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CEO excess compensation: The impact of firm size and managerial power☆

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ABSTRACT

Chief executive officer (CEO) compensation has received a great deal of attention over the past several decades. Critics assert that CEO compensation is "excessive" because it is only weakly linked to firm performance (i.e., managerial rent-extraction). On the other hand, defenders suggest that CEO compensation is "justified" given the incremental shareholder wealth created by CEOs, or that large CEO compensation packages merely reflect labor market forces. Prior research documents that CEO power and firm size are associated with larger compensation, but providing evidence that the larger compensation is excessive (i.e., not economically justified) has proven difficult. For each test firm we identify a potential replacement CEO (i.e., an executive-specific, within-country (US) compensation benchmark) and create an empirical test of excess compensation. We also examine the possibility that excess compensation is conditional upon firm size or CEO power. In spite of an inherent bias against finding excess compensation, the results suggest that the most powerful CEOs receive compensation that is not economically justified. We find no evidence of CEO excess compensation in the largest firms.

1. Introduction

Chief executive officer (CEO) compensation has received a great deal of attention over the past several decades. Shareholders, regulators, politicians, the business media and academics have all weighed in on the appropriateness of the level of CEO compensation (e.g., Bogle, 2008; Conyon, 2006; Core & Guay, 2010; Dvorak, 2009; Pandher & Currie, 2013). Critics assert CEO compensation is "excessive" because it is only weakly linked to firm performance and the problems associated with CEO compensation are so pervasive that most CEOs receive excessive compensation. For example, Bertrand and Mullainathan (2001) find that CEOs are paid for luck, and Bebchuk and Fried (2006) argue that a breakdown in the governance structure has resulted in the relationship between the board and the CEO no longer being arms-length. However, recent research argues that the level of CEO compensation is "justified" given the incremental shareholder wealth created by CEOs (e.g., Core & Guay, 2010; Gong, 2011), or that large CEO compensation packages merely reflect labor market forces, particularly the shortage of talented CEOs (Chen & Leng, 2004; Fulmer, 2009; Gabaix & Landier, 2008; Kaplan, 2008; Oyer, 2004; Rajgopal, Shevlin, & Zamora, 2006). Thus, whether CEO compensation is "justified" or "excessive" remains largely an unresolved empirical issue.

While there is a general public perception that CEO compensation is excessive, there is little empirical evidence to support this notion. There is research suggesting that larger firms pay substantially more than smaller firms (Hallock & Torok, 2010), and that executive characteristics related to CEO power are associated with more favorable compensation terms (Abernethy, Kuang, & Qin, 2015; Kalyta & Magnan, 2008; Skantz, 2012). However, this research has not been able to determine if the larger compensation is economically justified. Providing empirical evidence on whether CEO compensation is justified or excessive has proven to be difficult. The empirical challenge is succinctly described in Conyon et al. (2011, 405) when they note that "if the pay of *every* CEO within an economy is considered excessive (a notion advocated by critics of CEO pay), then there is no within-economy control group against which to evaluate the compensation package of any given CEO." The implication of this problem is that comparisons between US CEOs are biased towards not finding excess compensation. Conyon et al. (2011) address this issue by comparing US CEOs to UK CEOs, and they conclude that US CEO compensation is not excessive. However, they find that even though sales and assets are similar between US and UK firms, 2003 mean total pay for UK CEOs is 42% smaller than US CEOs and that mean equity incentives for UK CEOs are 82% smaller than US CEOs, which suggests that there are material, structural inter-economy differences between the US and the UK.

In addition to identifying reasonable benchmark firms, determining the presence of excess compensation also requires a framework for estimating the economically justified level of pay. We use the framework described in Core and Guay (2010), which states that CEO compensation

☆ Data is available upon request.

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can be thought of as the sum of four separate components: 1) compensation for ability (i.e., the minimum amount necessary to attract the CEO to the job and persuade him to forgo his next most attractive opportunity), 2) a payment that increases with the level of effort required of the CEO, 3) a premium for risk stemming from performance-based incentive risk, and 4) any excess pay (i.e., any portion that is unexplained by the other three components and that likely stems from unresolved agency conflicts and governance problems). Core and Guay (2010) make clear that if one wishes to suggest that CEOs are overpaid, it must be shown that the compensation received by the CEO cannot be explained by ability, effort or a risk premium.

In this paper, we advance CEO excess compensation literature by 1) measuring excess compensation as the difference in compensation between US test firm CEOs and potential replacement CEOs, also drawn from US firms, that is not explained by factors related to economically justified pay (i.e., ability, effort and risk), and 2) examining conditions which prior research suggests may be more prone to excessive compensation (i.e., sample partitions based on firm size and CEO power). This empirical approach has an inherent bias against finding evidence of excess compensation because the potential replacement CEOs may receive excess compensation, thus inflating the benchmark. Therefore, results indicating that excess compensation is not present should be interpreted with caution, while evidence of excess compensation suggests that the result is of sufficient magnitude to overcome the bias.

We match each US test firm CEO with a US benchmark firm CEO. Specifically, we construct portfolios based on firm size, industry, year and compensation structure. For each test firm we select as a benchmark, the firm with the next highest firm performance within that size/industry/year/compensation structure bin. This benchmark represents our empirical proxy for the test firm's next best CEO candidate. We then apply the Core and Guay (2010) framework to test whether the difference in pay between the test firm CEO and the benchmark firm CEO is explained by measures of CEO ability, effort and equity risk premiums (i.e., economically justified compensation). Consistent with Core and Guay (2010), we assert that differences in compensation between test firm CEOs and benchmark firm CEOs that are not explained by the economic determinants of CEO compensation related to effort, ability or compensation risk premiums, represent excessive compensation paid to the test firm CEO.[1]

In addition to evaluating excess compensation for the full sample, we also separately examine sample partitions where the presence of excess compensation may be more likely. Specifically, we examine firm size and CEO power. Academic research supports the notion that over the past three decades CEO compensation for large firms has increased at a dramatic rate relative to smaller firms (Bebchuk & Fried, 2004; Frydman & Saks, 2010; Hallock & Torok, 2010). However, there are mixed results on whether this disproportionate compensation increase for large firms is economically justified. Frydman and Saks (2010) and Gabaix and Landier (2008) suggest that the increases in CEO compensation for large firms are economically justified, while Bliss and Rosen (2001) and Bebchuk and Fried (2006) suggest that size-related compensation is not fully justified by economic determinants. Using these mixed results as motivation we examine the extent to which excess compensation varies cross-sectionally with firm size. If after controlling for CEO ability, effort, risk, and the labor market, firm size contributes to excess compensation as suggested by Bebchuk and Fried (2006), then we should find evidence of excess CEO compensation for the largest firms.[2]

To examine size, we partition the test firms into quartiles based on firm size (i.e., average market value). We find no evidence of excessive compensation in any of the size quartiles. Our evidence does not support the notion that the increases in CEO compensation attributable to firm size are excessive (i.e., not economically justified). However, as previously noted, due to the inherent bias in our empirical design, these results should be interpreted with caution.

Turning to CEO power, managerial power theory suggests that more powerful CEOs can exert influence over their own compensation which allows them to extract additional rents from the firm (Bebchuk, Fried, & Walker, 2002). Empirical studies show a positive association between CEO power and compensation (e.g., Core, Holthausen, & Larcker, 1999; Kalyta & Magnan, 2008; Skantz, 2012). Bebchuk and Fried (2004) use the managerial power theory to argue that, because of the association between CEO power and compensation, the level of excess compensation is increasing in the power of the CEO. On the other hand, Pandher and Currie (2013) suggest that a complex interplay of factors on CEO pay exists such that higher managerial power does not necessarily imply excessive compensation.

To test the managerial power theory, we partition the test firms into CEO power portfolios based on a CEO power index.[3] Consistent with the theory, we find significant evidence of excessive CEO total and cash compensation for only the most powerful executives (i.e., CEOs in the fourth CEO power portfolio). Our evidence suggests that more powerful CEOs earn compensation above that of their domestic benchmark that is not explained by ability, effort, risk premium, labor market premium and other determinants of compensation (i.e., they are paid excessively).

Our results are consistent with the notion that CEO compensation can be excessive (e.g., Bebchuk & Fried, 2004; Bertrand & Mullainathan, 2001). Using a test that is biased towards not finding excess compensation, we find evidence that a portion of the compensation paid to the most powerful CEOs is not economically justified. This paper extends prior research on questionable compensation terms rewarded to powerful CEOs (e.g., Abernethy et al., 2015; Kalyta & Magnan, 2008; Skantz, 2012) by showing that the most powerful CEOs have non-economically justified compensation that is of sufficient magnitude to produce statistically significant evidence of excessive compensation.

The remainder of this paper is organized as follows: Section 2 discusses relevant prior research and develops the hypotheses. The empirical design is described in Section 3, the sample and data are defined in Section 4, the results are presented in Section 5, and the model validation and sensitivity analyses are presented in Section 6. Section 7 summarizes the study.

2. Hypotheses development

2.1. Firm size

It is well-established in the academic literature that firm size is highly correlated with CEO compensation. The extant literature suggests that it doesn't matter whether company size is measured as assets (e.g., Finkelstein & Hambrick, 1989), or sales revenue (e.g., Lambert, Larcker, & Weigelt, 1991), the evidence is clear, bigger firms pay more. According to the 2010 US Top Executive Compensation Report by The Conference Board (Hallock & Torok, 2010) the median total CEO compensation in 2009 for CEOs of the largest 10% of US public companies ($10.2 million) is almost twelve times more than for CEOs heading the smallest 10% of U.S companies ($878 thousand). Hallock and Torok (2010) also report evidence consistent with a disproportionate increase in CEO total compensation across firm size deciles. For example, for the first nine firm size deciles they report a 20–35% increase in median CEO total compensation for each step up in firm size decile. However, when

[1] It should be noted that our estimates of excess compensation are potentially understated since we, by design, include the labor market premium as part of the economically justified portion of CEO compensation. It could be reasonably argued that at least some portion of the labor market premium may in itself represent excessive compensation.

[2] It is widely accepted that CEO compensation is increasing in firm size, and we treat firm size as one of the economic determinants of justified compensation. Therefore it is important to note that the aim of our empirical test is not to evaluate whether *total* compensation increases with firm size, but whether *excessive* compensation increases with firm size.

[3] To partition the sample, we create a CEO power index based on prior research (Combs, Ketchen, Perryman, & Donahue, 2007; Feng, Ge, Luo, & Shevlin, 2011; Haynes & Hillman, 2010; Hill & Phan, 1991). We discuss this index in more detail later in the text.

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going to the tenth decile the increase in median compensation is approximately 60% greater than compensation of the median CEO in the ninth firm size decile.

Prior academic research also reports evidence consistent with the notion that over the past 30 years CEO compensation for large firms has increased at a dramatic rate (Frydman & Saks, 2010; Lord & Saito, 2010; Zhao, Baum, & Ford, 2009). For example, Lord and Saito (2010) report evidence that inflation-adjusted CEO total compensation doubled for firms in the S&P 1500 between 1994 and 2000. Similarly, Zhao et al. (2009) report total inflation-adjusted CEO compensation increased 143% between 1993 and 2007 for S&P 500 firms. Prior research also suggests that not only has CEO compensation increased over time, it has been increasing at an increasing rate. Bebchuk and Fried (2004) report that in more recent years the top five executives of large US public companies capture about 10% of the net profits of the companies, up from about 5% in the early 1990s.[4]

While it is undisputed that firm size is a significant economic determinant for CEO compensation and that large firms have experienced a disproportionate increase in CEO compensation, it remains uncertain whether large firms are more likely to pay *excessive* compensation. Gabaix and Landier (2008) provide a theory to explain the economic justification for the compensation increases experienced by large firms. They suggest that small differences in CEO talent, when combined with larger firm size, can result in disproportionately higher levels of CEO compensation. Similarly, Frydman and Saks (2010) suggest that firms' competition for scarce managerial talent may lead to higher CEO compensation in larger firms. These studies suggest that the disproportionate increases in CEO compensation for large firms are economically justified.

On the other hand, Bebchuk and Fried (2006) suggest that because existing pay practices reward CEOs for increasing firm size, these pay practices provide executives with incentives to increase firm size even when such a strategy is not in the best interests of shareholders. Bliss and Rosen (2001) find that CEOs are rewarded after an acquisition due to the associated increase in firm size even when the merger does not benefit shareholders. These studies suggest that excessive compensation increases with firm size.

If after controlling for CEO ability, effort, risk, and the labor market, firm size contributes to excess compensation as suggested by Bebchuk and Fried (2006), then we should find evidence of excess CEO compensation for the largest firms. This leads to our first hypothesis stated in the alternative form:

H1. CEOs of large firms are more likely to receive excess compensation than are CEOs of smaller firms.

2.2. Managerial power

Bebchuk et al. (2002) propose a managerial power approach to the study of executive compensation which argues that CEOs with more managerial power are able to extract rents from the company thereby resulting in a compensation contract that does not maximize shareholder value. Bebchuk, Cohen, and Ferrell (2009) suggest that executive compensation practices in the US benefit corporate executives at the expense of shareholders through implicit and explicit corruption of the pay-setting process. They argue that CEO employment contracts are bad for shareholders because they are the product of managerial power.

Several papers examine the possibility that powerful CEOs can extract more favorable compensation terms. Core et al. (1999) find that poor corporate governance is related to larger CEO compensation, presumably because the CEO is not challenged. Kalyta and Magnan (2008) find that CEO power is related to larger supplemental executive retirement plans. Skantz (2012) finds that the reduction in option compensation resulting from the implementation of SFAS 123(R) was smaller for entrenched CEOs. Finally, Abernethy et al. (2015) find that more powerful CEOs are able to obtain less challenging targets for their performance-vested stock option plans. These papers all suggest that powerful CEOs can favorably influence at least some portion of their compensation. However, if the CEO power measures used in prior research are correlated with CEO ability, CEO effort, or risk premiums, it is possible that the favorable terms may represent economically justified pay.

Bebchuk and Fried (2004) suggest that because CEOs with more power over boards are paid more than CEOs with less power implies that they are paid excessively. On the other hand, Core, Guay, and Thomas (2005) argue that just because a "powerful CEO" is paid more does not necessarily mean that the CEO is paid compensation in excess of "what a value maximizing board" should pay. In addition, they suggest that allowing managers to extract some rents can be optimal if the cost of monitoring is high. That is, in equilibrium, rent extraction may be contractually offset by reductions in other forms of compensation so that the net does not result in higher total compensation. Consistent with this notion, Pandher and Currie (2013) suggest that a complex interplay of factors on CEO pay exists such that higher managerial power does not necessarily imply excessive compensation. Thus, observing that a CEO receiving a perk usually associated with rent extraction does not necessarily imply that the CEOs compensation is not economically justified (Frydman & Jenter, 2010).[5]

Managerial power theory predicts we should find evidence of excess CEO compensation for the most powerful CEOs (Bebchuk et al., 2002). If CEO ability, CEO effort, and risk premiums do not explain a significant portion of the favorable compensation agreements obtained by powerful CEOs observed in prior research (e.g., Abernethy et al., 2015; Core et al., 1999; Kalyta & Magnan, 2008; Skantz, 2012), we would observe excess compensation for powerful CEOs. This leads to our second hypothesis stated in the alternative form:

H2. More powerful CEOs are more likely to receive excess compensation than are less powerful CEOs.

3. Empirical design

While prior research (e.g., Bebchuk & Fried, 2004, 2006; Bebchuk et al., 2002; Bertrand & Mullainathan, 2001; Bogle, 2008) and the popular press (e.g., Dvorak, 2009) claim that CEO compensation is excessive, empirically measuring excessive CEO has proven to be a challenge because the literature lacked a comprehensive tractable empirical framework for evaluating whether CEO compensation is excessive. However, in a recent study, Core and Guay (2010, 15) provide such a framework. Specifically, their compensation model can be summarized as follows:

$$\text{Justified\_Pay} = \text{CEO Ability} + \text{Cost of Effort} + \text{Incentive Risk Premium} \quad (1)$$

$$\text{Actual\_Pay} = \text{Justified\_Pay} + \text{Excess Compensation} \quad (2)$$

Conyon et al. (2011) utilize this model and compare US CEO compensation to a benchmark level of economically justified compensation.

[4] The observed relationship between firm size and the increase in CEO compensation is potentially the result of larger firms using equity compensation to a greater extent in more recent years. The increasing use of equity compensation as part of CEO compensation packages has been proposed as a potential explanation for increases in compensation (Conyon et al., 2011). To control for this possibility, our empirical design specifically controls for the form of compensation.

[5] Another criticism of the managerial power hypothesis is that it is unable to explain the steady increase in CEO compensation since the 1970s (Frydman & Jenter, 2010). There is little evidence suggesting that corporate governance has weakened or managerial power increased over the last 30 years. On the contrary, most research suggests that corporate governance has substantially strengthened over this period (Hermalin, 2005; Kaplan, 2008).

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They use UK CEOs as their compensation benchmark under the assumption that the UK economy is similar to the US economy and that the "UK is generally considered to be less afflicted by problems of excessive executive compensation" (Conyon et al., 2011, 403). They find that total mean pay and equity incentives are considerably larger in US firms. However, they conclude US CEOs are not excessively compensated relative to UK CEOs because US CEOs need to be compensated for holding more equity in their firm than do UK CEOs. However, the differences between US and UK CEO compensation structure suggest that there are material inter-economy differences between the two countries.

We extend (modify) the Core and Guay (2010) framework by developing an executive-specific, within-country (US) compensation benchmark for each test firm. To identify benchmark firms, we group our sample into portfolios of firms matched on year, the Fama and French (1997) 48 industry classifications, size, and compensation structure. Within each industry-year combination, we sort firms based on MKTVAL (market value of equity plus book value of debt averaged from the beginning and end of year t), and partition the observations into quartiles. This approach is similar to that used by Albuquerque (2009) in identifying peer firms to evaluate CEO compensation and relative firm performance. Within each year, industry and size quartile, we further partition firms on the ratio of cash compensation to total compensation ratio (above or below the median).[6] All firms falling into the same partition for all four categories (i.e., year, industry, size, and compensation structure) are collectively considered a matched portfolio. We require a minimum of two firms in each portfolio.

For each observation, or test firm, we select a benchmark firm within the same portfolio.[7] We sort each portfolio by average firm performance (i.e., market return) for the previous two years. We then select as our benchmark the firm with the next highest firm performance (i.e., the benchmark firm has firm performance just below that of the test firm). This benchmark represents our empirical proxy for the test firm's next best CEO candidate. That is, our research design assumes that a reasonable candidate to replace the test firm CEO will be similar in terms of; 1) historical firm performance, 2) industry, 3) size and 4) compensation structure.

Having identified benchmark firms, we next develop a model to examine excess compensation. We begin by differencing compensation between each test firm and its respective benchmark firm, as shown below:

$$\text{Dif\_Actual\_Pay} = \text{Test\_Actual\_Pay}–\text{Bench\_Actual\_Pay} \tag{3}$$

In our setting the difference in actual pay is comprised of a justified pay component and an excess pay component. Thus, using this differencing approach allows us to determine how much of the difference between test and benchmark firm CEO compensation is explained by differences in firm and executive characteristics which leads to the following testable model:

$$\text{Dif\_Actual\_Pay} = \text{Dif\_Justified\_Pay} + \text{Excess\_Compensation} \tag{4}$$

The difference in justified pay (Dif_Justified_Pay) is the difference in CEO ability, CEO effort and risk premium. Applying Eq. (4) in a regression setting leads to the following empirical model of excessive compensation:

$$D\_Comp_{it} = \beta_0 + \sum \alpha ABILITY + \sum \delta EFFORT + \sum \lambda RISK\_PREMIUM + \varepsilon \tag{5}$$

D_Comp is calculated as test firm CEO compensation less benchmark firm CEO compensation. Compensation is measured as the log of total compensation[8] (TDC1 in ExecuComp). All *ABILITY*, *EFFORT* and *RISK_PREMIUM* variables are measured as the test firm value less the benchmark firm value, denoted with the prefix *D_*.

Compensation for ability represents the pay necessary to entice the CEO away from his or her next best opportunity. Prior research finds that CEO talent is associated with firm size and firms with greater growth opportunities (Smith & Watts, 1992). In addition, prior research often includes controls for company performance and firm risk as proxies for ability and demand for ability (Conyon et al., 2011; Jackson, Lopez, & Reitenga, 2008). Compensation for effort relates to payments intended to induce greater effort on the part of the CEO. Prior research finds that larger firms and firms in high-growth environments are associated with executive effort (Aggarwal & Samwick, 1999; Core et al., 1999; Rosen, 1982; Smith & Watts, 1992). Consistent with this literature, we include the following controls: stock return and return on assets (firm performance), the standard deviations of returns and return on assets (firm risk), the ratio of the market value of equity to the book value of equity (growth opportunities), firm market value (firm size), and chairman of the board (CEO ability and effort)[9] which are defined as follows:

RET (Core et al., 1999) — the annual percentage stock market return for year *t*.

ROA (Core et al., 1999; Jackson et al., 2008) — the return on assets for year *t*, calculated as income before extraordinary items divided by total average assets.

SDRTN (Aggarwal & Samwick, 1999; Core et al., 1999) — the standard deviation of *RET* for the five years ending $t - 1$.

SDROA (Aggarwal & Samwick, 1999; Core et al., 1999) — the standard deviation of *ROA* for the five years ending $t - 1$.

MB (Core et al., 1999; Rosen, 1982; Smith & Watts, 1992) — the ratio of market value of equity to book value of equity averaged over the five years ending $t - 1$.

MKTVAL (Core et al., 1999; Rosen, 1982; Smith & Watts, 1992) — the log of the sum of total market value of equity and total book value of debt for year $t - 1$.

Chair (Conyon et al., 2011; Core et al., 1999) — coded one if CEO serves as Chairman of the Board of Directors, and zero otherwise.

Since the relationship between compensation and ability/performance may be reflected over multiple years, we also include variables for the immediate prior year (denoted L1) and the first subsequent year (denoted P1) of *RET* and *ROA*. As noted earlier, control variables are calculated as the difference between the test firm and the benchmark firm. For example, *D_RET* is calculated as test firm *RET* less benchmark firm *RET*.

Risk premiums stem from two sources. First, CEOs will require extra compensation when stock ownership requirements force the CEO to hold an undiversified stock portfolio. For example, Conyon et al. (2011) report that the median CEO receives between $4.85 and $8.69 in extra annual pay for holding an undiversified position equivalent to

[6] We include the ratio of cash to total compensation in the matching scheme because Hall and Murphy (2002) suggest that because of risk aversion and non-diversification, executives will not value $1 of option compensation as being equal to $1 of cash compensation. That is, the form of pay will in part dictate the amount of pay.

[7] We identify benchmark firms based on portfolio matching instead of propensity score matching. While propensity score matching allows for strong statistical inferences, this technique requires that firms be naturally separated into test firms and control firms. Conyon et al. (2011) use propensity score matching with US firms as test firms and UK firms as control firms. Unlike Conyon et al. (2011), our sample consists solely of US firms and therefore does not naturally partition into two distinct groups of firms. As a result we rely on portfolios to construct our matches.

[8] Total compensation includes salary, bonus, the total value of restricted stock granted, the total Black-Scholes value of stock options granted, total long-term incentive payouts and all other compensation.

[9] The Chairman of the Board indicator variable is often used to indicate entrenchment and a potential contributor to excessive compensation (e.g., Core et al., 1999). In an effort to construct a test that biases against finding excessive compensation, we include this variable as part of justified pay under the premise that, all else being equal, a CEO holding a dual role should be paid more than a CEO only serving as CEO.

$100 in firm stock. This translates into a risk premium that ranges between 5.8 and 11.0% depending on the percentage of CEO wealth held in firm stock and the CEOs level of risk aversion. Assuming roughly equal cash compensation, a CEO with $1,000,000 in equity incentives in the firm, will require a risk premium between $58,000 and $110,000 to compensate for the lack of portfolio diversification (Conyon, 2006). Consistent with Conyon et al. (2011), we include a control variable for the magnitude of the CEO's equity investment in the firm. The second source of risk premium relates to the extra compensation required when paying CEOs with equity compensation in lieu of cash compensation. Because of risk aversion and non-diversification, executives will not value $1 of option compensation as being equal to $1 of cash compensation (Hall & Murphy, 2002). We therefore include a control variable for the ratio of cash compensation to total compensation. The variables are defined below:

INCENT (Conyon et al., 2011) — the log of [(share price × the number of shares held by the CEO) + (share price × option delta × the number of options held by the CEO)] measured as of the end of year $t-1$. The number of firm shares held represents shares owned by the CEO excluding stock options but including unvested restricted stock.

CASH_PCT (Conyon et al., 2011) — the current year cash compensation for the CEO divided by current year total compensation for period *t*.

D_Comp that is explained by differences in the economic determinants between test firms and benchmark firms is assumed to be CEO compensation that is economically justified. On the other hand, *D_Comp* that is not explained by differences in the economic determinants of CEO compensation is considered deficient or excessive. Consistent with Conyon et al. (2011), we interpret a significantly positive intercept (β_0) in Eq. (5) as compensation that is not explained by the economic determinants (i.e., ability, effort and risk premium), and thus represents excess CEO compensation. The model is a conservative test of excess CEO compensation, because any excess compensation paid to the benchmark firm CEO is implicitly included as part of the economically justified pay for the test firm CEO.

Rajgopal et al. (2006) report that market-wide shocks increase the demand for CEO talent outside the firm, which in turn, forces some firms to increase compensation levels to retain their more talented CEOs. Oyer (2004) and Himmelberg and Hubbard (2000) suggest that what looks like excess compensation might actually reflect the unique conditions in the labor market for talented CEOs. That is, if CEO talent is limited, then the supply of talented CEOs is relatively inelastic, in which case it is optimal for firms to reward their CEOs for market-wide shocks if such shocks increase the value of the firm and increase the CEOs outside employment opportunities. Gabaix and Landier (2008) suggest that contagion is another potential source of increased CEO compensation. That is, if a small fraction of firms decides to pay more than the other firms, the compensation of all CEOs can rise by a substantial amount in general equilibrium. Because of the controversy regarding the existence of excess CEO compensation, we specifically chose to design a model that is less likely to find excess; thus, our model implicitly assumes that the labor market premium, whatever the source, is part of justified pay.

Conyon et al. (2011) assume that their benchmark UK CEOs are not paid excess compensation. As a result, they interpret the intercept in their empirical model as the overall excess compensation paid to US CEOs. However, in our case we acknowledge that all US CEOs are potentially paid excess compensation. Thus, the intercept in our empirical model is better described as incremental excess compensation between test and benchmark firm CEOs, rather than the overall level of excess compensation. As noted previously, this particular empirical design choice specifically biases against finding evidence of excessive CEO compensation.

4. Sample and data

4.1. Sample selection and data sources

Executive compensation data is obtained from ExecuComp for the 17 year period 1992 through 2008. Since we use past CEO performance to identify our firm-specific benchmark and as a control variable, we require CEOs to have tenure in their position of at least three years. Financial information is obtained from Compustat and return data from the Center for Research in Security Price (CRSP). All observations with non-positive values for total sales or assets are deleted.[10] Table 1 shows that our sample selection criteria and data requirements result in a sample of 5939 firm-year observations from 1539 unique firms. The sample firms come from a wide range of industries, with the three largest industry groups being Computers, Retail and Communication representing 14.1, 10.3 and 10.1% of the sample, respectively.

4.2. Descriptive statistics

Table 2 reports the means, medians, and standard deviations for the test firms, the benchmark firms and the difference variables (i.e., the D_ variables). The descriptive statistics indicate that test firms performed better, have larger compensation, and the CEOs hold more stock. All of these differences are logical given that we are matching test firms to the next best performing firm. In addition to industry and year, we also match firms on size (*MKTVAL*) and compensation structure (*CASH_PCT*). Therefore we expect the differences in these variables between test firms and benchmark firms will be minimal. The mean and median for *D_CASH_PCT* are insignificant, as expected. However, while the median of *D_MKTVAL* is insignificant, the mean is positive and significant (mean = 0.02, *t*-statistic = 2.19). To control for the possibility that evidence of excess compensation is an artifact of this mismatch, we delete all observations in the top 99th percentile *D_MKTVAL* and re-estimate all tables (untabulated). With these observations deleted, the mean and median of *D_MKTVAL* are both insignificant.

5. Results

Table 3 presents results of the estimation of Eq. (5). The model is estimated using OLS with White's (1984) standard errors clustered at the firm level.[11] Consistent with theory and our expectations, the results indicate that the difference in pay between test and benchmark CEO pay (*D_Comp*) is positively related to ability, effort and compensation risk. We find significant evidence that the differences in total compensation between test firms and benchmarks are positively related to differences in current year stock return (*D_RET*), current year ROA (*D_ROA*), firm size (*D_MKTVAL*), being the chairman of the board (*D_CHAIR*), and the deviation in stock return (*D_SDRTN*). There is also evidence that the form of compensation is an important factor in explaining *D_Comp*. Consistent with that notion, we find that the difference in risk premiums associated with holding stock (*D_INCENT*) is positively related to compensation and the difference in the ratio of cash compensation to total compensation (*D_CASH_PCT*) between test firms and benchmarks is negatively and significantly related to total compensation. The insignificant intercept indicates that, in the full sample, all differences in compensation between test firm CEOs and benchmark CEOs are explained by ability, effort, incentive risk premium and labor market premiums.

[10] In supplemental tests we estimate an alternative measure of excess compensation based on residual models used in the prior literature (e.g., Core, Guay, & Larcker, 2008). For these tests we run cross sectional regression for each industry and year. To ensure sufficient data for these cross sectional regressions we require 20 observations for each industry and year. We discuss these tests in more detail in the sensitivity analysis section of the manuscript.

[11] To preserve sample size, we do not trim the sample for outliers. Results are quantitatively and qualitatively similar if we trim at the 1st and 99th percentiles of all variables.

Table 1
Sample selection.

	Firms	CEO years
1992 to 2008 ExecuComp firm-years with CEO compensation data	3080	29,542
Less: Observations missing compensation data	162	2472
Less: CEOs with tenure less than or equal to 2 years	103	5587
Less: Observations missing COMPUSTAT data or non-positive values for sales or assets	561	9912
Less: Observations with less than 20 total observations in industry/year	602	3976
Less: The lowest performing CEO in each portfolio[a]	113	1656
Sample	**1539**	**5939**

[a] Test firms are compared to benchmark firms drawn from the same portfolio of firms. Firms within a portfolio are sorted on the mean return for the previous two years, and the test firm is matched to the firm with the next best prior performance. Therefore, the lowest performing CEO within each portfolio is deleted for this test because there is no benchmark firm.

5.1. Empirical test of H1 — firm size partition

H1 predicts that we will find evidence of excess CEO compensation in larger firms. To test this hypothesis we partition our sample into size quartiles measured by the market value of equity within each industry and year. For example, Quartile 4 sub-sample includes only observations where the test firm is in the fourth quartile for firm size in that year within that firm's industry. We then compare excess compensation across size quartiles using two different estimation methodologies. First we include indicator variables for firm size quartiles two through four. The intercept in this model relates to firms that are in the first size quartile. For each size quartile, excess compensation is equal to the sum of the intercept and the respective size quartile indicator variable. The results for this estimation approach are presented in Column (A) of Table 4. For our second estimation methodology we run a separate regression for each size quartile. This approach allows all coefficients to vary with firm size. The intercept for each regression represents the excess compensation for that size quartile. We present these results in Columns (B) through (E) in Table 4.

The control variables are generally consistent with the results in Table 3. H1 predicts that excess compensation will be positive for the higher firm size quartiles. Our results are inconsistent with the prediction of H1. We find no evidence of excess for larger firms. Our evidence is consistent with the notion that differences in CEO compensation between test firms and benchmark firms are explained by differences in ability, effort, incentive risk premium and labor market premiums.

Table 2
Descriptive statistics.

	Test firm			Benchmark firm			Difference		
Observations	5939			5939					
	Mean	Median	Std dev	Mean	Median	Std dev	Mean	Median	Std dev
COMP	1.38	1.22	0.80	1.35	1.20	0.77	0.03**	0.02**	0.68
RET_L1	0.36	0.20	1.68	0.16	0.10	0.55	0.20**	0.10**	1.67
RET	0.21	0.13	0.64	0.23	0.13	0.89	−0.02	−0.00	0.99
RET_P1	0.14	0.08	0.61	0.15	0.08	0.61	−0.01	−0.00	0.76
ROA_L1	0.05	0.05	0.10	0.04	0.04	0.14	0.01**	0.01**	0.15
ROA	0.05	0.05	0.13	0.04	0.04	0.12	0.01**	0.01**	0.15
ROA_P1	0.04	0.04	0.13	0.03	0.04	0.14	0.01**	0.00**	0.18
MKTVAL	7.81	7.69	1.58	7.79	7.68	1.62	0.02*	0.01	0.74
MB	3.46	2.34	22.84	3.39	2.30	22.74	0.07	0.04*	32.23
SDROA	0.05	0.02	0.09	0.05	0.02	0.10	−0.00	−0.00	0.12
SDRTN	0.81	0.37	6.57	0.61	0.34	3.87	0.20*	0.03**	7.61
INCENT	3.42	3.32	1.48	3.30	3.21	1.47	0.12**	0.11**	1.47
CASH_PCT	0.48	0.45	0.28	0.49	0.45	0.28	−0.01	−0.00	0.22
CHAIR	0.66	1.00	0.47	0.68	1.00	0.47	−0.02*	0.00*	0.64
TENURE	10.23	7.90	7.45	10.25	7.91	7.42	−0.02	0.01	10.29
PAYSLICE	2.92	2.39	4.12	2.77	2.36	3.68	0.15*	0.03*	5.52
CEO_PWR	1.66	2.00	0.90	1.66	2.00	0.89	−0.00	0.00	1.26

Variable definitions

Benchmark next highest performing firm (mean of prior two year stock return) in the portfolio.
COMP the log of the sum of salary, bonus, other annual compensation, total value of restricted stock granted, total value of stock options granted (using Black-Scholes), long-term incentive payouts and all other compensation for year t,
RET_L1 the annual return to shareholders for the firm for year $t-1$,
RET the annual return to shareholders for the firm for year t,
RET_P1 the annual return to shareholders for the firm for year $t+1$,
ROA_L1 the return on assets for year $t-1$ calculated as income before extraordinary items divided by total average assets,
ROA the return on assets for year t,
ROA_P1 the return on assets for year $t+1$,
MKTVAL the log of total market value of equity plus book value of debt, averaged for beginning and end of year t,
MB the ratio of market value of equity to book value of equity averaged over the five years ending year $t-1$,
SDROA the standard deviation of the annual return on assets for the five years ending year $t-1$,
SDRTN the standard deviation of the annual percentage stock return for the five years ending year $t-1$,
INCENT the log of [(share price × the number of shares held) + (share price × option delta × the number of options held)] number of shares held = shares owned by the CEO and unvested restricted stock,
CASH_PCT current year cash compensation, divided by current year total compensation,
CHAIR 1 if CEO serves as Chairman of the Board of Directors; 0 otherwise,
TENURE the length of time, in years, in the CEO position,
PAYSLICE the ratio of CEO compensation compared to the mean total compensation for the four highest paid non-CEO executives; and
CEO_PWR *CHAIR* + *Hi_Tenure* + *Hi_Payslice* where *Hi_Tenure* = 1 if *TENURE* is above the contemporaneous median for all CEOs in the same industry and 0 otherwise, and *Hi_Payslice* = 1 if *PAYSLICE* is above the contemporaneous median for all CEOs in the same industry and 0 otherwise.

** Two-tailed p-value < 0.01.
* Two-tailed p-value < 0.05.

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Table 3
Compensation estimation full sample.

Variable	Predicted sign	Coefficient (*t*-statistic)
INTERCEPT	?	0.014 (1.303)
D_RET_L1	+	0.003 (0.978)
D_RET	+	0.046** (3.652)
D_RET_P1	+	0.014 (1.531)
D_ROA_L1	+	−0.066 (−1.274)
D_ROA	+	0.130** (2.620)
D_ROA_P1	+	0.034 (0.681)
D_MKTVAL	+	0.203** (14.226)
D_MB	+	−0.000 (−1.175)
D_SDROA	+	0.037 (0.579)
D_SDRTN	+	0.002** (3.803)
D_INCENT	+	0.038** (4.230)
D_CASH_PCT	−/+	−1.433** (−35.423)
D_CHAIR	+	0.086** (6.083)
Observations		5939
Adj R-squared		0.3213

Variable definitions

D_COMP Test firm *COMP* − Benchmark firm *COMP*, where *COMP* = the log of the sum of salary, bonus, other annual compensation, total value of restricted stock granted, total value of stock options granted (using Black-Scholes), long-term incentive payouts and all other compensation for year *t*,
D_RET_L1 Test firm *RET_L1* − Benchmark firm *RET_L1*, where *RET_L1* = the annual return to shareholders for the firm for year $t-1$,
D_RET Test firm *RET* − Benchmark firm *RET*, where *RET* = the annual return to shareholders for the firm for year *t*,
D_RET_P1 Test firm *RET_P1* − Benchmark firm *RET_P1*, where *RET_P1* = the annual return to shareholders for the firm for year $t+1$,
D_ROA_L1 Test firm *ROA_L1* − Benchmark firm *ROA_L1*, where *ROA_L1* = the return on assets for year $t-1$,
D_ROA Test firm *ROA* − Benchmark firm *ROA*, where *ROA* = the return on assets for year *t*,
D_ROA_P1 Test firm *ROA_P1* − Benchmark firm *ROA_P1*, where *ROA_P1* = the return on assets for year $t+1$,
D_MKTVAL Test firm *MKTVAL* − Benchmark firm *MKTVAL*, where *MKTVAL* = the log of total market value of equity plus book value of debt, averaged for beginning and end of year *t*,
D_MB Test firm *MB* − Benchmark firm *MB*, where *MB* = the market-to-book ratio averaged over the five years ending year $t-1$,
D_SDROA Test firm *SDROA* − Benchmark firm *SDROA*, where *SDROA* = the standard deviation of *ROA* for the five years ending year $t-1$,
D_SDRTN Test firm *SDRTN* − Benchmark firm *SDRTN*, where *SDRTN* = the standard deviation of *RET* for the five years ending year $t-1$,
D_INCENT Test firm *INCENT* Benchmark firm *INCENT*, where *INCENT* = the log of [(share price × the number of shares held) + (share price × option delta × the number of options held)] number of shares held = shares owned by the CEO and unvested restricted stock,
D_ CASH_PCT Test firm *CASH_PCT* − Benchmark firm *CASH_PCT*, where *CASH_PCT* = current year cash compensation, divided by current year total compensation, and
D_CHAIR Test firm *CHAIR* − Benchmark firm *CHAIR*, where *CHAIR* = 1 if CEO serves as Chairman of the Board of Directors; 0 otherwise.

** Two-tailed p-value < 0.01.

It is important to note that firm size is a significant economic determinant of justified compensation. We include firm size (*MKTVAL*) as one our control variables. We expect that differences in compensation between the test firm CEO and the benchmark firm CEO are attributable, in large part, to differences in firm size. The positive and significant (p value < 0.01) coefficient on *D_MKTVAL* is consistent with this expectation. The aim of the test presented in Table 4 is not to evaluate whether total compensation increases with firm size, but whether excessive compensation (i.e., rent extraction) increases with firm size. However, we find no evidence to support our prediction that large firms are more likely to pay excess compensation.

We examine whether our results are sensitive to the compensation measure used. Our primary analysis uses total compensation, which includes cash compensation and equity compensation. Core and Guay (1999) find that the level of equity compensation is in part related to the difference between the CEO's equity incentives and the optimal level of equity incentives. The agency considerations inherent in achieving an optimal level of CEO stock holdings present a potential confounding factor in our study. In untabulated results, we estimate the Table 4 regressions separately for cash compensation and all other compensation. Consistent with the results presented in Table 4, in all four size quartiles we find no evidence of excessive compensation. Overall, the results are inconsistent with the notion that CEOs of larger firms receive compensation that is excessive relative to peer CEOs. However, because our empirical test provides an inherent bias against finding evidence of excess compensation, our results indicating that excess compensation is not present should be interpreted with caution.

5.2. Empirical test of H2 — CEO power partition

H2 predicts that more powerful CEOs can influence their own compensation, which suggests that excess compensation may be greater in firms with more powerful CEOs. To perform our analyses, we create a CEO power index using three separate signals of CEO power: duality, tenure and pay slice. One way that CEOs acquire power is to hold the dual roles of CEO and Chairman of the Board (Combs et al., 2007; Haynes & Hillman, 2010). The first CEO power signal, *Chairman*, is coded 1 if the CEO is Chairman of the Board of Directors, and 0 otherwise. A CEO's influence also increases with tenure (Combs et al., 2007; Hill & Phan, 1991). The second CEO power signal, *Hi_Tenure*, is coded 1 if the tenure of the CEO is greater than the contemporaneous median tenure for all CEOs in the same industry and 0 otherwise. Lastly, we consider the ratio of CEO compensation compared to the mean total compensation for the four highest paid non-CEO executives (*Payslice*).[12] Prior research suggests that CEOs with a higher *Payslice* have greater power (Feng et al., 2011). The third CEO power signal, *Hi_PaySlice*, is coded 1 if the *Payslice* of the CEO is greater than the contemporaneous median *Payslice* for all CEOs in the same industry, and 0 otherwise. Our CEO power index (*CEO_Pwr*) equals the sum of our three CEO power signals (*Chairman*, *Hi_Tenure* and *Hi_Payslice*) and, therefore, ranges from zero (low power CEOs) to three (high power CEOs).

To test H2 we examine how excess compensation varies with CEO power. Similar to our approach for H1, we use two estimation methodologies. First we include in our empirical model indicator variables for firms with CEO power index (*CEO_Pwr*) equal to one through three. The intercept in this model relates to firms for which *CEO_Pwr* equal zero. The results for this estimation approach are presented in Column (A) of Table 5. For our second estimation methodology we run a separate regression for each CEO power partition. We interpret the intercept for each regression to represent the excess compensation for each CEO power partition. We present these results in Columns (B) through

[12] We use prior year data to calculate *Payslice* to remove the influence of current year compensation on the power index. Similar to the approach in Feng et al. (2011), when the firm reports compensation data for more than four non-CEO executives, we use only the four highest-paid executives in the ratio denominator. When the firm reports data for fewer than four non-CEO executives, we use the compensation for the lowest-paid executive as the assumed compensation for any unreported executives.

Table 4
Compensation estimation partitioned by test firm size.

Variable	Pred sign	(A) Full sample Coef (t-stat)	(B) Size Quartile 1 Coef (t-stat)	(C) Size Quartile 2 Coef (t-stat)	(D) Size Quartile 3 Coef (t-stat)	(E) Size Quartile 4 Coef (t-stat)
INTERCEPT	?	−0.007	0.001	0.018	0.016	0.017
		(−0.493)	(0.092)	(1.120)	(0.748)	(0.688)
D_RET_L1	+	0.003	0.002	0.003	−0.004	0.098**
		(0.970)	(0.138)	(1.166)	(−0.222)	(3.577)
D_RET	+	0.046**	0.090**	0.039*	0.046	0.043*
		(3.672)	(4.194)	(2.058)	(1.698)	(2.158)
D_RET_P1	+	0.014	0.012	−0.009	−0.001	0.075*
		(1.526)	(1.222)	(−0.504)	(−0.053)	(2.118)
D_ROA_L1	+	−0.062	0.012	−0.078	−0.071	−0.460
		(−1.202)	(0.220)	(−0.840)	(−0.443)	(−1.084)
D_ROA	+	0.130**	−0.008	0.101**	0.414*	0.428
		(2.631)	(−0.107)	(2.906)	(2.065)	(1.299)
D_ROA_P1	+	0.035	0.074	0.068	−0.158	−0.116
		(0.700)	(1.446)	(1.774)	(−0.936)	(−0.289)
D_MKTVAL	+	0.204**	0.087**	0.206**	0.297**	0.219**
		(14.276)	(5.921)	(7.290)	(8.005)	(10.584)
D_MB	+	−0.000	−0.000	−0.001	−0.002	0.001
		(−1.159)	(−1.679)	(−0.711)	(−1.286)	(1.511)
D_SDROA	+	0.037	0.142	0.008	0.295	−0.980
		(0.583)	(1.687)	(0.101)	(1.650)	(−1.768)
D_SDRTN	+	0.002**	0.002**	0.002*	0.004*	−0.124**
		(3.842)	(2.753)	(2.192)	(2.284)	(−2.659)
D_INCENT	+	0.038**	0.053**	0.040**	0.037*	0.054**
		(4.222)	(5.033)	(2.741)	(2.156)	(3.174)
D_CASH_PCT	−	−1.433**	−1.173**	−1.393**	−1.421**	−1.690**
		(−35.402)	(−18.733)	(−23.420)	(−17.617)	(−17.906)
D_CHAIR	+	0.086**	0.050**	0.071**	0.039	0.222**
		(6.069)	(2.963)	(3.060)	(1.316)	(5.491)
SIZEQ2	+	0.026				
		(1.237)				
SIZEQ3	+	0.026				
		(1.033)				
SIZEQ4	+	0.031				
		(1.070)				
Observations		5939	1405	1513	1462	1559
Adj R-squared		0.3212	0.3923	0.3290	0.2808	0.3647
SUMMED COEFFICIENTS:						
INTERCEPT + SIZEQ2		0.019				
		(1.120)				
INTERCEPT + SIZEQ3		0.019				
		(0.900)				
INTERCEPT + SIZEQ4		0.024				
		(0.950)				

This table examines excess compensation by size quartile using indicator variables for firm size quartile (Column (A)) and estimating separate regressions for each size quartile (Columns (B) through (E)). We partition our test firms into size quartile within each industry and year based on the firm's market value of equity.
Variable definitions

D_COMP Test firm *COMP* — Benchmark firm *COMP*, where *COMP* = the log of the sum of salary, bonus, other annual compensation, total value of restricted stock granted, total value of stock options granted (using Black-Scholes), long-term incentive payouts and all other compensation for year *t*,
D_RET_L1 Test firm *RET_L1* — Benchmark firm *RET_L1*, where *RET_L1* = the annual return to shareholders for the firm for year $t-1$,
D_RET Test firm *RET* — Benchmark firm *RET*, where *RET* = the annual return to shareholders for the firm for year *t*,
D_RET_P1 Test firm *RET_P1* — Benchmark firm *RET_P1*, where *RET_P1* = the annual return to shareholders for the firm for year $t+1$,
D_ROA_L1 Test firm *ROA_L1* — Benchmark firm *ROA_L1*, where *ROA_L1* = the return on assets for year $t-1$,
D_ROA Test firm *ROA* — Benchmark firm *ROA*, where *ROA* = the return on assets for year *t*,
D_ROA_P1 Test firm *ROA_P1* — Benchmark firm *ROA_P1*, where *ROA_P1* = the return on assets for year $t+1$,
D_MKTVAL Test firm *MKTVAL* — Benchmark firm *MKTVAL*, where *MKTVAL* = the log of total market value of equity plus book value of debt, averaged for beginning and end of year *t*,
D_MB Test firm *MB* — Benchmark firm *MB*, where *MB* = the market-to-book ratio averaged over the five years ending year $t-1$,
D_SDROA Test firm *SDROA* — Benchmark firm *SDROA*, where *SDROA* = the standard deviation of *ROA* for the five years ending year $t-1$,
D_SDRTN Test firm *SDRTN* — Benchmark firm *SDRTN*, where *SDRTN* = the standard deviation of *RET* for the five years ending year $t-1$,
D_INCENT Test firm *INCENT* Benchmark firm *INCENT*, where *INCENT* = the log of [(share price × the number of shares held) + (share price × option delta × the number of options held)] number of shares held = shares owned by the CEO and unvested restricted stock,
D_ CASH_PCT Test firm *CASH_PCT* — Benchmark firm *CASH_PCT*, where *CASH_PCT* = current year cash compensation, divided by current year total compensation,
D_CHAIR Test firm *CHAIR* — Benchmark firm *CHAIR*, where *CHAIR* = 1 if CEO serves as Chairman of the Board of Directors; 0 otherwise,
SIZEQ2 1 if the firm's market value of equity ranks in the 2nd quartile within a specific industry and year (Quartile 1 = smallest market value of equity); 0 otherwise,
SIZEQ3 1 if the firm's market value of equity ranks in the 3rd quartile within a specific industry and year (Quartile 1 = smallest market value of equity); 0 otherwise, and
SIZEQ4 1 if the firm's market value of equity ranks in the 4th quartile within a specific industry and year (Quartile 1 = smallest market value of equity); 0 otherwise.

** Two-tailed p-value < 0.01.
* Two-tailed p-value < 0.05.

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Table 5
Compensation estimation partitioned by CEO power.

Variable	Pred sign	(A) Full sample Coef (*t*-stat)	(B) CEO_Pwr = 0 Coef (*t*-stat)	(C) CEO_Pwr = 1 Coef (*t*-stat)	(D) CEO_Pwr = 2 Coef (*t*-stat)	(E) CEO_Pwr = 3 Coef (*t*-stat)
INTERCEPT	?	−0.049*	0.007	−0.039*	0.025	0.095**
		(−2.054)	(0.230)	(−2.304)	(1.627)	(3.103)
D_RET_L1	+	0.003	−0.003	0.003	0.001	0.028
		(0.959)	(−0.117)	(0.974)	(0.107)	(1.053)
D_RET	+	0.045**	−0.005	0.015	0.045**	0.152**
		(3.641)	(−0.168)	(0.997)	(2.671)	(3.527)
D_RET_P1	+	0.013	0.004	0.025	0.013	−0.024
		(1.404)	(0.202)	(1.848)	(0.896)	(−0.643)
D_ROA_L1	+	−0.060	−0.215	0.020	−0.074	−0.427
		(−1.149)	(−1.383)	(0.334)	(−1.007)	(−1.040)
D_ROA	+	0.131**	0.281	0.087	0.136*	0.511
		(2.631)	(1.767)	(0.671)	(2.276)	(1.654)
D_ROA_P1	+	0.034	0.049	−0.007	−0.068	0.175*
		(0.661)	(1.066)	(−0.076)	(−0.448)	(2.031)
D_MKTVAL	+	0.205**	0.182**	0.235**	0.216**	0.164**
		(14.489)	(6.584)	(7.607)	(11.099)	(5.227)
D_MB	+	−0.000	−0.002	−0.001	0.000	−0.000*
		(−0.949)	(−0.905)	(−0.717)	(0.152)	(−2.156)
D_SDROA	+	0.043	0.126	0.059	0.014	0.273
		(0.691)	(1.087)	(0.519)	(0.160)	(0.933)
D_SDRTN	+	0.002**	−0.000	0.001	0.002**	0.001
		(4.201)	(−0.405)	(1.494)	(4.354)	(0.637)
D_INCENT	+	0.032**	0.021	0.012	0.036**	0.070**
		(3.584)	(1.046)	(0.730)	(3.515)	(2.829)
D_CASH_PCT	−	−1.427**	−1.360**	−1.376**	−1.525**	−1.303**
		(−35.765)	(−14.010)	(−21.963)	(−26.911)	(−10.172)
D_CHAIR	+	0.052**	0.150**	0.060**	0.012	0.107*
		(3.698)	(4.031)	(2.772)	(0.565)	(2.196)
CEO_PWR1	+	0.009				
		(0.340)				
CEO_PWR2	+	0.068*				
		(2.390)				
CEO_PWR3	+	0.178**				
		(4.770)				
Observations		5939	652	1823	2385	1079
Adj R-squared		0.3278	0.3457	0.3166	0.3587	0.2373
Summed coefficients:						
INTERCEPT + *CEO_PWR1*		−0.040*				
		(−2.350)				
INTERCEPT + *CEO_PWR2*		0.019				
		(1.290)				
INTERCEPT + *CEO_PWR3*		0.129**				
		(4.520)				

This table examines excess compensation by CEO Power using indicator variables for values of the power index (CEO_Pwr) (Column (A)) and estimating separate regressions for each value of CEO_Pwr (Columns (B) through (E)).

Variable definitions

D_COMP Test firm *COMP* — Benchmark firm *COMP*, where *COMP* = the log of the sum of salary, bonus, other annual compensation, total value of restricted stock granted, total value of stock options granted (using Black-Scholes), long-term incentive payouts and all other compensation for year *t*,
D_RET_L1 Test firm *RET_L1* — Benchmark firm *RET_L1*, where *RET_L1* = the annual return to shareholders for the firm for year $t-1$,
D_RET Test firm *RET* — Benchmark firm *RET*, where *RET* = the annual return to shareholders for the firm for year *t*,
D_RET_P1 Test firm *RET_P1* — Benchmark firm *RET_P1*, where *RET_P1* = the annual return to shareholders for the firm for year $t+1$,
D_ROA_L1 Test firm *ROA_L1* — Benchmark firm *ROA_L1*, where *ROA_L1* = the return on assets for year $t-1$,
D_ROA Test firm *ROA* — Benchmark firm *ROA*, where *ROA* = the return on assets for year *t*,
D_ROA_P1 Test firm *ROA_P1* — Benchmark firm *ROA_P1*, where *ROA_P1* = the return on assets for year $t+1$,
D_MKTVAL Test firm *MKTVAL* — Benchmark firm *MKTVAL*, where *MKTVAL* = the log of total market value of equity plus book value of debt, averaged for beginning and end of year *t*,
D_MB Test firm *MB* — Benchmark firm *MB*, where *MB* = the market-to-book ratio averaged over the five years ending year $t-1$,
D_SDROA Test firm *SDROA* — Benchmark firm *SDROA*, where *SDROA* = the standard deviation of *ROA* for the five years ending year $t-1$,
D_SDRTN Test firm *SDRTN* — Benchmark firm *SDRTN*, where *SDRTN* = the standard deviation of *RET* for the five years ending year $t-1$,
D_INCENT Test firm *INCENT* Benchmark firm *INCENT*, where *INCENT* = the log of [(share price × the number of shares held) + (share price × option delta × the number of options held)] number of shares held = shares owned by the CEO and unvested restricted stock,
D_ CASH_PCT Test firm *CASH_PCT* — Benchmark firm *CASH_PCT*, where *CASH_PCT* = current year cash compensation, divided by current year total compensation,
D_CHAIR Test firm *CHAIR* — Benchmark firm *CHAIR*, where *CHAIR* = 1 if CEO serves as Chairman of the Board of Directors; 0 otherwise,
TENURE the length of time, in years, in the CEO position,
PAYSLICE the ratio of CEO compensation compared to the mean total compensation for the four highest paid non-CEO executives in the CEOs firm,
CEO_PWR *CHAIR* + *Hi_Tenure* + *Hi_Payslice* where *Hi_Tenure* = 1 if *TENURE* is above the contemporaneous median for all CEOs in the same industry and 0 otherwise, and *Hi_Payslice* = 1 if *PAYSLICE* is above the contemporaneous median for all CEOs in the same industry and 0 otherwise,
CEO_PWR1 1 if *CEO_PWR* = 1; 0 otherwise,
CEO_PWR2 1 if *CEO_PWR* = 2; 0 otherwise, and
CEO_PWR3 1 if *CEO_PWR* = 3; 0 otherwise.

** Two-tailed p-value < 0.01.
* Two-tailed p-value < 0.05.

Table 6
Residual based measure of abnormal compensation.

Panel A: Compensation regression ($COMP_t$)

Variable	Predicted sign	Mean coefficient (*t*-statistic)
INTERCEPT	?	−0.65** (−6.32)
RET_L1	+	0.08 (1.58)
RET	+	0.18** (2.97)
RET_P1	+	−0.05 (−0.91)
ROA_L1	+	−1.00 (−1.24)
ROA	+	1.25* (1.17)
ROA_P1	+	1.27 (1.65)
MKTVAL	+	0.32** (25.09)
MB	+	−0.03* (−3.30)
SDROA	+	6.10** (4.04)
SDRTN	+	−0.00 (−0.00)
INCENT	+	0.02 (1.23)
CASH_PCT	−/+	−2.30** (−33.15)
CHAIR	+	0.11** (3.98)
Observations		6627
Average R^2		0.854

**two-tailed p-value < 0.01; *two-tailed p-value < 0.05

Panel B: CEO power partition

	Pred sign	(A) *CEO_Pwr* = 0	(B) *CEO_Pwr* = 1	(C) *CEO_Pwr* = 2	(D) *CEO_Pwr* = 3
CEO firm-year observations		821	2340	3091	1343
Mean RESIDUAL from Panel A (*t*-statistic)	?	−0.052 (−3.22) **	−0.040 (−3.75) **	−0.003 (−0.38)	0.110 (7.25) **
Column (D) less Column (A), (B) or (C) (*t*-statistic)	+	0.162 (6.99) **	0.150 (8.22) **	0.113 (6.77) **	N/A

**two-tailed p-value < 0.01; *two-tailed p-value < 0.05.
Separate regressions were estimated for each industry and year. Coefficient estimates equal the mean of the 186 regression coefficients. *t*-Statistics were calculated by dividing the parameter estimate by its temporal standard error consistent with Fama and MacBeth (1973).
Variable definitions

COMP	the log of the sum of salary, bonus, other annual compensation, total value of restricted stock granted, total value of stock options granted (using Black-Scholes), long-term incentive payouts and all other compensation for year *t*,
RET_L1	the annual return to shareholders for the firm for year $t-1$,
RET	the annual return to shareholders for the firm for year *t*,
RET_P1	the annual return to shareholders for the firm for year $t+1$,
ROA_L1	the return on assets for year $t-1$ calculated as income before extraordinary items divided by total average assets,
ROA	the return on assets for year *t*,
ROA_P1	the return on assets for year $t+1$,
MKTVAL	the log of total market value of equity plus book value of debt, averaged for beginning and end of year *t*,
MB	the ratio of market value of equity to book value of equity averaged over the five years ending year $t-1$,
SDROA	the standard deviation of the annual percentage corporate return on assets for the five years ending year $t-1$,
SDRTN	the standard deviation of the annual percentage stock return for the five years ending year $t-1$,
INCENT	the log of [(share price × the number of shares held) + (share price × option delta × the number of options held)] number of shares held = shares owned by the CEO and unvested restricted stock,
CASH_PCT	current year cash compensation, divided by current year total compensation,
CHAIR	1 if CEO serves as Chairman of the Board of Directors; 0 otherwise,
TENURE	the length of time, in years, in the CEO position,
PAYSLICE	the ratio of CEO compensation compared to the mean total compensation for the four highest paid non-CEO executives in the CEOs firm,
CEO_PWR	*CHAIR* + *Hi_Tenure* + *Hi_Payslice* where *Hi_Tenure* = 1 if *TENURE* is above the contemporaneous median for all CEOs in the same industry and 0 otherwise, and *Hi_Payslice* = 1 if *PAYSLICE* is above the contemporaneous median for all CEOs in the same industry and 0 otherwise,
CEO_PWR1	1 if *CEO_PWR* = 1; 0 otherwise,
CEO_PWR2	1 if *CEO_PWR* = 2; 0 otherwise, and
CEO_PWR3	1 if *CEO_PWR* = 3; 0 otherwise.

(E) in Table 5. H2 predicts that excessive compensation will be positive for CEOs in the higher CEO power partitions.

Again, the control variables are generally consistent with the results presented in Table 3. In both methodologies, we find no evidence of excess compensation in the first three CEO power portfolios, and consistent with H2, we find evidence of excess compensation (two-tailed p-value < 0.01) for firms in the highest CEO power portfolio. We also consider how our empirical tests are influenced by the form of compensation. In untabulated results we estimate the Table 5 regressions separately for cash compensation and all other compensation. Consistent with the results presented in Table 5, we only find evidence of excessive compensation for the most powerful CEOs (*CEO_Pwr* = 3). Furthermore, we find this excess compensation for both cash compensation and all other compensation.

As explained above, our measure of CEO power is based on a combination of three factors: *Chairman*, *Hi_Tenure* and *Hi_Payslice*. It is possible, however, that individual power measures or other combinations of power measures will be related to excess compensation. In untabulated results we explore individual power measures and other combinations of power measures and only find evidence of excess compensation when the CEO has high payslice and high tenure (*Hi_Payslice* = 1 and *Hi_Tenure* = 1). In other words we find that the Chairman variable is not as influential as the other power variables in identifying excess compensation for powerful CEOs. This is likely due to the fact that we include a variable for Chairman of the Board in our model as part of justified pay under the premise that, all else being equal, a CEO holding a dual role should be paid more than a CEO only serving as CEO.

Overall our results suggest that the compensation premium received by powerful CEOs relative to the compensation paid to a reasonable replacement CEO is larger than would be expected given factors related to ability, effort incentive risk premiums, and labor market premiums.

Given that benchmark CEO compensation potentially includes excess compensation, the test is biased against finding excess compensation, suggesting that the magnitude of unexplained compensation may be even larger than that suggested in the results.

6. Sensitivity analysis

We interpret a positive and significant intercept to be evidence of excessive CEO compensation. This assumes that the intercept in our model represents compensation that is not explained by ability, effort, incentive risk premium, and the labor market premium. An alternative explanation is that the model is mis-specified. In this section we perform sensitivity tests to address this concern.

6.1. Additional control variables

We omit control variables that could be perceived as a form of excess compensation. For example, adding a control variable for corporate governance implicitly assumes that compensation explained by poor governance is not excess compensation. Also, it could be argued that compensation related to gender or tenure rather than performance or firm characteristics could be perceived by shareholders as excessive. To determine if our results are sensitive to the inclusion of alternative control variables, we add additional control variables to the models and re-estimate the models presented in Tables 4 and 5.

Prior research suggests a link between corporate governance and CEO compensation (e.g., Gabaix & Landier, 2008), and has even defined compensation that is attributable to weak corporate governance as excessive (Core et al., 1999). To determine if our results are influenced by corporate governance, we add a widely used control for corporate governance to our models. Specifically, we use the Gompers, Ishii and Metrick (2003) G-score (governance score), which we obtained from Risk Metrics. With a reduced sample, due to data availability of the G-score, we re-estimate the models presented in Tables 4 and 5 (i.e., firm-size and CEO power partitions) after including G-score (untabulated). If differences in corporate governance fully explain the excessive compensation between peer CEOs identified in Tables 4 and 5, then the addition of this governance variable should result in an insignificant or negative intercept. Our results, untabulated, are inconsistent with that conclusion. In particular, we find the intercepts for the most powerful CEOs remain positive and significant (two-tailed p-value < 0.01).[13]

CEO compensation has been shown to be increasing in the tenure of the executive (Himmelberg & Hubbard, 2000). In addition, other variables, such as age and gender, are possibly related to CEO compensation. The inclusion of age, gender and tenure as control variables involves a reduction in sample size due to the availability of this data, however the results (un-tabulated) with the inclusion of these variables are quantitatively and qualitatively similar to our tabulated results.

6.2. Residual based abnormal compensation

In our primary analyses we find evidence of excess compensation when the CEO is powerful. This conclusion assumes that the intercept in our model represents compensation that is not explained by ability, effort, incentive risk premium, or the labor market premium. An alternative explanation is that we have poorly identified a firm-specific benchmark for each CEO. We therefore examine the robustness of our cross sectional results by using an alternative measure of excessive compensation. Prior research uses the residual from a compensation model as a measure of abnormal compensation (e.g., Core et al., 2008). By definition, the OLS residual has an expected value of zero, resulting in an arbitrary level of "normal" compensation. While we cannot use the residual to test for the presence of excess compensation in the full sample, we expect that the residual approach to measuring excess compensation will produce a pattern of excess compensation in the four CEO power portfolios that is similar to that reported in Table 5.

To perform the residual based test, we revise Eq. (5). Instead of differencing the test firm and the benchmark firm we simply use levels for each test firm. Consistent with Core et al. (2008) we measure excess compensation as the residual from the following model:

$$Comp_{it} = \beta_0 + \sum \alpha \text{ABILITY} + \sum \delta \text{EFFORT} + \sum \lambda \text{RISK\_}PREMIUM + \varepsilon \quad (6)$$

where *Comp* is calculated as the log of compensation and the *ABILITY*, *EFFORT* and *RISK_PREMIUM* variables are measured as the test firm value.

We estimate separate regressions for each industry and year. In Table 6, Panel A, we present mean coefficients of the cross-sectional regressions. CEO compensation is positively related to current year ROA, firm size, the deviation in ROA and the CEO holding the chairman position, and negatively related to market to book and the ratio of cash compensation to total compensation. In Panel B, the mean values of excess compensation (i.e., residual from the compensation regression) are reported for the four CEO power portfolios. The residual is negative and significant in the first and second CEO power portfolios, insignificant in the third portfolio, and positive and significant in the fourth CEO power portfolio. Consistent with the primary results, when using the residual approach to estimating abnormal compensation, we only find evidence of excess compensation for the most powerful CEOs.

7. Summary and concluding remarks

While there are persistent claims in the business media and academic literature that CEO compensation is excessive, prior research has grappled with the difficulty of developing a method for measuring excessive CEO compensation. Conyon et al. (2011) assume that UK CEOs are not paid excess compensation, and therefore provide a good benchmark for measuring excess US CEO compensation. Their approach has the advantage of using a set of control firms that do not have inflated compensation, but is subject to inter-economy effects. They find that, US CEOs are paid substantially more than UK CEOs, but after adjusting for equity-related risk premiums, they conclude that the larger US CEO compensation is not excessive. We extend Conyon et al. (2011) by developing a domestic benchmark for US firms. Specifically, we compare CEOs to potential replacement CEOs, and determine if the differences in compensation can be explained by CEO ability, CEO effort or equity risk premiums. Compensation not related to CEO ability, CEO effort or equity risk premiums is considered excessive (i.e., not economically justified). Additionally, we separately examine contexts related to firm size and CEO power in which CEO compensation may be more likely to be excessive.

Using a model that is biased towards not finding excess compensation, we find evidence that the most powerful CEOs receive compensation that is not economically justified. Our results are consistent with the managerial power theory, and suggest that the awarding of excess CEO compensation is a function of CEO power. We do not find evidence that firm size is related to excess compensation. This paper identifies a context in which large CEO compensation should be viewed with skepticism.

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[13] Bebchuk et al. (2009) find that the entrenchment index, an index based on six components of the G-score, is the most influential subset of the G-score in explaining firm valuation. In untabulated results we use the entrenchment index as a control variable for corporate governance instead of the G-score. The results are quantitatively and qualitatively similar.

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