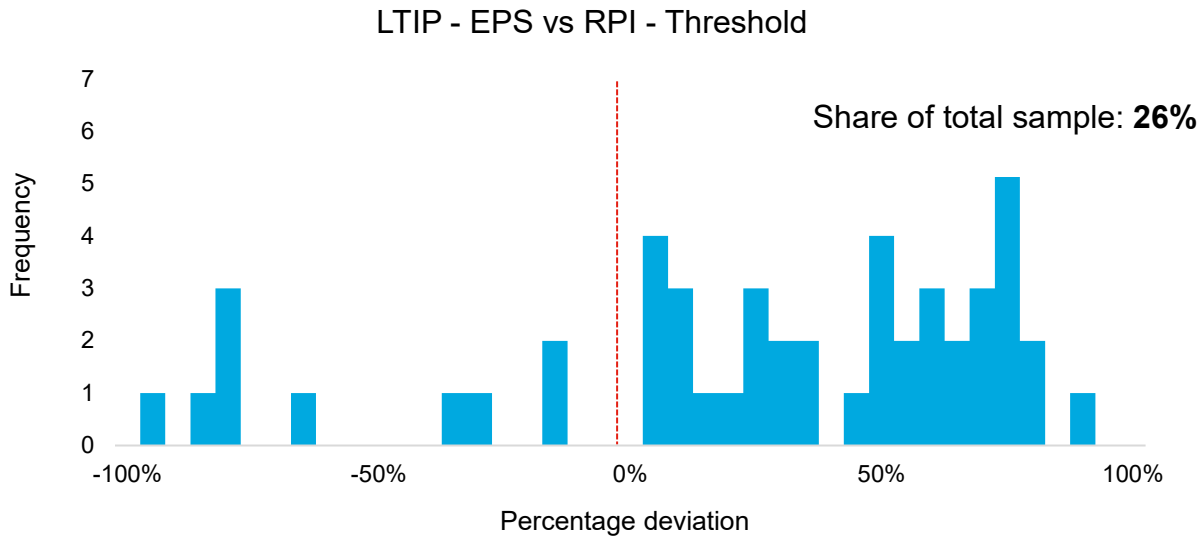

Annual bonus - Cashflow - Maximum
Share of total sample: 95%
Frequency
25
20
15
10
5
0
-100%
-50%
0%
50%
100%
Percentage deviation

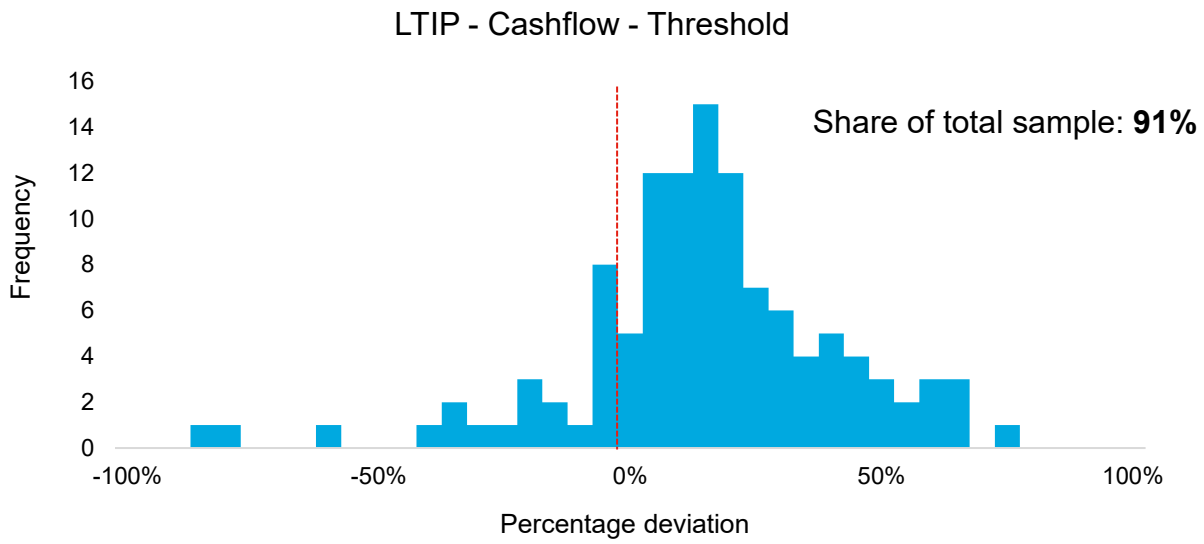
Figure A.C.7: Target deviation distributions for prevalent LTIP target categories (relative to threshold payout and maximum payout targets)

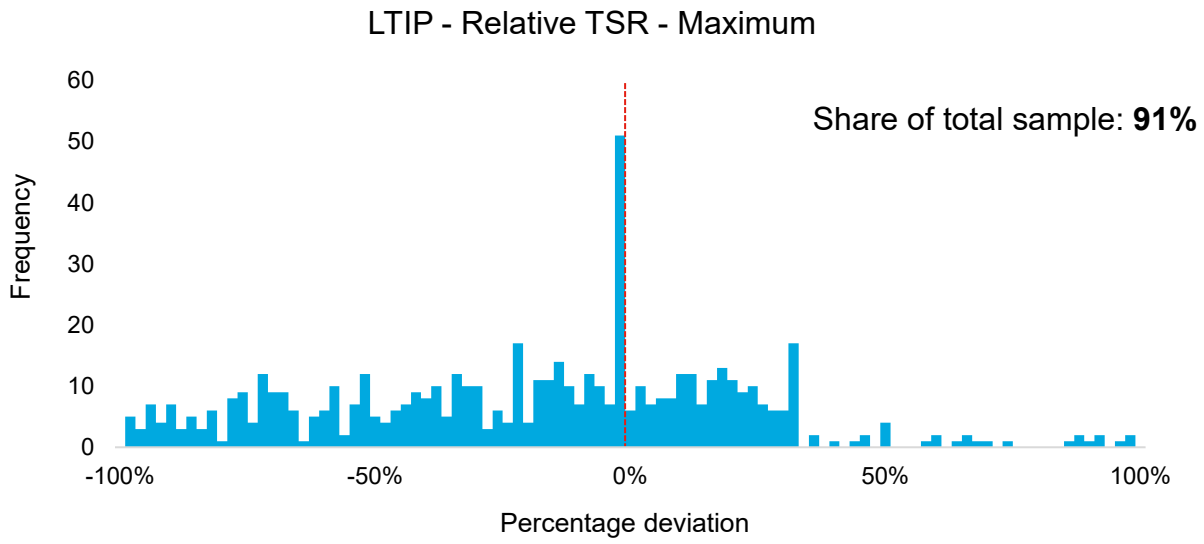


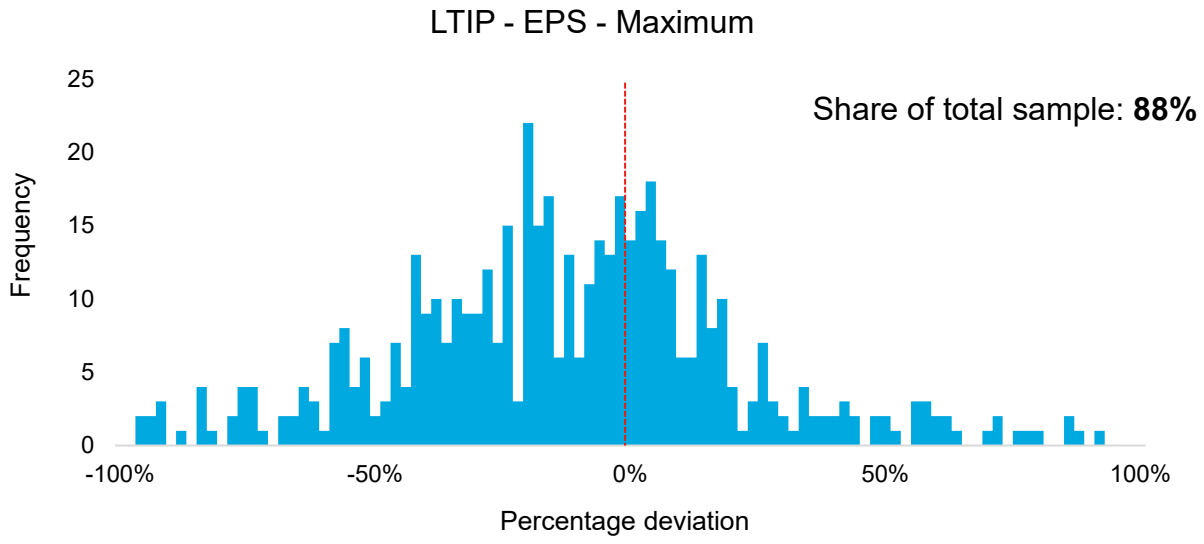

LTIP - ROCE - Threshold
Share of total sample: 91%
Frequency
18
16
14
12
10
8
6
4
2
0
-100%
-50%
0%
50%
100%
Percentage deviation

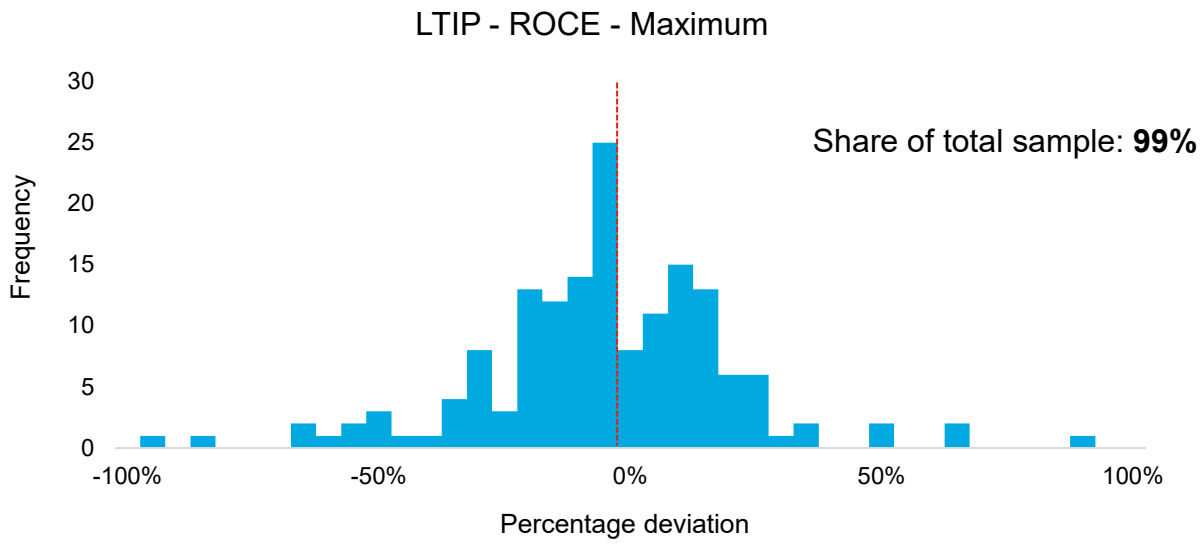

LTIP - Other financial - Threshold
Share of total sample: 74%
Frequency
18
16
14
12
10
8
6
4
2
0
-100%
-80%
-60%
-40%
-20%
0%
20%
40%
60%
80%
100%
Percentage deviation

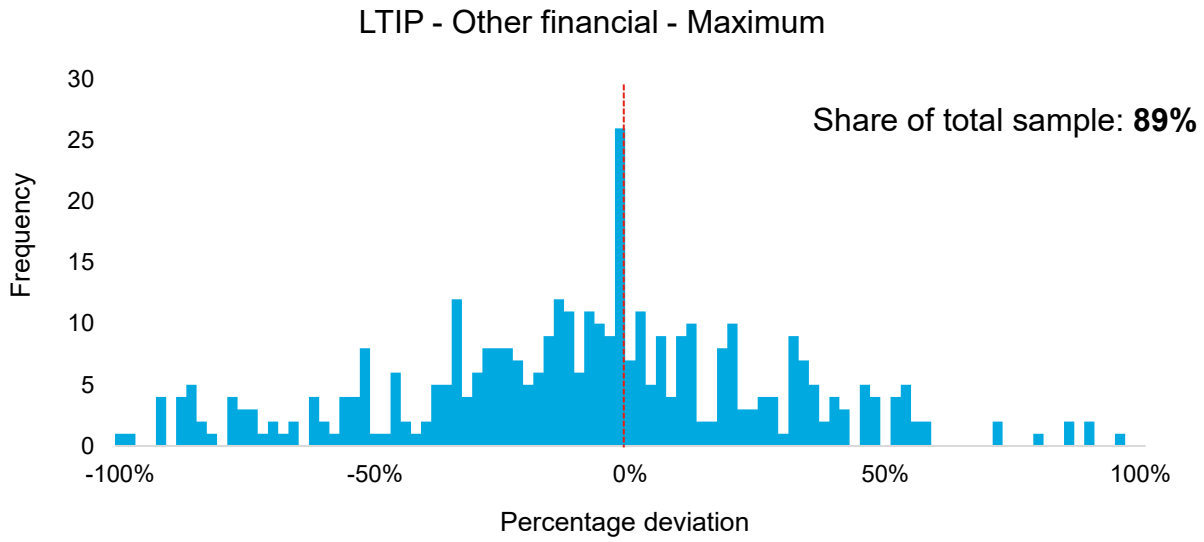

LTIP - EPS vs RPI - Threshold
Share of total sample: 26%
Frequency
7
6
5
4
3
2
1
0
-100%
-50%
0%
50%
100%
Percentage deviation

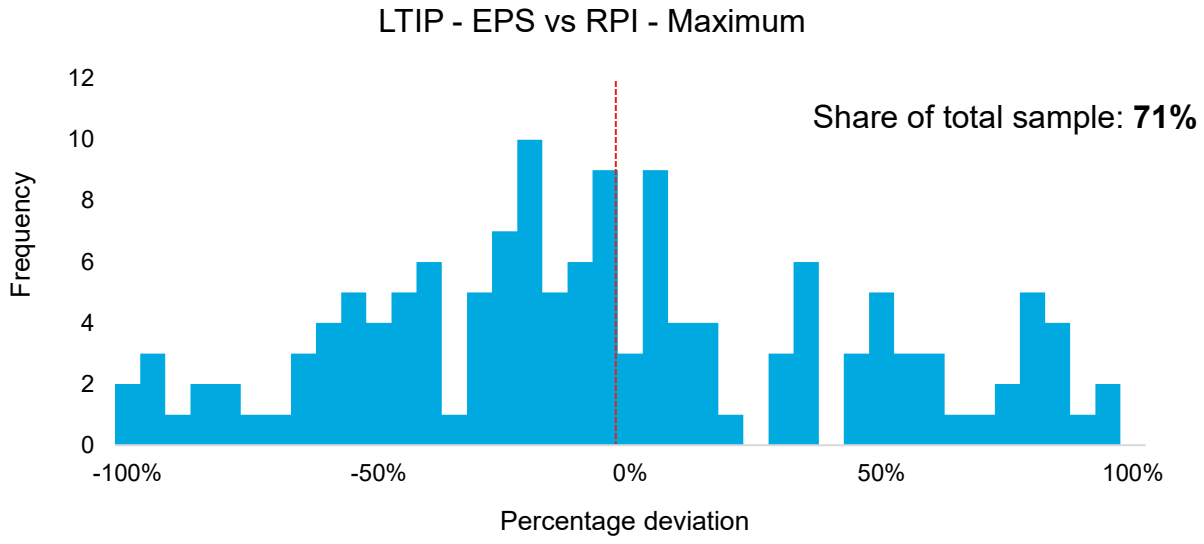

LTIP - Cashflow - Threshold
Share of total sample: 91%
Frequency
16
14
12
10
8
6
4
2
0
-100%
-50%
0%
50%
100%
Percentage deviation

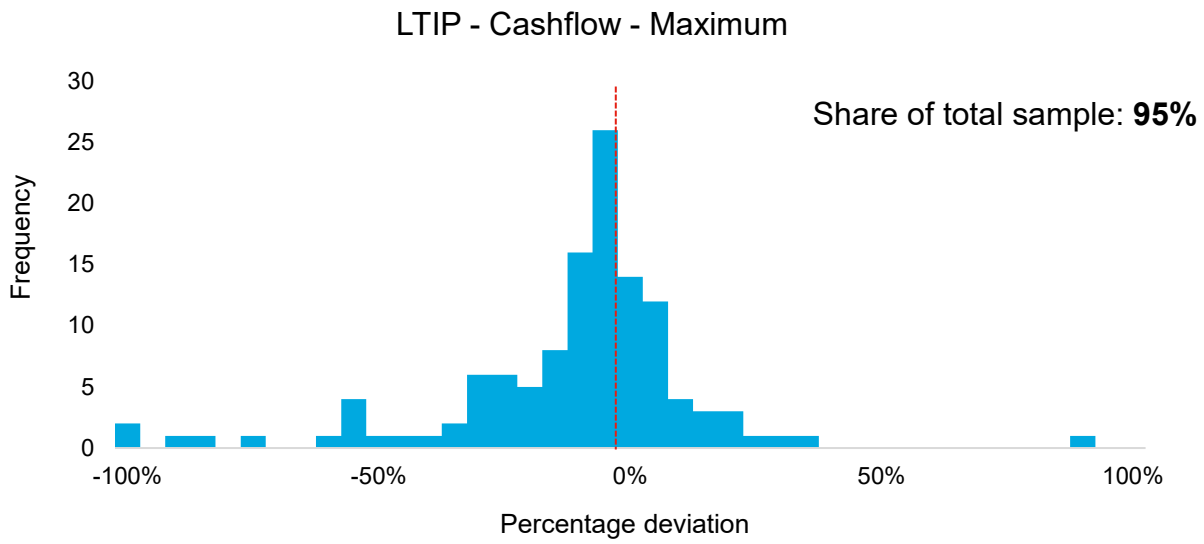

LTIP - Relative TSR - Maximum
Share of total sample: 91%
Frequency
60
50
40
30
20
10
0
-100%
-50%
0%
50%
100%
Percentage deviation


LTIP - EPS - Maximum
Share of total sample: 88%
Frequency
25
20
15
10
5
0
-100%
-50%
0%
50%
100%
Percentage deviation


LTIP - ROCE - Maximum
Share of total sample: 99%
Frequency
30
25
20
15
10
5
0
-100%
-50%
0%
50%
100%
Percentage deviation


LTIP - Other financial - Maximum
Share of total sample: 89%
Frequency
30
25
20
15
10
5
0
-100%
-50%
0%
50%
100%
Percentage deviation


LTIP - EPS vs RPI - Maximum
Share of total sample: 71%
Frequency
12
10
8
6
4
2
0
-100%
-50%
0%
50%
100%
Percentage deviation



Note on the LTIP histograms for EPS vs RPI target category

The deviation distributions for EPS vs. RPI targets are noticeably broad-based relative to the other LTIP categories, and there are significantly more observations captured in the maximum deviation distribution compared to the threshold deviation distribution. These findings arise because EPS vs. RPI targets measure EPS performance relative to RPI inflation, and therefore it is most common for these targets to be expressed in terms of compound annual EPS growth. This means that the threshold payout target is typically a small (positive) percentage figure, which results in the maximum payout often being well over 100% of this threshold payout. Similarly, when performance exceeds the threshold payout by several percentage points, this can lead to very large percentage deviations being recorded in our histogram analysis. This ultimately means that the threshold deviation histogram captures only a minority of the relevant target deviation observations (26%), as many of these deviations exceed +100% and are not captured through the histogram. By contrast, the maximum deviation histogram captures a much larger share of the total observed deviations (71%), although this is still small relative to the share captured for other target categories (typically 85%-100%). The same phenomenon also explains why the maximum deviation distribution is quite broad: even a small absolute difference between achieved performance and the maximum payout shows up as a substantial percentage deviation in the histogram.

The McCrary (2008) test tests for discontinuities in the density of a variable which could suggest manipulation.[76] The test assumes the null hypothesis that the variable has a continuous distribution and tests for whether there is a discontinuity at a chosen cut-off point.

[76] McCrary, J. (2008). 'Manipulation of the running variable in the regression discontinuity design: A density test' *Journal of Econometrics*, 142, pp.698-714.

Given that we are testing for discontinuities around the threshold and maximum payout performance levels in the target deviation series, we take the cut-off point as zero.

Table A.C.8 below presents the p-values for the McCrary (2008) test for each target category at the threshold and maximum payout performance level. A p-value below 0.050 indicates a statistically significant discontinuity in the distribution at the 95% significance level.

Table A.C.8: McCrary (2008) test p-values

Target	Threshold	Maximum
Annual bonus - profit	0.000	0.180
Annual bonus - other financial	0.000	0.871
Annual bonus - EPS	0.000	0.701
Annual bonus - revenue	0.000	0.000
Annual bonus - cashflow	0.000	0.598
LTIP - relative TSR	0.003	0.000
LTIP - EPS	0.024	0.035
LTIP - ROCE	0.014	0.359
LTIP - other financial	0.009	0.091
LTIP - EPS vs RPI	0.313	0.671
LTIP - cashflow	0.103	0.633

These results show that there is strong evidence of discontinuities around the threshold payout for all annual bonus categories, with the McCrary test being rejected at the 99% significance level. This is consistent with the annual bonus histograms presented above, which show clear asymmetries around the threshold. These results also show some evidence of threshold-based discontinuities for LTIP categories, although this is less statistically strong and less consistent across categories, which again aligns with our visual histogram evidence.

At the maximum payout, the McCrary test shows relatively little evidence of discontinuities across either annual bonus or LTIP categories.[77] For the annual bonus categories, this likely

[77] We note that there is statistically strong evidence of discontinuities in the LTIP relative TSR distributions, particularly for the distribution around maximum payout. This is strongly influenced by targeted spikes in the distribution, which reflect companies just hitting their threshold or maximum payout targets. As noted in Chapter 3, we believe there to be some truncation in the reporting of TSR performance, and therefore the TSR histograms (and by extension the McCrary test results) should be interpreted with additional caution relative to the others.

arises because there are a significant number of CEOs who just beat the maximum payout target, which weakens the case for discontinuities. The visual histogram evidence does suggest that clear asymmetries exist for annual bonus categories such as profit, other financial and EPS. However, these asymmetries occur above the maximum payout achievement point, and therefore they are not picked up in our McCrary test.[78] It is helpful to compare against the revenue distribution which follows a very similar shape, except that its asymmetry occurs just below the maximum payout achievement point. Our results show strong statistical evidence of asymmetry in this distribution.

[78] It is logical that asymmetries in the distribution around maximum payout could occur above the maximum payout achievement point, because CEOs do not have a strong disincentive to just exceed this point (whereas they have a stronger disincentive to significantly exceed this point).

Appendix D: Econometric analysis

This appendix provides further detail on our econometric analysis of CEO target performance and its relationships with investment, which supports the findings presented in Chapter 4 of this report. We first explain the types of econometric analysis we have conducted, including the econometric specifications and estimation approaches used. We then set out the detailed econometric results for each type of analysis. These results are more technical than those presented in Chapter 4, in that they incorporate coefficient estimates and statistical p-values.

Summary of our econometric analysis

As noted in Chapter 2 of this report, our research uses three main types of econometric analysis to investigate whether (and to what extent) CEO performance is associated with investment changes, whilst also testing for evidence of investment decisions that are intended to enhance CEO payout. These are as follows:

1. **Ex-post threshold analysis** investigates whether firms whose CEOs just hit targets undertook different investment growth compared to those whose CEOs just missed targets. If so, this might indicate that those executives made investment decisions based on their performance against targets.
2. **Ex-ante threshold analysis** investigates whether firms whose CEOs were on track to just miss targets (based on previous investment levels) undertook different investment growth compared to those whose CEOs were on track to just hit their targets. This might indicate that during the year executives who were on track to just hit or just miss targets made investment decisions in an attempt to alter their performance against targets.
3. **General regression analysis** of the link between the size and presence of different executive performance targets and different measures of investment. This is to test a more general hypothesis that executive pay design creates incentives that influence investment.

In this appendix, we also present a fourth analysis, which investigates the extent to which CEO performance targets act as de-facto base pay, and whether CEOs' broader pay contracts account for the relative difficulty of meeting their performance targets. This is designed to test whether CEO pay packages are rationally calibrated, such that the base salary is adjusted to take into account the relative difficulty of hitting the performance targets contained within the annual bonus or LTIP.

Table A.D.1 provides a high-level summary of these four analyses, outlining their respective scope and intended purpose.

Table A.D.1: Summary of econometric analyses in this report

Name	Focus	Core Hypothesis	Variables
Ex-post threshold analysis	CEOs who perform just above or just below their threshold and maximum payout targets	Do firms whose CEOs just hit their payout targets invest differently from firms whose CEOs just miss, thereby securing the desired CEO performance outcomes?	Key dependent variables: Investment (annual change) and accruals (level) Key independent variable: Indicator for ex-post performance (1 if target achieved, 0 otherwise)
Ex-ante threshold analysis	CEOs who perform just above or just below their threshold and maximum payout targets	Do firms whose CEOs are set to hit their payout targets invest differently from firms whose CEOs are set to just miss?	Key dependent variable: Investment (annual change) Key independent variable: Indicator for ex-ante performance (1 if target achieved, 0 otherwise)
General regression analysis	All CEOs, regardless of how they perform against pay targets	Does the use of particular performance targets encourage lower (or higher) investment? Do more financially material targets lead to lower (or higher) investment?	Key dependent variables: Investment (annual change) and accruals (level) Key independent variables: Indicator for target category presence; Target size (share of total CEO contract)
De-facto base pay analysis	All CEOs, regardless of how they perform against pay targets	Do CEOs' pay contracts account for the relative difficulty of meeting their performance targets?	Key dependent variables: CEO base salary (absolute) and CEO fixed pay (relative to annual bonus / LTIP pay) Key independent variable: Expected value of annual bonus / LTIP (absolute and expected vesting share)

We now set out the econometric specifications used to perform each of the four analyses above. For each analysis, we also explain the econometric estimation approach used to derive our results.

Econometric specifications and estimation approaches

Ex-post threshold analysis - econometric specification

Our baseline econometric specification can be expressed as follows:

$$\Delta INV_{i,t} = \alpha + \beta MEETEXPOST_{i,t} + \delta CONTROLS_{i,t} + \varepsilon_{i,t}$$

where $\Delta INV_{i,t}$ measures the year-on-year change in scaled investment[79] in firm i at time t, and $MEETEXPOST_{i,t}$ is an ex-post indicator that equals 1 if the CEO of firm i hits the target in time t, and 0 otherwise. $\delta CONTROLS_{i,t}$represents a series of control variables, which together control for time, industry characteristics and firm-level characteristics.

Alongside our baseline specification, we also estimate an augmented specification which examines whether the shape of the CEO's payout profile affects the strength of the relationship between ex-post target achievement and investment. This is designed to test whether a large payout discontinuity at the threshold performance level strengthens (or weakens) CEOs' propensity to engage in investment decisions that enhance their payout. To measure this, we include an interaction indicator variable which interacts ex-post target achievement with an indicator for whether the CEO in question has a large threshold discontinuity in their payout profile.

Our augmented econometric specification can be expressed as follows:

$$\Delta INV_{i,t} = \alpha + \beta_1 MEETEXPOST_{i,t} + \beta_2 PROFILE_{i,t} + \delta CONTROLS_{i,t} + \varepsilon_{i,t}$$

where $PROFILE_{i,t}$ is an indicator variable that equals 1 only when the CEO meets their performance target on an ex-post basis (i.e. the $MEETEXPOST_{i,t}$variable takes value 1) *and* the vesting share of that target is greater than 10% at the threshold payout level. If either (or both) of these conditions is not met, then the $PROFILE_{i,t}$variable takes a value of 0. $\delta CONTROLS_{i,t}$ is unchanged from our baseline specification presented above.

Ex-ante threshold analysis - econometric specification

Our baseline econometric specification can be expressed as follows:

$$\Delta INV_{i,t} = \alpha + \beta MEETEXANTE_{i,t} + \delta CONTROLS_{i,t} + \varepsilon_{i,t}$$

where $\Delta INV_{i,t}$ measures the year-on-year change in scaled investment in firm i at time t, and $MEETEXANTE_{i,t}$ is an ex-ante indicator variable that equals 1 if the CEO of firm i narrowly beats the studied target at time t assuming investment remains unchanged from the previous year, and 0 if they narrowly miss it. $\delta CONTROLS_{i,t}$represents a series of control variables, which together control for time, industry characteristics and firm-level characteristics.

[79] Scaled investment refers to investment divided by lagged total assets for firm i at time t.

As for the ex-post analysis, we also estimate an augmented specification which examines whether the shape of the CEO's payout profile affects the strength of the relationship between ex-ante target achievement and investment. This is constructed in an almost identical way.

Our augmented econometric specification can be expressed as follows:

$$\Delta INV_{i,t} = \alpha + \beta_1 MEETEXANTE_{i,t} + \beta_2 PROFILE_{i,t} + \delta CONTROLS_{i,t} + \varepsilon_{i,t}$$

where $PROFILE_{i,t}$ is an indicator variable that equals 1 only when the CEO meets their performance target on an ex-ante basis (i.e. the $MEETEXANTE_{i,t}$variable takes value 1) *and* the vesting share of that target is greater than 10% at the threshold payout level. If either (or both) of these conditions is not met, then the $PROFILE_{i,t}$variable takes a value of 0. $\delta CONTROLS_{i,t}$ is unchanged from our baseline specification presented above.

Threshold (ex-post and ex-ante) analysis - econometric estimation approach

For both of the threshold econometric analyses, we apply the same estimation approach.

- Our rationale for measuring the scaled **year-on-year change** in investment, rather than the scaled level of investment, is that we consider the change in investment to be less affected by unobservable cross-firm differences than the level. For example, it may be that our control variables (and our normalisation of investment, to account for lagged total assets) fail to adequately capture the positive effect of firm size on investment levels. This would lead to potential omitted variable bias in our estimates if we used the level of investment as our dependent variable. By contrast, scaled year-on-year changes in investment are likely to be less correlated with firm size.
- The use of investment changes (rather than investment levels) as our dependent variable also controls for any unobservable time-invariant fixed effects in investment at the firm level.
- Since our threshold analysis focuses only on those CEOs (and firms) which either *just hit* or *just missed* a performance target, there should in principle be no systematic differences between those firms either side of the target achievement divide. This follows from the idea that target achievement outcomes are effectively random within this sample. However, in practice we realise that there may be some differences in characteristics between our just hit and just missed samples. This is especially true in cases where the definition of just hit and just missed covers quite a substantial performance range (which we discuss later in this appendix). For these reasons, we include time, industry and firm-level controls to isolate the effect of CEO target performance on investment changes.
- We use the pooled Ordinary Least Squares (OLS) estimator to derive coefficient estimates for the above regressions. Given that we only have limited year coverage for some of the firms in our sample, this approach allows for a greater sample size than panel data estimators which exploit within-firm variation (such as the first-difference or

fixed-effects estimators).[80] This reduces the chance of selection bias in our sample, whilst also increasing the amount of variation we can capture. Overall, this improves the inference that can be drawn from our results.

- However, we do not use standard OLS assumptions to derive the standard errors used to evaluate the statistical significance of our results. Instead, we use a pairwise bootstrap procedure to estimate standard errors, construct confidence intervals and interpret the statistical significance of our findings. We chose this approach after running diagnostic tests on our estimated models, which assessed whether the estimated residuals follow the required behaviours for OLS estimation to be efficient. These tests found that whilst our residuals sometimes satisfied the homoscedasticity assumption, they were not normally distributed.[81] As a result, we opted to use bootstrapped standard errors.

General econometric analysis - econometric specification

Our econometric specification can be expressed as follows:

$$INV_{i,t} = \alpha + \beta TARGETIND_{i,t} + \delta CONTROLS_{i,t} + \varepsilon_{i,t}$$

$$INV_{i,t} = \alpha + \gamma TARGETSIZE_{i,t} + \delta CONTROLS_{i,t} + \varepsilon_{i,t}$$

where $INV_{i,t}$ is either the change in scaled investment undertaken by firm i at time t or the level of scaled accruals for firm i at time t, $TARGETIND_{i,t}$ refers to an indicator which takes the value 1 when a target category is present in the executive pay contract for firm i at time t, and 0 otherwise, and $TARGETSIZE_{i,t}$ measures the size of the incentive (share of total CEO pay under maximum pay conditions) associated with that target for firm i at time t.

We also include controls for industry fixed effects, time effects, firm-specific determinants of investment and CEO characteristics in order to isolate the impact of the size and presence of executive pay targets on investment. This is captured through the term $\delta CONTROLS_{i,t}$ above.

Note that we estimate separate regressions for the presence and size of target categories respectively. This is because of the strong correlations between these two measures for each category (over 0.75), which means that including both of these variables within the same

[80] An additional advantage of using pooled OLS estimation is that it allows us to model industry effects and thereby separate these from firm-level fixed effects. Under a within-firm panel estimator, these industry effects would tend to be lost (and effectively bundled together with firm-level fixed effects), as for most firms industry classification does not change over time.

[81] Specifically, we ran two diagnostic tests to assess whether our estimated residuals satisfied certain econometric properties. We ran a Shapiro-Wilk test to assess the normality of the error distribution, and we found that the null hypothesis of normality was strongly rejected, indicating non-normality. We ran a Breusch-Pagan test to check the homoscedasticity of the residuals, and we found that in some cases the null hypothesis was not rejected, indicating that the homoscedasticity assumption is satisfied. However, in many cases the null hypothesis was strongly rejected, indicating that the assumption of homoscedasticity is often not satisfied.

regression could lead to collinearity problems. If realised, these problems would result in large variances and a lack of statistical power in the estimated model.

Each of the target presence and target size regressions combines one of our five dependent variables with either (i) target presence indicators or (ii) target size variables for **all** of the prevalent annual bonus and LTIP target categories we have selected. We provide further details of which target categories we analyse in the Empirical calibration section below.

General econometric analysis - econometric estimation approach

Our general econometric analysis follows a broadly similar estimation approach to the threshold analysis described above.

- As done for the threshold analysis, we use the pooled Ordinary Least Squares (OLS) estimator to derive coefficient estimates for the above regressions. Given that we only have limited year coverage for some of the firms in our sample, this approach allows for a greater sample size than panel data estimators which exploit within-firm variation. This reduces the chance of selection bias in our sample, whilst also increasing the amount of variation we can capture. Overall, this improves the inference that can be drawn from our results.
- Our pooled OLS specification is also robust to both industry and time effects, whereas panel fixed-effects estimators do not typically control for time effects, and coefficient estimates can be biased due to their omission.
- Our use of a difference-level specification (when the dependent variable is an investment measure, and not an accruals measure) additionally enables us to control for industry and time effects in the *difference* of investment, as well as any firm-level fixed effects in the *level* of investment. This allows us to effectively capture all the robustness advantages from using a fixed-effects estimator, while also benefiting from a significantly larger sample size.
- We do not use standard OLS assumptions to derive the standard errors used to evaluate the statistical significance of our results. This decision was taken after conducting diagnostic tests on the residuals from our estimated models. Instead, as done for the threshold econometric analysis, we use a pairwise bootstrap procedure to estimate standard errors, construct confidence intervals and interpret the statistical significance of our findings.

An important limitation of our general econometric analysis is that it cannot uncover whether relationships between (i) target presence and/or size and (ii) investment are causal, i.e. the presence and/or size of particular targets *causes* lower investment. Unlike the threshold analysis, our general analysis can only tell us whether a correlation exists between these variables. This is because there are reasons why causality might follow the opposite direction: for example, low investment might encourage a firm towards using (or amplifying) a particular type of target. Alternatively, there may be omitted variables which drive both investment

decisions and target selection decisions. All results from our general econometric analysis must be assessed with this caveat in mind.

De-facto base pay analysis - econometric specification

Our econometric specification in levels can be expressed as follows:

$$SALARY_{i,t} = \alpha + \beta EXPECTEDVALUE_{i,t} + \delta CONTROLS_{i,t} + \varepsilon_{i,t}$$

where $SALARY_{i,t}$ measures the CEO base salary for firm i at time t, and $EXPECTED\ VALUE_{i,t}$ is the expected value of the annual bonus or LTIP. This is calculated by multiplying the expected vesting share of the annual bonus or LTIP by the maximum potential value of the annual bonus or LTIP. We explain this concept further in the paragraphs below.

The $\delta CONTROLS_{i,t}$ term captures a set of control variables, which capture time effects, industry fixed effects and firm scale effects. The controls for firm scale effects are particularly important, as a major determinant of CEO salary (in monetary terms), as well as the expected value of the annual bonus or LTIP (also in monetary terms), is the size of the firm.

For context, the expected vesting share of the annual bonus or LTIP is the sum of the expected vesting shares for each constituent target. The expected vesting share of a target is given by the weight of the target multiplied by the average achieved vesting share for that category of target across all firms.

We also estimate our specification in differences, by regressing the change in CEO salary on the change in expected value of the annual bonus or LTIP. This allows us to account for unobservable firm-level fixed effects which may be correlated with both the expected value of the annual bonus or LTIP, and base salary.

Our econometric specification in differences can be expressed as follows:

$$\Delta SALARY_{i,t} = \alpha + \beta \Delta EXPECTEDVALUE_{i,t} + \delta CONTROLS_{i,t} + \varepsilon_{i,t}$$

where $\Delta SALARY_{i,t}$ measures the change in CEO base salary since the previous year for firm i at time t, and $\Delta EXPECTED\ VALUE_{i,t}$ is the change in the expected value of the annual bonus or LTIP since the previous year for firm i at time t.

Additionally, we test a further econometric specification which examines the size of the CEO's fixed pay relative to the maximum potential value of the annual bonus or LTIP payout, and compares this against the expected vesting share of the annual bonus or LTIP.[82] The key

[82] It should be noted that the maximum potential value of the annual bonus and LTIP is pre-recorded within the PwC executive pay database, and this has not been calculated. Under UK legislation, large and medium sized firms are required to report the maximum pay receivable for each director (including the CEO). As well as providing a total pay estimate, firms must decompose this into (i) fixed pay, (ii) pay linked to short-term incentives (including annual bonuses) and (iii) pay linked to long-term incentives (including LTIPs). It is these values which are used in the de-facto base pay analysis.

advantage of this 'fractions' specification is that it allows us to avoid absolute (monetary) values for fixed pay and the annual bonus or LTIP, and instead analyse standardised proportions which are more comparable across firms. This is comparable to scaling investment by lagged total assets in our threshold and general econometric analysis.

Our econometric specification in fractions can be expressed as follows:

$$MAXPAYRATIO_{i,t} = \alpha + \beta EXPECTEDVESTING_{i,t} + \delta CONTROLS_{i,t} + \varepsilon_{i,t}$$

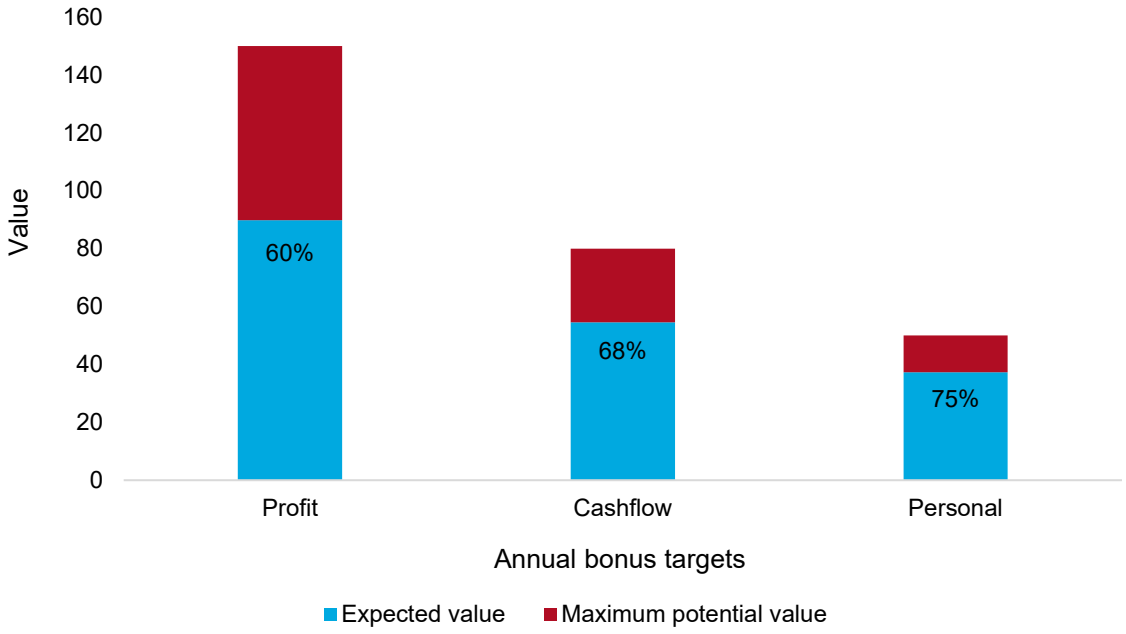
where $MAXPAYRATIO_{i,t}$ measures the ratio of CEO fixed pay to annual bonus or LTIP pay at maximum payout for firm i at time t, and $EXPECTED\ VESTING_{i,t}$ is the expected vesting share of the annual bonus or LTIP for firm i at time t. We explain the expected vesting share in the paragraphs above.

Conceptual note on the expected value of the annual bonus or LTIP

The annual bonus or LTIP acts as de-facto base pay if it has a high *expected* value. The expected value of the annual bonus or LTIP is the proportion of the maximum potential value of the annual bonus or LTIP that the executive can expect to achieve on average. A large maximum potential annual bonus or LTIP only acts as de-facto base pay if its constituent targets are easy to achieve and therefore executives can expect to earn a substantial proportion of the maximum potential value in a typical year.

In Figure A.D.2 below, we demonstrate the distinction between the expected value and maximum potential value. In this illustrative example the executive has an annual bonus composed of three target types: profit, cashflow and personal. The maximum potential value of the annual bonus is the sum of the maximum potential value of the three targets. The expected value of the annual bonus is the sum of the expected value of each target. The expected value of each target is the maximum potential value multiplied by the expected vesting share for that target. For example, the expected value of the profit target below is 60% of the maximum potential value. Across the three targets used in this example, the maximum potential value of the annual bonus is £280 but the expected value is £182.

Figure A.D.2: Illustration of the expected value of an annual bonus



Therefore, the extent to which the annual bonus or LTIP acts as de-facto base pay depends on the difficulty of hitting the constituent targets, the weight assigned to the constituent targets and the expected aggregate value of the annual bonus or LTIP relative to CEO base pay.

De-facto base pay analysis - econometric estimation approach

Our de-facto base pay analysis follows a broadly similar estimation approach to both the threshold and general econometric analysis described above.

- As done for our other econometric analyses, we use the pooled Ordinary Least Squares (OLS) estimator to derive coefficient estimates for the above regressions. Given that we only have limited year coverage for some of the firms in our sample, this approach allows for a greater sample size than panel data estimators which exploit within-firm variation. This reduces the chance of selection bias in our sample, whilst also increasing the amount of variation we can capture. Overall, this improves the inference that can be drawn from our results.
- Again, we do not use standard OLS assumptions to derive the standard errors used to evaluate the statistical significance of our results. This decision was taken after conducting diagnostic tests on the residuals from our estimated models. Instead, as done for the threshold and general econometric analysis, we use a pairwise bootstrap procedure to estimate standard errors, construct confidence intervals and interpret the statistical significance of our findings.

Empirical calibration of each analysis (performance target and investment variables studied, sample used and sensitivity testing)

Ex-post threshold analysis

A key aspect of calibrating our ex-post threshold analysis involves selecting appropriate target category and investment variables to study (with the target category being the independent variable and the investment variable being the dependent variable in our econometric specifications). Our selection of target categories was driven by the following criteria:

1. Prevalence of the target category within annual bonus and LTIP contracts
2. Availability of target deviation data to compute ex-post performance
3. Importance of the target category for overall CEO pay (as estimated through measures like achieved package share from our statistical analysis of executive pay data, which is presented in Chapter 3)
4. Presence of direct or indirect theoretical linkages between investment and target performance

After considering these factors holistically, we decided to focus our ex-post analysis on two target categories (profit targets within annual bonuses, and EPS targets within LTIPs). This decision was driven principally by the substantial availability of target deviation data for these target categories, which allows for relatively precise calibration of *just hit* and *just missed* performance (we discuss this further below). However, these target categories also have high prevalence and financial materiality within annual bonus and LTIP contracts.

We study the influence of these target categories on three investment measures, to test for whether target performance incentivises real earnings management. These measures, which we scale by lagged total assets, are:

- Capex
- Net investment
- R&D expenditure

We also study the influence of these target categories on two accounting-based earnings measures, to test for whether target performance incentivises accounting earnings management. These measures, which we scale by lagged total assets, are:

- Total accruals (change in net operating assets)
- Discretionary accruals (a component of total accruals, estimated using the Jones (1991) model)

For investment measures we take the scaled year-on-year change as the dependent variable in order to remove any unobservable time-invariant fixed effects at the firm level. However, for

accounting-based earnings measures, we take the scaled level of accruals in a given year as the dependent variable. The reason for this is that accruals can be considered akin to a flow variable, that is the default level returns to zero each year. Therefore, firm-specific fixed effects are unlikely to be present in measures of accruals.

Table A.D.3 below sets out the full list of independent variables, dependent variables and control variables used in our econometric analysis.

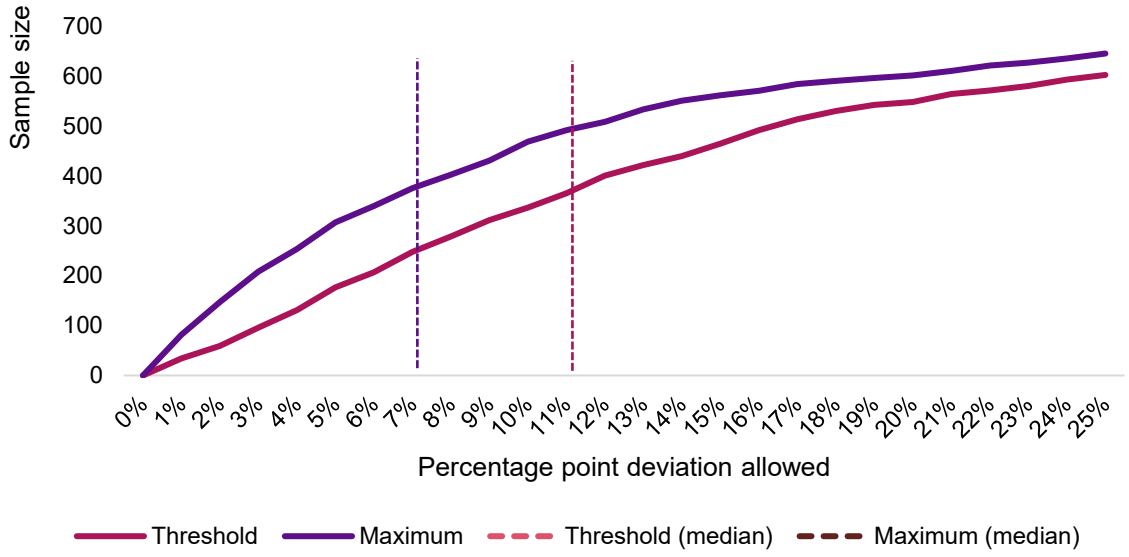
Table A.D.3: Full list of variables used in our ex-post econometric analysis

Dependent variables - measures scaled by lagged total assets	Independent variables - indicator of whether the target was hit or missed	Independent variables - controls
Capex (annual change) Net investment (annual change) R&D (annual change) Total accruals (level) Discretionary accruals (level)	Annual bonus: profit targets (threshold and maximum pay-out performance levels) LTIP: EPS targets (threshold and maximum pay-out performance levels)	Time effects ● Indicators for years 2014-2019 (2013 being the base year) Industry effects ● Energy ● Industrials ● Consumer discretionary ● Healthcare ● Financials ● Real estate ● Materials ● Communication services ● Information technology ● Consumer staples ● Utilities Firm financial effects ● Market capitalisation scaled by lagged total assets ● Market-to-book ratio

Having chosen the target category and investment variables to study, we must then select a suitable sample for the analysis. We use data for current FTSE All-Share firms from the 2013-2019 period. An important aspect of the threshold analysis involves defining those firms which *just hit* or *just missed* a particular reference target (either threshold payout or maximum payout), and including only those firms that fall within these boundaries. In doing so, we face a trade-off between capturing only those observations closest to the threshold payout or maximum payout level, and ensuring that we have a sufficiently large sample size to conduct robust analysis and draw meaningful conclusions.

Figure A.D.4 below demonstrates the trade-off for annual bonus profit target data, showing how the available sample size increases as the allowed deviation (measured as a percentage of the median deviation) from threshold and maximum payout targets is widened. Allowed deviation is expressed in absolute (i.e. positive) terms here for all observations.

Figure A.D.4: Available sample size versus allowed target deviation percentage for ex-post annual bonus profit performance



Specifically, we must choose allowed sample deviation windows which define where the boundaries of our *just hit* and *just missed* groups fall.

We set the allowed sample deviation windows just wide enough to give a sufficient sample size. Table A.D.5 below captures the allowed sample deviation windows chosen for the two targets studied in our ex-post analysis. For annual bonus profit targets, the windows are expressed in terms of the maximum allowed percentage point deviation between ex-post performance and the target. For LTIP EPS targets, the windows are expressed in terms of the maximum allowed absolute deviation between ex-post performance and the target.

Table A.D.5: Chosen sample deviation windows for ex-post econometric analysis

Target	Target type	Threshold pay-out: allowed deviation	Maximum pay-out: allowed deviation
Profit	Annual bonus	+/- 7.04% (65% of median deviation)	+/- 4.43% (65% of median deviation)
EPS	LTIP	+/- 0.05 (85% of median deviation)	+/- 0.05 (85% of median deviation)

We run both the baseline and augmented econometric specifications (described in the

previous sub-section) using the allowed deviation windows specified in Table A.D.5. However, we also test the sensitivity of our results to changes in these windows. By widening the allowed windows, we are able to increase the sample size for our ex-post regressions without allowing achieved performance to deviate too far from the reference target level (i.e. threshold payout or maximum payout).

We specifically run three sensitivity tests, with allowed deviation windows widened as follows. All of these sensitivity tests are applied to the augmented econometric specification, not the baseline specification.

1. +/- 100% of median deviation
2. +/- 150% of median deviation
3. +/- 200% of median deviation

The results of our ex-post econometric analysis are presented in the Econometric results sub-section below.

Ex-ante threshold analysis

The calibration of our ex-ante threshold analysis follows many similarities to our ex-post threshold analysis. In deciding which target category and investment variables to study, we are again guided by the same underlying criteria.

However, there are stronger data suitability requirements for our ex-ante analysis. This is because ex-ante performance cannot be directly observed and must be estimated, based on a direct assumed link between investment changes and target performance.[83] Although relationships between investment and target performance can often be indirect (or non-mechanical), the estimation of ex-ante performance requires a reasonably strong direct link to ensure sufficient robustness and minimise subjectivity.

As a result, our ex-ante analysis has a narrower scope than our ex-post analysis, and focuses exclusively on two target and investment variable combinations. Specifically, our analysis considers:

- The relationship between profit targets within annual bonuses and the change in R&D expenditure
- The relationship between cashflow targets within annual bonuses and the change in capex

Given that R&D expenditure affects profit and capex very often affects cashflow, with both of these relationships being one-for-one, our analysis assumes a direct trade-off (or negative relationship) between an additional £1 towards CEO target performance and an additional £1

[83] As a reminder, our ex-ante analysis estimates what target performance would have been in the absence of any material changes in investment.

expenditure on investment.[84] This is appropriate for profit and cashflow targets, given how these are typically expressed in absolute monetary terms.

This assumption means that where firms have significantly *increased* investment versus last year, estimated ex-ante performance is significantly *worse* than ex-post performance, and vice versa. The extent of this difference is determined by the year-on-year change in investment.

Table A.D.6 below sets out the full list of independent variables, dependent variables and control variables used in our econometric analysis.

Table A.D.6: Full list of variables used in our ex-ante econometric analysis

Dependent variables - measures scaled by lagged total assets	Independent variables - indicator of whether the target was hit or missed	Independent variables - controls
Capex (annual change) R&D (annual change)	Annual bonus: profit and cashflow targets (threshold and maximum pay-out performance levels)	Time effects ● Indicators for years 2014-2019 (2013 being the base year) Industry effects ● Energy ● Industrials ● Consumer discretionary ● Healthcare ● Financials ● Real estate ● Materials ● Communication services ● Information technology ● Consumer staples ● Utilities Firm financial effects ● Market capitalisation scaled by lagged total assets ● Market-to-book ratio

[84] Capex decisions typically do not count towards operating cashflow or financing cashflow measures, but they do count towards investing cashflow, free cashflow and total (overall) cashflow. For this reason, our ex-ante analysis only incorporates those cashflow performance targets which measure investing cashflow, free cashflow or total (overall) cashflow.

As done for our ex-post econometric analysis, the next step is to select an appropriate sample for our ex-ante analysis. We need to select a sample which captures only those observations close to the reference target level whilst also ensuring that we have a sufficiently large sample size to allow for robust analysis. We again follow a baseline approach of setting allowed sample deviation windows just wide enough to allow for sufficient sample size.

Table A.D.7 below captures the allowed sample deviation windows chosen for each of the two ex-ante target and investment relationships we study. These windows are expressed in terms of maximum allowed percentage deviation between ex-ante performance and the relevant payout target.

Table A.D.7: Chosen sample deviation windows for ex-ante econometric analysis

Investment measure	Target measure	Threshold payout: allowed deviation	Maximum payout: allowed deviation
R&D	Profit	+/- 8.68% (75% of median sample deviation)	+/- 4.80% (65% of median sample deviation)
Capex	Cashflow	+/- 48.62% (180% of median sample deviation)	+/- 26.46% (165% of median sample deviation)

As Table A.D.7 shows, our chosen deviation windows for cashflow performance are significantly larger than for profit performance. This is largely driven by the smaller number of available observations for cashflow performance, which means that a wider deviation window is required. Although this results in a window significantly wider than the median sample deviation, our use of multiple controls (including firm-level controls) within the econometric specification helps to prevent this from compromising the reliability of our findings.

We run both the baseline and augmented econometric specifications (described in the previous sub-section) using the allowed deviation windows specified in Table A.D.7. However, we also test the sensitivity of our results to changes in these windows.

Mirroring our approach to the ex-post analysis, we specifically run three such sensitivity tests, with allowed deviation windows widened as follows. All of these sensitivity tests are applied to the augmented econometric specification, not the baseline specification.

1. +/- 100% of median deviation
2. +/- 150% of median deviation
3. +/- 200% of median deviation

For the ex-ante analysis, we additionally run a further sensitivity analysis which uses the

sample deviation windows in Table A.D.7 above but changes the counterfactual investment assumption used to calculate ex-ante performance. Whereas our baseline (and augmented) analysis calculates ex-ante performance based on investment remaining unchanged from the previous year's level (i.e. zero growth), our sensitivity analysis hypothesises that investment instead grows in line with the annualised rate of UK CPIH inflation, and calculates ex-ante performance on this basis. Given that UK CPIH inflation has been positive during our sample period, the use of this alternative investment assumption tends to slightly weaken ex-ante performance compared to the baseline approach (all else being equal).

The results of our ex-ante econometric analysis are presented in the econometric results sub-section below.

General econometric analysis

As a reminder, our general econometric analysis investigates whether the size and presence of different executive pay targets in the CEO contract affect investment and accruals decisions made by firms, once all other determinants have been controlled for.

As with the threshold analysis, our selection of target categories to study is again driven by a number of key criteria including target prevalence, financial materiality and data availability. However, the relatively wide availability of data on target presence and financial materiality means that we are able to analyse a greater range of target categories and investment variables compared to our threshold analyses, which require granular data on achieved CEO performance. Moreover, our general econometric analysis recognises that there may be a range of direct and indirect relationships between target size and/or presence and investment (including the potential for reverse causality, i.e. investment levels influencing the usage or financial materiality of target categories). Rather than testing a small prescriptive group of target and investment relationships, we instead assess a large number of target and investment variable combinations for full visibility of their inter-relationships.

As well as studying investment variables to test for real earnings management, we also run regressions using two accruals measures as the dependent variable. This allows us to test for accounting earnings management.

Since our analysis considers a wide range of relationships across a diverse sample of firms, we include a large number of controls for firm and CEO characteristics. Whilst the inclusion of these controls cannot enable causal interpretations (because there is still potential for reverse causality), it does significantly reduce the chance of omitted variable bias, and therefore it provides greater assurance that any correlations identified are robust.

Table A.D.8 below sets out the full list of independent variables, dependent variables and control variables used in our general econometric analysis.

Table A.D.8: Full list of variables used in our general econometric analysis

Dependent variables - measures scaled by lagged total assets	Independent variables - presence and size of target	Independent variables - controls
Capex (annual change) Net investment (annual change) R&D (annual change) Total accruals (level) Discretionary accruals (level)	Annual bonus: profit, EPS, cashflow and revenue targets LTIP: absolute TSR, relative TSR, EPS and cashflow targets	Time effects • Indicators for years 2014-2019 (2013 being the base year) Industry effects • Energy • Industrials • Consumer discretionary • Healthcare • Financials • Real estate • Materials • Communication services • Information technology • Consumer staples • Utilities Firm financial effects • Firm age • Full-time employees • Repurchases • Dividends • Market-to-book ratio • Market capitalisation • Stock returns • Revenue • Profit • Cashflow • Debt • Leverage CEO characteristics • Tenure • Age • New CEO indicator • Shareholding

As explained in the Econometric specifications and estimation approaches section above, we analyse the effects of target presence and target size separately to avoid multicollinearity problems. Our target presence analysis incorporates presence indicators for all target categories within the same econometric specification, and similarly our target size analysis

incorporates target size variables for all target categories within the same econometric specification.

Unlike our threshold econometric analyses, the samples used for our general analysis are drawn from right across the CEO performance distribution. This allows us to test whether there are general relationships that exist between target presence (or size) and investment regardless of how a CEO performs relative to their payout targets.

The results of our general econometric analysis are presented in the Econometric results sub-section below.

De-facto base pay analysis

As a reminder, our de-facto base pay analysis investigates the extent to which CEO performance targets act as de-facto base pay, and whether CEOs' broader pay contracts account for the relative difficulty of meeting their performance targets.

Unlike our other analyses, the de-facto base pay analysis pools together different target categories to estimate the expected vesting share and expected value of the overall annual bonus or LTIP of which they are part. Another important difference is that this analysis does not incorporate investment (or accruals) variables, as these are not the focus of this particular analysis.

Our analysis does include a range of control variables, including several controls for firm scale, which aim to account for firm-level characteristics that may jointly influence the size of CEOs' annual bonus or LTIP and the size of their base salary. This is of particular importance for this analysis, as larger firms may be more able to pay both more base pay and more performance-based reward, and be more able to attract a higher quality CEO who can command more base pay and more performance-based reward.

Table A.D.9 below sets out the full list of independent variables, dependent variables and control variables used in our general econometric analysis.

Table A.D.9: Full list of variables used in our de-facto base pay analysis

Dependent variables - measures of base pay	Independent variables - measures of performance-based pay	Independent variables - controls
Base salary (level and annual change). Fraction of fixed pay relative to annual bonus / LTIP payout at maximum performance.	Annual bonus: expected value and expected vesting share (fraction) LTIP: expected value and expected vesting share (fraction)	Time effects • Indicators for years 2014-2019 (2013 being the base year) Industry effects • Energy • Industrials • Consumer discretionary • Healthcare • Financials • Real estate • Materials • Communication services • Information technology • Consumer staples • Utilities Firm scale effects • Market capitalisation • Market-to-book ratio • Firm age • Revenue

As noted in the Econometric specifications and estimation approaches section above, we analyse the relationship between annual bonus or LTIP size and base pay using three econometric specifications to control for unobservable firm-specific effects. We refer the reader to that section for more detail on these specifications and the differences between them.

Econometric results

This section presents detailed results from each of our econometric analyses, together with very brief commentary on the findings. It covers the following analyses:

1. Ex-post threshold econometric analysis
2. Ex-ante threshold econometric analysis

3. General econometric analysis
4. De-facto base pay analysis

The commentary featured here focuses solely on insights that cannot be straightforwardly elicited from Chapter 4 of this report, where we present the key findings from our analysis using concise summary results tables. The exception to this is the de-facto base pay analysis, for which we provide more detailed commentary because this analysis is not covered in Chapter 4 (instead it is covered very briefly in Chapter 3).

For a full discussion of key findings from our econometric analysis and their implications, we refer the reader to Chapter 4.

Guidance on interpreting the econometric results tables

The below bullet points provide guidance on interpreting the econometric results presented in this section.

- For each analysis, we present a series of results tables. The number of tables shown varies significantly by type of analysis.
- Every results table contains a number of rows, each of which presents a set of regression results. Rows are further subdivided into cells. The top line in a given reporting cell shows the coefficient estimate, whilst the bottom line shows the p-value corresponding to that estimate (this is presented in brackets). The p-value has been derived based on a pairwise bootstrap procedure, and captures the probability of obtaining the observed coefficient estimate under the null hypothesis (which in our analysis is no econometric relationship, or equivalently a coefficient of zero). For example, the below reporting cell tells us that the coefficient estimate is +0.001, and the p-value associated with that coefficient is 0.896.

0.001 [0.896]

- To capture whether our coefficients are statistically significant or not, we follow the same convention as Chapter 4 and use asterisk notation to identify the level of statistical significance:
  - * represents significance at the 10% level (i.e. the p-value is smaller than 0.10)
  - ** represents significance at the 5% level (i.e. the p-value is smaller than 0.05)
  - *** represents significance at the 1% level (i.e. the p-value is smaller than 0.01)

Ex-post threshold analysis - results

In this sub-section, we present the results from our ex-post threshold analysis. Each results table shown below captures a particular combination of the below variables/parameters:

Dependent variables - measures scaled by lagged total assets	Independent variables - indicator of whether the target was hit or missed	Reference pay-out target
• Capex (annual change) • Net investment (annual change) • R&D (annual change) • Total accruals (level) • Discretionary accruals (level)	• Annual bonus: Profit targets • LTIP: EPS targets	• Threshold pay-out • Maximum pay-out

Because there are 5 possible dependent variables, 2 possible independent variables and 2 reference payout targets, this gives 5x2x2 = 20 combinations. Each of these combinations has its own results table, meaning that there are 20 results tables below. The title above the table shows the dependent variable, independent variable and reference payout target under consideration.

Each results table contains three results reporting columns:

- **Success coefficient** - this column reports the coefficient on the target success indicator in our baseline regression
- **SD coefficient** - this column reports the coefficient on the target success indicator (captured through the term $\beta_1 MEETEXPOST_{i,t}$ in the Econometric specifications section above) in our augmented regression and sensitivity analyses.
    - This captures the difference in the dependent variable (investment growth or accruals) between (i) those CEOs which just hit their target and have a **small (or non-existent)** discontinuity in their payout profile[85], and (ii) those CEOs which just miss their target
- **LD coefficient** - this column reports a joint coefficient which is based on the coefficient on the target success and large threshold discontinuity interaction indicator (captured through the term $\beta_2 PROFILE_{i,t}$ in the Econometric specifications section above) in our augmented regression and sensitivity analyses.
    - The interaction indicator itself captures the difference in the dependent variable (investment growth or accruals) between (i) those CEOs which just hit their target and have a **large** discontinuity in their payout profile, and (ii) those CEOs which

[85] We refer the reader to Figure 3.2.1 in Chapter 3 for further explanation of how CEOs' payout profiles can differ, including the existence (or non-existence) of discontinuities in these profiles at the threshold performance level.

just hit their target and have a **small (or non-existent)** discontinuity in their payout profile

- The joint coefficient reported below adds the $\beta_2 PROFILE_{i,t}$ coefficient to the $\beta_1 MEETEXPOST_{i,t}$ coefficient, and evaluates their joint statistical significance. This allows us to capture the difference in the dependent variable (investment growth or accruals) between (i) those CEOs which just hit their target and have a **large** discontinuity in their payout profile, and (ii) those CEOs which just miss their target

Annual bonus profit threshold - capex

Specification	Controls	Success coefficient [p-value]	SD coefficient [p-value]	LD coefficient [p-value]
Baseline	None	0.001 [0.896]	-	-
Baseline	Time, industry and financial controls	-0.001 [0.770]	-	-
Augmented	None	-	-0.001 [0.774]	0.003 [0.562]
Augmented	Time, industry and financial controls	-	-0.003 [0.528]	0.002 [0.714]
100% SDW	None	-	-0.001 [0.692]	0.001 [0.794]
100% SDW	Time, industry and financial controls	-	-0.003 [0.466]	0.001 [0.944]
150% SDW	None	-	-0.002 [0.578]	0.000 [0.960]
150% SDW	Time, industry and financial controls	-	-0.002 [0.540]	0.000 [0.954]
200% SDW	None	-	-0.001 [0.772]	0.001 [0.714]
200% SDW	Time, industry and financial controls	-	-0.001 [0.690]	0.001 [0.732]

Annual bonus profit maximum – capex

Specification	Controls	Success coefficient [p-value]	SD coefficient [p-value]	LD coefficient [p-value]
Baseline	None	0.007 [0.162]	-	-
Baseline	Time, industry and financial controls	0.006 [0.348]	-	-
Augmented	None	-	0.011 [0.134]	0.001 [0.790]
Augmented	Time, industry and financial controls	-	0.006 [0.508]	0.001 [0.714]
100% SDW	None	-	0.008 [0.256]	0.002 [0.358]
100% SDW	Time, industry and financial controls	-	0.006 [0.386]	0.003 [0.274]
150% SDW	None	-	0.006 [0.470]	0.003 [0.112]
150% SDW	Time, industry and financial controls	-	0.004 [0.560]	0.005* [0.088]
200% SDW	None	-	0.005 [0.550]	0.003 [0.214]
200% SDW	Time, industry and financial controls	-	0.005 [0.594]	0.004 [0.108]

Annual bonus profit threshold - net investment

Specification	Controls	Success coefficient [p-value]	SD coefficient [p-value]	LD coefficient [p-value]
Baseline	None	0.001 [0.914]	-	-
Baseline	Time, industry and financial controls	-0.002 [0.688]	-	-
Augmented	None	-	0.001 [0.880]	0.001 [0.928]
Augmented	Time, industry and financial controls	-	-0.001 [0.776]	-0.003 [0.686]
100% SDW	None	-	0.000 [0.914]	-0.001 [0.826]
100% SDW	Time, industry and financial controls	-	-0.002 [0.634]	-0.003 [0.588]
150% SDW	None	-	-0.001 [0.822]	-0.001 [0.820]
150% SDW	Time, industry and financial controls	-	-0.002 [0.684]	-0.002 [0.690]
200% SDW	None	-	0.000 [0.968]	0.001 [0.874]
200% SDW	Time, industry and financial controls	-	-0.001 [0.848]	0.000 [0.962]

Annual bonus profit maximum - net investment

Specification	Controls	Success coefficient [p-value]	SD coefficient [p-value]	LD coefficient [p-value]
Baseline	None	0.007 [0.120]	-	-
Baseline	Time, industry and financial controls	0.006 [0.324]	-	-
Augmented	None	-	0.010 [0.202]	0.002 [0.232]
Augmented	Time, industry and financial controls	-	0.005 [0.534]	0.003 [0.310]
100% SDW	None	-	0.008 [0.246]	0.003 [0.116]
100% SDW	Time, industry and financial controls	-	0.005 [0.468]	0.004* [0.094]
150% SDW	None	-	0.005 [0.532]	0.004* [0.076]
150% SDW	Time, industry and financial controls	-	0.003 [0.684]	0.005* [0.060]
200% SDW	None	-	0.005 [0.500]	0.004** [0.028]
200% SDW	Time, industry and financial controls	-	0.004 [0.614]	0.005** [0.030]

Annual bonus profit threshold - R&D

Specification	Controls	Success coefficient [p-value]	SD coefficient [p-value]	LD coefficient [p-value]
Baseline	None	-0.003 [0.404]	-	-
Baseline	Time, industry and financial controls	-0.003 [0.620]	-	-
Augmented	None	-	-0.004 [0.638]	-0.002** [0.030]
Augmented	Time, industry and financial controls	-	-0.003 [0.694]	-0.001 [0.648]
100% SDW	None	-	-0.002 [0.626]	0.000 [0.962]
100% SDW	Time, industry and financial controls	-	-0.003 [0.678]	0.000 [0.952]
150% SDW	None	-	-0.002 [0.600]	0.000 [0.942]
150% SDW	Time, industry and financial controls	-	-0.002 [0.688]	0.000 [0.892]
200% SDW	None	-	-0.001 [0.884]	0.001 [0.592]
200% SDW	Time, industry and financial controls	-	0.000 [0.864]	0.001 [0.624]

Annual bonus profit maximum - R&D

Specification	Controls	Success coefficient [p-value]	SD coefficient [p-value]	LD coefficient [p-value]
Baseline	None	0.005** [0.022]	-	-
Baseline	Time, industry and financial controls	0.006** [0.016]	-	-
Augmented	None	-	0.003 [0.118]	0.009** [0.030]
Augmented	Time, industry and financial controls	-	0.005* [0.060]	0.012** [0.040]
100% SDW	None	-	0.003 [0.176]	0.007 [0.106]
100% SDW	Time, industry and financial controls	-	0.004* [0.064]	0.008 [0.168]
150% SDW	None	-	0.003 [0.196]	0.007** [0.042]
150% SDW	Time, industry and financial controls	-	0.004 [0.146]	0.004 [0.430]
200% SDW	None	-	0.003 [0.236]	0.007* [0.052]
200% SDW	Time, industry and financial controls	-	0.004 [0.144]	0.004 [0.422]

Annual bonus profit threshold - total accruals (level)

Specification	Controls	Success coefficient [p-value]	SD coefficient [p-value]	LD coefficient [p-value]
Baseline	None	0.002 [0.676]	-	-
Baseline	Time, industry and financial controls	0.003 [0.686]	-	-
Augmented	None	-	-0.001 [0.868]	0.007 [0.260]
Augmented	Time, industry and financial controls	-	-0.001 [0.808]	0.009 [0.212]
100% SDW	None	-	0.000 [0.978]	0.005 [0.432]
100% SDW	Time, industry and financial controls	-	0.000 [0.986]	0.005 [0.352]
150% SDW	None	-	0.003 [0.492]	0.003 [0.500]
150% SDW	Time, industry and financial controls	-	0.002 [0.624]	0.003 [0.514]
200% SDW	None	-	0.001 [0.858]	0.001 [0.864]
200% SDW	Time, industry and financial controls	-	0.001 [0.876]	0.001 [0.804]

Annual bonus profit maximum - total accruals (level)

Specification	Controls	Success coefficient [p-value]	SD coefficient [p-value]	LD coefficient [p-value]
Baseline	None	0.001 [0.740]	-	-
Baseline	Time, industry and financial controls	0.000 [0.976]	-	-
Augmented	None	-	0.004 [0.452]	-0.004 [0.562]
Augmented	Time, industry and financial controls	-	0.002 [0.644]	-0.005 [0.472]
100% SDW	None	-	0.007* [0.100]	-0.005 [0.370]
100% SDW	Time, industry and financial controls	-	0.005 [0.296]	-0.005 [0.366]
150% SDW	None	-	0.006 [0.180]	-0.004 [0.426]
150% SDW	Time, industry and financial controls	-	0.004 [0.384]	-0.005 [0.372]
200% SDW	None	-	0.006 [0.132]	-0.003 [0.536]
200% SDW	Time, industry and financial controls	-	0.005 [0.248]	-0.004 [0.472]

Annual bonus profit threshold - discretionary accruals (level)

Specification	Controls	Success coefficient [p-value]	SD coefficient [p-value]	LD coefficient [p-value]
Baseline	None	0.001 [0.768]	-	-
Baseline	Time, industry and financial controls	0.001 [0.708]	-	-
Augmented	None	-	-0.001 [0.858]	0.004 [0.288]
Augmented	Time, industry and financial controls	-	-0.002 [0.744]	0.006 [0.140]
100% SDW	None	-	0.000 [0.916]	0.002 [0.520]
100% SDW	Time, industry and financial controls	-	0.000 [0.994]	0.004 [0.330]
150% SDW	None	-	0.002 [0.506]	0.001 [0.820]
150% SDW	Time, industry and financial controls	-	0.002 [0.534]	0.002 [0.602]
200% SDW	None	-	0.002 [0.596]	0.000 [0.940]
200% SDW	Time, industry and financial controls	-	0.002 [0.600]	0.001 [0.754]

Annual bonus profit maximum - discretionary accruals (level)

Specification	Controls	Success coefficient [p-value]	SD coefficient [p-value]	LD coefficient [p-value]
Baseline	None	0.002 [0.578]	-	-
Baseline	Time, industry and financial controls	0.000 [0.924]	-	-
Augmented	None	-	0.004 [0.292]	-0.003 [0.474]
Augmented	Time, industry and financial controls	-	0.002 [0.560]	-0.003 [0.410]
100% SDW	None	-	0.005 [0.134]	-0.002 [0.644]
100% SDW	Time, industry and financial controls	-	0.003 [0.308]	-0.002 [0.682]
150% SDW	None	-	0.005 [0.138]	-0.002 [0.666]
150% SDW	Time, industry and financial controls	-	0.003 [0.376]	-0.002 [0.606]
200% SDW	None	-	0.004 [0.124]	-0.002 [0.592]
200% SDW	Time, industry and financial controls	-	0.003 [0.272]	-0.002 [0.588]

LTIP EPS threshold – capex

Specification	Controls	Success coefficient [p-value]	SD coefficient [p-value]	LD coefficient [p-value]
Baseline	None	0.003* [0.086]	-	-
Baseline	Time, industry and financial controls	0.004* [0.056]	-	-
Augmented	None	-	0.000 [0.950]	0.004** [0.034]
Augmented	Time, industry and financial controls	-	0.001 [0.702]	0.004** [0.042]
100% SDW	None	-	0.000 [0.924]	0.003 [0.152]
100% SDW	Time, industry and financial controls	-	0.001 [0.582]	0.003 [0.150]
150% SDW	None	-	0.002 [0.516]	0.003 [0.202]
150% SDW	Time, industry and financial controls	-	0.003 [0.342]	0.003 [0.114]
200% SDW	None	-	0.008* [0.072]	0.003 [0.194]
200% SDW	Time, industry and financial controls	-	0.011** [0.020]	0.004* [0.088]

LTIP EPS maximum - capex

Specification	Controls	Success coefficient [p-value]	SD coefficient [p-value]	LD coefficient [p-value]
Baseline	None	0.005** [0.018]	-	-
Baseline	Time, industry and financial controls	0.003 [0.106]	-	-
Augmented	None	-	0.015 [0.170]	0.003** [0.048]
Augmented	Time, industry and financial controls	-	0.015 [0.194]	0.002 [0.322]
100% SDW	None	-	0.015 [0.150]	0.003 [0.112]
100% SDW	Time, industry and financial controls	-	0.015 [0.186]	0.001 [0.602]
150% SDW	None	-	0.014 [0.136]	0.002 [0.112]
150% SDW	Time, industry and financial controls	-	0.015 [0.146]	0.001 [0.358]
200% SDW	None	-	0.018** [0.038]	0.002 [0.226]
200% SDW	Time, industry and financial controls	-	0.019** [0.034]	0.001 [0.398]

LTIP EPS threshold - net investment

Specification	Controls	Success coefficient [p-value]	SD coefficient [p-value]	LD coefficient [p-value]
Baseline	None	0.002 [0.428]	-	-
Baseline	Time, industry and financial controls	0.002 [0.342]	-	-
Augmented	None	-	-0.003 [0.470]	0.002 [0.274]
Augmented	Time, industry and financial controls	-	-0.002 [0.570]	0.003 [0.240]
100% SDW	None	-	-0.002 [0.546]	0.001 [0.664]
100% SDW	Time, industry and financial controls	-	-0.001 [0.690]	0.001 [0.570]
150% SDW	None	-	0.000 [0.932]	0.001 [0.624]
150% SDW	Time, industry and financial controls	-	0.001 [0.878]	0.002 [0.368]
200% SDW	None	-	0.006 [0.182]	0.000 [0.862]
200% SDW	Time, industry and financial controls	-	0.008 [0.118]	0.001 [0.560]

LTIP EPS maximum - net investment

Specification	Controls	Success coefficient [p-value]	SD coefficient [p-value]	LD coefficient [p-value]
Baseline	None	0.002 [0.316]	-	-
Baseline	Time, industry and financial controls	0.001 [0.760]	-	-
Augmented	None	-	0.008 [0.388]	0.001 [0.588]
Augmented	Time, industry and financial controls	-	0.006 [0.524]	0.000 [0.804]
100% SDW	None	-	0.008 [0.412]	-0.001 [0.530]
100% SDW	Time, industry and financial controls	-	0.006 [0.566]	-0.002 [0.294]
150% SDW	None	-	0.008 [0.406]	-0.001 [0.746]
150% SDW	Time, industry and financial controls	-	0.006 [0.496]	-0.001 [0.644]
200% SDW	None	-	0.011 [0.136]	-0.001 [0.640]
200% SDW	Time, industry and financial controls	-	0.010 [0.166]	-0.001 [0.608]

LTIP EPS threshold - R&D

Specification	Controls	Success coefficient [p-value]	SD coefficient [p-value]	LD coefficient [p-value]
Baseline	None	0.001 [0.620]	-	-
Baseline	Time, industry and financial controls	0.002 [0.248]	-	-
Augmented	None	-	0.003 [0.690]	0.000 [0.768]
Augmented	Time, industry and financial controls	-	0.004 [0.370]	0.002 [0.294]
100% SDW	None	-	0.003 [0.673]	0.001 [0.578]
100% SDW	Time, industry and financial controls	-	0.003 [0.442]	0.001 [0.274]
150% SDW	None	-	0.003 [0.836]	0.000 [0.766]
150% SDW	Time, industry and financial controls	-	0.002 [0.636]	0.001 [0.562]
200% SDW	None	-	0.001 [0.874]	0.000 [0.828]
200% SDW	Time, industry and financial controls	-	0.001 [0.754]	0.000 [0.746]

LTIP EPS maximum - R&D

Specification	Controls	Success coefficient [p-value]	SD coefficient [p-value]	LD coefficient [p-value]
Baseline	None	0.003** [0.030]	-	-
Baseline	Time, industry and financial controls	0.002 [0.138]	-	-
Augmented	None	-	-0.002 [0.308]	0.004 [0.274]
Augmented	Time, industry and financial controls	-	0.000 [0.978]	0.002 [0.376]
100% SDW	None	-	-0.002 [0.268]	0.003 [0.344]
100% SDW	Time, industry and financial controls	-	0.000 [0.944]	0.001 [0.584]
150% SDW	None	-	-0.002 [0.270]	0.003 [0.298]
150% SDW	Time, industry and financial controls	-	0.000 [0.910]	0.002 [0.340]
200% SDW	None	-	-0.002 [0.102]	0.003 [0.118]
200% SDW	Time, industry and financial controls	-	0.000 [0.876]	0.002 [0.164]

LTIP EPS threshold - total accruals (level)

Specification	Controls	Success coefficient [p-value]	SD coefficient [p-value]	LD coefficient [p-value]
Baseline	None	0.000 [0.976]	-	-
Baseline	Time, industry and financial controls	0.004 [0.522]	-	-
Augmented	None	-	-0.014 [0.298]	0.002 [0.778]
Augmented	Time, industry and financial controls	-	0.000 [0.974]	0.005 [0.468]
100% SDW	None	-	-0.012 [0.320]	0.002 [0.624]
100% SDW	Time, industry and financial controls	-	-0.001 [0.880]	0.006 [0.298]
150% SDW	None	-	-0.006 [0.562]	0.000 [0.394]
150% SDW	Time, industry and financial controls	-	0.004 [0.626]	0.003 [0.560]
200% SDW	None	-	0.002 [0.830]	-0.004 [0.294]
200% SDW	Time, industry and financial controls	-	0.008 [0.404]	-0.002 [0.574]

LTIP EPS maximum - total accruals (level)

Specification	Controls	Success coefficient [p-value]	SD coefficient [p-value]	LD coefficient [p-value]
Baseline	None	-0.003 [0.476]	-	-
Baseline	Time, industry and financial controls	-0.002 [0.688]	-	-
Augmented	None	-	0.017 [0.188]	-0.005 [0.170]
Augmented	Time, industry and financial controls	-	0.020 [0.124]	-0.005 [0.262]
100% SDW	None	-	0.014 [0.268]	-0.012*** [0.002]
100% SDW	Time, industry and financial controls	-	0.017 [0.192]	-0.001** [0.020]
150% SDW	None	-	0.015 [0.158]	-0.014*** [0.002]
150% SDW	Time, industry and financial controls	-	0.019 [0.118]	-0.016*** [0.004]
200% SDW	None	-	0.014 [0.118]	-0.130*** [0.004]
200% SDW	Time, industry and financial controls	-	0.016 [0.106]	-0.014*** [0.004]

LTIP EPS threshold - discretionary accruals (level)

Specification	Controls	Success coefficient [p-value]	SD coefficient [p-value]	LD coefficient [p-value]
Baseline	None	0.001 [0.806]	-	-
Baseline	Time, industry and financial controls	0.003 [0.476]	-	-
Augmented	None	-	-0.021 [0.282]	0.004 [0.386]
Augmented	Time, industry and financial controls	-	-0.005 [0.734]	0.004 [0.280]
100% SDW	None	-	-0.018 [0.358]	0.004 [0.274]
100% SDW	Time, industry and financial controls	-	-0.004 [0.740]	0.005 [0.188]
150% SDW	None	-	-0.013 [0.406]	0.001 [0.872]
150% SDW	Time, industry and financial controls	-	-0.001 [0.996]	0.002 [0.562]
200% SDW	None	-	-0.006 [0.666]	-0.002 [0.464]
200% SDW	Time, industry and financial controls	-	0.001 [0.908]	-0.002 [0.542]

LTIP EPS maximum - discretionary accruals (level)

Specification	Controls	Success coefficient [p-value]	SD coefficient [p-value]	LD coefficient [p-value]
Baseline	None	-0.002 [0.468]	-	-
Baseline	Time, industry and financial controls	-0.002 [0.390]	-	-
Augmented	None	-	0.006 [0.142]	-0.003 [0.270]
Augmented	Time, industry and financial controls	-	0.008* [0.080]	-0.004 [0.188]
100% SDW	None	-	0.006 [0.178]	-0.006** [0.024]
100% SDW	Time, industry and financial controls	-	0.007 [0.160]	-0.007*** [0.002]
150% SDW	None	-	0.006 [0.146]	-0.008** [0.030]
150% SDW	Time, industry and financial controls	-	0.009* [0.092]	-0.011*** [0.002]
200% SDW	None	-	0.006 [0.132]	-0.008** [0.024]
200% SDW	Time, industry and financial controls	-	0.007 [0.124]	-0.009** [0.010]

Ex-post threshold analysis - commentary

- Across our 20 results tables, we tend to find that most coefficient estimates fall between -0.010 and +0.010 in magnitude. Our dependent variables measure investment growth and accruals, and these are captured as a percentage of lagged total assets. A coefficient of -0.010 therefore implies that CEOs which just hit their target *reduce* the dependent variable (scaled investment growth or scaled accruals) by 1.0 percentage points relative to those CEOs which just miss. Similarly, a coefficient of +0.010 implies

that CEOs which just hit their target *increase* the dependent variable (investment growth or accruals) by 1.0 percentage points relative to those CEOs which just miss.

- Relatively few of the estimated coefficients are statistically significant (i.e. significantly different from zero), but among those that are, a majority are positive. This implies that those CEOs which just hit their (threshold or maximum) payout target tend to have higher investment growth than those CEOs which just miss their payout target.

Ex-ante threshold analysis - results

In this sub-section, we present the results from our ex-ante threshold analysis. Each results table shown below captures a particular combination of the below variables/parameters:

Dependent variables - measures scaled by lagged total assets	Independent variables - indicator of whether the target was hit or missed	Reference pay-out target
• Capex (annual change) • R&D (annual change)	• Annual bonus: Profit targets; Cashflow targets	• Threshold pay-out • Maximum pay-out

Because there are 2 possible dependent variables, 1 possible independent variable (for each of the dependent variables) and 2 reference payout targets, this gives 2x1x2 = 4 combinations. Each of these combinations has its own results table, meaning that there are 4 results tables below. The title above the table shows the dependent variable, independent variable and reference payout target under consideration.

As with our ex-post analysis, each results table contains three results reporting columns:

- **Success coefficient** - this column reports the coefficient on the target success indicator in our baseline regression
- **SD coefficient** - this column reports the coefficient on the target success indicator (captured through the term $\beta_1 MEETEXANTE_{i,t}$ in the Econometric specifications section above) in our augmented regression and sensitivity analyses.
    - This captures the difference in the dependent variable (investment growth or accruals) between (i) those CEOs which just hit their target (ex-ante) and have a small (or non-existent) discontinuity in their payout profile, and (ii) those CEOs which just miss their target
- **LD coefficient** - this column reports a joint coefficient which is based on the coefficient on the target success and large threshold discontinuity interaction indicator (captured through the term $\beta_2 PROFILE_{i,t}$ in the Econometric specifications section above) in our augmented regression and sensitivity analyses.

- The interaction indicator itself captures the difference in the dependent variable (investment growth or accruals) between (i) those CEOs which just hit their target (ex-ante) and have a **large** discontinuity in their payout profile, and (ii) those CEOs which just hit their target ex-ante) and have a **small (or non-existent)** discontinuity in their payout profile
- The joint coefficient reported below adds the $\beta_2 PROFILE_{i,t}$ coefficient to the $\beta_1 MEETEXANTE_{i,t}$ coefficient, and evaluates their joint statistical significance. This allows us to capture the difference in the dependent variable (investment growth or accruals) between (i) those CEOs which just hit their target (ex-ante) and have a **large** discontinuity in their payout profile, and (ii) those CEOs which just miss their target

Annual bonus profit threshold - R&D

Specification	Controls	Success coefficient [p-value]	SD coefficient [p-value]	LD coefficient [p-value]
Baseline	None	0.003 [0.386]	-	-
Baseline	Time, industry and financial controls	0.000 [0.898]	-	-
Augmented	None	-	0.004 [0.234]	0.001 [0.794]
Augmented	Time, industry and financial controls	-	0.001 [0.802]	-0.001 [0.926]
CPIH	None	-	0.003 [0.536]	0.000 [0.966]
CPIH	Time, industry and financial controls	-	-0.002 [0.702]	-0.003 [0.728]
100% SDW	None	-	0.004 [0.236]	0.003 [0.556]
100% SDW	Time, industry and financial controls	-	0.002 [0.650]	0.000 [0.928]
150% SDW	None	-	0.005 [0.142]	0.003 [0.378]
150% SDW	Time, industry and	-	0.003	0.002

Specification	Controls	Success coefficient [p-value]	SD coefficient [p-value]	LD coefficient [p-value]
	financial controls		[0.220]	[0.582]
200% SDW	None	-	0.003 [0.260]	0.003 [0.370]
200% SDW	Time, industry and financial controls	-	0.003 [0.370]	0.003 [0.384]

Annual bonus profit maximum - R&D

Specification	Controls	Success coefficient [p-value]	SD coefficient [p-value]	LD coefficient [p-value]
Baseline	None	0.003 [0.264]	-	-
Baseline	Time, industry and financial controls	0.005 [0.114]	-	-
Augmented	None	-	0.002 [0.454]	0.007** [0.026]
Augmented	Time, industry and financial controls	-	0.004 [0.284]	0.008** [0.032]
CPIH	None	-	0.001 [0.596]	0.005** [0.048]
CPIH	Time, industry and financial controls	-	0.002 [0.430]	0.006* [0.090]
100% SDW	None	-	0.002 [0.290]	0.005** [0.028]
100% SDW	Time, industry and financial controls	-	0.003 [0.336]	0.005 [0.130]
150% SDW	None	-	0.003 [0.156]	-0.005 [0.722]
150% SDW	Time, industry and	-	0.004**	-0.002

Specification	Controls	Success coefficient [p-value]	SD coefficient [p-value]	LD coefficient [p-value]
	financial controls		[0.054]	[0.950]
200% SDW	None	-	0.003 [0.128]	-0.002 [0.944]
200% SDW	Time, industry and financial controls	-	0.004* [0.086]	0.000 [0.840]

Annual bonus cashflow threshold - capex

Specification	Controls	Success coefficient [p-value]	SD coefficient [p-value]	LD coefficient [p-value]
Baseline	None	0.008* [0.058]	-	-
Baseline	Time, industry and financial controls	0.007 [0.188]	-	-
Augmented	None	-	0.008* [0.058]	0.008 [0.128]
Augmented	Time, industry and financial controls	-	0.007 [0.148]	0.004 [0.506]
CPIH	None	-	0.010** [0.030]	0.009* [0.064]
CPIH	Time, industry and financial controls	-	0.008* [0.084]	0.005 [0.402]
100% SDW	None	-	0.009* [0.052]	0.008 [0.158]
100% SDW	Time, industry and financial controls	-	0.009 [0.114]	0.005 [0.400]
150% SDW	None	-	0.008* [0.058]	0.008 [0.112]
150% SDW	Time, industry and	-	0.007	0.004

Specification	Controls	Success coefficient [p-value]	SD coefficient [p-value]	LD coefficient [p-value]
	financial controls		[0.182]	[0.510]
200% SDW	None	-	0.008* [0.064]	0.008* [0.082]
200% SDW	Time, industry and financial controls	-	0.007 [0.160]	0.005 [0.338]

Annual bonus cashflow maximum - capex

Specification	Controls	Success coefficient [p-value]	SD coefficient [p-value]	LD coefficient [p-value]
Baseline	None	-0.001 [0.794]	-	-
Baseline	Time, industry and financial controls	0.000 [0.930]	-	-
Augmented	None	-	0.000 [0.824]	0.000 [0.928]
Augmented	Time, industry and financial controls	-	0.000 [0.898]	-0.001 [0.864]
CPIH	None	-	0.002 [0.448]	0.002 [0.406]
CPIH	Time, industry and financial controls	-	0.002 [0.576]	0.001 [0.766]
100% SDW	None	-	-0.001 [0.744]	-0.001 [0.692]
100% SDW	Time, industry and financial controls	-	-0.001 [0.818]	-0.002 [0.662]
150% SDW	None	-	-0.001 [0.628]	-0.001 [0.794]

Specification	Controls	Success coefficient [p-value]	SD coefficient [p-value]	LD coefficient [p-value]
150% SDW	Time, industry and financial controls	-	-0.001 [0.796]	-0.003 [0.518]
200% SDW	None	-	0.001 [0.592]	0.003 [0.456]
200% SDW	Time, industry and financial controls	-	0.002 [0.508]	0.001 [0.846]

Ex-ante threshold analysis - commentary

- Across our 4 results tables, we find that all of the coefficient estimates fall between -0.010 and +0.010 in magnitude. Our dependent variables measure investment growth, and these are captured as a percentage of lagged total assets. A coefficient of -0.010 therefore implies that CEOs who are on track to just hit their target *reduce* scaled investment growth by 1.0 percentage points relative to those CEOs who are on track to just miss. Similarly, a coefficient of +0.010 implies that CEOs who are on track to just hit their target *increase* scaled investment growth by 1.0 percentage points relative to those CEOs who are on track to just miss.
- As with the ex-post analysis, we find that few of the estimated coefficients are statistically significant (i.e. significantly different from zero). All coefficients that do have statistical significance are positive. This implies that those CEOs who are on track to just hit their (threshold or maximum) payout target tend to have higher investment growth than those CEOs who are on track to just miss their payout target.

General econometric analysis - results

In this sub-section, we present the results from our general econometric analysis.

We arrange our results tables such that all relationships which involve a particular dependent variable (across all target categories) are captured within the same table. This means that there are 5 results tables below, each of which presents results for one of the following dependent variables:

- Capex (change)
- Net investment (change)
- R&D (change)
- Total accruals (level)
- Discretionary accruals (level)

Each results table contains two results reporting columns: the first captures relationships between target *presence* and investment (or accruals), and the second captures relationships

between target *size* and investment (or accruals).

Capex (change)

Target	Presence coefficient [p-value]	Size coefficient [p-value]
Annual bonus - profit	-0.003 [0.448]	0.005 [0.692]
Annual bonus - cashflow	-0.002 [0.370]	0.012 [0.676]
Annual bonus - EPS	-0.001 [0.804]	0.004 [0.858]
Annual bonus - revenue	0.005* [0.078]	0.040* [0.078]
LTIP - relative TSR	0.004** [0.024]	0.007 [0.222]
LTIP - absolute TSR	#N/A	#N/A
LTIP – EPS	-0.001 [0.684]	-0.003 [0.630]
LTIP - cashflow	0.001 [0.828]	0.015 [0.254]

Net Investment (change)

Target	Presence coefficient [p-value]	Size coefficient [p-value]
Annual bonus - profit	-0.002 [0.466]	0.019 [0.160]
Annual bonus - cashflow	0.001 [0.494]	0.055** [0.028]
Annual bonus - EPS	-0.006 [0.132]	-0.004 [0.810]
Annual bonus - revenue	0.003	0.012

Target	Presence coefficient [p-value]	Size coefficient [p-value]
	[0.168]	[0.576]
LTIP - relative TSR	0.004** [0.034]	0.013** [0.026]
LTIP - absolute TSR	#N/A	#N/A
LTIP – EPS	0.001 [0.778]	-0.001 [0.890]
LTIP - cashflow	0.001 [0.524]	0.001 [0.272]

R&D (change)

Target	Presence coefficient [p-value]	Size coefficient [p-value]
Annual bonus - profit	-0.001 [0.608]	0.007 [0.360]
Annual bonus - cashflow	-0.002 [0.210]	-0.004 [0.822]
Annual bonus - EPS	0.005 [0.062]	0.037*** [0.006]
Annual bonus - revenue	0.002 [0.356]	0.034 [0.110]
LTIP - relative TSR	-0.000 [0.904]	-0.002 [0.602]
LTIP - absolute TSR	#N/A	#N/A
LTIP – EPS	-0.001 [0.568]	-0.005 [0.188]
LTIP - cashflow	-0.002 [0.316]	-0.011 [0.342]

Total Accruals (level)

Target	Presence coefficient [p-value]	Size coefficient [p-value]
Annual bonus - profit	0.002 [0.846]	-0.035 [0.222]
Annual bonus - cashflow	-0.002 [0.746]	-0.051 [0.452]
Annual bonus - EPS	-0.002 [0.854]	-0.047 [0.412]
Annual bonus - revenue	-0.008 [0.352]	-0.095 [0.230]
LTIP - relative TSR	0.004 [0.572]	0.014 [0.444]
LTIP - absolute TSR	#N/A	#N/A
LTIP – EPS	-0.002 [0.722]	-0.011 [0.508]
LTIP - cashflow	0.001 [0.968]	0.017 [0.712]

Discretionary Accruals (level)

Target	Presence coefficient [p-value]	Size coefficient [p-value]
Annual bonus - profit	0.001 [0.906]	-0.030 [0.300]
Annual bonus - cashflow	-0.001 [0.800]	-0.033 [0.572]
Annual bonus - EPS	-0.005 [0.650]	-0.043 [0.422]
Annual bonus - revenue	-0.007 [0.488]	-0.076 [0.412]
LTIP - relative TSR	0.005	0.019

Target	Presence coefficient [p-value]	Size coefficient [p-value]
	[0.468]	[0.344]
LTIP - absolute TSR	#N/A	#N/A
LTIP – EPS	-0.002 [0.750]	-0.015 [0.386]
LTIP - cashflow	-0.001 [0.894]	0.005 [0.920]

General econometric analysis - commentary

- Across our results tables, we tend to find that coefficient estimates commonly fall between -0.010 and +0.010 in magnitude. However, there are numerous cases where coefficients are significantly greater than this, particularly for relationships between our investment/accruals dependent variables and target size.
- Our dependent variables measure the change in scaled investment and level of scaled accruals, and these are captured as a percentage of lagged total assets. A coefficient of -0.010 therefore implies that:
    - Where the independent variable is target presence, the presence of a target category within the annual bonus or LTIP is associated with a 1.0 percentage point reduction in the dependent variable.
    - Where the independent variable is target size, a 100% (or 1.0) higher share of total CEO pay associated with a particular target (under maximum pay conditions) is associated with a 1.0 percentage point reduction in the dependent variable.
- Overall, our results are mostly lacking in statistical significance, with relatively few coefficients being significantly different from zero. Focusing on those coefficients that are statistically significant, we find that all of these relationships are positive.

General econometric analysis - comparison with 2019 study

Our 2019 study found a significant negative relationship between the size of LTIP EPS targets and capex. This relationship is not replicated by the general econometric analysis undertaken as part of this study, despite drawing on a similar dataset for both executive pay and financial variables. However, there are several differences between the sample and specification used in each study:

Table A.D.10: Summary of differences between 2019 study and this study

	2019 study	2020 study
Time period	2009-2016	2013-2019
Firms	FTSE 350	FTSE All-Share
Dependent variable	Level of capex	Annual change in capex

When we align the sample and dependent variable specification of this study with the 2019 study, we do find a significant negative relationship between the size of LTIP EPS targets and capex. Interestingly we also find a significant negative relationship between the size and presence of annual bonus EPS targets and capex for this regression. Table A.D.11 below presents the results of this analysis:

Table A.D.11: Results of general econometric analysis for capex using 2019 study sample and specification

Target	Presence coefficient [p-value]	Size coefficient [p-value]
Annual bonus - profit	0.001 [0.760]	-0.019 [0.332]
Annual bonus - cashflow	-0.003 [0.580]	-0.138** [0.018]
Annual bonus - EPS	-0.010* [0.078]	-0.091*** [0.004]
Annual bonus - revenue	-0.001 [0.920]	-0.011 [0.828]
LTIP - relative TSR	-0.003 [0.562]	0.006 [0.636]
LTIP - absolute TSR	-0.004 [0.596]	0.005 [0.858]
LTIP – EPS	-0.005 [0.282]	-0.017* [0.056]
LTIP - cashflow	0.004 [0.538]	0.055 [0.106]

These findings suggest that the difference in results is driven by differences in the sample and model specification between the two studies. This significant negative result does not hold when the time period, firm sample or dependent variable specification are changed.

This study has a larger sample due to covering a longer time series and more firms. We also consider the annual change in investment, which more accurately captures firm decisions than the level of investment. As such, the findings from this study are more likely to be representative.

De-facto base pay analysis - results

In this sub-section, we present the results from our de-facto base pay analysis. We use a single results table to capture the results from each of our three regressions (which are explained in the Econometric specification section above):

1. Levels specification
2. Difference specification
3. Fractions (ratios) specification

Our results table has two columns, which report results for annual bonus and LTIP data respectively.

Dependent variable	Expected value of annual bonus coefficient [p-value]	Expected value of LTIP coefficient [p-value]
CEO base salary (level)	0.271*** [0.000]	0.030** [0.036]
CEO base salary (annual change)	0.015 [0.522]	0.017 [0.420]
CEO fixed pay (ratio)	-1.814 [0.194]	-0.175*** [0.000]

De-facto base pay analysis - commentary

This piece of analysis considers whether either the annual bonus or LTIP acts as de-facto base pay. As detailed above, we estimate these relationships in levels, differences and ratios.

We find a positive significant relationship between the level of CEO base salary and the expected value of both the annual bonus and LTIP.

- In particular, a £1 increase in the expected value of the annual bonus is associated with a £0.27 increase in CEO base salary. Similarly, although less substantially, a £1 increase in the expected value of the LTIP is associated with a £0.03 increase in CEO base salary.
- This positive relationship reflects the existence of factors that contribute to CEOs that receive higher base salary having a higher expected value of their annual bonus and

LTIP. We aim to remove these effects by controlling for time, industry and firm financial effects. For example, controlling for firm revenue removes some of the scale effect whereby larger firms will pay their CEOs larger salaries (and also offer them larger annual bonus or LTIP packages).

- However, these results suggest that there may be further unobserved factors correlated with both CEO base salary and the expected value of the annual bonus and/or LTIP. Such factors may include CEO quality, whereby a higher quality CEO might command a larger pay package overall (with implications for both base salary and the expected value of their annual bonus or LTIP). The fact that our difference specification produces statistically insignificant results further supports the idea that the positive relationships found in our levels specification may reflect unobservable omitted variables rather than genuine economic relationships.

In contrast, we find a significant negative relationship between the ratio of fixed pay to LTIP pay at maximum payout and the expected vesting share of the LTIP.[86]

- A 1 percentage point increase in the expected vesting share of the LTIP is associated with a 1.8 unit reduction in CEO fixed pay relative to LTIP pay at maximum payout.
- Such a finding implies optimal contracting behaviour among FTSE All-Share firms, in that the fixed component of CEO pay is lower when CEOs can expect to earn more from LTIPs. In other words, fixed CEO pay is lower when it is relatively easy for CEOs to earn rewards from their LTIP.
- However, if LTIPs become seen (even in part) as de-facto base pay (especially where relatively achievable LTIP-based awards displace fixed pay), they may have less power to incentivise the CEO to prioritise firm performance. As such, LTIPs may not be used to serve their intended purpose.
- A potential counter-argument is that optimal contracting results in LTIPs (i.e. the variable component of CEO pay) taking up a greater proportion of total CEO pay than otherwise, meaning that total CEO pay is more sensitive to firm performance. This may strengthen rather than weaken incentives for CEOs to prioritise firm performance (and improve their LTIP award), particularly in those cases where fixed pay is perceived to be low.

The relationship between expected vesting share of the annual bonus and the ratio of fixed pay to annual bonus pay at maximum payout is also negative, but it is not statistically significant.

Overall, this evidence suggests that CEO pay contracts do tend to be set rationally with regards to the expected value of the LTIP, such that CEO fixed pay is set lower when the LTIP performance targets are relatively easy to achieve. Optimal contracting practices of this kind suggest that firms hold some power in the market for CEOs. Nonetheless, as we note above,

[86] As a reminder, by 'fixed pay' we mean the combination of base salary, pension(s) and benefits. We refer the reader to Chapter 3 for a full explanation of how overall CEO pay is typically decomposed.

these practices also create risk that easier LTIP targets are seen as de-facto base pay, potentially reducing CEOs' incentives to prioritise firm performance.

Such optimal contracting does not appear to occur with regards to annual bonuses (at least not systematically). This implies that easy performance targets within annual bonuses may be seen as a pay top-up, rather than a replacement for CEOs' base pay.

Appendix E: Bibliography

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