

**THE TWO SIDES OF CEO PAY INJUSTICE:
A POWER LAW CONCEPTUALIZATION OF CEO OVER AND UNDERPAYMENT**

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In Press

*Management Research,
The Journal of the Iberoamerican
Academy of Management*

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Abstract

Purpose - The goal of our study was to examine the extent to which CEOs deserve the pay they receive both in terms of over as well as underpayment.

Design/methodology/approach – Rather than using the traditional normal distribution view in which CEO performance clusters around the mean with relatively little variance, we adopt a novel power law approach. We studied 22 industries and N = 4,158 CEO-firm combinations for analyses based on Tobin's Q and N = 5,091 for analyses based on return on assets. Regarding compensation, we measured the CEO distribution based on total compensation and three components of CEO total pay: salary, bonus, and value of options exercised.

Findings - 86% of CEO performance and 91% of CEO pay distributions fit a power law better than a normal distribution, indicating that a minority of CEOs are producing top value for their firms (i.e., CEO performance) and a minority of CEOs are appropriating top value for themselves (i.e., CEO pay). But, we also found little overlap between CEOs who are the top performers and CEOs who are the top earners.

Implications - Our findings shed new light on CEO pay deservingness by using a novel conceptual and methodological lens that highlights systematic over and underpayment. Results suggest a violation of distributive justice and offer little support for agency theory's efficient contracting hypothesis, which have important implications for agency theory, equity theory, justice theory, and agent risk sharing and agent risk bearing theories.

Practical implications – Results highlight erroneous practices when trying to benchmark CEO pay based on average levels of performance in an industry because the typical approach to CEO compensation based on averages significantly underpays stars and overpays average performers.

Originality/value - Results offer new insights on the extent of over and underpayment. Our findings uncover an extremely large non-overlap between the top earning and top performing CEOs and to an extent far greater in magnitude than previously suggested.

Keywords chief executive officers (CEOs), executive compensation, firm performance, corporate governance, justice, power

Paper type Research paper

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The compensation received by chief executive officers (CEOs) is a hotly debated issue in scholarly research, political circles, and the media (e.g., Kaplan, 2008a, 2008b; Larraza-Kintana, Gomez-Mejia, & Wiseman, 2011; Murphy, 1986; Walsh, 2008). We suggest that one key impediment to theoretical advancement, as well as sound regulatory policy and practices about executive compensation, is the failure to comprehend the implications following from the power law versus normal shapes of CEO performance and CEO pay distributions. A better understanding of these distributions allows for novel insights regarding distributive justice: Whether CEOs receive outcomes (i.e., compensation) that are commensurate with their contributions (i.e., performance). In other words, our study aims at answering the following question: *Do CEOs receive the pay they deserve?*

We found that the CEO pay distribution (total compensation as well as salary, bonus, and value of options exercised) exhibits qualities of a power law as opposed to a normal distribution. To offer a visual depiction of differences between power law and normal distributions, Figure 1 includes a generic graph of their shapes (Aguinis & Bradley, 2015). As shown in Figure 1, in a normal distribution, scores cluster around the mean and then fan out into symmetrical tails. By contrast, power law distributions allow for a greater number of extreme values. For example, whereas a value exceeding three standard deviations from the mean is often thought to be an error in a normal distribution (Aguinis et al., 2013), these values are expected in a power law distribution (Vancouver, Li, Weinhardt, Purl, & Steel, 2016). Moreover, due to the presence of so many extreme scores, power law distributions are typified by unstable means and (quasi) infinite variance.

There seems to be recognition that pay distributions are non-normal because several past studies have used transformations such as the log and natural log aimed at normalizing scores (e.g., Fong, Misangyi, & Tosi, 2010; Seo, Gamache, Devers, & Carpenter, 2015). Moreover, a consequence of these data transformations is that they squeeze scores into a normal curve and artificially reduce the observed variance between scores (i.e., differences in observed pay among CEOs). In turn, making CEO compensation scores appear more homogeneous than they actually are may prevent us from gaining a deeper understanding about the deservingness of various levels of compensation. In other words, these transformations mask the true nature of the data and, in addition, relations between pay scores and other variables. By using a power law conceptualization of the CEO pay distribution, we are able to examine differences in pay across CEOs as they actually exist. Our results provide evidence that these differences are much larger than previously thought, thus offering novel insights about theories addressing the CEO pay deservingness question.

Insert Figure 1 about here

As a second way to gain a deeper understanding of the CEO pay deservingness issue, we analyzed the degree to which the CEO performance distribution also exhibits qualities of a power law. Similar to our conceptualization of the CEO pay distribution, this approach allowed us to understand differences in CEO performance as they actually exist and without applying data transformations that artificially reduce observed differences among CEOs.

Third, we examined the correspondence (i.e., overlap) between CEO pay and CEO performance distributions to understand the extent to which the top performers are also the top earners. Rather than relying on parametric methods based on the general linear model that makes

the untenable normality assumption, we used non-parametric procedures that are appropriate when assumptions of the general linear model (e.g., normality, linearity) are clearly violated.

Our results uncovered the conformance to a power law rather than a normal distribution for both CEO performance and CEO pay, as well as little overlap between top earners and top performers. The overlap was surprisingly weakest where one would expect it to be greatest: The overlap between the power law incentive and performance distributions. In short, our results indicate that (1) CEOs at the top of the performance distribution create vastly more value than those at succeeding lower levels of the performance distribution; (2) those CEOs at the top of the pay distribution are remunerated far more than those at succeeding lower levels of the pay distribution; and (3) there is minimal overlap between the CEO pay and CEO performance power law distributions, thereby suggesting significant scope for both over *and* underpayment. As we describe in more detail in the Discussion section, our results provide new insights relating to old questions concerning agency theory, equity theory, justice theory, agent risk sharing and agent risk bearing theories, and also executive compensation, governance, and human resource management practices.

THEORETICAL BACKGROUND

Executive Compensation, Executive Performance, and Pay Deservedness

Researchers have studied CEO compensation in many different fields (see reviews by Gomez-Mejia, 1994; Gomez-Mejia & Wiseman, 1997; Wowak, Gomez-Mejia & Steinbach, in press) by mostly relying on agency theory (e.g., Fulmer, 2009). Specifically, an “agency problem” occurs when the interests of a CEO do not align with those of the firm (Goergen & Renneboog, 2011). CEOs may opportunistically manipulate compensation contracts to appropriate as much value as possible for themselves without looking after the interests of their

firms (Bebchuk & Fried, 2009; Devers, Cannella, Reilly, & Yoder, 2007). On the other hand, the presence of CEO-shareholder interest alignment supports the efficient contracting hypothesis that views CEO compensation as a useful governance instrument to create a “common fate” between CEOs and shareholders (Abernethy et al., 2015). According to this view, “top executives are worth every nickel they get” (Murphy, 1986: 125). Highlighting the ongoing scholarly controversy regarding CEO compensation, this view has been challenged quite vigorously (e.g., Bogle, 2008; Gabaix et al., 2014; Walsh, 2008), and the debate continues unabated among scholars who espouse positions that are in stark contrast with each other (e.g., Nyberg et al., 2010 vs. Kolev, Wiseman & Gomez-Mejia, 2017).

Several studies have tested agency theory predictions about alignment, or lack thereof, and its consequences. Regarding the existence of alignment, Tosi et al. (2000) conducted a meta-analysis and concluded that alignment was weak because many CEOs are overpaid. However, Nyberg et al. (2010) noted that the Tosi et al. (2000) conclusion that CEOs are overpaid may be due to the small number of studies as well as the inclusion of samples collected in the 1940s; this is when measures of CEO pay included salary and bonus but excluded equity-based pay (i.e., stock options), which is the most typical way of creating alignment. Expanding upon but also challenging Tosi et al.’s (2000) conclusions, Nyberg et al. (2010) provided evidence suggesting that there is alignment between CEO return (i.e., change in total firm-specific CEO wealth during a given fiscal year) and shareholder return.

A second line of research examining CEO compensation originated in psychology and relies on equity theory (Adams, 1965). Equity theory posits that CEOs compare their pay to that of their peers, and the perception that they are under- or overpaid is likely to result in different behavioral responses with important implications for themselves and their firms. For example,

Seo et al. (2015) reported that CEOs who have a negative relative pay standing are more motivated to make acquisitions and use greater firm complexity as a rationalization to demand higher pay. The equity theory framework was also used by Fong et al. (2010), who argued that underpayment leads CEOs to increase firm size in order to legitimize higher pay.

Incentive Alignment: CEO Pay and Performance

To expand on our earlier discussion of research relying on agency theory, two competing perspectives have dominated the discourse regarding the effectiveness and efficiency of CEO compensation design in aligning CEOs' interests with those of a firm's shareholders. According to classical agency theory, firms design "self-monitoring" contracts that motivate CEOs to act on behalf of principals, thereby addressing the problem of moral hazard in agency relationships (i.e., the absence of incentives to protect shareholders from the negative consequences of managerial agents' behaviors) (Fama, 1980; Fama & Jensen, 1983; Holmstrom, 1979; Jensen & Meckling, 1976). This theoretical perspective is often referred to as the efficient contracting hypothesis, and its proponents endorse the use of equity-based pay (e.g., stock options) as a useful instrument to create a "common fate" between CEOs and shareholders. The argument is that shareholders should be less worried about the magnitude of CEO pay and more concerned with the adoption of equity-based incentives that are conducive to a win-win situation for the principal and agent (Gabaix et al., 2014; Nyberg et al., 2010). Interestingly, the academic endorsement of equity-based pay (e.g., Jensen & Murphy, 1990) seems to have been a key contributor to tax breaks that resulted in significant increases in the use of this form of compensation since the beginning of the 1990s. In addition, a large literature has emerged from financial economics examining the characteristics of a purportedly ideal agent-principal contract by using an optimal mix of cash, stock, and options (e.g., Core & Guay, 1999; Core, Guay, & Larcker, 2003; Gao, 2010).

In contrast to the efficient contracting hypothesis, CEO compensation practices have been criticized as leading to excessive payment to CEOs and also lacking alignment with shareholder and societal outcomes. Bebchuk and Fried (2009) challenged the assumption that the agent-principal contract is devised at arms-length between CEOs and boards. Rather, they suggested that CEOs leverage significant power in their negotiations. This leads to perverse incentives, lack of transparency regarding pay-performance alignment, CEO opportunism, lack of board accountability, and ever increasing CEO pay. Similarly, Dey-Tortella, Gomez-Mejia, De Castro, and Wiseman (2005) listed a set of maneuvers, such as the timing of news announcements and the manipulation of company reports, which CEOs may use to increase their equity-based pay in a way that may lead to excessive rent extraction from shareholders. Others have criticized the use of stock options because CEOs share disproportionately in the upside of successful risk taking, while shareholders bear the brunt of failed risk. This asymmetry encourages incentives for careless risk taking by CEOs (Hall & Murphy, 2003; Jensen, 2004; Martin, Gomez-Mejia, & Wiseman, 2013; Martin, Washburn, Makri, & Gomez-Mejia, 2015b; Sanders & Hambrick, 2007). Note that this research stream has addressed CEO overpayment, but it is mostly silent about the possible presence of CEO underpayment—the other side of the CEO pay deservingness question.

Next, we offer predictions regarding the shapes of CEO performance and pay distributions. Assessing these predictions allows us to advance our theory-based understanding of CEO pay deservingness and the CEO compensation story—regarding both over and underpayment.

Normal Distribution, Normality Assumption, and Data Transformations

As is the case for management research in general (e.g., Aguinis & O'Boyle, 2014;

Delbridge & Fiss, 2013), past empirical work on the relation between CEO performance and CEO pay has relied on the assumption that performance is normally distributed or can be readily transformed to normality with little to no loss of data integrity. Although this assumption is sometimes made explicit (e.g., “In any sample of firms, it can reasonably be assumed that performance will vary normally around a mean,” Wiklund & Shepherd, 2011: 927), in most cases the assumption is implicit. For example, studies examining the effectiveness of incentive alignment and monitoring usually rely on statistical techniques that assume normality such as ordinary least squares (OLS) regression. Moreover, the implicit normality assumption becomes evident when researchers discover non-normal data and, subsequently, “fix” distributions through a variety of data manipulation techniques such as the log and other types of data transformations (e.g., Winsorization to decrease the influence of “unexpected” extreme scores or the deletion of extreme scores considered to be undesirable outliers; Aguinis, Gottfredson, & Joo, 2013). In other words, observed non-normal data are often “squeezed” into a normal curve.

Power Law Distribution

Power laws are known to underlie empirical results in many contexts and research domains, such as the finding that about 80 percent of a brand’s volume is purchased by about 20 percent of its buyers (Anschuetz, 1997) and that about 80 percent of land is owned by about 20 percent of the population (Pareto, 1897). The shape of the distribution is not just a methodological curiosity. Rather, it has profound implications for theory because it changes how we conceptualize the nature of constructs such as CEO performance and CEO pay. For example, we expect a much larger degree of variability in a power law distribution because a small minority of CEOs would be responsible for producing a disproportionately large amount of value for their firms. Consequently, they could also be awarded a justifiably high amount of pay based

on distributive justice rules. Clearly, these implications are consequential for the ongoing scholarly debate on CEO pay deservingness, the CEO compensation story, and practical decisions involved in the design of executive compensation and corporate governance programs.

CEO Performance Distribution

Aguinis, O'Boyle, Gonzalez-Mulé, and Joo (2016) argued that autonomy and complexity are job-related factors that lead to the presence of power law distributions. In other words, they are “conductors” (i.e., enhancers) of power law distributions—and these are two prominent characteristics of the job of a CEO. First, job autonomy allows CEOs discretion in how they accomplish the tasks, duties, and responsibilities of the job. Job autonomy is likely to lead to power law distributions of performance because it gives individuals flexibility and control over processes that may lead to stratification of CEOs' performance levels (Kohn & Schooler, 1983).

Regarding job complexity, jobs that are more complex are more mentally demanding, difficult to perform, and require higher levels of information processing (Humphrey, Nahrgang, & Morgeson, 2007). Because the CEO's role is complex, there will be more variance in worker performance (Hunter, Schmidt, & Judiesch, 1990), similar to the effects of autonomy. For this reason, as noted by Aguinis et al. (2016), complex jobs (such as those held by academic researchers and software engineers) have long been known to demonstrate a non-normal performance distribution, but this is not the case for less complex jobs often found in the manufacturing sector where there is little variance in outputs. Accordingly, we expect a large degree of CEO performance variability and also expect that a small minority of CEOs will be responsible for producing a disproportionately large amount of value for their firms. In short,

Hypothesis 1. The distribution of CEO performance will fit a power law distribution better than a normal distribution.

CEO Pay Distribution

Boards of public corporations are charged with monitoring CEO performance and pay relative to peers in their industry (Murphy, 1999). In fact, in a study involving 100 firms, Bizjak, Lemmon, and Naveen (2008) found that 96 firms used benchmarking in the compensation contracting process. If the efficient contracting hypothesis holds (Abernethy et al., 2015), CEO pay levels should exhibit a distribution similar to that of CEO performance which, as predicted in Hypothesis 1, should follow a power law. Likewise, under the rules of distributive justice (Kolev et al., 2017), if CEO performance follows a power distribution, CEO pay levels should exhibit an analogous pattern. Finally, the common practice of data transformations to normalize skewed pay scores, as described earlier, provides additional evidence regarding the presence of power law distributions since transformations are used to normalize non-normal distributions. In short,

Hypothesis 2. The distribution of CEO pay will fit a power law distribution better than a normal distribution.

Overlap of CEO Performance and Pay Distributions

Similarity in the shapes of the CEO performance and CEO pay distributions is a necessary condition to establish evidence regarding CEO pay deservingness from a distributive justice perspective. However, similarity in the shapes of the distributions alone is not a sufficient condition because the CEOs at the top of the (power law) performance distribution may not be the same CEOs at the top of the (power law) pay distribution. The overlap is unlikely to be complete because boards may consider mitigating factors in making compensation decisions such as bad luck, unexpected environmental changes, systematic market risks, and poor choices made by prior CEOs (Gomez-Mejia, Berrone, & Franco-Santos, 2010). Yet, as predicted by the efficient contracting hypothesis, economic rationality, and distributive justice, we expect that if

CEO contracting (i.e., the agent-principal contract) practices are fair and efficient, the top performing CEOs should in general also be the top paid CEOs. Thus,

Hypothesis 3. There will be substantial overlap between CEOs positioned at the top of the (power law) performance distribution and CEOs positioned at the top of the (power law) pay distribution.

Compensation Structure

The objective of awarding equity to CEOs is to ensure that they share in both the upside and downside of the value they produce, as usually manifested in share price (Jensen & Murphy, 1990). Stock options and bonus payments create strong incentives for the CEO to pursue risk taking opportunities that have the potential to increase the firm's share price (Hall & Murphy, 2003; Jensen, 2004).

In contrast to stock options and bonus payments, which purportedly capture the incentive components of a CEO's pay, the salary distribution is less likely to follow a power law distribution. The reason is that salary is viewed as costing more and provides less upside compared to incentive-based pay (Bebchuk & Fried, 2009, 2010; Jensen, 2004). In fact, salary is generally referred to as "fixed pay" because it is not expected to show much variation over time or exhibit much sensitivity to performance gyrations (Gomez-Mejia et al., 2010). Furthermore, salary differentials among CEOs of firms of similar size in the same industry tend to be much smaller than pay differentials in the form of equity or bonuses (Bebchuk & Fried, 2009; Gabaix et al., 2014). Thus, in terms of understanding the sources of the power law distribution for CEO total compensation, we hypothesize that the distribution of CEO pay in terms of value of options exercised and bonus is more prone than salary to exhibit a power law. In addition, applying the same logic leading to Hypothesis 3, we expect greater overlap between top CEO performers and

top CEO earners for value of options exercised and bonus compared to salary. In short,

Hypothesis 4. The power law will fit the value of options exercised and bonus distributions better compared to the power law fit of the salary distribution.

Hypothesis 5. There will be greater overlap between CEOs positioned at the top of the (power law) performance distribution and CEOs positioned at the top of the (power law) pay distribution when pay is assessed based on value of options exercised and bonus compared to salary.

METHOD

Measures and Data-Analytic Approach

CEO performance. The first step involved obtaining firm performance data from the Compustat database, and CEO pay data from the Execucomp database, for the period spanning 1992 to 2012. Our dataset consists of $N = 4,158$ CEO-firm combinations for analyses based on Tobin's Q and $N = 5,091$ for analyses based on return on assets (ROA) (this difference in N was due to differential availability of information in the databases). We examined firm performance and CEO pay during the tenure of each separate CEO and excluded the first year of each CEO's tenure. Our variables are taken as an average of the period during which CEOs held their post. Our analysis included all CEOs that populated both the performance and CEO pay variables, respectively, in Compustat and Execucomp across all industry groups. We excluded CEOs whose performance and compensation information were not available in the databases.

Our initial database reflected a firm-level, market-based, and risk-adjusted performance measure: Tobin's Q (Byrd & Hickman, 1992; Carpenter & Sanders, 2002; Coles, Daniel, & Naveen, 2006; Palia, 2000). Also, we used a firm-level and accounting-based performance measure: ROA. Using both market and accounting measures of performance allows us to

minimize the impact that manipulation of earnings can have on the integrity of purely accounting-based performance measures (cf. Healy & Wahlen, 1999). Tobin's Q is calculated as: $(\text{Market Valuation} + \text{Book Value of Total Debt}) / \text{Total Assets}$. ROA is calculated as: $\text{Net income} / \text{Total Assets}$.

As a second step in our data collection effort, recognizing the potentially psychometrically contaminated nature of firm performance as a direct proxy for CEO contributions (Mackey, 2008; Sánchez Marín & Aragón Sánchez, 2003), we implemented procedures in an attempt to control for factors other than the CEO that may affect firm performance. We did so by capturing the residual after controlling for several variables that are known to relate to firm performance directly or indirectly. That is, based on best-practice recommendations regarding the use of control variables (Bernerth & Aguinis, 2016) and as done in previous work differentiating CEO from firm performance (Hambrick & Quigley, 2014; Sanders & Hambrick, 2007), we used the residual scores from these regressions as our measure of CEO performance. Henceforth, we refer to these residual scores as "CEO performance." Control variables included measures of risk (i.e., capital expenditure and R&D), firm size (i.e., total assets), and organizational slack (i.e., cash and short-term investments) (e.g., Bromiley, 1991; He & Huang, 2011; Martin, Gözübüyük, & Becerra, 2015a). We also included CEO tenure as an additional control variable given that the longer the time a CEO has been at the helm of the firm, the greater is the opportunity to take initiatives that affect organizational performance. Following this same rationale, and as mentioned earlier, we excluded CEOs with tenure of less than one year given their limited time to influence firm outcomes (Hambrick & Quigley, 2014). The calculation of residual scores did not consider the impact of time (i.e., including past performance as a predictor in the model) because the goal of our study was to understand

between-CEO and not within-CEO effects (i.e., we used a between-subjects and not a within-subjects design).

CEO pay. For total CEO compensation, we used Execucomp's measure of total compensation, which includes salary, cash bonus, other annual payouts, total value of restricted stocks granted, long-term incentive pay payouts, net value of stock options exercised, and all other annual compensation. Total compensation does not include current year stock option grants and the value of options exercised because this would involve double counting. Instead, Execucomp provides two measures of total compensation: the value of stock option grants (based on the Black-Scholes pricing model) and the value of options exercised (based on the market value of exchange traded options). We used the latter because the value of stock option grants (i.e., their value in the year they are granted) is likely to change significantly if and when the options are vested. In addition to total compensation, we conducted analyses using three components of CEO total pay: salary, bonus, and value of options exercised. Greater firm size may be used to justify higher CEO pay (because of higher human capital requirements, operational complexity, and higher asset responsibility; Conyon et al., 2009; Gomez-Mejia et al., 2010). Indeed, firm size is the single most important predictor of CEO pay, accounting for approximately half of its variance (Tosi et al., 2000). Thus, following best-practice recommendations in the use of control variables (Bernerth & Aguinis, 2016), we calculated residual scores by regressing total pay and the pay components on firm size (i.e., total assets). Henceforth, when we refer to total pay, as well as bonus, salary, and the value of options exercised, we are referring to CEO residual pay. Consistent with our approach to measuring CEO performance, we used the average annual value received by CEOs during their tenure.

Data-analytic approach. A distribution could range from exactly normal to extremely

non-normal (i.e., very heavy-tailed or skewed). Accordingly, similar to Aguinis et al. (2016), we conceptualized the shape of the distribution as a continuous variable.

A value x follows a power law if drawn from the following probability density function (Clauset, Shalizi, & Newman, 2009): $p(x) \propto x^{-\alpha}$, where α is the scaling exponent (i.e., scaling parameter), which is a constant (Maillard & Sornette, 2010). The scaling exponent is calculated using maximum likelihood estimation (MLE) and based on running a semi-parametric Monte Carlo bootstrap calculation 1,000 times; specifically, the Hill estimator (Hill, 1975). Heavy-tailed distributions are characterized by a slow hyperbolic decay in their tails, and the scaling exponent quantifies the rate of decay. Note that a difference between the aforementioned power law function and the more familiar exponential function is that, in exponential functions, the exponent is the variable and x is constant. The power laws we examine involve the relation between two quantities: (a) number of CEOs (Y axis) and CEO performance (X axis), and (b) number of CEOs (Y axis) and CEO pay (X axis). Because α is expressed as an exponent, as α decreases to unity, the tail of the distribution is heavier. Thus, α values closer to unity signal the presence of a greater proportion of extreme CEO performers and extreme CEO earners. For example, a distribution with $\alpha = 1.5$ has a heavier tail compared to a distribution with $\alpha = 2.5$ or $\alpha = 3.5$, as illustrated in Figure 2.

Insert Figure 2 about here

In addition to the size of the scaling exponent, we assessed the extent to which each distribution is likely to conform to a power law with the Kolmogorov-Smirnov (K-S) goodness of fit statistic and its associated p -value (Massey, 1951). The K-S statistic is a non-parametric goodness of fit index similar to chi-square. Like the chi-square statistic, smaller K-S values and

higher p -values indicate better conformity to a power law because the null hypothesis is no absolute deviation between the empirically observed distribution and a theoretical power law distribution (Aguinis & Harden, 2009; Clauset et al., 2009). Thus, the K-S statistic can be used to assess the probability that there is a power law underlying each empirically obtained distribution. Note that researchers have loosened the definition of “normally distributed” from a statistical exactitude of zero skew and equal values for the mean, median, and mode to a more general approximation. We take the same strategy in how we refer to a “power law” distribution. Specifically, we use the term “power law” to refer to those heavy-tailed distributions where high performance or high pay is clearly dominated by a small group of CEOs, as shown in Figure 1, where most observations are below (i.e., to the left of) the mean. We used the PLFIT and PLPVA packages in MATLAB 7.10 to calculate the scaling exponent α , as well as K-S statistic and its associated p -value, for all CEO performance and pay distributions. Code to conduct these analyses is available at <http://tuvalu.santafe.edu/~aaronc/powerlaws/plfit.m> and <http://tuvalu.santafe.edu/~aaronc/powerlaws/plpva.m>.

Finally, we also conducted analyses based on the number and percentage of CEOs who were in the top performing and top earning brackets (i.e., the top 1%, 5%, 10%, and 20% CEOs in each distribution). This analysis allowed us to understand the relative overlap between CEOs who are producing top value for their firms (i.e., CEO performance) and those who are appropriating top value for themselves (i.e., CEO pay). In addition, as a more formal examination of the overlap between the two distributions, we calculated Kendall’s rank correlation coefficient τ to assess the degree of association between CEO performance and CEO pay rankings. Kendall’s τ is conceptually identical to a Pearson’s r correlation coefficient and its squared value is similarly interpreted as proportion of variance explained, but Kendall’s τ is

more appropriate for situations involving ordinal variables with score that are not necessarily normally distributed.

RESULTS

Table 1 includes descriptors for distributions of CEO performance based on Tobin's Q and also CEO pay. Table 2 includes descriptors for distributions of CEO performance based on ROA and also CEO pay. Results are at the industry level of analysis, except the first rows in each of the two tables which show averages across the 22 industry groups. Note that differences in pay-related results between the tables are due to their different sample sizes noted earlier.

Insert Tables 1 and 2 about here

Hypothesis 1 predicted that CEO performance would conform to a power law distribution better than to a normal curve. Results in Tables 1 and 2 indicate that the mean value for the majority of distributions is higher than the median value. This offers initial evidence that, indeed, the distributions are not normal because extreme scores to the right of the distribution pull the mean in that direction. Moreover, values for skew and kurtosis deviate from zero and 3, respectively, indicating deviations from normality.

In addition to descriptive statistics, Tables 1 and 2 include K-S values, which allow for a more precise and formal statistical test of Hypothesis 1. Recall that small K-S values (and p values larger than .05) provide evidence in favor of a power law distribution. Table 1 shows that, for CEO performance across all industries combined, the K-S value based on Tobin's Q is .13 ($p = .50$). Table 2 shows that, also for CEO performance across all industries, the K-S value based on ROA is .39 ($p = .47$). Thus, results in both tables indicate a better fit of the data with an underlying power law rather than a normal curve. At the industry level of analysis, results in

Tables 1 and 2 show that 38 of the 44 CEO performance distributions (i.e., 86%) provide a better fit with a power law compared to a normal distribution, with p values greater than .05. In short, we found support for Hypothesis 1, given that the CEO performance distribution conforms more closely to a power law than normality for the entire population of CEOs and also for most industries.

Although the majority of distributions (38 of the 44 CEO performance distributions) have a better fit with a power law, there are a few industries that did not conform to the power law (i.e., $p < .05$ in the far right column in Tables 1 and 2). These are agriculture, forestry, and mining (ROA); resources and building equipment (Tobin's Q and ROA); financial non-bank (ROA); media (ROA); and other (Tobin's Q). We discuss these findings later.

Hypothesis 2 predicted that CEO pay would conform to a power law curve. The top rows of Tables 1 and 2 show that, across all industries, K-S values for total pay, as well as the three pay components (i.e., value of options exercised, salary, and bonus), are small and not statistically significant (with p values greater than .05), suggesting a superior fit of a power law compared to a normal distribution. Tables 1 and 2 also show results for total CEO pay within industry categories. At the industry-level of analysis, results for value of options exercised, salary, and bonus were very similar to total pay and, therefore, are not reported in Tables 1 and 2 but are available upon request. Overall, results suggest the superior fit of a power law for 40 of the 44 industry-based total pay distributions, or 19 of the 22 industries (p values $> .05$). Thus, 91% of the distributions, or 86% of the industries, included in our study exhibited a power law distribution for CEO pay. This means that pay differentials among CEOs rise at a rapidly increasing rate at the top of the distribution, and top earners capture a disproportionate amount of total pay across all CEOs. Results using total compensation, as well as the three pay components

(i.e., value of options exercised, salary, and bonus) led to the same conclusion regarding the superior fit of the power law distribution. This finding provides evidence regarding the robustness of the results because, if the total compensation measure were not reliable, it would be mathematically impossible to obtain this type of consistent and triangulated pattern in the results (Scandura & Williams, 2000). Related to this same issue, there is a possibility that there are differences between public filings and actual pay, but these differences are not so large as to include random error (i.e., noise) in our data. Otherwise, we would not have been able to obtain the convergent and consistent results we found across various types of pay measures. In short, given the overall power law nature of the distributions, a minority of CEOs usually appropriate a disproportionate amount of the total value. Thus, results offer support for Hypothesis 2.

Hypothesis 3 predicted substantial overlap of the top CEO performance and pay distributions based on the efficient contracting hypothesis. The shapes of the CEO performance and CEO pay distributions are similar, but this result does not convey how much the two distributions overlap. In other words, although their shapes are similar, the tails of the distributions may be populated by different subsets of CEOs. Table 3 (for Tobin's Q) and Table 4 (for ROA) show results pertaining to the degree of overlap for the top 1%, 5%, 10%, and 20% of CEOs. Specifically, overlap-related results in these tables are based on ranking CEOs across industries by performance and also by pay. The higher the percent in each cell of Tables 3 and 4, the stronger the evidence that the highest performers are also the highest paid. If CEO pay were truly based on their performance, the values in the cells would be close to 100% or at least more than 50% such that the top 1%, 5%, 10%, and 20% of the most highly performing CEO will mostly be the same individuals as the top 1%, 5%, 10%, and 20% of the most highly paid CEOs.

Insert Tables 3 and 4 about here

Regarding total pay, results in Table 3 indicate that only 5% of CEOs in the top 1% in terms of CEO performance (based on Tobin's Q) are also in the top 1% highest paid. This result is 14%, 20% and 29% for the top 5%, 10%, and 20% CEO performance, respectively. Table 4, based on ROA, shows even less overlap. Specifically, the top 1%, 5%, 10%, and 20% in terms of CEO performance overlap only at 4%, 11%, 17%, and 27% with the top 1%, 5%, 10%, and 20% of earners. That is, CEOs who increasingly enjoy greater pay advantages relative to their peers as we move towards the top of the pay distribution are generally not the same CEOs as those who deliver the greatest value for their firms. In fact, the degree of mismatch increases as we move toward the tail of the distribution. For instance, by deducting the top row of Table 4 from 100%, we show that 96%, 89%, 83%, and 73% of those individuals at the top 1%, 5%, 10% and 20% of CEO earners do not fall in the top 1%, 5%, 10%, and 20% of the CEO performance distribution.

Analyses at the industry level using Tobin's Q—beyond those shown in Table 3—provide additional evidence regarding the large degree of mismatch between CEO performance and pay. For example, in terms of overpayment (i.e., CEOs who are among the top earners but not among the top performers), 25% of the CEOs who are in the top 10% bracket in terms of total compensation are in the *bottom* 10% bracket in terms of performance in the commercial/retail banking industry. This value was 50% in lumber and pulp and 13% in services (excluding computer, air, and bank). On the other side of the coin, there are many CEOs who are performing at a very high level and yet are not compensated accordingly. For instance, 15% of the top 10% of CEO performers were in the bottom 10% of CEOs by total compensation for chemical manufacturing, 20% for real estate, and 14% for consumer goods. In sum, the overlap between the distributions of CEO performance and CEO pay is shockingly low—particularly for

those CEOs who arguably matter the most: The very best performers and the highest paid. Thus, Hypothesis 3 is not supported.

Results based on the calculation of Kendall's τ coefficients provided additional empirical evidence regarding the lack of association between CEO performance and CEO pay. First, consider results regarding CEO pay and performance using Tobin's Q. τ^2 values between total pay and performance (indicating proportion of variance in pay explained by performance) were .008 for the top 1% of the distribution ($N = 42$), .003 for the top 5% of the distribution ($N = 208$), .001 for the top 10% of the distribution ($N = 416$), and also .001 for the top 20% of the distribution ($N = 832$). z values for all of these coefficients were not statistically significant ($p > .01$). Second, coefficients between CEO pay and performance using ROA as the measure of performance were also statistically non-significant (i.e., for all z values, $p > .01$). Specifically, τ^2 values between total pay and performance based on ROA (indicating proportion of variance in pay explained by performance) were .06 for the top 1% of the distribution ($N = 51$), .005 for the top 5% of the distribution ($N = 255$), .001 for the top 10% of the distribution ($N = 509$), and .000 for the top 20% of the distribution ($N = 1,018$). These results are particularly noteworthy given that many of the sample sizes used in the analyses are the several hundreds, therefore maximizing statistical power—the probability that an existing relation would be found.

Hypothesis 4 predicted that incentive forms of pay (i.e., value of options exercised and bonus) would follow a power law distribution to a greater extent compared to salary. Overall, and across industries, Table 1 shows that K-S for salary = .12 ($p = .45$), and Table 2 shows that K-S salary = .44 ($p = .51$). Tables 1 and 2 also show that these values are very similar to those for options and bonus and, consequently, Hypothesis 4 is not supported.

Finally, Hypothesis 5 predicted greater overlap between top CEO performance and pay

for value of options exercised and bonus compared to salary. When performance is assessed based on Tobin's Q, Table 3 shows that none of the top 1% performing CEOs are also among the top 1% paid CEOs regarding salary or bonus, whereas 10% of the top 1% performing CEOs are also among the top 1% paid CEOs in terms of value of options exercised. So, when comparing salary with value of options exercised (but not salary with bonus), there is a difference in performance-pay overlap regarding the top 1% of performers across types of pay, suggesting partial support for Hypothesis 5. Similarly, Table 3 shows that only 5% of the top 5% performing CEOs are also among the top 5% paid CEOs regarding salary or bonus, whereas 20% of the top 5% performing CEOs are also among the top 5% paid CEOs in terms of value of options exercised. Thus, when comparing salary with value of options exercised (but not salary with bonus), there is a difference in performance-pay overlap regarding the top 5% of performers across types of pay, once again providing partial support for Hypothesis 5. However, Table 3 shows that while only 7% of the top 10% of CEO performers are among the top 10% of CEOs in terms of salary, this overlap is 10% for bonus (1.43 times higher than 7%) and 27% for value of options exercised (3.86 times higher than 7%). Hypothesis 5 receives additional support when we consider the top 20% performing CEOs in Table 3. Among the top 20% performing CEOs, 14% are also among the top 20% paid based on salary, but 19% if we consider bonus (1.36 times higher than 14%), and an even higher 36% if we consider value of options exercised (2.57 times higher than 14%). As shown in Table 4, results regarding the percent of CEO performance-pay overlap are similar when we consider performance as measured by ROA rather than Tobin's Q.

More formal results based on Kendall's τ coefficients showed a similar pattern. First, consider results using Tobin's Q. Among the top 1% CEO performers, τ^2 was .032 for bonus, .005 for options, and .007 for salary; among the top 5% CEO performers these values were .003,

.000, and .000, respectively; among the top 10% CEO performers, these values were .003, .001, and .002, respectively; and among the top 20% CEO performers, these values were .001, .003, and .006, respectively. Results using ROA were substantively similar in that, except for one coefficient, there were no instances where CEO performance explained more than half of 1% of variance in CEO pay for any particular type of compensation—fixed or variable.

Overall, relatively speaking, results showed some degree of greater overlap between the distributions of CEO pay and CEO performance when we compare fixed pay (i.e., salary) with one or more incentive forms of pay (i.e., value of options exercised and, at times, bonus). To keep these results in perspective, however, we emphasize that the actual performance-incentive pay overlap in the best scenario is very low. In fact, out of the 32 cells in Tables 3 and 4, the best one in terms of CEO performance-incentive pay overlap shows that 64% (referring to the 36% statistic in Table 3) of CEOs who are in the top 20% of value of options exercised are *not* in the top 20% of the Tobin's Q performance distribution. In fact, the proportion of variance explained by any type of pay based on either type of performance measure (Tobin's Q or ROA) using Kendall's τ is very small (cf. Bosco, Aguinis, Singh, Field, & Pierce, 2015). In sum, regarding Hypothesis 5, we found that the overlap between top CEO performance and pay for value of options exercised or bonus was only partially greater than the overlap between top CEO performance and salary.

DISCUSSION

For the majority of industries, the key findings are as follows. First, the CEO performance and pay distributions across a diverse set of industries conform to a power law distribution. This result was replicated when using an accounting (i.e., ROA) as well as a market measure of CEO performance (i.e., Tobin's Q) and persisted even after taking into account

features of the firms they helm (e.g., firm size, organizational slack).

Second, although the majority of the CEO performance and pay distributions across industries follow a power law, the overlap of the highest performers with the highest earners in terms of total pay is very low. The weak overlap means that CEOs who make disproportionately high performance contributions (e.g., those in the top 10% of the performance bracket) are rarely the same CEOs as those who receive disproportionately high pay (e.g., those in the top 10% of the pay bracket). These results were replicated whether using ROA or Tobin's Q as the measure of CEO performance. Moreover, Kendall's τ coefficients suggested that there is no association between CEO performance and pay. For example, CEO performance—measured using Tobin's Q or ROA—generally explains less than half of 1% of variance in pay as measured using any type of compensation—fixed or variable.

Third, in addition to the finding that total pay follows a power law distribution better than a normal curve, each of the pay components (i.e., salary, value of options exercised, and bonus) followed a power law distribution. Fourth, similar to results regarding total pay, there was little overlap between the top performers based on ROA or Tobin's Q and the top earners based on each of the three pay components. Kendall's coefficients offered additional evidence regarding this finding. Finally, there was relatively less overlap for salary compared to value of options exercised and, at times, bonus.

Implications for Theory and Future Research

Because of the fundamental differences between a power law and a normal distribution, the discovery that the distributions fit a power law distribution better than a normal distribution will likely change how we theorize CEO performance and pay in future research. For example, heterogeneity of scores in power laws is much greater than in a normal distribution. In fact, the

heterogeneity of scores in power law distributions is so large that the variance is often considered “pseudo-infinite.” This means that the top performing and top paid CEOs are many multiple times higher than the rest, and this result is informative regarding the ongoing debate on high versus low pay dispersion (Shaw, 2014, 2015). For example, consider the ROA value of 1.23 for one of the CEOs included in our study, John J. Legere of Global Crossing. Under a normal distribution of CEO performance, the likelihood of this value given the distribution’s mean and SD is a highly unlikely probability of .00049. But, Legere is not an unusual case. For example, Joseph F. O’Neill of Orchestra Therapeutics has an ROA score of 24.12. If the underlying distribution is normal, the probability of this value is less than $2.78 * 10^{-308}$ (i.e., 2.78 preceded by 308 zeroes). Now, consider results regarding Tobin’s Q. Timothy Koogle, former CEO of Yahoo, has a Tobin’s Q value of 38.33, and Glen T. Meakem, former CEO of FreeMarkets, has a Tobin’s Q value of 24.69. In spite of their extremely positive performance, there is another CEO who has produced even more positive results: Dennis L. Barsema, CEO of Redback Networks, is associated with a Tobin’s Q value of 78.63. Under a normal distribution, the probabilities of these three CEOs’ performance levels are $2.17 * 10^{-69}$, $8.62 * 10^{-40}$, and $6.20 * 10^{-287}$, respectively. A conclusion from these results is that, if the underlying performance distribution is normal, CEOs such as Legere, O’Neill, Koogle, Meakem, Barsema, and many more should simply “not exist”! In other words, a normal distribution renders them effectively impossible, meaning they are likely to be dismissed (and excluded from analysis) as outliers—yet, the presence of these CEO stars is found in our analysis using both accounting and market-based performance measures.

Second, this new empirical reality uncovered by our results points to the need to revise the theoretical framework and dominant paradigm used to conceptualize CEO pay and

performance from a normal to a power law perspective. Indeed, the dominant paradigm appears to be that CEO talent is narrowly dispersed (Gabaix, 2008; Gabaix & Landier, 2008), which has perhaps perpetuated the view that the normality assumption is warranted. Consider the implications of the power law re-conceptualization for research examining the effects of CEO under- and overpayment based mostly on equity theory. Routinely, studies examining this issue have transformed pay distributions to minimize skew and normalize scores. For example, Seo et al. (2015: 1883) noted that “Due to skewness, we used the natural logarithm of the compensation variables.” As noted earlier, normalizing scores reduces the variance in the distribution artificially. As a consequence, it is likely that previous research has underestimated the effects of under- and overpayment. In fact, our results suggest that all previous studies using CEO pay as the predictor of CEO and firm outcomes are likely to have underestimated effects hypothesized based on equity theory. This way, we pave the way for a fruitful research agenda aimed at investigating the magnitude of this underestimation and the extent to which previously reported results may have to be revisited.

Third, another implication of our results is the overall lack of support for the efficient contracting hypothesis, which is directly related to agency and justice theories. Efficient contracting is captured in (1) a positive CEO pay-performance relation and (2) benchmarking such that CEO pay relative to peers reflects their performance levels, avoiding the possibility that shareholders overpay for their CEO’s performance (Bizjak et al., 2008). The poor overlap between the group of highest CEO performers with the group of highest CEO earners suggests that the highest paid are typically not the best performers and vice versa, elucidating a significant failure in the benchmarking dimension of contracting efficiency as well as a high incidence of both CEO over- *and* under-payment. For instance, regarding CEO total pay and performance

based on Tobin's Q (Table 3), only 14% of CEOs in the top 5% earning bracket are also in the top 5% bracket in terms of performance. Moreover, the mismatch between relative standing of CEOs regarding their performance and pay is found for fixed (i.e., salary) as well as incentive-based pay components (i.e., value of options exercised and, at times, bonus). For example, also regarding Tobin's Q (Table 3), only 0% to 10% of the top 1% earners based on salary, bonus, or value of options exercised are also among the top 1% performers. As shown in Tables 3 and 4, results regarding the decoupling between CEO performance and pay were similar when we considered ROA instead of Tobin's Q. This finding was consistent across types of pay even though equity-based incentives should presumably be more closely aligned with value creation (Nyberg et al., 2010). In short, the observed decoupling between top CEO pay and performance seems difficult to justify based on rational economic and distributive justice grounds.

Fourth, our results also suggest additional avenues for future research. For example, what are the mechanisms through which the highest paid CEOs who are not the top performers are able to "game the system"? Some possibilities involve their ability to negotiate a beneficial contract. For example, some CEOs may have excellent negotiation skills, but not a similarly high level of leadership skills, which may be more closely related to CEO performance. Also, as noted by Dey-Tortella et al. (2005), some CEOs may be skilled at managing the timing of news announcements and the release of company reports, which they may use to increase their equity-based pay but may not be directly related to CEO performance (Bergh et al., 2016). Another distinct possibility is the use of unrestricted CEO power to extract rents that are not justified by performance (Bebchuk & Fried, 2009), and the use of consultants to legitimize it (Crystal, 1990), particularly when ownership is highly dispersed so that monitoring is weak (Gomez-Mejia, Tosi, & Hinkin, 1987; Tosi & Gomez-Mejia, 1989, 1994).

Fifth, our results point to the need for future research to explain a phenomenon that has not received sufficient empirical attention to date: CEO underpayment. For example, what are the factors that prevent top-performing CEOs from not receiving the compensation they deserve based on their superior performance? What is the relative importance of individual-level factors such as CEO negotiation skills compared to contextual factors such as environmental constraints in explaining CEO underpayment? Clearly, researchers, the media, and public in general have focused on CEO overpayment, but our results point to the need for a new research stream focused on CEO underpayment.

Sixth, related to our results and implications regarding efficient contracting, our findings elucidate the extent to which industry matters when drawing conclusions about CEO pay deservingness. Even though the overlap between top performers and top earners was minimal in the top 5% across most industries, chemical manufacturing and petroleum industries showed more overlap compared to other industries—with 50% to 57% of the top 5% performing CEOs (in terms of Tobin's Q) also in the top 5% bracket of earners. At the other end of this spectrum are air travel, banking, car manufacturing, lumber and pulp, and tobacco, for which overlap is practically non-existent. These are quite different industries in terms of profitability and growth rates, with the banking industry being unique in terms of the pre-2007 growth that ended disastrously. Although it is difficult to isolate unique features in the firms that contract more efficiently relative to those that do not, industry-specific compensation practices appear to exist. In fact, we observed the smallest degree of overlap in many industries with less munificent environments (reflected by lower growth). These industries include consumer goods, lumber and pulp, and tobacco, all three of which were industries with below-median growth rates (with median annualized sales growth rates during the period of our study being 5%, 7% and 5%,

respectively). In addition to the aforementioned factors, other possible explanations include differences in ownership structure (Gomez-Mejia, Nunez-Nickel, & Gutierrez, 2001; Gomez-Mejia, Larraza-Kintana, & Makri, 2003), managerial discretion (Hambrick & Finkelstein, 1987), competitive dynamics (Murphy, 1999), systematic risk (Miller, Wiseman, & Gomez-Mejia, 2002), and the presence of interlocking directorates that may favor the CEO (Zona, Gomez-Mejia, & Withers, in press). In short, our results point to a fruitful research agenda aimed at improving our understanding of these observed industry differences.

Finally, our findings lead to a reinterpretation of the large literature on agent risk sharing and risk bearing (see reviews by Devers, McNamara, Wiseman, & Arrfelt, 2008 and also Martin et al., 2013). Classical agency theory suggests that shareholders, through their boards, should grant stock and options to coax the CEO out of the risk aversion assumed to be created by their concentrated firm-specific investment of human capital (Holmstrom, 1979). Our results regarding the power law distribution of CEO performance provide an important caveat for the prescription that encouraging agent risk taking is good for shareholders. Specifically, a power law distribution suggests that variation in CEO ability to derive positive returns from risk taking is significantly larger than would have been the case if the performance distribution were normal. An implication is that a minority of CEOs consistently derive positive returns from risk taking, while the majority is far less likely to do so. The large heterogeneity in CEO performance uncovered by the power law distribution prompts us to reconsider blanket prescriptions for the use of incentives to encourage CEO risk-taking—prescriptions that are based on the assumption that CEO risk-taking is beneficial for shareholders (Bebchuk & Fried, 2009, 2010; Holmstrom, 1979; Jensen & Murphy, 1990).

Implications for Executive Compensation, Governance, and Human Resource Management

Practices

Our study offers new insights into CEO compensation practices. A typical approach to negotiating and designing CEO compensation contracts is for the board's pay committee (usually with the help of compensation consultants) to ascertain the average CEO pay for a particular performance cohort in a given industry. The committee then uses that figure as a reference to estimate CEO capability relative to their peer group and then set CEO pay accordingly (Bogle, 2008; Conyon et al., 2009; Jensen, 2004; Murphy, 1999). This is a reasonable approach if the distribution of CEO performance is normal, meaning that there is relatively little variation across the performance of, for example, those in the top quartile. However, a power law distribution suggests that there is a large amount of variation in the performance outcomes delivered by CEOs even in the same performance cohort, with the top performers delivering results many multiples better than the average. This implies that the typical approach to CEO compensation based on averages would significantly underpay stars while overpaying average performers. Our results may explain, at least in part, why CEO poaching is a frequent phenomenon and the typical CEO lasts just a few years on the job. After all, information on CEO performance is readily accessible to recruiters and headhunters, making it easy to identify the individuals producing top results.

Moreover, our results point to the need to shift practitioner-thinking towards the power law view. Headhunting firms that adopt the power law view, rather than a normal distribution mindset, will be able to more accurately identify CEOs who are not the highest earners but are among the top performers. These are the CEOs that headhunters will be able to proactively approach and tempt with an offer to move to another firm. Similarly, firms will be well served by examining the relation between CEO pay and CEO performance based on a power law

perspective to possibly prevent dysfunctional turnover (i.e., the departure of a high performing CEO). In addition to possibly preventing dysfunctional turnover, from a public relations perspective, our results suggest that firms should also embrace a power law perspective to anticipate and prevent possible shareholder disapproval and unwanted media attention. Just as important to knowing whether a top performing CEO is not paid accordingly is identifying top earning CEOs who are not creating commensurate results.

CONCLUDING COMMENTS

Our findings shed new light on CEO pay deservingness by using a novel conceptual and methodological lens that highlights systematic over and underpayment. We contributed new insights to the question of whether CEOs deserve their pay based on distributive justice and agency theory. Our results show that CEOs at the top of the performance distribution create vastly more value than those at succeeding lower levels of the performance distribution, and those CEOs at the top of the pay distribution are remunerated far more than those at succeeding lower levels of the pay distribution. But, there is little overlap between CEOs who are the top performers and CEOs who are the top earners. In addition, our results provide evidence regarding CEO *underpayment*. These results suggest a violation of distributive justice and offer little support for agency theory's efficient contracting hypothesis, which have important implications for agency theory, equity theory, justice theory, and agent risk sharing and agent risk bearing theories, as well as executive compensation and governance practices in general. In short, CEOs usually do *not* deserve the pay they receive in that some deserve less (particularly those at the top of the pay distribution) whereas others deserve more—as judged based on their performance levels and a distributive justice perspective that higher performance should be associated with higher pay. We hope our results will pave the way for a fruitful research agenda

aimed at further understanding the two sides of CEO pay injustice: Why CEOs who create disproportionately large amounts of value is a different group from the small proportion of CEOs who secure disproportionately large amounts of compensation, and vice versa.

REFERENCES

- Abernethy, M. A., Kuang, Y. F., & Qin, B. 2015. The influence of CEO power on compensation contract design. *The Accounting Review*, 90: 1265–1306.
- Adams, J. S. 1965. Inequity in social exchange. In L. Berkowitz (Ed.), *Advances in experimental social psychology*, vol. 2: 267–299. New York: Academic Press.
- Aguinis, H., & Bradley, K. J. 2015. The secret sauce for organizational success: Managing and producing star performers. *Organizational Dynamics*, 44: 161–168.
- Aguinis, H., Gottfredson, R. K., & Joo, H. 2013. Best-practice recommendations for defining, identifying, and handling outliers. *Organizational Research Methods*, 16: 270–301.
- Aguinis, H., & Harden, E. E. 2009. Cautionary note on conveniently dismissing χ^2 goodness-of-fit test results: Implications for strategic management research. In D. D. Bergh & D. J. Ketchen (Eds.), *Research methodology in strategy and management*: 111–120. Howard House, UK: Emerald.
- Aguinis, H., & O’Boyle, E. 2014. Star performers in twenty-first-century organizations. *Personnel Psychology*, 67: 313–350.
- Aguinis, H., O’Boyle, E., Gonzalez-Mulé, E., & Joo, H. 2016. Cumulative advantage: Conductors and insulators of heavy-tailed productivity distributions and productivity stars. *Personnel Psychology*, 69: 3–66.
- Anschuetz, N. 1997. Profiting from the “80-20 rule of thumb”. *Journal of Advertising Research*, 37: 51–66.
- Bebchuk, L. A., & Fried, J. M. 2009. *Pay without performance: The unfulfilled promise of executive compensation*. Cambridge, MA: Harvard University Press.
- Bebchuk, L. A., & Fried, J. M. 2010. Paying for long-term performance. *University of Pennsylvania Law Review*, 158: 1915–1959.
- Bergh, D. D., Aguinis, H., Heavey, C. Ketchen, D. J., Boyd, B. K., Su, P., Lau, C., & Joo, H. 2016. Using meta-analytic structural equation modeling to advance strategic management research: Guidelines and an empirical illustration via the strategic leadership-performance relationship. *Strategic Management Journal*, 37: 477–497.
- Bernerth, J. B., & Aguinis, H. 2016. A critical review and best-practice recommendations for control variable usage. *Personnel Psychology*, 69: 229–283.
- Bizjak, J. M., Lemmon, M. L., & Naveen, L. 2008. Does the use of peer groups contribute to

- higher pay and less efficient compensation? *Journal of Financial Economics*, 90: 152–168.
- Bogle, J. C. 2008. Reflections on CEO compensation. *Academy of Management Perspectives*, 22: 21–25.
- Bosco, F. A., Aguinis, H. Singh, K., Field, J. G., & Pierce, C. A. 2015. Correlational effect size benchmarks. *Journal of Applied Psychology*, 100: 431–449.
- Bromiley, P. 1991. Testing a causal model of corporate risk taking and performance. *Academy of Management Journal*, 34: 37–59.
- Byrd, J. W., & Hickman, K. A. 1992. Do outside directors monitor managers? Evidence from tender offer bids. *Journal of Financial Economics*, 32: 195–221.
- Carpenter, M. A., & Sanders, W. M. 2002. Top management team compensation: The missing link between CEO pay and firm performance? *Strategic Management Journal*, 23: 367–375.
- Clauset, A., Shalizi, C. R., & Newman, M. E. J. 2009. Power-law distributions in empirical data. *SIAM Review*, 51: 661–703.
- Coles, J. L., Daniel, N. D., & Naveen, L. 2006. Managerial incentives and risk-taking. *Journal of Financial Economics*, 79: 431–468.
- Canyon, M. J., Peck, S. I., & Sadler, G. V. 2009. Compensation consultants and executive pay: Evidence from the United States and the United Kingdom. *Academy of Management Perspectives*, 23: 43–55.
- Core, J., & Guay, W. 1999. The use of equity grants to manage optimal equity incentive levels. *Journal of Accounting and Economics*, 28: 151–184.
- Core, J. E., Guay, W. R., & Larcker, D. F. 2003. Executive equity compensation and incentives: A survey. *Economic Policy Review*, 9: 27–50.
- Crystal, G. S. 1990. The great CEO pay sweepstakes. *Fortune*, 18: 99–102.
- Delbridge, R., & Fiss, P. 2013. Styles of theorizing and the social organization of knowledge. *Academy of Management Review*, 38: 325–331.
- Devers, C. E., Cannella, A. A., Reilly, G. P., & Yoder, M. E. 2007. Executive compensation: A multidisciplinary review of recent developments. *Journal of Management*, 33: 1016–1072.
- Devers, C. E., McNamara, G., Wiseman, R. M., & Arrfelt, M. 2008. Moving closer to the action: Examining compensation design effects on firm risk. *Organization Science*, 19: 548–566.

- Deya-Tortella, B., Gomez-Mejia, L., De Castro, J., & Wiseman, R. M. 2005. Incentive alignment or perverse incentives? A behavioral view of stock options. *Management Research*, 3: 109–120.
- Fama, E. F. 1980. Agency problems and the theory of the firm. *Journal of Political Economy*, 88: 288–307.
- Fama, E. F., & Jensen, M. C. 1983. Agency problems and residual claims. *Journal of Law and Economics*, 26: 327–349.
- Fong, E., Misangyi, V., & Tosi, H. 2010. The effect of CEO pay deviations on CEO withdrawal, firm size, and firm profits. *Strategic Management Journal*, 31: 629–651.
- Fulmer, I. S. 2009. The elephant in the room: Labor market influences on CEO compensation. *Personnel Psychology*, 62: 659–695.
- Gabaix, X. 2008. Power laws in economics and finance. *Annual Review of Economics*, 1: 255–294.
- Gabaix, X., & Landier, A. 2008. Why has CEO pay increased so much? *The Quarterly Journal of Economics*, 123: 49–100.
- Gabaix, X., Landier, A., & Sauvagnat, J. 2014. CEO pay and firm size: An update after the crisis. *The Economic Journal*, 124: F40–F59.
- Gao, H. 2010. Optimal compensation contracts when managers can hedge. *Journal of Financial Economics*, 97: 218–238.
- Goergen, M., & Renneboog, L. 2011. Managerial compensation. *Journal of Corporate Finance*, 17: 1068–1077.
- Gomez-Mejia, L. R. 1994. Executive compensation: A reassessment and future research agenda. In G. R. Ferris (Ed.), *Research in personnel and human resource management*, vol. 12: 161–222. Greenwich, CT: JAI Press.
- Gomez-Mejia, L. R., Berrone, P., & Franco-Santos, M. 2010. *Compensation and organizational performance*. Armonk, NY: M.E. Sharpe.
- Gomez-Mejia, L. R., Larraza-Kintana, M., & Makri, M. 2003. The determinants of executive compensation in family controlled firms. *Academy of Management Journal*, 46: 226–237.
- Gomez-Mejia, L. R., Nunez-Nickel, M., & Gutierrez, I. 2001. The role of family ties in agency contracts. *Academy of Management Journal*, 44: 1–15.

- Gomez-Mejia, L. R., Tosi, H., & Hinkin, T. 1987. Managerial control, performance, and executive compensation. *Academy of Management Journal*, 30: 51–70.
- Gomez-Mejia, L. R., & Wiseman, R. 1997. Reframing executive compensation: An assessment and outlook. *Journal of Management*, 23: 291–374.
- Hall, B. J., & Murphy, K. J. 2003. *The trouble with stock options*. NBER working paper no. 9784, National Bureau of Economic Research, Cambridge, MA.
- Hambrick, D., & Finkelstein, S. 1987. Managerial discretion: A bridge between polar views of organizational outcomes. In L. L. Cummings & B. M. Staw (Eds.), *Research in organizational behavior*, vol. 9: 369–406. Greenwich, CT: JAI Press.
- Hambrick, D. C., & Quigley, T. J. 2014. Toward more accurate contextualization of the CEO effect on firm performance. *Strategic Management Journal*, 35: 473–491.
- He, J., & Huang, Z. 2011. Board informal hierarchy and firm performance: Exploring a tacit structure guiding boardroom interactions. *Academy of Management Journal*, 54: 1119–1139.
- Healy, P. M., & Wahlen, J. M. 1999. A review of the earnings management literature and its implications for standard setting. *Accounting Horizons*, 13: 365–383.
- Hill, B. M. 1975. A simple general approach to inference about the tail of a distribution. *The Annals of Statistics*, 3: 1163–1174.
- Holmstrom, B. 1979. Moral hazard and observability. *Bell Journal of Economics*, 10: 74–91.
- Humphrey, S. E., Nahrgang, J. D., & Morgeson, F. P. 2007. Integrating motivational, social, and contextual work design features: A meta-analytic summary and theoretical extension of the work design literature. *Journal of Applied Psychology*, 92: 1332–1356.
- Hunter, J. E., Schmidt, F. L., & Judiesch, M. K. 1990. Individual differences in output variability as a function of job complexity. *Journal of Applied Psychology*, 75: 28–42.
- Jensen, M. C. 2004. The agency cost of overvalued equity and the current state of corporate finance. *European Financial Management*, 10: 549–565.
- Jensen, M. C., & Meckling, W. H. 1976. Theory of the firm: Managerial behavior, agency costs and ownership structure. *Journal of Financial Economics*, 3: 305–360.
- Jensen, M. C., & Murphy, K. J. 1990. Performance pay and top-management incentives. *Journal of Political Economy*, 98: 225–264.
- Kaplan, S. N. 2008a. Are US CEOs overpaid? *Academy of Management Perspectives*, 22: 5–20.
- Kaplan, S. N. 2008b. Are US CEOs overpaid? A response to Bogle and Walsh. *Academy of*

- Management Perspectives*, 22: 28–34.
- Kohn, M. L., & Schooler, C. 1983. *Work and personality: An inquiry into the impact of social stratification*. Norwood, NJ: Ablex Publishing Corporation.
- Kolev, K., Wiseman, R. M., & Gomez-Mejia, L. R. 2017. Do CEOs ever lose? Fairness perspective on the allocation of residuals between CEOs and shareholders. *Journal of Management*, 43: 610–637.
- Larraza-Kintana, M., Gomez-Mejia, L. R., & Wiseman, R. M. 2011. Compensation framing and the risk-taking behavior of the CEO: Testing the influence of alternative reference points. *Management Research: Journal of the Iberoamerican Academy of Management*, 9: 32-55.
- Mackey, A. 2008. The effect of CEOs on firm performance. *Strategic Management Journal*, 29: 1357–1367.
- Maillart, T., & Sornette, D. 2010. Heavy-tailed distribution of cyber-risks. *The European Physical Journal B-Condensed Matter and Complex Systems*, 75: 357–364.
- Martin, G. P., Gomez-Mejia, L. R., & Wiseman, R. M. 2013. Executive stock options as mixed gambles: Revisiting the behavioral agency model. *Academy of Management Journal*, 56: 451–472.
- Martin, G., Gözübüyük, R., & Becerra, M. 2015a. Interlocks and firm performance: The role of uncertainty in directorate interlock-performance relationship. *Strategic Management Journal*, 36: 235–253.
- Martin, G., Washburn, N., Makri, M., & Gomez-Mejia, L. R. 2015b. Not all risk taking is equal: The behavioral agency model and CEO’s perception of firm efficacy. *Human Resource Management*, 54: 483–498.
- Massey, F. J. 1951. The Kolmogorov-Smirnov test for goodness of fit. *Journal of the American Statistical Association*, 46: 68–78.
- Miller, J. S., Wiseman, R., & Gomez-Mejia, L. R. 2002. The fit between CEO compensation design and firm risk. *Academy of Management Journal*, 45: 745–756.
- Murphy, K. J. 1986. Top executives are worth every nickel they get. *Harvard Business Review*, 64(2): 125–132.
- Murphy, K. J. 1999. Executive compensation. In O. C. Ashenfelter & D. Card (Eds.), *Handbook of labor economics*, vol. 3B: 2485–2563. Amsterdam: Elsevier/North-Holland.
- Nyberg, A. J., Fulmer, I. S., Gerhart, B., & Carpenter, M. A. 2010. Agency theory revisited:

- CEO returns and shareholder interest alignment. *Academy of Management Journal*, 53: 1029–1049.
- O’Boyle, E. H., & Aguinis, H. 2012. The best and the rest: Revisiting the norm of normality of individual performance. *Personnel Psychology*, 65: 79–119.
- Palia, D. 2000. The impact of regulation on CEO labor markets. *The RAND Journal of Economics*, 31: 165–179.
- Pareto, V. 1897. *Cours d’économie politique*. London: Macmillan.
- Sánchez Marín, G., & Aragón Sánchez, A. 2003. Top managers’ compensation, strategic orientations, and firm performance: Empirical evidence from Spanish firms. *Management Research: Journal of the Iberoamerican Academy of Management*, 1: 27-44.
- Sanders, W. G., & Hambrick, D. C. 2007. Swinging for the fences: The effects of CEO stock options on company risk taking and performance. *Academy of Management Journal*, 50: 1055–1078.
- Scandura, T. A., & Williams, E. A. 2000. Research methodology in management: Current practices, trends, and implications for future research. *Academy of Management Journal*, 43: 1248–1264.
- Seo, J., Gamache, D. L., Devers, C. E., & Carpenter, M. A. 2015. The role of CEO relative standing in acquisition behavior and CEO pay. *Strategic Management Journal*, 36: 1877–1894.
- Shaw, J. D. 2014. Pay dispersion. *Annual Review of Organizational Psychology and Organizational Behavior*, 1: 521–544.
- Shaw, J. D. 2015. Pay dispersion, sorting, and organizational performance. *Academy of Management Discoveries*, 1: 165–179.
- Tosi, H. L., & Gomez-Mejia, L. R. 1989. The decoupling of CEO pay and performance: An agency theory perspective. *Administrative Science Quarterly*, 34: 169–189.
- Tosi, H. L., & Gomez-Mejia, L. R. 1994. CEO monitoring and firm performance. *Academy of Management Journal*, 37: 1002–1016.
- Tosi, H. L., Werner, S., Katz, J. P., & Gomez-Mejia, L. R. 2000. How much does performance matter? A meta-analysis of CEO pay studies. *Journal of Management*, 26: 301–339.
- Vancouver, J. B., Li, X., Weinhardt, J., Purl, J., & Steel, P. 2016. Using a computational model to understand possible sources of skews in distributions of job performance. *Personnel*

Psychology, 69: 931–974.

Walsh, J. P. 2008. CEO compensation and the responsibilities of the business scholar to society. *Academy of Management Perspectives*, 22: 26–33.

Wiklund, J., & Shepherd, D. A. 2011. Where to from here? EO-as-experimentation, failure, and distribution of outcomes. *Entrepreneurship Theory and Practice*, 35: 925–946.

Wowak, A., Gomez-mejia, L., & Steinbach, A. in press. Inducements and motives at the top: A holistic perspective on the drivers of executive behavior. *Academy of Management Annals*. doi:10.5465/annals.2015.0121.

Zona, F., Gomez-Mejia, L. R., & Withers, M. in press. Board interlocks and firm performance: Toward a combined agency-resource dependence perspective. *Journal of Management*, doi:10.1177/0149206379512.

TABLE 1
CEO Performance (Tobin's Q) and Pay Distribution Descriptors^a

Variable	N	median	mean	SD	skew	kurtosis	α	K-S	<i>p</i>
Performance (across industries)	4,158	-0.35	-0.07	1.53	2.13	16.56	3.42	0.13	0.50
Total Pay		-2,239	-411.97	6,956	3.22	19.59	2.80	0.13	0.51
Options		-1,755	-408.21	4,872	4.18	28.81	2.74	0.15	0.49
Salary		-43.57	-10.06	327.81	1.10	4.10	5.62	0.12	0.45
Bonus		-270.4	-61.06	942.86	2.78	15.70	2.65	0.15	0.37
Performance (agriculture, forestry, and mining)	185	-0.13	-0.07	0.85	0.73	1.93	3.16	0.11	0.29
Total Pay		-3,629	-1,403	7,954	3.90	17.37	2.09	0.16	0.06
Performance (air travel)	21	-0.16	-0.04	0.72	0.96	0.24	1.63	0.19	0.30
Total Pay		-2,814	-596.8	8,047	1.33	1.17	3.22	0.18	0.74
Performance (commercial/retail banking)	38	-0.82	-0.12	1.84	1.54	1.55	7.72	0.17	0.79
Total Pay		-924.1	42.32	21,316	0.23	5.13	2.20	0.16	0.58
Performance (basic manufacturing)	182	-0.07	-0.04	0.92	1.07	2.84	3.55	0.13	0.19
Total Pay		-956.3	-162.6	2,769	1.54	2.93	5.77	0.13	0.40
Performance (car and related manufacturing)	60	-0.53	-0.31	0.83	1.75	5.34	2.17	0.15	0.32
Total Pay		-1,222	-376.9	3,483	2.41	7.44	2.31	0.15	0.37
Performance (chemical manufacturing)	134	-0.21	-0.06	1.03	1.21	3.33	3.31	0.11	0.53
Total Pay		-1,119	-232.5	4,402	4.33	28.66	2.20	0.08	0.75
Performance (computer manufacturing)	88	-1.07	-0.34	3.66	6.08	43.75	2.30	0.10	0.95
Total Pay		-4,467	-1,765	6,969	2.44	8.00	2.80	0.09	0.81
Performance (consumer goods)	145	-0.25	-0.18	1.19	1.00	3.26	4.28	0.11	0.81
Total Pay		-1,192	-122.0	4,750	3.86	20.64	2.80	0.09	0.86
Performance (pharmaceutical and medical)	161	-0.47	0.11	2.87	-1.29	17.44	3.70	0.12	0.41
Total Pay		-3,287	-836.0	6,066	1.83	3.18	6.85	0.13	0.71
Performance (resources and build equipment)	741	-0.38	-0.07	1.73	2.64	15.22	2.57	0.08	0.03
Total Pay		-1,907	-451.8	5,044	3.69	20.53	2.77	0.07	0.47
Performance (financial non-bank)	337	-0.43	-0.21	1.34	3.16	16.85	3.84	0.10	0.70
Total Pay		-2,675	-312.1	7,653	3.59	20.43	2.88	0.11	0.23

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Performance (food products)	108	-0.40	0.02	1.50	1.59	3.03	2.35	0.14	0.09
Total Pay		-1,523	-194.3	5,028	3.21	16.75	2.87	0.07	0.99
Performance (lumber and pulp)	24	-0.15	-0.17	0.65	0.35	-0.33	2.97	0.16	0.79
Total Pay		-1,251	-763.5	1,568	1.25	1.56	2.09	0.19	0.57
Performance (media)	128	-0.31	-0.09	1.58	4.69	36.48	2.37	0.11	0.40
Total Pay		-4,361	-659.3	11,021	3.35	13.16	1.74	0.11	0.22
Performance (petro refining and related)	31	-0.10	-0.12	0.65	-0.22	-0.15	3.44	0.16	0.65
Total Pay		-3,362	-959.0	7,482	1.39	1.31	3.19	0.17	0.73
Performance (real estate)	49	-0.04	0.04	0.69	0.19	0.28	2.32	0.16	0.11
Total Pay		-3,506	-1,263	7,307	2.32	6.31	1.73	0.20	0.10
Performance (retail)	364	-0.37	-0.14	1.47	1.29	2.91	7.41	0.10	0.87
Total Pay		-2,060	-459.2	5,498	3.61	17.99	2.07	0.12	0.01
Performance (services excl comp, air, and bank)	301	-0.40	-0.01	2.12	5.97	60.35	2.97	0.07	0.87
Total Pay		-2,101	-704.1	5,074	5.58	53.81	2.71	0.14	0.02
Performance (software, data, and storage)	367	-0.76	0.31	5.25	10.43	140.68	2.43	0.07	0.85
Total Pay	366	-4,170	-1,366	10,871	6.27	46.18	1.93	0.06	0.72
Performance (tobacco)	7	-0.35	0.04	1.28	0.72	-1.17	5.25	0.36	0.60
Total Pay		347.1	3,999	8,665	0.89	-0.57	2.68	0.22	0.82
Performance (utilities)	291	-0.05	-0.01	0.62	1.69	7.09	2.74	0.09	0.30
Total Pay		-1,382	144.6	7,206	8.65	100.56	2.61	0.08	0.82
Performance (other)	397	-0.26	-0.11	0.96	1.23	3.42	2.72	0.10	0.04
Total Pay		-1,702	-622.2	4,856	5.20	38.43	2.07	0.08	0.28

^a CEO performance scores are residuals from models regressing Tobin's Q on measures of risk (i.e., capital expenditure and R&D), firm size (i.e., total assets), organizational slack (i.e., cash and short-term investments), and CEO tenure. Total pay = salary, cash bonus, other annual payouts, total value of restricted stocks granted, long-term incentive pay payouts, net value of stock options exercised, and all other compensation computed as the annual average across the tenure of each CEO; options = total options exercisable; salary = cash salary; and bonus = cash bonus. Total pay and pay components are based on residuals from models regressing pay on firm size. N = sample size. Compensation N are the same for each distribution except for the industry group "software, data, and storage", where we had one observation that provided salary and bonus data but not the option exercise values. SD = standard deviation; α = scaling exponent (i.e., parameter) of the power law curve (the closer the value to 1.0, the heavier the tail of the distribution); K-S = Kolmogorov-Smirnov goodness-of-fit statistic (the lower the value, the higher the probability of an underlying power law distribution); and p = statistical significance for the K-S statistic (non-statistically significant results such as $p > .05$ suggest a better the fit with an underlying power law distribution).

TABLE 2
CEO Performance (ROA) and Pay Distribution Descriptors^a

Variable	N	median	mean	SD	skew	Kurtosis	α	K-S	<i>p</i>
Performance (across industries)	5,091	0.01	0.00	0.18	-0.59	33.49	3.87	0.39	0.47
Total Pay		-1,910	-476.3	6,580	3.46	22.95	2.62	0.43	0.48
Options		-1,536	-379.8	4,605	4.54	33.74	8.52	0.56	0.42
Salary		-65.97	-15.68	334.1	1.22	4.91	5.71	0.44	0.51
Bonus		-268.38	-39.54	1,106	3.51	21.18	2.51	0.39	0.42
Performance (agriculture, forestry, and mining)	224	0.01	0.00	0.07	-3.07	18.57	2.79	0.01	0.02
Total Pay		-3,268	-1,623	7,252	4.34	21.84	2.09	0.46	0.07
Performance (air travel)	29	0.00	0.00	0.05	0.67	0.33	3.86	0.78	0.81
Total Pay		-3,483	-1,534	7,017	1.79	3.03	3.22	0.30	0.76
Performance (commercial/retail banking)	54	-0.02	0.00	0.05	1.29	1.71	4.41	0.09	0.32
Total Pay		-627.5	753.3	19,871	0.30	5.45	1.77	0.12	0.30
Performance (basic manufacturing)	232	0.00	-0.01	0.10	1.62	32.70	2.88	0.89	0.69
Total Pay		-362.7	-53.72	2,542	1.54	3.65	1.99	0.43	0.01
Performance (car and related manufacturing)	78	0.00	-0.01	0.08	-0.97	1.92	2.63	0.33	0.48
Total Pay		-621.7	-124.4	3,219	2.23	7.51	2.44	0.40	0.39
Performance (chemical manufacturing)	171	0.00	0.00	0.06	0.25	3.68	3.10	0.73	0.73
Total Pay		-815.4	-167.9	4,015	4.49	32.61	2.31	0.41	0.57
Performance (computer manufacturing)	117	0.03	-0.03	0.19	-1.85	3.43	5.55	0.13	0.60
Total Pay		-3,607	-2,007	6,161	2.80	10.99	2.79	0.77	0.89
Performance (consumer goods)	170	-0.01	-0.01	0.08	-0.44	2.11	2.93	0.27	0.41
Total Pay		-801.2	-101.8	4,448	4.03	23.20	2.77	0.02	0.91
Performance (pharmaceutical and medical)	188	0.09	0.14	1.80	12.70	167.38	3.04	0.33	0.07
Total Pay		-2,465	-862.2	5,657	1.95	4.04	6.85	0.63	0.70
Performance (resources and build equipment)	872	0.03	-0.01	0.24	-9.75	132.97	3.65	0.01	0.01
Total Pay		-1,380	-258.5	4,872	3.66	20.66	2.81	0.70	0.54
Performance (financial non-bank)	423	-0.01	0.00	0.07	-2.66	29.62	2.01	0.01	0.00
Total Pay		-2,299	-415.1	7,297	3.53	20.46	3.00	0.63	0.30

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Performance (food products)	130	-0.01	0.00	0.06	0.19	1.68	3.46	0.00	0.08
Total Pay		-1,423	114.3	5,433	3.15	13.98	2.52	0.72	0.56
Performance (lumber and pulp)	29	0.00	-0.01	0.06	-1.75	3.32	5.56	0.68	0.78
Total Pay		-534.6	241.6	3,247	2.20	4.57	2.06	0.54	0.57
Performance (media)	163	0.02	-0.01	0.12	-2.94	12.15	3.36	0.79	0.00
Total Pay		-4,120	-939.5	10,277	3.61	15.19	1.73	0.32	0.11
Performance (petro refining and related)	41	0.00	-0.01	0.05	-1.03	1.96	4.06	0.97	0.78
Total Pay		-4,220	-1,836	6,683	1.81	2.95	3.19	0.05	0.75
Performance (real estate)	57	0.01	0.00	0.07	-0.30	2.27	3.34	0.07	0.62
Total Pay		-3,507	-1,562	6,816	2.57	7.99	1.73	0.12	0.11
Performance (retail)	452	0.00	-0.02	0.12	-4.36	36.26	3.90	0.79	0.94
Total Pay		-1,539	-414.5	5,239	3.96	21.45	2.10	0.52	0.03
Performance (services excl comp, air, and bank)	359	-0.01	-0.01	0.11	-3.62	33.63	3.01	0.28	0.30
Total Pay		-1,513	-561.8	4,714	5.77	60.24	2.79	0.08	0.06
Performance (software, data, and storage)	404	0.03	-0.02	0.22	-4.97	37.11	10.35	0.11	0.90
Total Pay	403	-3,767	-1,301	10,660	6.25	46.15	1.91	0.01	0.51
Performance (tobacco)	9	-0.04	0.02	0.16	0.96	-0.43	5.31	0.56	0.54
Total Pay		347.1	2,593	8,693	0.72	-0.24	2.62	0.66	0.83
Performance (utilities)	398	0.00	-0.01	0.09	4.58	94.77	2.50	0.60	0.76
Total Pay		-977.4	23.08	6,215	9.92	134.53	2.64	0.66	0.90
Performance (other)	492	0.00	-0.01	0.14	2.45	119.64	3.46	0.17	0.41
Total Pay		-1,045	-441.1	4,426	5.44	44.56	2.30	0.85	0.67

^a CEO performance scores are residuals from models regressing return on assets (ROA) on measures of risk (i.e., capital expenditure and R&D), firm size (i.e., total assets), organizational slack (i.e., cash and short-term investments), and CEO tenure. Total pay = salary, cash bonus, other annual payouts, total value of restricted stocks granted, long-term incentive pay payouts, net value of stock options exercised, and all other compensation computed as the annual average across the tenure of each CEO; options = total options exercisable; salary = cash salary; and bonus = cash bonus. Total pay and pay components are based on residuals from models regressing pay on firm size. N = sample size. Compensation N are the same for each distribution except for the industry group “software, data, and storage”, where we had one observation that provided salary and bonus data but not the option exercise values. SD = standard deviation; α = scaling exponent (i.e., parameter) of the power law curve (the closer the value to 1.0, the heavier the tail of the distribution); K-S = Kolmogorov-Smirnov goodness-of-fit statistic (the lower the value, the higher the probability of an underlying power law distribution); and p = statistical significance for the K-S statistic (non-statistically significant results such as $p > .05$ suggest a better the fit with an underlying power law distribution).

TABLE 3
Percent of Top 1%, 5%, 10%, and 20% of the Most Highly Performing CEOs based on Tobin's Q Who Are Also in the Same Percent of Top Earners^a

	Top 1% Performers	Top 5% Performers	Top 10% Performers	Top 20% Performers
Total Pay	5%	14%	20%	29%
Fixed Pay				
Salary	0%	5%	7%	14%
Incentive-based Pay				
Bonus	0%	5%	10%	19%
Value of Options Exercised (Equity)	10%	20%	27%	36%
N	42	208	416	832

^a A perfect overlap between the top performers and the top earners (i.e., efficient contracting hypothesis) would be reflected by 100% in each cell. In the very least, the overlap should be more than 50% to provide partial support for agency theory's efficient contracting hypothesis. Values based on total pay are not necessarily similar to values based on the three pay components (i.e., salary, bonus, and value of options exercised) because total pay is based on these and other types of pay as well (i.e., salary, cash bonus, other annual payouts, total value of restricted stocks granted, long-term incentive pay payouts, net value of stock options exercised, and all other annual compensation).

TABLE 4
Percent of Top 1%, 5%, 10%, and 20% of the Most Highly Performing CEOs based on ROA Who Are Also in the Same Percent of Top Earners^a

	Top 1% Performers	Top 5% Performers	Top 10% Performers	Top 20% Performers
Total Pay	4%	11%	17%	27%
Fixed Pay				
Salary	0%	6%	10%	19%
Incentive-based Pay				
Bonus	0%	5%	12%	23%
Value of Options Exercised (Equity)	6%	15%	20%	30%
N	51	255	509	1,018

^a A perfect overlap between the top performers and the top earners (i.e., efficient contracting hypothesis) would be reflected by 100% in each cell. In the very least, the overlap should be more than 50% to provide partial support for agency theory's efficient contracting hypothesis. Values based on total pay are not necessarily similar to values based on the three pay components (i.e., salary, bonus, and value of options exercised) because total pay is based on these and other types of pay as well (i.e., salary, cash bonus, other annual payouts, total value of restricted stocks granted, long-term incentive pay payouts, net value of stock options exercised, and all other annual compensation).

FIGURE 1
Generic Normal Distribution Overlaying a Generic Power Law Distribution ($\mu = \text{mean}$)

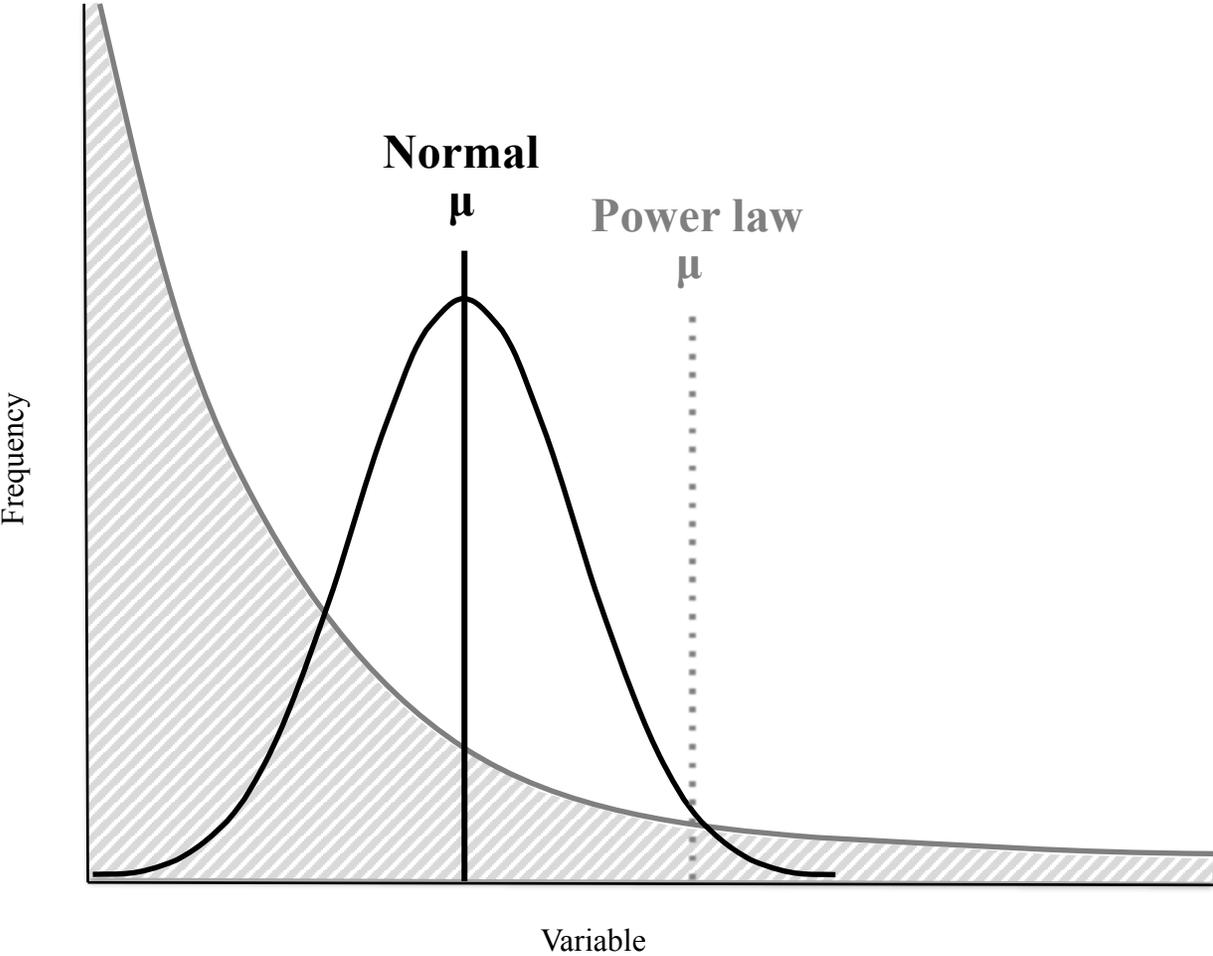
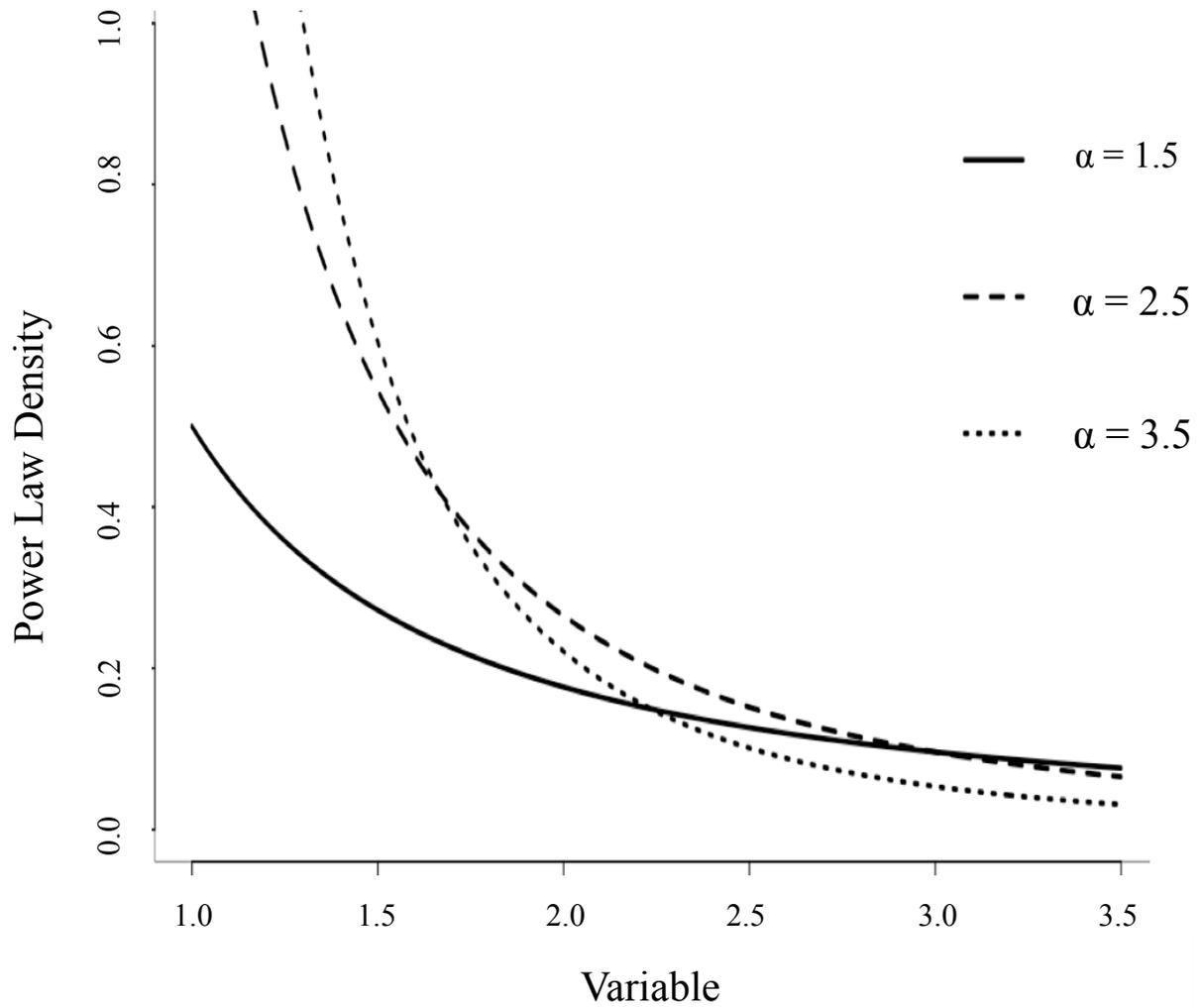


FIGURE 2
Probability Density Function of Power Law Curves with Different Values for Scaling Parameter Alpha (α) Illustrating that Alpha Values Closer to Unity Are Associated with Distributions with Heavier Tails



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