Performance for pay? The relation between CEO incentive compensation and future stock price performance

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Abstract

Measures of Chief Executive Officer (CEO) excess compensation are negatively related to future firm returns and operating performance. The effect is stronger for more overconfident CEOs at firms with weaker corporate governance. Overconfident CEOs receiving high excess pay undertake activities such as overinvestment and value-destroying mergers and acquisitions that lead to shareholder wealth losses.

Keywords: Executive compensation; Pay-performance relationship

JEL Classification: G34; J33

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I. Introduction

Over the last few years, politicians and the media have increasingly argued that CEOs are paid too much and that current executive compensation practices push employees to take short-term risks with little regard for the long-term effect on their companies. Consequently, recent regulatory proposals have called for significant proportions of pay being offered through options, restricted equity, or other forms of long-term compensation designed not to reward short-term performance.[1] These proposals follow the recommendations of the academic literature on agency theory and executive compensation which has argued for the past three decades that CEO compensation should be aligned to firm performance (see for example, Holmström, 1979, Grossman and Hart, 1983, and Jensen and Murphy, 1990). To the extent that long-term compensation plans offer incentives to CEOs to act in the best interest of shareholders going forward, and to the extent that markets do not fully incorporate pay information when it is made public, these proposals would seem to imply a positive relation between incentive pay and future returns. However, the evidence on whether compensation is related to future firm performance is decidedly mixed. For example, Abowd (1990), Lewellen, Loderer, Martin, and Blum (1992), and Tai (2004) find a positive relation between pay and future stock returns. Other papers document an equally strong negative relation between executive pay and future returns (see for example, Core, Holthausen, and Larcker, 1999, or Brick, Palmon, and Wald, 2006). The former set of papers attributes the positive relation between executive compensation and future performance to incentive alignment between the shareholders and the executives, while the latter set of papers attributes the negative relation between compensation and firm performance to agency issues.

Both sets of papers typically assume that managers are rational economic actors who understand the incentives provided by the board and act accordingly, either to maximize shareholder value or their own private benefits. During the past decade however, an increasing number of papers have argued that managers are prone to behavioral biases that have real effects on firm actions and performance. One particular behavioral bias is overconfidence. An

[1] See among others, Schäfer, Daniel, and Sam Fleming, "Bank of England proposes six-year bonus clawback rule", *Financial Times*, March 13, 2014. Restrictions on bonuses proposed by the European Union limit the type of instruments that can be used to pay banker bonuses so that variable remuneration becomes more closely linked to the performance of the bank. In Japan, a new corporate governance code introduced in June 2015, recommended that firms lift the variable component in pay packages that is linked to long-term results. The Economist argues that "openly paying bosses oodles of […] stock options might work best in […] Japan." (see "Pay Check", *Economist*, April 6 2016).

increasingly prominent stream of research (see for example, Humphery-Jenner, Lisic, Nanda, and Silveri, 2016) has argued that overconfident CEOs are more likely to accept option-heavy incentive compensation. A second stream has argued that overconfident CEOs and CFOs engage in sub-optimal behavior, such as wasteful capital expenditures, empire building, and earnings mismanagement, destroying shareholder value (see for example, Ben-David, Graham, and Harvey, 2013, or Malmendier and Tate, 2005, 2008, 2009).

In this paper, we bring these two streams together. We hypothesize that overconfident CEOs are more likely to accept particular types of pay contracts, those that involve long-term commitments to increasing the value of the firm, and are also significantly more likely to subsequently *underperform*, creating a *negative* relationship between pay and future stock performance. In a broad cross-section of Execucomp S&P1500 firms over the 1994-2015 period, we analyze the relation between CEO compensation and future firm performance, using details of the pay contracts, proxies for CEO overconfidence, investment, merger and acquisition data, and controls for measures of potential firm agency problems and show that a negative relation holds in the cross-section of firms over this time period.

We first show that CEO compensation is correlated with variables associated with overconfidence. Using two measures of "excess" incentive compensation ("peer-adjusted incentive compensation", computed after adjusting pay for industry and size controls and "model-adjusted incentive compensation," estimated using a model that controls for standard economic determinants of pay), we find that pay is positively correlated with a popular measure of overconfidence, the proportion of unexercised in-the-money options to total compensation, a measure similar to that used in Malmendier and Tate (2005). Managers in the top pay deciles typically exhibit a significantly greater level of overconfidence than do managers in the lower deciles. Further, consistent with the characteristics of overconfident managers in Ben-David, Graham, and Harvey (2013), high paid CEOs, relative to lower paid CEOs, invest more, engage in more mergers, and use more debt.

Next, we form calendar time portfolios by sorting firms into deciles of total peer-adjusted or model-adjusted incentive compensation using the report date of quarterly earnings from Compustat. We update the decile groups whenever new pay information is released for a firm. We find that firms in the highest decile of excess incentive pay earn significantly lower average monthly returns than low pay firms: the average monthly equal-weighted portfolio return of the high peer-adjusted pay minus low peer-adjusted pay portfolio is -0.34% (*t*-statistic = -2.35), the Fama-French (1993) three-factor alpha is -0.30% (*t*-statistic = -2.66), and the Carhart (1997) four-factor model alpha is -0.27 (*t*-statistic = -2.40). The results are qualitatively similar when we form portfolios by sorting on the model-adjusted pay measure and for value-weighted portfolios. We find that the reduction in returns is strongest for the CEOs in the highest deciles of our pay measures.

The pay effect is strongly related to the overconfidence of the CEO. When we form portfolios by double sorting on pay and the overconfidence measure, we find that firms with highly paid CEOs earn significantly lower returns when the CEO is overconfident. For example, the average monthly portfolio return of the high peer-adjusted pay minus low peer-adjusted pay portfolio is -0.46% (*t*-statistic = -2.82) for CEOs in the top median of annually ranked unexercised exercisable options. The results are qualitatively similar using model-adjusted pay. In contrast, we find no pay effect when we examine the spreads between high and low-pay for either peer-adjusted or model-adjusted pay in a sample of CEOs with below median overconfidence.

Why don't boards anticipate this relation ex ante and explicitly limit shareholder value destruction activities? To answer this question, we next test if the link between pay and future returns is related to measures of corporate governance. If well-governed firms can explicitly limit CEO value-destruction activities, the lower returns earned by more overconfident CEOs should be particularly evident at weaker governance firms. That is precisely what we find. We form portfolios by triple-sorting on pay, the overconfidence measure, and the BCF corporate governance index from Bebchuk, Cohen, and Ferrell (2009). When we further condition on governance, and examine the spread in returns between high pay and low paid CEOs for firms with high overconfidence CEOs *and* weak governance, the spread increases in absolute magnitude to -0.68% per month (*t*-statistic = -3.35). The results are qualitatively similar using model-adjusted pay. Hence, the effect of high pay predicting lower returns appears distinctively stronger for overconfident CEOs at firms with weaker governance.

We confirm these results in panel regressions of monthly returns on lagged pay. Controlling for variables that have been shown to explain the cross-section of returns, variables that capture significant pay and governance characteristics (such as board size, board independence, institutional holdings, CEO tenure, delta - the sensitivity of CEO wealth to share value, vega - the sensitivity of CEO wealth to stock return volatility, and others), using firm and time fixed effects, and double-clustered standard errors by firm and time, we find that the coefficient on lagged pay (for both peer and model-adjusted pay) is negative and almost always highly statistically significant. In models where we include interaction effects of pay and overconfidence, pay and governance, and pay/overconfidence/governance, the triple interaction effect dominates, and remains negative and highly significant.

What links pay to the lower returns earned by a firm? We directly test for evidence of shareholder wealth destruction and fundamental performance effects at these firms. We do this in three ways. First, we examine the stock price reaction over the three months following the announcement of takeovers. Second, we examine the changes in firm profitability after the announcement of pay, and third, we examine how the pay/future return effect varies across periods of higher and lower overconfidence. If high paid CEOs engage in wasteful acquisition-related spending that destroys value in the future, we should observe negative abnormal returns following takeover announcements. Similarly, we should observe decreases in operating performance for the high paid CEOs relative to the low paid CEOs. Finally, the link between pay and returns should be stronger following periods of greater CEO overconfidence.

We find evidence for each of these effects. Specifically, firms led by over-confident CEOs earn significantly lower negative returns over the three months following the announcement of takeovers. The risk adjusted return spread between the firms in the highest quintile of peer-adjusted incentive pay relative to firms in the lowest quintile of pay is approximately -1% (or -4% annually). When we condition on CEOs above the median of overconfidence, the returns from the 90-day abnormal return spread between high and low paid CEO firms is approximately -5%. When we further split the sample on governance, the spread between firms with high pay/high overconfidence/weak governance and firms with low pay/high overconfidence/weak governance grows to approximately -13%. We find similar results using the model-adjusted pay measure. We also find a link between pay and future profitability. In regressions of future firm operating performance on lagged pay, pay is negatively related to future firm performance and the effects strengthen for more overconfident CEOs at firms with weaker governance. Finally, we find some evidence that the pay effect is stronger following periods of greater aggregate overconfidence. To define periods of high and low overconfidence, we draw on the findings in Ben-David, Graham, and Harvey (2013) that executives are more confident following periods of high market returns and less confident following low market returns. We interact lagged market returns with pay and the firm specific option overconfidence measure and find that the overconfidence CEO/pay effect is stronger following increasing lagged market returns. Thus, all three findings – the returns following takeover announcements, the drop in future firm profitability, and increases in the pay effect following periods of greater overconfidence -- are consistent with the hypothesis that highly paid overconfident CEOs destroy firm value through overinvestment, and that these effects are stronger at firms with weaker governance.

An alternative explanation for our results is that investors overreact to announcements of high pay, pushing up prices, which at some point generates mean reversion in returns as the mispricing is corrected. We first note that our previous finding of a negative link between pay and future profitability is inconsistent with an investor overreaction story, since investor overreaction would seem to affect publicly observable prices but not underlying firm operating performance. To explicitly capture potential investor overreaction to firm information, we examine analyst forecasts. While we find some evidence that analyst forecast errors are more positive for announcements of higher pay, a comparison of variables that capture CEO overconfidence and pay, and investor overreaction and pay, shows that CEO overconfidence remains negative and statistically significant in explaining future returns. Meanwhile, the investor overreaction variables are not significantly related to future returns. Therefore, it appears that the ability of pay to predict future returns flows from a CEO overconfidence channel rather than investor overreaction to compensation and other related firm information.

Overall, we conclude that the mechanism driving the negative relationship between pay and future performance is that CEOs who accept high long-term incentive pay are, on average, overconfident and engage in value destroying activities that result in lower future operating performance and stock returns. The pay effect is negatively related to the strength of governance at the firm and positively related to the level of overconfidence. We argue therefore, that standard recommendations such as offering CEOs long-term incentive compensation plans, without controlling for managerial biases such as overconfidence, are unlikely to achieve their objectives in maximizing shareholder value.

The remainder of the paper is organized as follows. In Section II, we provide a brief overview of the literature on executive compensation and CEO overconfidence. In Section III, we describe the data used in our analysis and describe how our main compensation metrics are formed. In Section IV, we document an association between compensation and CEO overconfidence, and perform tests that use pay and CEO overconfidence to predict future returns and firm profitability. We also show that the source of the predictability is related to the overconfidence of the CEO and the strength of the governance at the CEO's firm. Section V concludes.

II. Literature review

The literature on the relationship between compensation and future stock performance is relatively sparse. In part, this is likely due to the implicit assumption that in efficient markets, investors will immediately capitalize the present value of future firm performance changes into the stock price when the incentive pay becomes public information. There is some evidence for this. Fich and Shivdasani (2005) and Brickley, Bhagat, and Lease (1985), for example, document positive abnormal returns for firms adopting stock-based compensation plans.

However, there are reasons to expect that information in CEO incentive pay may not be completely impounded into returns. For example, as Hayes and Schaefer (2000) conjecture, from the standpoint of outside investors, CEO compensation contracts may incorporate observable and unobservable measures of performance. If the unobservable contract features are correlated with future returns, then variation in current pay that is not explained by variation in current observable performance measures may predict future returns. Yermack (1997) for example, documents a significant positive abnormal return drift that persists for at least 4 months after a firm awards stock options to its CEO. In addition, the non-cash component of total pay, in particular, is potentially less transparent than cash pay, given the hard to value nature of the option component of non-cash pay. For example, the true value of option pay may be distorted by the apparent wide spread practices of option backdating and option repricing (Lie, 2005, Heron and Lie, 2007, or Narayanan and Seyhun, 2008). Finally, Benmelech, Kandel, and Veronesi (2010) argue that stock-based compensation supplies incentives for suboptimal investment policies designed to hide bad news about the firm's long-term growth. They identify conditions under which stock-based executive compensation leads to misreporting, suboptimal investment, run-up, and a subsequent sharp decline in equity prices.

The early literature reports some evidence of a positive relationship between high pay levels and future stock price performance. Masson (1971) tests the structure of executive compensation on firm performance for a sample of top executives in 39 firms from 1947-1966 and finds that firms with executives whose financial rewards more closely parallel stockholders' interest perform better in the stock market over the postwar period. Abowd (1990) analyzes the effects that the level of pay-performance sensitivity has on firm performance, in a sample of 16,000 managers in 250 large corporations over the 1981-86 period, and shows that operating income after taxes is significantly and positively related to pay-performance sensitivity. Firms with above-median pay-performance sensitivity had a higher probability of above-median future performance in both accounting and market returns. Lewellen, Loderer, Martin, and Blum (1992) also show a relation between the levels of compensation and the firms' economic performance. In data drawn from 49 Fortune 500 firms between 1964 and 1973, they find that the total compensation of a firm's three highest-paid officers is positively related to differences in both common stock returns and operating profitability. In a multiple regression of stock returns on contemporaneous and next year's compensation, value-weighted market and industry returns, firm size, and other variables, compensation (especially future compensation) is significant. Yermack (1997) finds that stock prices increase after grants of executive stock options. Kato, Lemmon, Luo, and Schallheim (2005) find that firm operating performance increases following option plan adoption for Japanese firms.

However, there is an equally large body of literature that shows that high pay is associated with poor stock price performance. In these papers, the poor performance is typically not solely driven by pay; rather, managers in firms with weak governance are prone to agency concerns, both extracting high pay and performing poorly. For example, in a sample of 205 firms over 1982-1984, Core, Holthausen, and Larcker (1999) find a negative relation between compensation (predicted on the basis of board and ownership structure) and subsequent firm operating and stock return performance. They conclude that firms with weaker governance structures have greater agency problems; that CEOs at firms with greater agency problems receive greater compensation; and that firms with greater agency problems perform worse. Similarly, Malmendier and Tate (2009) examine a sample of 264 CEOs over the 1975-2002 period, to show that firms managed by "superstar" CEOs subsequently underperform for up to two years after the CEOs win important business awards. They also attribute the lower performance to agency problems, showing that superstar CEOs extract more compensation following the award, and spend more time on public and private activities outside their companies, such as assuming board seats or writing books. Brick, Palmon, and Wald (2006) attribute a negative relation between excess compensation (both director and CEO) and firm underperformance to mutual back scratching or cronyism on the parts of directors and CEOs. Ariely, Gneezy, Lowenstein, and Mazar (2009) test whether very high monetary rewards can decrease performance in an experimental setting in which subjects receive performance-contingent payments that vary in amount from small to very large relative to their typical levels of pay. They document that very high reward levels have a detrimental effect on performance.

In both streams of literature, the managers are rational economic actors who understand the incentives provided by the board and act accordingly, either to maximize shareholder value or their own private benefits. Over the past decade however, an increasing number of papers have argued that managers are prone to behavioral biases, in particular, overconfidence, that have real effects on firm actions and performance. Gervais, Heaton, and Odean (2011) show theoretically that overconfidence leads managers to accept convex compensation contracts (such as pay in the form of options) that expose them to excessive risk. Larkin and Leider (2012) confirm this hypothesis in a laboratory experiment showing that, despite clear feedback, overconfident subjects are more likely than others to choose a convex pay scheme over piece rate pay, even when it leads to lower pay. Humphery-Jenner, Lisic, Nanda, and Silveri (2016) document that firms offer option incentive-heavy compensation contracts to overconfident CEOs to exploit their positively biased views of firm prospects. Chang, Chen and Fuh (2013) show that executives appear to value employee stock options (ESOs) at a 48% premium to the Black-Scholes value. These premia suggest a high level of executive overconfidence. In a tournament model, Goel and Thakor (2008) show that overconfident employees, who sometimes make value-destroying investments, have a higher likelihood than a rational manager of being promoted to CEO. Paredes (2005) argues that highly paid CEOs may become overconfident. He argues that large executive compensation package gives positive feedback to a CEO and signals that the chief executive is a success, possibly resulting in CEO overconfidence and bad business decisions, particularly overinvestment.

Overconfident CEOs have been shown to have significant effects on firm value. Ben-David, Graham, and Harvey (2013) and Malmendier and Tate (2005, 2008, 2009) among others, show that overconfident CEOs and CFOs engage in sub-optimal behavior, such as wasteful capital expenditures, empire building, and earnings mismanagement, destroying shareholder value.

Typically, these effect are worse at firms with weaker corporate governance (Malmendier and Tate, 2009).

Our paper is couched in this latter behavioral bias literature. The mechanism driving our hypothesized relationship is the idea that highly paid CEOs are on average overconfident, and engage in value destroying activities that reduce future stock performance. In addition, not only should pay be negatively related to future stock returns, but the value destroying activities, if they are material in nature, should result in lower future operating performance.

III. Data and methodology

Our data consists of all NYSE, AMEX, and NASDAQ firms jointly listed on the Compustat Execucomp Database, the Compustat annual industrial files, and the CRSP files from 1994 through 2015. Specifically, CEO compensation data from Execucomp and accounting data from Compustat are collected over 1994 to 2015 and CRSP data is obtained over 1994 to 2015. We update the pay decile groups whenever new compensation data is available. We use the report date of quarterly earnings from Compustat (RDQ variable from Compustat's Fundamentals Quarterly database) as the announcement date for compensation data. We assume that the pay information is publicly available at the end of the month in which earnings are announced.[2] When we form portfolios by sorting on pay, we use a rolling twelve-month window to identify pay decile groups; firms are assigned to a decile pay group based on the pooled distribution of pay across all firms in that twelve month window. When a new month of pay data becomes available, the oldest month is dropped and new firms are allocated into decile groups. A firm retains its decile assignment for a year, until its next year's pay is announced. Equal and value weighted returns to these sorted portfolios are measured over the following month.

We use two measure of excess incentive compensation in our tests.[3] The motivation for our two compensation measures is to capture the part of compensation that is potentially related to

[2] It is possible that the precise report dates of proxy statements are different from the report dates of quarterly earnings. However, differences in release days do not matter for our analysis as long as the announcement day of earnings and the proxy statement release date are in the same month. To test if the existence of late filers of proxy statements makes a material impact in our results, we repeat our tests assuming that the proxy statements are released in either the first month or second month following the month in which earnings are made publicly available. In these tests, we form portfolios at the end of the assumed proxy statement release month and find that our results are qualitatively similar.
[3] We define incentive compensation as the difference between total compensation and total cash compensation (defined as TDC1-TCC in the Execucomp database).

CEO overconfidence. To do this, we subtract from incentive compensation the portion of pay that a CEO is likely to earn for standard firm size and industry or standard firm-performance economic determinants of pay.[4] The adjusted compensation is more likely to be related to overconfidence.

Our first pay measure, peer-adjusted incentive compensation is based on the finding that firms benchmark pay on peer groups (Bizjak, Lemmon, and Naveen, 2008, and Faulkender and Yang, 2010). They show that these benchmarks are used extensively, with over 95% of the firms in their respective samples using benchmarking or peer groups to determine levels of executive salary, bonus or option awards. Peer groups are typically based on industry or size. Albuquerque (2009) documents that the use of peer groups formed on the basis of industry and size increases the power of tests to detect relative performance evaluation (RPE) in CEO compensation. Hence, for our first measure, peer-adjusted incentive pay, we use industry- and size-adjusted CEO compensation data. Specifically, to calculate peer-adjusted CEO compensation, we use the following procedure. First, we allocate firms into 49 industry portfolios using industry classifications from Ken French's website. Firms in each industry are then allocated into two size groups (high or low) based on the median sales (or market capitalization) of the firms in the industry. Industry and size adjusted incentive compensation for each firm is then measured as the difference between the incentive compensation for firm *i* and the median incentive compensation of the firms in the same industry and size portfolio. In the rest of the paper, following Bizjak, Lemmon, and Naveen (2008), we report results based on sales as our proxy for firm size, though our results are similar if we use market capitalization. All the compensation figures are adjusted for inflation using the consumer price index. 2006 is used as the base year for inflation adjustment.

Our second pay measure, model-adjusted incentive compensation, is based on a simple model of the economic determinants of firm pay. We compute residual compensation using a model of pay that is similar to Core, Holthausen, and Larcker (1999). Each month *m* of year *t*, using firms which released annual proxy statements over the previous 12 months ending in month *m* of year *t*, we regress firm compensation on sales, investment opportunities, ROA, annual returns, standard deviation of annual returns, and standard deviation of ROA. Sales, ROA, and investment opportunities are for the prior year spanning the fiscal period covered by the proxy statement.

[4] Total compensation (TDC1 variable in Execucomp) includes salary, bonus, total value of restricted stock granted, total value of stock options granted (using Black-Scholes), and long term incentive payouts.

Annual returns are the prior 12-month returns ending in the month prior to the pay announcement month. Standard deviation of annual returns and standard deviation of ROA are measured over the 5 years prior to the pay announcement month.

Table I reports the results of the compensation regression estimated on the full sample. There are strong links between total compensation (model 1), cash (model 2) and incentive compensation (model 3) and many of the standard economic determinants of pay. For example, the coefficient on lagged sales is positive and significant across all three models. Compensation is also positively related to ROA and prior annual stock returns. Across the three measures of pay, investment opportunities do not appear to be significant. The standard deviation of past annual returns and the standard deviation of ROA are not significantly related to total or incentive compensation, but are negatively related to cash compensation. The positive coefficients on sales and stock returns are similar to findings in Table 2 of Core, Holthausen, and Larcker (1999). However, there are also some differences. Core, Holthausen, and Larcker, for example, find an insignificant coefficient on ROA, whereas we find a highly significant positive coefficient. They also find different results than we do for coefficients on investments opportunities and standard deviation of ROA. It may not be too surprising that there are differences in the coefficients on these economic determinants of compensation given the differences in the sample sizes, periods and control variables. However, our basic finding that incentive pay increases as sales, ROA, and returns increase seems intuitive. To obtain our model-adjusted pay measure, we compute monthly predicted pay using the coefficients from the incentive compensation model (i.e., model 3 in Table I). So that the model-adjusted pay measure is ex ante in nature, we use a rolling twelve month window to estimate the Table I regression parameters, updating the regression parameters monthly. We then use the estimated coefficients each month to compute model-adjusted incentive compensation as actual pay in month *t* minus predicted pay in month *t* from this model. Predicted firm pay in each month is estimated as the coefficient times the realized firm values of the respective independent variables from the regression.

For our primary measure of CEO overconfidence, we use a measure similar in spirit to Malmendier and Tate (2005). We define an overconfident CEO as one who maintains a large proportion of unexercised exercisable in-the-money options relative to her total compensation (we refer to this measure as "unexercised in-the-money options" (UNEXOP) in the tables).[5] This measure is updated as new compensation data is reported. For the accounting control variables in our tests, all data is updated whenever a new annual proxy statement is released (i.e., using the report date of quarterly earnings variable for a given fiscal year end from Compustat as the pay announcement date). For price- or market value-scaled accounting ratios, such as book-to-market (BM), we use price or market value (MV) from the month prior to when annual pay data is released. When our tests include lagged return measures (for example, twelve-month lagged returns), these returns are estimated as the prior 12-month buy-and-hold returns ending in the month prior to the pay announcement month. The Appendix contains the definition of all the variables used in the paper along with details on the construction of these variables.

IV. Results

IV.A. *Descriptive statistics*

Table II reports descriptive statistics on our peer-adjusted and model-adjusted CEO incentive compensation measures, raw levels of CEO compensation, and its components for the pooled sample over 1994-2015. Panel A reports the mean, median, standard deviation, and maximum values, along with the percentage of total compensation each component represents. On average, cash compensation (salary and bonus) forms a smaller proportion of total compensation (44%) than incentive compensation (56%). However, incentive pay in particular, exhibits a great deal of variation relative to cash pay. The maximum cash compensation granted to any executive over our time period is on the order of $142 million. In contrast, the maximum incentive compensation is $848 million. The standard deviation for cash compensation is also approximately a fifth of the standard deviation for incentive compensation. Within cash compensation, cash salaries form a larger component than bonuses (31% to 13%). Options are the predominant form of incentive compensation. The average yearly value of the peer-adjusted pay measure is $1.36 million. For the

[5] From a pure diversification standpoint, and ignoring any tax considerations, it is optimal for risk-averse CEOs with high exposure to their company's stock to exercise vested in-the-money options and sell the resulting shares. Thus, the market value of unexercised exercisable in-the-money options relative to total pay may capture CEO overconfidence assuming CEOs cannot hedge their exposure to company stock and that they are not well diversified. Similar measures of CEO overconfidence are also used in Billett and Qian (2008), Liu and Taffler (2008), Hirshleifer, Low, and Teoh (2010), Galasso and Simcoe (2011), Campbell, Gallmeyer, Johnson, Rutherford, and Stanley (2011) and Humphery-Jenner, Lisic, Nanda, and Silveri (2016).

model-adjusted pay measure, the average yearly value is, by construction, zero. The standard deviations of the abnormal pay measures are both close to $8 million per year.

Panel B reports data on the correlation between these pay components. The variation of total compensation seems largely driven by the variation in total incentive compensation. The correlation between total and incentive compensation is 98% while that between total and cash compensation is 45%. Panel B also reports data on the correlations amongst the pay components and our measures of excess compensation. The correlation between our two measures of excess pay is high at 92%, suggesting that our results are robust to alternative measures of excess pay. Not surprisingly, given the larger relative magnitudes of incentive pay to cash pay in Panel A, the correlation between both our excess pay measures and incentive pay is high (78% for the peer-adjusted measure and 72% for the model-adjusted measure).

We next report simple univariate comparisons between our compensation measures and various firm and CEO characteristics including overconfidence, acquisition intensity, asset growth, investment intensity, and leverage in Table III. Specifically, we report median levels of firm characteristics for annual decile sorts on our two compensation measures. In Panels A.1 and B.1, we report median values of firm characteristics for the year prior to sorting on peer-adjusted and model-adjusted pay, respectively. In Panels A.2 and B.2, we report median values of firm characteristics for the year after sorting on peer-adjusted and model-adjusted pay, respectively. The Appendix provides exact formulae for all of the variables used in our tests.

Consistent with Table II Panel B, our two excess compensation measures appear related to the proportion of total pay paid in the form of incentives though as we go to the higher deciles, the increase in incentive pay is not monotonic but mildly U-shaped. At the highest excess compensation deciles, the proportion of incentive pay is over four-fifths of total pay while at the lowest decile, incentive pay accounts for less than half total pay. In addition, the proportion of incentive compensation also is closely correlated with the *change* in total compensation from the prior year. CEOs in the highest decile earned an increase in total compensation of nearly 50%, while CEOs in the lowest decile decreased marginally (Panel A.1) or stayed almost the same (Panel B.1) in the level of total pay.

In contrast, the percentage of total shares owned by the CEO monotonically shrinks (Panel B.1) or almost so (Panel A.1) as we go from decile 1 (least paid) to decile 10 (highest paid).

However, this is not simply a firm size effect attributable to the fact that, ceteris paribus, CEOs are likely to own a smaller percentage of shares in larger firms. Market capitalization also exhibits the same U-shaped relation as we saw for incentive compensation – firms paying the least in excess executive compensation are not the smallest firms. This implies that any relationship between executive compensation and firm performance is not likely to be a firm size effect. There is no clear pattern with the book-to-market ratio – while the differences between the extreme deciles is significant, the sign changes from the peer-adjusted pay to model-adjusted pay measure. In addition, the magnitude of the ratio appears to be essentially random away from the extremes. Finally, as judged by the year t (Panels A.1 and B.1) and year t+1 (Panels A.2 and B.2) values for the percentage change in total compensation column, pay is not stable nor persistent over time. This volatility in pay would seem to be a necessary condition for there to be a relationship between pay and future returns.

Turning to our measure of overconfidence (unexercised in-the-money options scaled by total pay – UNEXOP), we find a strong positive association between pay and overconfidence. For example, in Panels A.1 and A.2, CEOs in the higher deciles of peer-adjusted pay are more overconfident than lesser paid CEOs, with a statistically significant spread from pay decile 1 to decile 10 in UNEXOP. For the model-adjusted pay measure, the spread in the overconfidence measure is not significant in Panel B.1 for year t, but is strongly significant in Panel B.2 for year t+1.

Next, we examine firm characteristics that have been shown to be associated with overconfident managers. Ben-David, Graham, and Harvey (2013) show that overconfident managers engage in more mergers, invest more, and have higher leverage than less confident managers. In Table III, we find results broadly consistent with these patterns. First, we find that high paid CEOs engage in more mergers than low paid CEOs; the spread in acquisition intensity across top to bottom pay deciles is positive and statistically significant for both measures of pay. Second, there is a general pattern of greater total investment for high paid CEOs. Specifically, high paid CEOs exhibit higher levels of asset growth and investment intensity than lower paid CEOs when we rank pay on peer-adjusted compensation in Panels A.1 and A.2. However, the investment patterns are less clear when we consider model-adjusted pay in Panels B.1 and B.2. In those panels, we find that asset growth and investment intensity are negatively related to pay, perhaps because the variables used in the model-adjusted pay regressions of Table I potentially subsume the link between model-adjusted pay and these investment measures. Finally, we find that leverage is much larger for high paid CEOs for both measures of excess pay. For example, for peer-adjusted pay in year t, in Panel A.1, the highest pay decile firms have much greater *Leverage*, defined as total long-term debt/total assets, than decile 1 firms. Taken as a whole, many of the characters of high paid CEOs in Table III are strongly consistent with the traits of overconfident CEOs as discussed in Malmendier and Tate (2005), Ben-David, Graham, and Harvey (2013) and others.

IV.B. *CEO pay and future returns*

In this section, we formally test the hypotheses that excess pay is negatively related to future returns, that the effect is stronger for more overconfident CEOs, and for CEOs at firms with weaker governance.

First, to test the hypothesis that pay is related to future returns, we form equal-weighted (EW) and value-weighted (VW) calendar time portfolios by sorting firms into deciles of peer-adjusted or model-adjusted incentive compensation. The deciles are updated monthly as new pay information is released. For each portfolio, we report average monthly returns, Fama-French (1993) three-factor alphas, and Carhart (1997) four-factor model alphas.

In Table IV, we report EW peer-adjusted compensation sorts in Panel A.1 and EW model-adjusted compensation sorts in Panel A.2. We find that firms in the highest decile of peer-adjusted pay earn lower average monthly returns than low pay firms: the average monthly EW portfolio return of the high excess pay minus low excess pay portfolio is -0.34% (*t*-statistic = -2.35), the Fama-French (1993) three-factor alpha is -0.30% (*t*-statistic = -2.66), and the Carhart (1997) four-factor model alpha is -0.27% (*t*-statistic = -2.40). The results are similar in Panel A.2 for model-adjusted pay sorts: the average monthly EW portfolio return of the high excess pay minus low excess pay portfolio is -0.31% (*t*-statistic = -2.57), the Fama-French (1993) three-factor alpha is -0.31% (*t*-statistic =-2.59), and the Carhart (1997) four-factor model alpha is -0.30% (*t*-statistic = -2.50). The results are also similar when we compute value-weighted (VW) returns.[6] In untabulated

[6] Our results are robust to using a more conservative date for the release date of proxy statements. We repeat our portfolio tests assuming that the proxy statements are released in either the first month or second month following the month in which earnings are made publicly available. For example, forming portfolios at the end of the first month following the earnings announcement month, we find that for the peer-adjusted compensation sorts, the average monthly EW portfolio return of the high excess pay minus low excess pay portfolio is -0.29% (*t*-statistic = -1.99), the Fama-French (1993) three-factor alpha is -0.25% (*t*-statistic = -2.21), and the Carhart (1997) four-factor model alpha is -0.23% (*t*-statistic = -2.00). For model-adjusted compensation sorts, the average monthly EW portfolio return of the high excess pay minus low excess pay portfolio is -0.31% (*t*-statistic = -2.44), the Fama-French (1993) three-factor

results, we find that the average monthly VW portfolio return of the peer-adjusted high pay minus low pay portfolio is -0.33% (*t*-statistic = -2.91), the Fama-French (1993) three-factor alpha is -0.31% (*t*-statistic = -3.12), and the Carhart (1997) four-factor model alpha is -0.33% (*t*-statistic = -3.28). For the model-adjusted pay sorts, the average monthly VW portfolio return of the high excess pay minus low excess pay portfolio is -0.22% (*t*-statistic = -2.19), the Fama-French (1993) three-factor alpha is -0.29% (*t*-statistic = -2.92), and the Carhart (1997) four-factor model alpha is -0.27% (*t*-statistic = -2.66). Hence there appears to be a strong negative relation between pay and future returns. When we examine the returns across each pay deciles, we find that the main effect comes from the reduction in returns for the CEOs in the highest decile of pay, consistent with Gervais, Heaton, and Odean (2011) who find that extreme levels of overconfidence may be detrimental to a firm, and Goel and Thakor (2008) who find that excessive overconfidence destroys firm value, and our findings in Table III that higher paid CEOs have much greater levels of overconfidence compared to lower paid CEOs as measured by the unexercised in-the-money options measure.

Next, we test the hypothesis that the link between pay and future returns is stronger in the presence of CEO overconfidence. To directly measure CEO overconfidence, we use the unexercised options measure. We form portfolios by sorting firms independently into medians on the overconfidence measure, and then sorting the top and bottom overconfidence groups into pay deciles. High (low) overconfidence is defined as firms in the top (bottom) median of annually ranked unexercised in-the-money options (UNEXOP). We report the returns to the pay decile portfolio for the high overconfidence firms in Panel B of Table IV. Peer-adjusted pay sorts are reported in Panel B.1 and model-adjusted pay sorts are reported in Panel B.2. The average monthly portfolio return of the high peer-adjusted pay minus low excess pay portfolio for the high overconfidence CEO group is -0.46% (*t*-statistic = -2.82), the Fama-French (1993) three-factor alpha is -0.44% (*t*-statistic = -3.15), and the Carhart (1997) four-factor model alpha is -0.43% (*t*-

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alpha is -0.30% (*t*-statistic = -2.52), and the Carhart (1997) four-factor model alpha is -0.29% (*t*-statistic = -2.39). Similarly, allowing for three months between the earnings release date and the month in which the proxy statements are assumed to be public does not make a difference. Forming portfolios at the end of the second month following the earnings announcement month, we find for peer-adjusted compensation sorts that the average monthly EW portfolio return of the high excess pay minus low excess pay portfolio is -0.29% (*t*-statistic = -1.97), the Fama-French (1993) three-factor alpha is -0.25% (*t*-statistic = -2.28), and the Carhart (1997) four-factor model alpha is -0.22% (*t*-statistic = -2.02). For model-adjusted compensation sorts, the average monthly EW portfolio return of the high excess pay minus low excess pay portfolio is -0.34% (*t*-statistic = -2.58), the Fama-French (1993) three-factor alpha is -0.35% (*t*-statistic = -2.81), and the Carhart (1997) four-factor model alpha is -0.33% (*t*-statistic = -2.63).

statistic = -3.05). Similarly, for the model-adjusted pay measure, the average monthly portfolio return of the high pay minus low pay portfolio for the high overconfidence CEO group is -0.47% (t-statistic = -3.02), the Fama-French (1993) three-factor alpha is -0.43% (t-statistic = -3.00), and the Carhart (1997) four-factor model alpha is -0.43% (t-statistic = -2.96).

Finally, we condition the portfolio sorts on firm governance. Is the effect stronger for overconfident CEOs at firms with weak governance? We answer this questions by sorting firms independently into medians on the overconfidence measure, then medians on the BCF corporate governance index from Bebchuk, Cohen, and Ferrell (2009). Strong (weak) governance is defined as firms in the bottom (top) median of annually ranked BCF corporate governance index. The BCF measure is constructed so that higher values equate to weaker governance. We then sort each of these four groups (i.e., high and low overconfidence/weak and strong governance) into pay deciles. We report the returns to the pay decile portfolios for the high overconfidence and weak governance firms in Panel C of Table IV. Peer-adjusted pay sorts are reported in Panel C.1 and model-adjusted pay sorts are reported in Panel C.2. The average monthly portfolio return of the high peer-adjusted pay minus low excess pay portfolio for the high overconfidence CEO and weak corporate governance firms is -0.68% (t-statistic = -3.35), the Fama-French (1993) three-factor alpha is -0.67% (t-statistic = -3.47), and the Carhart (1997) four-factor model alpha is -0.61 (t-statistic = -3.15). The results are similar using the model-adjusted pay measure; the average monthly portfolio return of the high pay minus low pay portfolio for the high overconfidence CEO and weak corporate governance firms is -0.63% (t-statistic = -2.98), the Fama-French (1993) three-factor alpha is -0.58% (t-statistic = -2.74), and the Carhart (1997) four-factor model alpha is -0.55% (t-statistic = -2.57). We find similar results for value-weighted conditional portfolios.[7]

Finally, in panels D and E, we show that the negative effect between pay and performance does not hold when we examine CEOs with low overconfidence or CEOs with low overconfidence and strong governance. None of the spreads are significant in these panels. Overall, the portfolio sorts

[7] The average value-weighted monthly portfolio return of the high peer-adjusted pay minus low peer-adjusted pay portfolio for the high overconfidence CEO firms and weak corporate governance firms is -0.57% (t-statistic = -2.97), the Fama-French (1993) three-factor alpha is -0.57 % (t-statistic = -2.96), and the Carhart (1997) four-factor model alpha is -0.54 (t-statistic = -2.85). The results are similar using the model-adjusted pay measure; the average monthly portfolio return of the high pay minus low pay portfolio for the high overconfidence CEO firms and weak corporate governance firms is -0.44% (t-statistic = -2.14), the Fama-French (1993) three-factor alpha is -0.40% (t-statistic = -1.95), and the Carhart (1997) four-factor model alpha is -0.45% (t-statistic = -2.89).

confirm the three hypotheses: high pay predicts lower returns, the effect exists only for overconfident CEOs, and the effect is stronger for overconfident CEOs at weak governance firms.

IV.C. *Panel regressions*

In this section, we test the pay and return hypotheses in a panel regression setting. This allows us to control for other known determinants of returns, to control for important executive compensation variables, and to perform tests to determine the relative importance of CEO overconfidence and firm governance in the pay/future return relation. Specifically, we regress t+1 monthly returns on lagged peer-adjusted and model-adjusted compensation, CEO overconfidence (the proportion of unexercised in-the-money options to total compensation (UNEXOP)), firm governance (the BCF corporate governance index (BCFGOVI)), and controls. All control variables use the most recent publicly available data prior to month t+1.

To ensure that compensation effects are not picking up mean reversion in prior returns, we also control for lagged firm performance by including one-, two-, three-, four- and five-year lagged buy-and-hold returns. We include asset growth (Cooper, Gulen, and Schill, 2008), book-to-market, and firm capitalization. Other control variables include an indicator variable for the CEO-chairman duality (equal to one if the CEO is also the chairman of the board and zero otherwise), board size, percentage of independent directors, CEO tenure, an institutional blockholder dummy (equal to one if no institutional blockholders with a 5% or greater ownership stake are present and zero otherwise). Finally, we include option delta and vega (Brick, Palmon, Wald, 2012).[8] All the regression specifications include firm and time fixed effects. Standard errors are clustered within firms and time.

Table V reports the coefficients from these panel regressions. Models 1-3 use peer-adjusted pay and models 4-6 use model-adjusted pay as dependent variables, respectively. Models 1 and 4 do not contain interactive pay variables. In Models 2 and 5, we incorporate interactive measures of pay, where we interact pay × overconfidence, pay × governance, and pay × overconfidence × governance. Models 3 and 6 add delta and vega. In general, the coefficients on the control variables line up with previous results from the cross-sectional return literature. For example, the coefficients on asset growth and market value of equity are negative and significant. Vega has a

[8] We thank Lalitha Naveen for providing us delta and vega data.

negative and significant coefficient (t-statistic = -3.98 in the peer-adjusted pay model and t-statistic = -3.91 in the model-adjusted pay model), consistent with results in Brick, Palmon, and Wald (2012). There are some exceptions. For example, we find an insignificant coefficient on delta (Brick, Palmon, and Wald find a negative and significant coefficient). Also, we obtain marginal significance for the coefficient on book-to-market (BM). This may be due to the fact that on average, the Execucomp universe consists of larger capitalization firms than the set of stocks in the full merged CRSP/Compustat universe and hence, at least in this sample of firms, and time period, the B/M effect is weaker.

Most important, controlling for previous determinants of returns and important measures of corporate governance, there is a strong negative relation between lagged pay and future monthly returns across the cross-section of firms. For both measures of compensation, in the non-interactive pay models, we find that increases in lagged pay predict lower future returns. In Model 1, the coefficient on lagged peer-adjusted pay is negative and statistically significant (t-stat. = -5.04). Likewise, in Model 4, the coefficient on lagged model-adjusted pay is negative and statistically significant (t-stat. = -5.43). We note that the coefficient on the lagged CEO overconfidence options measure is negative and marginally significant in Model 3 using peer-adjusted pay (t-stat. = -1.63) and negative and significant in models 6 using model-adjusted pay (t-stats = -3.72). The coefficients on the BCF corporate governance index is negative but only marginally significant.

Next, we consider the models with interaction effects of pay and overconfidence, pay and governance, and pay/overconfidence/governance. In Models 2 and 3, using peer-adjusted pay, and in Models 5 and 6, using model-adjusted pay, we report coefficients for overconfidence × excess pay, governance × excess pay, and overconfidence × governance × excess pay. We find that the triple interaction effect dominates either pay alone, or pay interacted with either overconfidence or governance. For example, in Models 3 and 6, the coefficients on overconfidence × governance x excess pay (i.e., UNEXOP × BCFGOVI × Excess pay) is negative and statistically significant (t-stat. = -2.30 and -3.31, respectively). Thus, as pay and overconfidence increase and governance weakens (recall that the BCF corporate governance index is constructed so that higher values equate to weaker governance), future returns decrease.[9] Overall, these panel regressions support

[9] The results are qualitatively similar using Fama-MacBeth regressions instead of panel regressions. The t-statistic for the triple interaction term of overconfidence × governance ×excess pay is -3.58 for peer-adjusted pay and -2.70 for model-adjusted pay.

the hypotheses that pay is negatively associated with future returns, and that the effect is driven by overconfident managers who engage in suboptimal behavior at firms with weaker governance.

IV.C. *Determinants of the pay effect*

The results in Table V are consistent with a story of overconfident CEOs at weak corporate governance firms engaging in overspending that result in shareholder wealth destruction. Of course, higher levels of investment and M&A are not necessarily indicative of value destroying spending. Hence, in this section, we directly test for the determinants of the pay effect. We do this in three ways – first, we examine the stock price reaction in the months following the announcement of increased investment via takeovers, second, we examine firm profitability in the year after the announcement of pay, and third, we examine the strength of the pay effect on future returns across periods of arguably higher and lower aggregate overconfidence using an approach from Ben-David, Graham, and Harvey (2013) to define periods of high and low manager overconfidence. If high paid CEOs engage in wasteful acquisition related spending that creates poor future performance, and investors are not aware of these effects at the announcement of the acquisition, we should observe negative long-run abnormal returns following takeover announcements and decreases in firm fundamental performance for the high paid CEOs relative to the low paid CEOs. In addition, the pay effect should be stronger following periods of greater CEO aggregate overconfidence.

IV.C.1 *Post takeover announcement returns*

We analyze the returns to high and low paid firms following the announcements of mergers/acquisitions from Securities Data Company (SDC). For an event to be included in this analysis, the value of the target firm must be at least 1% of the parent firm's market value as of just prior to the merger. We retain all firms that announce a merger, regardless of merger completion. We report the 90-day post announcement (from the close of day +1 to the close of day +90) buy-and-hold abnormal returns for firms in the top and bottom decile of pay. Abnormal returns are market adjusted returns using the CRSP VW index. From Table III, the acquisition intensity increases dramatically as we move to higher deciles of peer or model-adjusted compensation. Firms in the top decile of excess pay (whether using a peer-group or a model-adjusted measure) announce a significantly greater proportion of acquisitions relative to their size than firms in the lower deciles. This is consistent with Croci and Petzemas (2015) who show that CEOs with risk-taking incentives are more likely to invest in acquisitions, though they find no evidence that this is related to overconfidence. Similarly, Yim (2013) finds that acquisitions are accompanied by large, permanent increases in CEO compensation, which create strong financial incentives for CEOs to pursue acquisitions. [10]

The question we examine is whether these acquisitions are treated as good news by investors. In Table VI, we report the buy-and-hold abnormal return spread between the firms in the highest quintile of pay relative to firms in the lowest quintile of pay in the 90 days following the announcement. When we sort on peer-adjusted pay, the 90-day return spread is -1.09% (t-stat. = -0.38). When we sort on model-adjusted pay, the 90-day return spread is -2.18% (t-stat. =-0.76). Hence while there is some economic evidence that wasteful acquisition spending on the part of the high paid CEOs can help explain the pay effect in returns, the results are not statistically significant.

Next, we test if the post takeover returns are more negative for more overconfident CEOs and for CEOs at firms with weaker corporate governance. We sort the event firms into medians on the unexercised options overconfidence measure and then independently sort each of those two groups into pay quintiles. For the firms in the top median of overconfidence, when we sort on peer-adjusted pay, the 90-day return spread is -5.26% (t-stat. =-1.42). When we sort on model-adjusted pay, the 90-day return spread is -2.21% (t-stat. =-0.56). Finally, we group the event firms by sorting them into medians on the overconfidence measure and medians on the BCF corporate governance index, and then independently sort each of those four groups into pay deciles. Consistent with our hypotheses that the pay effect should be stronger for overconfident CEOs at firms with weaker governance, we find that the market reacts very negatively to takeover announcements for these types of firms; for the firms in the top median of overconfidence and top median of the BCF corporate governance index, the 90-day return spread between high and low paid CEOs is -12.57%

[10] In untabulated results, we also examine whether high paid overconfident CEOs announce mergers in industries unrelated to their own. We find weak evidence in favour of this hypothesis. 33% (32%) of acquisitions announced by CEOs with high overconfidence who are employed in firms with weak governance and who are in the *top* quintile of peer-adjusted (model-adjusted) compensation, are in industries different from their own. In contrast, 19% (22%) of acquisitions announced by CEOs with high overconfidence who are employed in firms with weak governance and who are in the *bottom* quintile of peer-adjusted (model-adjusted) compensation are in industries different from their own.

(t-stat. =-2.54). When we sort on model-adjusted pay, the 90-day return spread is -12.99% (t-stat. =-2.24).[11]

IV.C.2 *Pay and future firm operating performance*

We examine if firms managed by higher paid CEOs experience lower future operating performance. If high paid CEOs engage in potentially value destroying activities, such as the shareholder-value destroying M&A activity documented in the previous section, then the negative effects from those activities should map into decreases in fundamental performance, such as decreases in profitability in addition to decreased returns. Hence we next regress year-ahead industry and sales adjusted ROA (measured as of next fiscal year end) on lagged peer or model-adjusted compensation, lagged industry and sales adjusted ROA, and control variables measured as of the end of the previous fiscal year end. We report these results in Table VII. In models with two- and three-way interaction combinations of pay, governance, and overconfidence, we find that in general the coefficients are consistent with our hypotheses that pay is negatively related to future firm performance and that the effects strengthen for more overconfident CEOs at firms with weaker governance. In Model 1, the coefficient on lagged peer-adjusted pay is negative and significant (t-stat. = -2.71). In Model 2, the coefficient on lagged model-adjusted pay is also negative and significant (t-stat. = -2.14). For peer-adjusted pay, the double interaction of pay × overconfidence is significant (t-stat. = - 1.91), but the triple interaction of pay × overconfidence × governance is not significant (t-stat. = 0.78). For model-adjusted pay, the triple interaction term of pay × overconfidence × governance dominates the double interaction terms and is significant (t-stat. = -2.13). Overall, both excess compensation measures are negatively related to future operating performance. In addition, there is some evidence that future operating performance is worse for high pay CEOs that are both overconfident and work at firms with weak governance, though these conditional effects are not as strong as we found in the future return/pay regressions of Table V.

[11] The driver of this result appears to be overconfidence and not poor governance. When we examine the abnormal returns following takeover announcements for CEOs with *low* overconfidence and weak governance, the 90-day return spread between high and low paid CEOs is statistically insignificant.

IV.C.3 *Time varying overconfidence*

Finally, the level of CEO overconfidence may vary depending on the market state. Hence we analyze the link between pay, overconfidence, and future returns by considering an aggregate time-varying measure of overconfidence as suggested by David, Graham, and Harvey (2013). To define periods of high and low aggregate overconfidence, we use the findings in Ben-David, Graham, and Harvey that executives are more confident following periods of high market returns and less confident following low market returns. We interact lagged market returns with pay and the firm specific option overconfidence measure and use that in the pay/return panel regression framework of Table V. We follow Cooper, Gutierrez, and Hameed (2004) and use a lagged 36-month buy-and-hold return of the CRSP VW market index as a proxy for time variation in aggregate overconfidence. In panel regressions that use the same set of controls as Table V, including lagged firm returns, time and firm fixed effects, and standard errors clustered by time and firm, we find (not tabulated) that the triple interaction of lagged market × pay × unexercised options is negative and significant (t-stat. = -2.55) for the model-adjusted pay measure. Using the peer-adjusted pay measure, the results are not significant.

Overall, all three findings – the returns following takeover announcements, the drop in future firm profitability, and increases in the pay effect following periods of greater overconfidence, are consistent with the hypothesis that high paid overconfident CEOs destroy firm value through overinvestment, and that these effects are stronger at firms with weaker governance.

IV.D. *Investor overreaction to pay*

Finally, a competing hypothesis to the CEO overconfidence hypothesis is an investor over-reaction hypothesis. It is plausible that investors overreact to announcements of high pay, overestimating its incentive effect, for example, and pushing up prices. At some point, the initial over-reaction generates mean reversion in returns as mispricing is corrected – similar to a naive extrapolation process as originally proposed in Lakonishok, Shleifer, and Vishny (1994). The literature has shown that analysts play a significant role in bringing information to the attention of investors and analyst coverage. Chan and Hameed (2006) show for example, that securities which are covered by more analysts incorporate greater (lesser) market-wide (firm-specific) information. Mola, Rau, and Khorana (2012) show that analyst coverage adds value to a firm both because it reduces information asymmetries about the firm's future performance and because it maintains investor recognition for that firm's stock. Hence we proxy for investor over-optimism by using analyst forecast errors in the 12 months following the announcement of pay. If analysts over-estimate the incentive effects of pay, there should be a positive relationship between analyst forecast errors and incentive pay.

We measure the forecast error as the difference between mean I/B/E/S consensus forecast of annual earnings per share and the I/B/E/S actual earnings per share scaled by the stock price. We use the report date of quarterly earnings from Compustat as the date of the earnings release and match I/B/E/S data with the accounting and compensation data using the fiscal year covered by the earnings release date. Stock price performance and forecast errors are measured during the following 12-month period after the earnings release date. We perform panel regressions of forecast errors on the two pay measures and other controls as in Core, Guay, and Rusticus (2006). If stock analysts overreact to pay following the announcement of pay, then in a regression of analysts forecast errors on lagged pay, we should see a positive coefficient on lagged pay. Regressions include firm and time fixed effects with standard errors clustered in two dimensions (firm and time).

We find evidence consistent with this hypothesis in Table VIII. In Models 1 and 2, we regress year-ahead analyst forecast errors on lagged excess pay and the controls. In model 1, the coefficient on lagged peer-adjusted compensation is positive and significant (t-stat. = 1.87). In Model 2, the coefficient on lagged model-adjusted compensation is also positive and significant (t-stat. = 2.52). Thus, similar to the findings in DeBondt and Thaler (1990) concerning analysts overreaction to changes in earnings, we find that analysts seem to overreact to compensation.[12]

To compete the investor overreaction hypothesis with the CEO overconfidence hypothesis, in Models 3 and 4, we regress future monthly returns on pay interacted with analyst forecast errors and pay interacted with the CEO overconfidence measure (UNEXOP). The Forecast error × Excess pay term serves as our variable to capture evidence of investor overreaction to pay, and the UNEXOP × Excess pay term captures the CEO overconfidence effect. In Model 3, using peer-adjusted pay, we find that the coefficient on UNEXOP × Excess pay is negative and statistically significant (t-stat. = -5.73) and the coefficient on Forecast error × Excess pay is statistically insignificant. In Model 4, using model-adjusted pay, we find that the coefficient on UNEXOP ×

[12] We obtain similar results when we add lagged forecast errors and the level of earnings in Models 1 and 2.

Excess pay is negative and statistically significant (t-stat. = -2.18) and the coefficient on Forecast error × Excess pay is statistically insignificant. Thus, it appears that while investors do overreact to pay, it seems that the overreaction does not map into future returns. Instead, it appears that the ability of pay to predict future returns flows from a CEO overconfidence channel rather than investor overreaction to compensation and other related firm information. We also note that our previous finding from Table VII of a negative link between pay and future profitability is inconsistent with an investor overreaction story, since investor overreaction would seem to affect publicly observable prices but not underlying firm fundamental performance. Overall, the results in this section appear more consistent with the managerial overconfidence hypothesis. Overconfident CEOs accept high levels of incentive compensation and subsequently underperform both in terms of stock and operating performance.

V. Conclusions

We investigate whether excess incentive pay, where excess incentive pay is defined as payment of restricted stock, options and other forms of long-term compensation in excess of the median incentive pay to peer firms in the same industry and size group (peer-adjusted pay), or in excess of predicted incentive pay from an economic-determinants-of-pay model (model-adjusted pay), is related to the future stock performance of the firm.

We find marked differences in performance across high and low paid CEOs. In the year after the firms are classified into the lowest and highest excess incentive compensation deciles respectively, firms in the highest decile earn significantly lower abnormal returns than firms in the lowest decile of excess pay. In a multiple regression framework, after controlling for variables that have been shown to explain the cross-section of returns, both peer and model-adjusted pay are significantly negatively related to future returns earned by the firm. We also document evidence of channels through which the pay effect translates into performance. For example, excess pay appears significantly negatively linked to forward profitability. We show that the negative link between excess incentive compensation and future firm returns and profitability appears only when the CEOs are overconfident. In addition, the effect is stronger at firms with weaker corporate governance.

Our results imply that managerial compensation components such as restricted stock, options and long-term incentive payouts, that are meant to align managerial interests with shareholder value, do not always translate into higher future returns, and quite in contrast, for firms with high paid CEOs, translate into lower future shareholder wealth. Hence, proposals to restructure managerial pay towards providing long-term incentive effects may not have the desired effects of maximizing shareholder value without considering the relation between pay and managerial style.

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Appendix

The variables used in the paper are described below (with Compustat variable names in parentheses).

Accruals is calculated as *[(change in current assets - change in cash) - (change in current liabilities - change in short-term debt - change in taxes payable) - depreciation expense]/average total assets).* $[(\Delta ACT - \Delta CHE) - (\Delta LCT - \Delta DLC - \Delta TXP) - DP]/[(AT_t + AT_{t\text{-}1})/2]$.

Acquisition intensity is computed as in Ben-David, Graham, and Harvey (2007) as acquisitions (AQC)/lagged total assets (*AT*)

Adjusted ROA is industry and sales adjusted ROA. It is computed as follows: For each fiscal year *t*, firms are allocated into 49 industry portfolios using industry classification from Ken French's website. Firms in each industry are then allocated into two size groups (High or Low) based on the fiscal year-end median Sales of the firms in the same industry. Industry and size adjusted ROA for each firm is then measured as the difference between the ROA for firm *i* and the median ROA of the firms in the same industry and size portfolio. ROA is measured as earnings before interest and taxes scaled by total assets (*AT*).

Analyst forecast errors (FE) are constructed as the difference between mean I/B/E/S consensus forecast of annual earnings per share and the I/B/E/S actual earnings per share scaled by the stock price. We use the report date of quarterly earnings from Compustat as the date of the earnings release and match I/B/E/S data with the accounting and compensation data using the fiscal year covered by the earnings release date.

Asset growth (ASSETG) is the one-year percentage change in total firm assets $[(\text{Assets}_t - \text{Assets}_{t-1})/\text{Assets}_{t-1}] = [(\text{AT}_t - \text{AT}_{t-1})/\text{AT}_{t-1}]$

BCF corporate governance index (BCFGOVI) is based on six governance provisions as suggested by Bebchuk, Cohen, and Ferrell (2009): staggered boards, limits to shareholder bylaw amendments, poison pills, golden parachutes, and supermajority requirements for mergers and charter amendments.

Blockholder is an indicator equal to one if no institutional blockholders with a 5% or greater ownership stake are present and zero otherwise.

Board size is the natural log of number of directors on the board.

Book-to-market (*BM*), for the fiscal year ending in calendar year *t*, is as defined in Davis, Fama, and French (2000) where book equity (BE) is the stockholders book equity (*CEQ*), plus balance sheet deferred taxes and investment tax credit (*TXDITC*), minus book value of preferred stock (in the following order: *PSTKRV* or *PSTKL* or *PSTK*) and ME is the price times shares outstanding at the end of December of calendar year *t*.

CEO tenure is the number of years that a CEO has been in office, calculated using Execucomp's *becameceo v*ariable.

CEO Chairman duality indicator is an indicator equal to one if the CEO is also the chairman of the board of directors.

Delta is the dollar change in CEO wealth associated with a 1% change in the firm's stock price (in $000s) as calculated in Core and Guay (2002) and Coles, Daniel, and Naveen (2006).

Forecast error is the difference between mean I/B/E/S consensus forecast of annual earnings per share and the I/B/E/S actual earnings per share scaled by the stock price.

Institutional holdings in a given firm are calculated using data from Thompson Institutional Holdings database (S34).

Investment intensity is computed as in Ben-David, Graham, and Harvey (2013) as (Net Investments)/ (lagged book value of total assets) = (*Capital Expenditures + Increase in Investments + Acquisitions - Sale of Property, Plant & Equipment - Sale of Investments) /lagged total assets* (*CAPX + IVCH + AQC - SPPE – SIV*)/*AT*

Investment opportunities is measured as the ratio of fiscal year-end market equity to book equity, as defined in Davis, Fama, and French (2000).

Leverage, is defined as Leverage = total long-term debt/total assets [*DLTT* / *AT*]

Market value or market capitalization (MV) is calculated using the price and the number of shares outstanding at the end of the fiscal period end month.

Model-adjusted incentive compensation is computed as follows: We use a model of pay that is similar to Core, Holthausen, and Larcker (1999). Each month *m* of year *t*, using firms which released annual proxy statements over the previous 12 months ending in month *m* of year *t*, we regress a panel of firms' incentive compensation on sales, investment opportunities, ROA, annual returns, standard deviation of annual returns and standard deviation of ROA. Sales and ROA are for the prior year spanning the fiscal period covered by the proxy statement. Annual returns are the prior 12-month returns ending in the month prior to the pay announcement month. Investment opportunities and standard deviation of ROA are measured over the 5 years prior to the announcement of pay. The model-adjusted pay, updated monthly, is actual incentive pay minus predicted incentive pay from the regression model.

Percentage of independent directors is the percentage of independent board members. Independent directors are directors that are not affiliated with the company according to the RiskMetrics (formerly IRRC) definition.

Percentage of total shares owned by the CEO is the *SHROWNPC* variable in Execucomp.

Peer-adjusted incentive compensation is computed as follows: For each fiscal year *t*, firms are allocated into 49 industry portfolios using industry classification from Ken French's website. Firms in each industry are then allocated into two size groups (High or Low) based on the fiscal year-end median Sales of the firms in the same industry. Industry and size adjusted incentive compensation for each firm is then measured as the difference between the incentive compensation for firm *i* and the median incentive compensation of the firms in the same industry and size portfolio.

Return [t-i, t-i+1] is the one year buy-and-hold return over year (t-i) to year (t-i+1) is computed as $[(1+r_1) \times ... \times (1+r_{12})-1]$ where r_i is the return in month *i*.

ROA is the earnings before interest and taxes scaled by total assets (*AT*).

Sales is fiscal year end year's net sales.

Standard deviation of returns is the standard deviation of annual stock returns over the five years prior to the pay announcement date.

Standard deviation of ROA is the standard deviation of annual ROA over the prior five years.

TDC1PCT is the year-to-year percentage change in total CEO compensation in Execucomp.

Total cash compensation (TCC variable in Execucomp) which includes salary and bonus.

Total compensation (TDC1 variable in Execucomp) which includes salary, bonus, total value of restricted stock granted, total value of stock options granted (using Black-Scholes), and long term incentive payouts.

Total incentive compensation is measured as the difference between total compensation and total cash compensation (TDC1-TCC).

Unexercised in-the-money options (UNEXOP) is the ratio of the estimated value of in-the-money unexercised exercisable options (Execucomp data item OPT_UNEX_EXER_EST_VAL) to total CEO compensation (Execucomp data item TDC1).

Vega is the dollar change in CEO wealth associated with a 0.01 change in the standard deviation of the firm's returns (in $000s) as calculated in Core and Guay (2002) and Coles, Daniel, and Naveen (2006).

Table I
Regressions of CEO compensation on its economic determinants

This table reports panel regressions of CEO compensation on economic determinants of pay. The dependent variable is CEO compensation (total, cash, and incentive) in the fiscal year *t*. Cash compensation includes salary and bonus, and incentive compensation includes restricted stock grants, option grants, and long term incentive payouts. Explanatory variables include sales, investment opportunities (ratio of fiscal year-end market equity to book equity, as defined in Davis, Fama, and French (2000)), return on assets (ratio of earnings before interest and taxes to total assets for the prior year), standard deviation of ROA (calculated as the standard deviation of annual ROAs over the prior five years). $Return_{[t-1,t]}$ is the prior 12-month returns ending in the month prior to the pay announcement date. Standard deviation of returns is calculated as the standard deviation of annual stock returns over the five years prior to the pay announcement date. All accounting based variables are measured in the fiscal year prior to the release date of accounting information. Regressions include firm and year fixed effects. More details on the construction of these variables are provided in the Appendix. Robust *t*-statistics adjusting for clustering in two dimensions (firm, time) are reported in parentheses.

	CEO Compensation		
	(1)	(2)	(3)
	Total	Cash	Incentive
Sales	0.13	0.02	0.11
	(16.57)	(13.83)	(16.42)
Investment Opportunities	-0.16	-0.07	-0.09
	(-0.47)	(-0.80)	(-0.30)
Return on assets (ROA)	3718	642	3077
	(5.86)	(8.10)	(4.97)
$Return_{[t-1,t]}$	746	111	635
	(4.83)	(7.28)	(4.20)
Standard deviation of ROA	99.77	-989	1089
	(0.13)	(-4.22)	(1.65)
Standard deviation of returns	-113	-71.13	-41.91
	(-1.15)	(-3.66)	(-0.45)
N	26,582	26,582	26,582
R-square	7.2%	5.5%	5.8%

Table II
Descriptive statistics on CEO compensation

This table reports descriptive statistics on CEO compensation for firms listed in the S&P Execucomp database over 1994-2015. Panel A reports mean, median, and other statistics for components of pay while Panel B reports correlations between components of pay. Total compensation (Execucomp data item TDC1) includes salary, bonus, restricted stock grants, option grants, and long term incentive payouts while cash compensation (Execucomp data item TCC) includes salary and bonus. Incentive compensation is computed as the difference between TDC1 and TCC. Excess incentive compensation is measured in two ways. Peer-adjusted incentive compensation for each firm is measured as the difference between the incentive compensation for firm *i* and the median incentive compensation of the firms in the same industry and size portfolio. Model-adjusted incentive compensation is obtained as the residual from rolling regressions in which incentive pay is regressed on economic determinants of pay from Table I.

Panel A

		Dollar values of compensation (in $000s)			
	Percentage of total compensation	Mean	Median	Standard Deviation	Maximum
Total compensation	100.0%	5,513	3,000	11,334	853,572
Total cash compensation	43.6%	1,407	952	2,026	141,567
Total incentive compensation	56.4%	4,104	1,758	10,724	847,581
Salary	30.8%	793	729	444	8,452
Bonus	12.8%	615	111	1,856	140,968
Restricted stock grants	17.0%	1170	0	5,300	847,535
Other compensation	4.4%	223	41	1,402	129,361
Value of options granted	26.9%	2,077	523	8,527	756,226
Peer-adjusted incentive compensation		1,358	0	8,619	649,325
Model-adjusted incentive compensation		0	-770	7,883	632,285

Panel B: Correlations

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1. Total compensation	1.000									
2. Total cash compensation	0.451	1.000								
3. Total incentive compensation	0.977	0.251	1.000							
4. Salary	0.368	0.460	0.290	1.000						
5. Bonus	0.408	0.981	0.209	0.280	1.000					
6. Restricted stock grants	0.447	0.176	0.443	0.280	0.129	1.000				
7. Other compensation	0.235	0.121	0.226	0.109	0.108	0.090	1.000			
8. Value of options granted	0.861	0.191	0.888	0.147	0.175	0.083	0.042	1.000		
9. Peer-adjusted incentive compensation	0.761	0.189	0.780	0.176	0.166	0.349	0.143	0.699	1.000	
10. Model-adjusted incentive compensation	0.691	0.136	0.717	0.149	0.115	0.318	0.137	0.643	0.917	1.000

Table III
CEO compensation deciles: Firm characteristics

The table reports median characteristics for firms in the merged Execucomp, COMPUSTAT, and CRSP databases over 1994-2015. Using annual sorted decile cutoff points, stocks are allocated into deciles based on excess incentive compensation measures. Panels A.1 and A.2 report compensation sorts in which excess incentive compensation is measured as the difference between the incentive compensation for firm *i* and the median incentive compensation of the firms in the same industry and size portfolio (peer-adjusted incentive compensation). Panels B1 and B2 report compensation sorts in which excess compensation is obtained as the residual from rolling regressions in which incentive pay is regressed on economic determinants of pay from Table I (model-adjusted incentive compensation). Panels A.1 and B.1 report firm characteristics using accounting and compensation information over the fiscal year immediately prior to the pay announcement date. Panels A.2 and B.2 report the firm characteristics in the year following the pay announcement date. Total compensation (Execucomp data item TDC1) includes salary, bonus, restricted stock grants, option grants, and long term incentive payouts. Both the percentage of company stock held by the CEO and the year-on-year percentage change in total CEO compensation are from the Execucomp database. Market capitalization, in millions of $, is calculated using the price and the number of shares outstanding at the end of the fiscal period end month. The numbers in each cell are time-series averages of yearly cross-sectional medians. Details on the construction of these variables are provided in the Appendix. Spreads significant at the 1% level are bolded.

Panel A.1: Peer-adjusted compensation and firm characteristics – year t

Decile	Peer-adjusted incentive compensation	Incentive comp/ total comp	Percentage change in total comp year to year (in %)	Percentage of total shares owned	Market cap	Book-to-market	Unexercised in-the-money Options (UNEXOP)	Acquisition Intensity	Asset growth	Investment Intensity	Leverage (%)
1	-2,981	42%	-1.10	1.21	2,533	0.48	0.40	0.00	0.07	0.060	0.45
2	-1,420	38%	-0.33	1.35	1,250	0.51	0.31	0.00	0.06	0.058	0.42
3	-801	32%	-1.51	1.66	644	0.49	0.31	0.00	0.07	0.058	0.21
4	-419	41%	2.50	1.50	581	0.52	0.27	0.00	0.06	0.060	0.26
5	-58	55%	6.12	1.25	790	0.50	0.42	0.00	0.06	0.060	0.36
6	128	62%	10.29	1.19	851	0.47	0.41	0.00	0.07	0.057	0.27
7	615	70%	13.18	1.10	1,158	0.44	0.54	0.00	0.08	0.067	0.34
8	1,508	77%	20.69	1.08	1,767	0.42	0.58	0.00	0.08	0.062	0.31
9	3,229	84%	25.68	0.76	3,358	0.38	0.63	0.20	0.08	0.069	0.61
10	8,882	90%	47.52	0.42	9,558	0.37	0.57	0.20	0.09	0.070	0.79
Spread (10-1)	**11,863**	**48%**	**48.62**	**-0.79**	**7,875**	**-0.11**	**0.17**	**0.20**	**0.02**	**0.010**	**0.34**

Panel A.2: Peer-adjusted incentive compensation and firm characteristics – Year t+1

Decile	Peer-adjusted incentive compensation	Incentive comp/ total comp	Percentage change in total comp year to year (in %)	Percentage of total shares owned	Market cap	Book-to-market	Unexercised in-the-money Options (UNEXOP)	Acquisition Intensity	Asset growth	Investment Intensity	Leverage (%)
1	-2,981	60%	24.33	1.15	2,745	0.49	0.30	0.00	0.06	0.056	0.41
2	-1,420	55%	19.20	1.27	1,456	0.51	0.28	0.00	0.06	0.055	0.41
3	-801	50%	18.11	1.66	713	0.49	0.25	0.00	0.07	0.057	0.18
4	-419	51%	17.37	1.46	640	0.52	0.26	0.00	0.06	0.058	0.29
5	-58	59%	11.88	1.21	856	0.50	0.39	0.00	0.07	0.058	0.36
6	128	63%	7.16	1.15	915	0.49	0.41	0.00	0.07	0.061	0.28
7	615	69%	5.01	1.10	1,263	0.45	0.54	0.10	0.08	0.065	0.32
8	1,508	74%	0.36	1.01	1,899	0.42	0.63	0.00	0.07	0.063	0.35
9	3,229	80%	-3.73	0.72	3,593	0.39	0.69	0.20	0.07	0.065	0.53
10	8,882	83%	-17.08	0.38	9,963	0.38	0.85	0.20	0.07	0.066	0.82
Spread (10-1)	**11,863**	**23%**	**-41.41**	**-0.77**	**7,217**	**-0.11**	**0.55**	**0.20**	**0.01**	**0.010**	**0.41**

Panel B.1: Model-adjusted incentive compensation and firm characteristics – Year t

Decile	Model-adjusted incentive compensation	Incentive comp/ total comp	Percentage change in total comp year to year (in %)	Percentage of total shares owned	Market cap	Book-to-market	Unexercised in-the-money Options (UNEXOP)	Acquisition Intensity	Asset growth	Investment Intensity	Leverage (%)
1	-4,599	43%	0.00	1.88	1,985	0.36	0.54	0.00	0.10	0.076	0.34
2	-2,921	41%	0.17	1.69	1,028	0.45	0.47	0.00	0.07	0.062	0.24
3	-2,203	47%	3.20	1.35	856	0.50	0.34	0.00	0.07	0.060	0.26
4	-1,651	50%	4.12	1.25	885	0.53	0.32	0.00	0.06	0.057	0.29
5	-1,115	57%	5.08	1.12	936	0.54	0.35	0.00	0.05	0.056	0.36
6	-585	63%	5.72	1.17	1,074	0.52	0.37	0.00	0.06	0.059	0.44
7	-21	69%	9.61	0.98	1,462	0.49	0.45	0.10	0.06	0.060	0.45
8	799	76%	13.37	0.75	2,130	0.44	0.49	0.10	0.06	0.058	0.49
9	2,342	82%	20.67	0.75	3,163	0.41	0.57	0.10	0.06	0.060	0.55
10	6,809	89%	42.94	0.57	7,595	0.39	0.55	0.20	0.08	0.066	0.69
Spread (10-1)	**11,408**	**48%**	**42.94**	**-1.31**	**5,610**	**0.03**	0.01	**0.20**	**-0.02**	**-0.010**	**0.35**

Panel B.2: Model-adjusted incentive compensation and firm characteristics – Year t+1

Decile	Model-adjusted incentive compensation	Incentive comp/ total comp	Percentage change in total comp year to year (in %)	Percentage of total shares owned	Market cap	Book-to-market	Unexercised in-the-money Options (UNEXOP)	Acquisition Intensity	Asset growth	Investment Intensity	Leverage (%)
1	-4,599	61%	19.72	1.76	2,245	0.36	0.36	0.00	0.09	0.074	0.34
2	-2,921	55%	15.93	1.52	1,115	0.47	0.35	0.00	0.07	0.058	0.23
3	-2,203	54%	15.36	1.23	927	0.51	0.31	0.00	0.07	0.058	0.26
4	-1,651	57%	15.11	1.25	952	0.53	0.32	0.00	0.06	0.057	0.27
5	-1,115	60%	11.26	1.16	1,015	0.54	0.33	0.00	0.05	0.054	0.38
6	-585	66%	10.87	1.13	1,138	0.52	0.38	0.00	0.06	0.057	0.37
7	-21	69%	8.19	0.94	1,584	0.48	0.44	0.10	0.06	0.056	0.45
8	799	73%	3.66	0.76	2,262	0.46	0.56	0.00	0.05	0.057	0.45
9	2,342	77%	-1.94	0.67	3,387	0.42	0.63	0.10	0.06	0.062	0.60
10	6,809	83%	-18.07	0.56	7,754	0.39	0.89	0.20	0.07	0.062	0.69
Spread (10-1)	**11,408**	**22%**	**-37.79**	**-1.20**	**5,509**	**0.03**	**0.53**	**0.20**	**-0.02**	**-0.012**	**0.34**

Table IV
CEO excess incentive compensation decile portfolio returns in calendar time

At the end of month m of year t, in which accounting and compensation information are publicly available, stocks are allocated into excess compensation deciles based on the decile breakpoints of the values of (i) peer-adjusted (using industry and size benchmarks) incentive compensation, and (ii) model-adjusted incentive compensation based on a model of economic determinants of pay. All firms that announced over the previous year are used to determine decile cutoffs. Firms that recently announced in month m are then allocated in these portfolio bins based on excess incentive compensation compared to all previously announced incentive compensation in the previous year. Equal weighted decile portfolios are rebalanced every month when new firms announce pay. Each stock stays in its assigned portfolio for a year, until its next annual announcement of pay. Portfolio return statistics are reported over the period of January 1994 to December of 2015. The raw returns and alphas are reported in decimal form, that is 0.01 is 1%. The Fama-French and Fama-French-Carhart alphas are obtained from regressions using monthly returns. Panel A reports univariate sorts. Panels B and D report bivariate sorts in which firms are independently allocated into bins based on decile sorts of excess compensation and high or low CEO overconfidence. Panels C and E report three-way independent sorts in which firms are allocated into bins based on excess compensation, high or low CEO overconfidence, and strong or weak corporate governance. High (low) overconfidence is defined as firms in the top (bottom) median of annually ranked unexercised in-the-money options. Strong (weak) governance is defined as firms in the bottom (top) median of annually ranked BCF corporate governance index. The BCF measure is constructed so that higher values equate to weaker governance.

Panel A.1. Peer-adjusted incentive compensation

	Deciles											
	1	2	3	4	5	6	7	8	9	10	Spread (10-1)	t (10-1)
Raw Returns	0.0128	0.0130	0.0138	0.0136	0.0117	0.0123	0.0125	0.0112	0.0122	0.0094	-0.0034	-2.35
FF Alpha	0.0023	0.0021	0.0031	0.0033	0.0010	0.0018	0.0020	0.0006	0.0019	-0.0070	-0.0030	-2.66
Four Factor Alpha	0.0040	0.0036	0.0050	0.0040	0.0022	0.0030	0.0032	0.0020	0.0035	0.0013	-0.0027	-2.40

Panel A.2. Model-adjusted incentive compensation

	Deciles											
	1	2	3	4	5	6	7	8	9	10	Spread (10-1)	t (10-1)
Raw Returns	0.0132	0.0133	0.0117	0.0135	0.0111	0.0119	0.0114	0.0116	0.0132	0.0101	-0.0031	-2.57
FF Alpha	0.0030	0.0030	0.0010	0.0030	0.0003	0.0013	0.0008	0.0010	0.0028	-0.0001	-0.0031	-2.59
Four Factor Alpha	0.0045	0.0044	0.0022	0.0042	0.0016	0.0024	0.0020	0.0025	0.0043	0.0015	-0.0030	-2.50

Panel B.1. Peer-adjusted incentive compensation – High overconfidence

	Deciles											
	1	2	3	4	5	6	7	8	9	10	Spread (10-1)	t (10-1)
Raw Returns	0.0126	0.0131	0.0123	0.0130	0.0101	0.0117	0.0126	0.0109	0.0118	0.0080	-0.0046	-2.82
FF Alpha	0.0030	0.0029	0.0022	0.0034	0.0000	0.0018	0.0031	0.0013	0.0024	-0.0013	-0.0044	-3.15
Four Factor Alpha	0.0042	0.0039	0.0037	0.0041	0.0008	0.0027	0.0038	0.0021	0.0034	-0.0001	-0.0043	-3.05

Panel B.2. Model-adjusted incentive compensation – High overconfidence

	Deciles											
	1	2	3	4	5	6	7	8	9	10	Spread (10-1)	t (10-1)
Raw Returns	0.0129	0.0127	0.0105	0.0133	0.0100	0.0111	0.0116	0.0112	0.0121	0.0082	-0.0047	-3.02
FF Alpha	0.0032	0.0031	0.0005	0.0035	0.0000	0.0015	0.0020	0.0015	0.0026	-0.0011	-0.0043	-3.00
Four Factor Alpha	0.0044	0.0041	0.0011	0.0046	0.0009	0.0021	0.0028	0.0025	0.0035	0.0001	-0.0043	-2.96

Panel C.1. Peer-adjusted incentive compensation – High overconfidence and weak governance

	Deciles											
	1	2	3	4	5	6	7	8	9	10	Spread (10-1)	t (10-1)
Raw Returns	0.0138	0.0128	0.0107	0.0124	0.0095	0.0107	0.0119	0.0115	0.0096	0.0070	-0.0068	-3.35
FF Alpha	0.0045	0.0026	0.0006	0.0028	-0.0004	0.0008	0.0026	0.0020	0.0003	-0.0023	-0.0067	-3.47
Four Factor Alpha	0.0050	0.0033	0.0014	0.0034	0.0005	0.0018	0.0031	0.0022	0.0011	-0.0012	-0.0061	-3.15

Panel C.2. Model-adjusted incentive compensation – High overconfidence and weak governance

	Deciles											
	1	2	3	4	5	6	7	8	9	10	Spread (10-1)	t (10-1)
Raw Returns	0.0133	0.0128	0.0094	0.0103	0.0104	0.0097	0.0106	0.0108	0.0109	0.0071	-0.0063	-2.98
FF Alpha	0.0039	0.0038	-0.0004	0.0009	0.0010	0.0003	0.0014	0.0014	0.0018	-0.0019	-0.0058	-2.74
Four Factor Alpha	0.0043	0.0040	0.0002	0.0018	0.0015	0.0008	0.0019	0.0022	0.0024	-0.0012	-0.0055	-2.57

Panel D.1. Peer-adjusted incentive compensation – Low overconfidence

	Deciles											
	1	2	3	4	5	6	7	8	9	10	Spread (10-1)	t (10-1)
Raw Returns	0.0127	0.0129	0.0148	0.0137	0.0127	0.0128	0.0121	0.0110	0.0128	0.0107	-0.0020	-1.20
FF Alpha	0.0017	0.0015	0.0038	0.0030	0.0017	0.0020	0.0010	-0.0002	0.0016	0.0001	-0.0016	-1.17
Four Factor Alpha	0.0037	0.0033	0.0058	0.0038	0.0032	0.0034	0.0026	0.0019	0.0039	0.0027	-0.0010	-0.76

Panel D.2. Model-adjusted incentive compensation – Low overconfidence

	Deciles											
	1	2	3	4	5	6	7	8	9	10	Spread (10-1)	t (10-1)
Raw Returns	0.0133	0.0133	0.0124	0.0138	0.0121	0.0122	0.0109	0.0114	0.0145	0.0118	-0.0015	-0.92
FF Alpha	0.0030	0.0025	0.0016	0.0028	0.0009	0.0009	-0.0004	0.0003	0.0035	0.0011	-0.0019	-1.16
Four Factor Alpha	0.0047	0.0043	0.0031	0.0041	0.0025	0.0024	0.0011	0.0021	0.0054	0.0029	-0.0018	-1.07

Panel E.1. Peer-adjusted incentive compensation – Low overconfidence and strong governance

	Deciles											
	1	2	3	4	5	6	7	8	9	10	Spread (10-1)	t (10-1)
Raw Returns	0.0121	0.0146	0.0156	0.0126	0.0116	0.0126	0.0131	0.0108	0.0122	0.0103	-0.0018	-1.03
FF Alpha	0.0012	0.0032	0.0046	0.0020	0.0006	0.0023	0.0019	-0.0003	0.0012	-0.0004	-0.0015	-0.97
Four Factor Alpha	0.0036	0.0051	0.0070	0.0029	0.0023	0.0037	0.0033	0.0020	0.0032	0.0022	-0.0014	-0.87

Panel E.2. Model-adjusted incentive compensation – Low overconfidence and strong governance

	Deciles											
	1	2	3	4	5	6	7	8	9	10	Spread (10-1)	t (10-1)
Raw Returns	0.0134	0.0124	0.0119	0.0132	0.0120	0.0113	0.0097	0.0132	0.0141	0.0115	-0.0019	-1.01
FF Alpha	0.0034	0.0019	0.0010	0.0021	0.0008	-0.0001	-0.0011	0.0023	0.0030	0.0007	-0.0027	-1.42
Four Factor Alpha	0.0049	0.0039	0.0026	0.0035	0.0029	0.0015	0.0001	0.0041	0.0053	0.0027	-0.0022	-1.17

Table V
Cross-sectional time-series regressions of monthly stock returns on CEO compensation

This table reports coefficients obtained by regressing monthly stock returns on lagged compensation, and other variables measured as of the fiscal period immediately prior to the pay announcement date. Peer-adjusted incentive compensation is measured as the difference between the incentive compensation for firm *i* and the median incentive compensation of the firms in the same industry and size portfolio. Model-adjusted incentive compensation is obtained as the residual from rolling regressions in which incentive pay is regressed on economic determinants of pay as explained in Table I. Regressions include firm and time fixed effects. Control variables include both accounting (book-to-market, asset growth) and market based variables (market capitalization, annual cumulative stock returns over the previous 5 years), option greeks (Delta and Vega), unexercised in-the-money options (UNEXOP), and measures of the quality of corporate governance (CEO-chairman duality dummy, board size, percentage of independent directors, CEO tenure, existence of a blockholder dummy, and the BCF corporate governance index). More details on the construction of these variables are provided in the Appendix. The sample is from 1994 to 2015. Robust *t*-statistics adjusting for clustering in two dimensions (firm, time) are reported in parentheses.

	(1)	(2)	(3)	(4)	(5)	(6)
Peer-adjusted incentive compensation	-0.236	-0.193	-0.111			
	(-5.04)	(-1.95)	(-1.08)			
Model-adjusted incentive compensation				-0.289	-0.282	-0.225
				(-5.43)	(-2.40)	(-1.43)
Firm market capitalization	-0.314	-0.302	-0.297	-0.320	-0.310	-0.306
	(-3.37)	(-3.26)	(-3.09)	(-3.51)	(-3.40)	(-3.14)
Book-to-market	12.83	13.09	12.10	12.39	12.63	11.63
	(1.78)	(1.79)	(1.68)	(1.72)	(1.73)	(1.62)
Asset growth	-10.77	-11.10	-12.65	-9.65	-9.97	-12.39
	(-4.44)	(-4.43)	(-5.25)	(-3.42)	(-3.45)	(-5.22)
$\text{Return}_{[t-1,t]}$	-0.206	-0.206	-0.212	-0.204	-0.205	-0.211
	(-3.25)	(-3.24)	(-3.32)	(-3.18)	(-3.17)	(-3.25)
$\text{Return}_{[t-2,t-1]}$	-0.192	-0.193	-0.198	-0.194	-0.195	-0.198
	(-6.07)	(-6.09)	(-6.27)	(-6.11)	(-6.15)	(-6.32)
$\text{Return}_{[t-3,t-2]}$	-0.113	-0.116	-0.119	-0.114	-0.116	-0.119
	(-4.70)	(-4.78)	(-4.79)	(-4.69)	(-4.76)	(-4.77)
$\text{Return}_{[t-4,t-3]}$	-0.032	-0.034	-0.037	-0.031	-0.033	-0.035
	(-1.95)	(-2.07)	(-2.17)	(-1.83)	(-1.94)	(-2.02)
$\text{Return}_{[t-5,t-4]}$	-0.093	-0.095	-0.098	-0.092	-0.094	-0.098
	(-4.78)	(-4.67)	(-4.84)	(-4.65)	(-4.54)	(-4.70)
CEO-chairman duality indicator	1.676	1.272	1.699	1.910	1.576	2.052
	(0.64)	(0.52)	(0.70)	(0.71)	(0.63)	(0.81)
Board size	-1.088	-1.043	-0.875	-1.100	-1.056	-0.880
	(-2.08)	(-2.00)	(-1.76)	(-2.10)	(-2.02)	(-1.76)
Percentage of independent directors	-23.10	-15.72	-11.58	-21.60	-14.60	-11.04
	(-2.47)	(-2.34)	(-1.70)	(-2.29)	(-2.16)	(-1.64)
CEO tenure	0.013	0.024	0.092	0.001	0.010	0.073
	(0.11)	(0.20)	(0.72)	(0.01)	(0.08)	(0.56)
Blockholder	0.434	0.800	0.802	0.708	1.100	1.067
	(0.24)	(0.45)	(0.45)	(0.39)	(0.60)	(0.58)
BCF corporate governance index (BCFGOVI)		-2.017	-2.222		-1.967	-2.117
		(-1.42)	(-1.55)		(-1.39)	(-1.50)
Unexercised options (UNEXOP)		-0.008	-0.011		-0.021	-0.020
		(-1.03)	(-1.63)		(-3.27)	(-3.72)

BCFGOVI × Excess pay		-0.028	0.004		-0.005	0.024
		(-0.48)	(0.08)		(-0.08)	(0.34)
UNEXOP × Excess pay		0.003	0.001		0.001	0.001
		(0.95)	(0.41)		(1.59)	(2.01)
UNEXOP × BCFGOVI × Excess pay		-0.003	-0.002		-0.002	-0.002
		(-2.01)	(-2.30)		(-2.64)	(-3.31)
Delta			0.091			0.087
			(1.14)			(1.05)
Vega			-0.019			-0.018
			(-3.98)			(-3.91)
N	15,569	15,536	14,879	15,089	15,056	14,424

Table VI
CEO compensation and merger activity

This table presents the 90-day cumulative abnormal return (from the close of day +1 to the close of day +90) to acquirers following the merger announcement day over the period of January 1994 to December of 2015. Acquiring firms are sorted into quintiles based on excess incentive compensation of the CEO of the acquiring firm. Panel A reports univariate sorts. Panel B reports bivariate sorts in which firms are independently allocated into bins based on quintile sorts on excess compensation and high CEO overconfidence. Panel C reports three-way independent sorts in which firms are allocated into bins based on excess compensation, high CEO overconfidence, and weak corporate governance. Excess compensation are quintiles based on the quintile breakpoints of the values of (i) peer-adjusted incentive compensation, and (ii) model-adjusted incentive compensation. All firms that announced over the previous year are used to determine quintile cutoffs. Firms that recently announced in month m are then allocated in these portfolio bins based on excess incentive compensation compared to all previously announced incentive compensation in the previous year. Abnormal returns are market adjusted returns using the CRSP VW index and are reported in decimal form, that is 0.01 is 1%. Peer-adjusted incentive compensation is measured as the difference between the incentive compensation for firm *i* and the median incentive compensation of the firms in the same industry and size portfolio. Model-adjusted incentive compensation is obtained as the residual from rolling regressions in which incentive pay is regressed on economic determinants of pay from Table I. High (low) overconfidence is defined as firms in the top (bottom) median of annually ranked unexercised in-the-money options. Strong (weak) governance is defined as firms in the bottom (top) median of annually ranked BCF corporate governance index. The BCF measure is constructed so that higher values equate to weaker governance.

90-day cumulative abnormal returns to acquirers following merger announcements

	Quintile 1	Quintile 5	Spread (Quintile 5- Quintile 1)	t (spread)
Panel A: One-way sort – Excess pay				
Peer-adjusted incentive compensation	-0.0165	-0.0274	-0.0109	(-0.38)
Model-adjusted incentive compensation	-0.0230	-0.0448	-0.0218	(-0.76)
Panel B: Two-way sort – High overconfidence and excess pay				
Peer-adjusted incentive compensation	0.0046	-0.0480	-0.0526	(-1.42)
Model-adjusted incentive compensation	-0.0183	-0.0404	-0.0221	(-0.56)
Panel C: Three-way sort – High overconfidence, weak governance, and excess pay				
Peer-adjusted incentive compensation	0.0190	-0.1066	-0.1257	(-2.54)
Model-adjusted incentive compensation	0.0395	-0.0904	-0.1299	(-2.24)

Table VII

Cross-sectional time-series regressions of ROA on CEO compensation

Industry and sales adjusted ROAs (Adjusted ROA) in the fiscal year following the pay announcement date are regressed on lagged compensation, and other variables measured as of fiscal period immediately prior to pay announcement date. Peer-adjusted incentive compensation is measured as the difference between the incentive compensation for firm *i* and the median incentive compensation of the firms in the same industry and size portfolio. Model-adjusted incentive compensation is obtained as the residuals from rolling regressions in which incentive pay is regressed on economic determinants of pay from Table I. Regressions include firm and time fixed effects. Control variables include both accounting (book-to-market, accruals, asset growth, lagged industry and size adjusted ROA) and market based variables (market capitalization, annual cumulative stock returns over the previous 5 years), unexercised in-the-money options (UNEXOP), and the corporate governance index (BCFGOVI). More details on the construction of these variables are provided in the Appendix. The sample is from 1994 to 2015. Robust *t*-statistics adjusting for clustering in two dimensions (firm, time) are reported in parentheses.

	(1)	(2)
Peer-adjusted incentive compensation	-0.027	
	(-2.71)	
Model-adjusted incentive compensation		-0.026
		(-2.14)
Firm market capitalization	-0.178	-0.214
	(-1.02)	(-1.28)
Book-to-market	-4.861	-4.807
	(-7.16)	(-7.22)
Lagged Adjusted ROA	0.436	0.449
	(10.81)	(11.81)
Asset growth	-2.894	-3.087
	(-5.25)	(-5.92)
Accruals	-0.066	0.242
	(-0.03)	(0.10)
$Return_{[t-1,t]}$	0.017	0.173
	(4.54)	(4.43)
$Return_{[t-2,t-1]}$	0.007	0.006
	(3.37)	(3.35)
$Return_{[t-3,t-2]}$	0.004	0.004
	(3.78)	(3.72)
$Return_{[t-4,t-3]}$	0.003	0.003
	(2.23)	(2.16)
$Return_{[t-5,t-4]}$	0.001	0.001
	(0.99)	(0.07)
BCF corporate governance index (BCFGOVI)	-0.322	-0.294
	(-3.73)	(-3.38)
Unexercised options (UNEXOP)	-0.001	-0.002
	(-0.52)	(-2.40)
BCFGOVI × Excess pay	0.001	-0.001
	(0.47)	(-0.19)
UNEXOP × Excess pay	-0.001	-0.001
	(-1.91)	(-0.90)
UNEXOP × BCFGOVI × Excess pay	0.0001	-0.0001
	(0.78)	(-2.13)
N	18,778	18,235

Table VIII
Cross-sectional time-series regressions of analyst forecast errors on CEO compensation and regressions of returns on CEO compensation and analyst forecast errors

Analyst forecast errors (FE) in the calendar year following the pay announcement date are regressed on lagged compensation, and other variables measured as of fiscal period immediately prior to pay announcement date (in Models 1 and 2). Peer-adjusted incentive compensation is measured as the difference between the incentive compensation for firm *i* and the median incentive compensation of the firms in the same industry and size portfolio. Model-adjusted incentive compensation is obtained as the residual from rolling regressions in which incentive pay is regressed on economic determinants of pay from Table I. In models (3) and (4) we regress future monthly returns on pay interacted with analyst forecast errors and pay interacted with unexercised in-the-money options (UNEXOP). Control variables include both accounting (book-to-market, accruals, asset growth) and market based variables (market capitalization, annual cumulative stock returns over the previous 5 years), and the BCF corporate governance index (BCFGOVI). More details on the construction of these variables are provided in the Appendix. The sample is from 1994 to 2015 and the regressions include firm and time fixed effects. Robust *t*-statistics adjusting for clustering in two dimensions (firm, time) are reported in parentheses.

Dependent variable:	FE	FE	Returns	Returns
	(1)	(2)	(3)	(4)
Peer-adjusted incentive compensation	0.115		0.009	
	(1.87)		(0.02)	
Model-adjusted incentive compensation		0.135		-0.540
		(2.52)		(-0.86)
Firm market capitalization	0.001	0.001	-36.65	-36.44
	(2.41)	(2.22)	(-10.39)	(-10.45)
Book-to-market	0.008	0.008	45.11	45.53
	(3.87)	(3.72)	(2.45)	(2.46)
Asset growth			-6.738	-6.734
			(-3.05)	(-3.03)
Accruals			-7.360	-7.529
			(-0.40)	(-0.41)
Return[t-1,t]			-0.054	-0.055
			(-1.52)	(-1.53)
Return[t-2,t-1]			-0.048	-0.048
			(-1.70)	(-1.71)
Return[t-3,t-2]			-0.026	-0.027
			(-1.30)	(-1.35)
Return[t-4,t-3]			0.004	0.004
			(0.22)	(0.19)
Return[t-5,t-4]			-0.074	-0.074
			(-3.64)	(-3.64)
BCF corporate governance index (BCFGOVI)			-1.365	-2.024
			(-0.60)	(-0.88)
Unexercised options (UNEXOP)			-0.004	-0.001
			(-3.83)	(0.25)
Forecast error			-561.3	-555.9
			(-5.07)	(-5.23)
BCFGOVI × Excess pay			-0.012	0.110
			(-0.05)	(0.44)
UNEXOP × Excess pay			-0.002	-0.007
			(-5.73)	(-2.18)

Forecast error × Excess pay			12.76	12.78
			(0.58)	(0.72)
N	18,194	18,194	11,204	11,204