

# Hierarchical Pay Incentives and Firm Performance

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## Abstract

How do firms structure pay inside and outside C-suites to incentivize performance? Amidst limited, conflicting research, we investigate links between firm performance and hierarchical compensation, including CEO pay relative to not only executive but also non-executive employees. Firms often incentivize employees through large pay differentials, sometimes referred to as tournament incentives, which we link to the ratio of CEO and median employee pay. We account for pay levels and show hierarchical pay spans entire firms. Next, by studying CEO residual compensation and accounting for gaps between CEO and non-CEO executive compensation, we find high CEO pay ratios are connected to hierarchical incentives more than to overpaid CEOs. Finally, firms with both well paid employees and large pay differentials exhibit better performance, suggesting hierarchical and tournament incentives within and beyond the C-suite can effectively motivate employees. Hierarchical pay and resulting corporate cultures also have valuable operational efficiency, informing controversies in the financial press.

**JEL Classification:** G3; J3; M12; K22; M52

**Keywords:** Tournament Incentives; CEO Pay Ratio; Relative Compensation; Firm Efficiency

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## I. Introduction

Executive compensation is among the most controversial topics within the financial press, leading to attention from policy makers and academics alike. As a result, regulators have instituted a novel disclosure of the ratio of pay between CEOs and other employees, which could inform the structure of pay throughout the firm. Still, use of the ratio and comparisons across firms often ignore the complexity of compensation within the middle of firms. However, academics recognize the importance of pay comparisons in firms. For example, researchers have examined differentials at the top of firms (e.g., tournament incentives), noting potential benefits. As a result, we combine these literatures to investigate whether the structure of compensation beyond the C-suite adds value, where research has been constrained by data limitations.

Though mandated data on pay within the middle of a firm provides information, the new ratio prompts questions about how average employee compensation should be set and may oversimplify the controversy of rising CEO pay relative to the median employee (e.g., Boone, Starkweather, and White, 2021; Murphy, 1999; Kaplan, 2008; Bertrand, 2009; Frydman and Saks, 2010; Edmans et al., 2012; Quigley and Hambrick, 2015; Murphy and Jensen, 2018).<sup>1</sup> While some may argue this ratio could serve as a disincentive for the average employee, theory suggests income levels may impact the importance and perception of inequality, suggesting higher average pay may also impact incentives (Nishi, Shirado, Rand, and Christakis, 2015). Moreover, employees may be incentivized to seek promotion from rank-order pay structures, in addition to finding motivation from downward comparisons, emphasizing the importance of hierarchical pay within firms (Chi,

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<sup>1</sup> See e.g., Economic Policy Institute's "CEO compensation surged 14% in 2019 to \$21.3 million: CEOs now earn 320 times as much as the typical worker," in August of 2020 by Lawrence Mishel and Jori Kandra: <https://www.epi.org/publication/ceo-compensation-surged-14-in-2019-to-21-3-million-ceos-now-earn-320-times-as-much-as-a-typical-worker>. Also, see e.g., Equilar's "Dissecting the CEO Pay Ratio by Sector," in January of 2020 by Jonathon LaCross: <https://www.equilar.com/blogs/438-ceo-pay-ratio-by-sector.html>.

Liao, Wang, Zhao and Ye, 2018).<sup>2</sup> Therefore, we explore the role and implications of hierarchical pay structure in linking tournament incentives of CEOs with compensation throughout the firm and the resulting value and performance thereof.<sup>3</sup>

Effectively motivating management and setting compensation to align incentives with shareholders is central to a core tenet of corporate finance: maximizing firm value (Fama and Jensen, 1983). As a result, researchers study the role of the distribution of compensation within the C-suite, in addition to CEO pay size and structure, in motivating executives, by investigating the corporate benefits of tournament incentives, i.e., large pay differentials between CEOs and other executives (Kini and Williams 2012; Burns, Minnick, and Starks 2017; Lee, Lev, and Yeo, 2008). Some researchers show such pay dispersion can benefit firms by incentivizing competition among executives, improving corporate performance (Knoeber and Thurman, 1994; Green and Stokey, 1983; Kale, Reis, and Venkateswaran, 2009). However, the performance implications of hierarchical structure within non-executive employees remain unknown, particularly when median employees are more highly paid (Lazear and Rosen, 1981; Malcomson, 1984).

Still, finance researchers have yet to investigate the role of hierarchical pay structures and tournament incentives within firms, beyond top executives competing for the CEO position.<sup>4</sup> Prior

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<sup>2</sup> See e.g., Rosenbaum (1979), Lazear and Rosen (1981), and Rosen (1986). Connelly, Tihanyi, Crook, and Gangloff (2014) summarizes as follows: “firms induce effort from employees by effectively pooling some portion of wages from all the employees at one rank into the wages at the next highest rank, giving each the opportunity to win promotion to that rank.”

<sup>3</sup> In addition to Lazear and Rosen (1981), Tim Harford’s Forbes May 20, 2006, article titled, “Why Your Boss is Overpaid,” investigates the incentives arising from the pay difference between CEO and other non-CEO executives to improve firm performance: [https://www.forbes.com/2006/05/20/executive-compensation-tournament\\_cx\\_th\\_06work\\_0523pay.html?sh=609e01ce6f72](https://www.forbes.com/2006/05/20/executive-compensation-tournament_cx_th_06work_0523pay.html?sh=609e01ce6f72). Harford notes that both the gap between summit and top echelons and the gap between the earnings of summit and average wage of workers produce strong incentives to everyone in the firm: “The ugly truth is that your boss is probably overpaid--and it's for your benefit, not his. Why? It might be because he isn't being paid for the work he does but, rather, to inspire you. In other words, we work our socks off in underpaying jobs in the hope that one day we'll win the rat race and become overpaid fat cats ourselves. Economists call this ‘tournament theory.’”

<sup>4</sup> See e.g., New York Times’ “More Than Ever, It Pays to Be the Top Executive,” by Eduardo Porter on May 25, 2007, which quotes Mark Van Clieaf, a director of MVC Associated International, as saying “it’s executive pay chasing executive pay,” noting that the compensation gap between the CEO and other executives from top hierarchical

research documents that (1) employee motivations are connected to the compensation structure of those around them and (2) tournament incentives are linked to performance and risk-taking among a variety of different workers across industries, from sports organizations to mutual funds (Ehrenberg and Bognanno, 1990; Brown, 2011; Becker and Huselid, 1992; Fee, Hadlock, and Pierce, 2006; Brown, Harlow, and Starks, 1996; Chen, Hughson, and Stoughton, 2011), as well as C-suites of the firms (Kale, Reis, and Venkateswaran, 2009; Kini and Williams, 2012; Burns, Minnick, and Starks, 2017). As a result, tournaments have implications in a variety of settings but to date have not been applied to firms beyond the top executives, due in part to data limitations.

Therefore, to evaluate the role of tournaments in the relative compensation of executives compared to both each other and non-executive employees, we focus on the ratio of CEO pay to the average firm employee (i.e., median CEO pay ratio), in addition to other internal pay differential (i.e., traditional tournament) measures, such as Executive Pay Gap, Executive Pay Slice, and Executive Pay Ratios. Specifically, we analyze how the CEO pay ratio relates to tournament incentives among executives and, therefore, could serve as a proxy for hierarchical pay and incentives beyond the C-suite. We also evaluate whether these pay structures are linked to performance by incentivizing employees through a hierarchical pay structure, both within and beyond the C-suite. Finally, we attempt to explain this performance relation and understand the mechanisms underlying hierarchical pay structure to corporate outcomes.

First, we explore how the Executive Pay Gap, Executive Pay Slice and ratio of CEO to non-CEO executive pay are linked to the CEO Pay Ratio. We observe a positive relation between tournament incentives and the CEO pay ratio, implying that when CEOs are paid much more than

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echelons would incentivize those underpaid workers to do well:  
<https://www.nytimes.com/2007/05/25/business/25execs.html>.

other executives, it is also true relative to non-executive employees. Moreover, this offers evidence that firms employ hierarchical pay structures not just within the C-suite but throughout the firm in order to develop a culture of competition across all employees who may be seeking promotion. In addition, while all tournament incentives are linked with the pay ratio initially, we show that the link is the strongest between the CEO Pay Ratio and Executive Pay Gap, which measures the dollar value of difference between CEOs and other top executives. We also perform principal component analysis to identify the overall tournament structure and observe that the Executive Pay Gap offers distinct information beyond other tournament incentives. The connection between the Executive Pay Gap and CEO Pay Ratio persists after accounting for the level of CEO pay, median employee pay, residual compensation, and other tournament structure measures. This suggests the results are not driven by the level of compensation, the level of median employee pay, expected CEO compensation, or other tournament measures. Instead, the Executive Pay Gap offers information regarding the hierarchical pay structure beyond other measures of compensation and incentives. Moreover, our findings regarding the link with residual compensation imply that the positive relation between the Executive Pay Gap and the CEO Pay Ratio are not caused by overpaid CEOs but more likely to be tied to undercompensated employees at the firm.

Next, we examine firm performance and find that firms with high CEO Pay Ratios and high Executive Pay Gaps also exhibit significantly positive accounting and stock performance, as well as operational efficiency and profitability. These results are strongest when median employees are highest paid and suggest firms benefit from the incentive structures setup by the firm and the corporate culture connected to hierarchical pay structures. Overall, our findings inform the compensation structure within firms by both linking tournament incentives within the C-suite to

the hierarchical pay structure beyond executive compensation and relating hierarchical pay throughout the firm and incentives for employees in general with the performance of the firm.

This study contributes to research on corporate labor markets, as well as the understanding of executive incentives, corporate culture, and determinants of corporate outcomes. By incorporating tournament incentives, we use a novel approach to understanding the relatively unknown pay ratio and offer some of the first understandings of how CEO pay ratios are linked to more efficient firms with improved performance and culture. Though regulators, academics, and the media have long been interested in the ratio of pay between CEOs and other employees, relatively little is known about the ratio. Much of the early research is constrained by limited data with small samples of firms that voluntarily disclose this information. More recently, Boone, Starkweather, and White (2021) analyze Russell 3000 firms and observe that firms take advantage of the Securities and Exchange Commission's (SEC) flexible rules to spin the ratio with longer narratives and more exemptions before disclosing higher than industry average ratios. Surprisingly, they observe that these attempts to contextualize their disclosure are ineffective, with these efforts being followed by more negative media attention, increasing shareholder voting dissent and diminishing productivity. Due to limited research on CEO pay ratios and the recent shift toward regulatory attention in the area, understanding how this ratio is linked to other executive compensation and incentives is a natural and important question.

Moreover, while tournament incentives have been studied substantially at the top of the firm, across industries (Coles, Li, and Wang, 2018) and in countless other settings (Ehrenberg and Bognanno, 1990; Becker and Huselid, 1992; Adcroft and Teckman, 2009; Brown, 2011; Fee, Hadlock, and Pierce 2006; Brown, Harlow, and Starks 1996; Chen, Hughson, and Stoughton 2011), much less is known about the structure of pay throughout firms and the incentives tied to

non-executive compensation, from both upward and downward comparisons. Given that internal mobility is one of the most common forms of promotion and job transition, not just within the C-suite but throughout firms when searching for workers to fill roles, investigating the connection between pay structures at the top and middle of firm compensation levels is central to understanding how firms motivate work forces and provide value to shareholders. This study provides evidence of a link between compensation structures as the top and middle of the firm, in addition to corporate performance. In doing so, this analysis affirms research suggesting corporate culture is set from the top down. We also offer empirical evidence that consistent hierarchical pay structures both within the C-suite (e.g., the executive pay gap) and throughout the rest of the firm (e.g., the CEO pay ratio) benefit shareholders. The remainder of this paper is organized as follows. Section II introduces the background, while Section III discusses the methodology and results before Section IV concludes.

## **II. Background and Related Literature**

Researchers across a variety of disciplines, from economics and finance to human resources and management, have studied organizational structure and the relation between compensation across different individuals and the performance resulting from a number of pay structures. In general, firms strive to select optimal CEOs and structure compensation to align incentives of management with those of shareholders (Jensen and Meckling, 1976; Bebchuk and Fried, 2003).

### ***A. Comparison of Equity and Tournament Theories***

However, some researchers have developed a theory that draws from the literature of other-regarding preferences within economics, with employees seeking equality and fairness compared to each other (Bolton and Ockenfels, 2000; Cooper and Kagel, 2016; Finkelstein, Hambrick, and Cannella, 2009; Connelly, Haynes, Tihanyi, Gamache, and Devers, 2016). For example, Cowherd

and Levine (1992) suggest differences in pay may reduce employee motivation and discourage effort. Similarly, Becker and Huselid (1992) argue it may lead to excess risk taking to win, which can result in negative outcomes like employee turnover (Bloom and Michel, 2002; Dye, 1984; Gupta et al., 2012; Cornelißen, Himmler, and Koenig, 2011; Bloom, 1999). Some research also provides evidence consistent with equity theory by finding a negative relation between pay dispersion and performance (Fredrickson, Davis-Blake, and Sanders, 2010; Grund and Westergaard-Nielsen, 2008; Siegel and Hambrick, 2005; Blank, Hadley, Minnick, and Rivolta, 2021).

More recently, Edmans, Gosling, and Jenter (2021) indicate that pay is relative to a variety of reference points and external factors, noting that CEOs and corporate stakeholders care about the fairness of pay and perceptions thereof. They even observe that 67% of directors would sacrifice shareholder value to avoid CEO pay controversies, suggesting that the perception of fairness is pivotal to decision-making.

In contrast to the equity theory, some researchers suggest it is firm outcomes that should dictate the compensation-setting process. This led to the development of a literature examining corporate outcomes resulting from competition over pay or so-called tournaments. Tournaments are contests in which candidates compete for prizes awarded by relative rank. The goal is to design a competition that incentivizes those involved to put forth the optimal level of effort (Becker and Huselid, 1992; Lazear, 1999). To maximize employee productivity and firm performance, prizes are often set through high compensation, since relatively small pay raises (i.e., prizes) do not sufficiently motivate competition or could even result in drops in productivity from the tournament candidates (Knoeber, 1989; Knoeber and Thurman, 1994; Lazear and Rosen, 1981). These findings are consistent with much of the literature on tournament theory documenting corporate



benefits from large pay differentials as tournament incentives (Kale, Reis, and Venkateswaran 2009; Kini and Williams 2012; Burns, Minnick, and Starks 2017; Lee, Lev, and Yeo, 2008).

While tournament theory is often studied within the context of top executives, other scholars have also linked pay dispersion and incentive compensation to performance among mutual fund managers (Brown, Harlow, and Starks, 1996; Chen, Hughson, and Stoughton, 2011), professors (Gomez-Mejia, Trevino, and Mixon, 2009), lawyers (Price, 2003), coaches (Fee, Hadlock, and Pierce, 2006), athletes (Frick, 2003), such as golfers (Ehrenberg and Bognanno, 1990) and race-car drivers (Brown, 2011; Becker and Huselid, 1992), football teams (Adcroft and Teckman, 2009), and even drug dealers (Levitt and Dubner, 2009). Researchers also extend analysis of corporate tournaments beyond internal pay structures by investigating how industry and local tournament incentives motivate executives' performance (Coles, Li, and Wang, 2018; Ma, Pan, and Stubben, 2020). As a result, tournament theory may have important implications for any group of individuals competing for an opportunity or prize, including non-executive employees within the firm as well.

### ***B. Early Pay Dispersion Measurement throughout Firms***

Compensation data limitations have constrained research from using broad samples with precise measures when studying differences in pay throughout the firm. Some early studies rely on voluntarily disclosed (Cullen and Perez-Truglia, 2022), experimental (Kelly and Seow, 2016), or specific firm (Brown, 1999) or industry data (Crawford et al., 2018), yet find positive implications of pay dispersion (Faleye et al., 2013; Cheng et al., 2017). Other countries sometimes offer data such that Mueller, Ouimet, and Simintzi (2017a) analyze UK firms, while Dittmann, Montone, and Zhu (2023) examine performance of German firms, with large gaps in wages.

However, much of the research on smaller samples of firms, in smaller countries, or using earlier data before CEO pay became such a lightning rod may not be generalizable.

Some of this early research suggests employees may be motivated by the compensation of their managers or higher-ranking employees at the firm as they aspire toward future career goals. However, employees could also be motivated by looking downward at compensation of those at or below their level, which could also induce effort toward self enhancement and higher self-esteem (Goethals and Darley, 1977; Wills, 1981; Chi, Liao, Wang, Zhao, and Ye, 2018; Perez-Truglia, 2020). Further, using matched employer-employee data on nearly 10,000 managers Heyman (2005) finds a positive link between wage dispersion and profit for both executives and rank-and-file workers. Moreover, Faleye et al. (2013) note the importance of not only the CEO's power relative to those with whom the executive works, but also that of employees relative to management, indicating that the hierarchy of pay throughout the firm may be worth studying.

Although data constraints limit research on pay dispersion throughout firms, researchers have used the ratio of the CEO's pay to that of an average executive to proxy for excessive CEO pay. The ratio may indicate whether high compensation of a CEO is the result of effective incentive alignment or rent extraction. Some propose higher pay of CEOs relative to other executives may measure managerial power and harm firm value (Yermack, 1996; Gompers, Ishii, and Metrick, 2003; Bebchuk, Cremers, and Peyer, 2011). Nevertheless, other scholars theorize that high ratios are necessary to retain superior, talented CEOs, where pay differentials of those managers and downward comparison ultimately result in improved efficiency and firm performance (Gabaix and Landier, 2008; Bloom, 2017; Cheng, Ranasinghe, and Zhao, 2017; Atay, 2019).

Finally, a third group of researchers observes no relation at all (Axelsson and Ulander, 2017), suggesting the empirical question remains unanswered. Gupta, Conroy, and Delery (2012)

argue this is due to measurement concerns affecting pay variation studies. For example, Li, Dasgupta, and Marler (2021) demonstrate the complexity of executive pay dispersion and its impact on the firm by showing that the unexplained portion of pay dispersion is negatively linked to short-term performance, while the explained portion is positively related to long-term firm performance. Overall, the research on pay inequality could benefit from a broader investigation of the hierarchical pay throughout firms and its implications. Given data limitations and selection biases that result from voluntary disclosure, the SEC recently mandated that firms provide the ratio of CEO and employee pay.

***C. CEO Pay Ratio Background: CEO and Median Employee Compensation***

The ratio of CEO pay to that of the median employee at the firm has become increasingly contentious as focus on pay disparities has risen since the financial crisis (Murphy and Zabojnik, 2004; Gordon and Dew-Becker 2007; Kaplan and Rauh, 2009, 2013; Piketty, 2015; Mueller et al., 2017a; Mueller et al., 2017b). Following the 2010 Dodd-Frank Wall Street Reform and Consumer Protection Act, debate regarding disclosing the ratio of CEO and median employee compensation arose as lawmakers sought to avoid a future crisis. In 2015, the SEC passed a rule requiring firms to disclose the ratio of pay between CEO and the average employee beginning for fiscal years that start on or after January 1, 2017. However, some argue the costs of disclosing the ratio exceed the information it provides (Loh, 2016; Parrino, 2016). Further, shareholders may be the ones bearing the costs and consequences from responses to perceived high ratios by rule-makers and other stakeholders. Still, others believe the ratio can inform shareholders regarding low employee morale, discourage pay practices that lead to the financial crisis, and demonstrate firms' long-term focus (Shorter, 2013; Paulo and le Roux, 2016).

While most researchers have yet to investigate the topic since the rule change, Boone, Starkweather, and White (2021) offer a study on the ratio of CEO pay to median employees following the SEC's rule. They observe that firms attempt to spin the CEO pay ratio by providing longer narratives and using more exemptions before disclosing above average ratios. Boone et al. (2020) find, however, these efforts exacerbate negative media attention, increase shareholder dissent on say-on-pay votes and diminish labor productivity. In addition to the complexity they demonstrate, a related study by Rouen (2020) also shows that the ratio of CEO and median employee pay is multi-faceted, noting that the ratio is not directly linked to performance and, therefore, must be more carefully investigated to understand additional context at the firm to comprehend the implications of pay disparity. Finally, Pan, Pikulina, Siegel, and Wang (2022) provide evidence that investor preferences regarding pay inequality could impact firm value through their rebalancing decisions favoring firms with relatively low CEO pay ratios. As a result, researchers may need to analyze multiple pay dispersion measures to study the hierarchical pay structure at the firm.

Given the controversy surrounding this new ratio and uncertainty regarding firm decision-making, additional analysis is imperative to an informed decision for rule makers moving forward. With the limitations of prior research on hierarchical compensation and new information regarding the compensation of CEOs relative to median employees, researchers have a new opportunity to provide a more comprehensive review of compensation throughout firms. Further, the ratio of pay between CEOs and the median employee may proxy for the overall hierarchical nature of compensation structure throughout the firm. Additionally, the structure of compensation among CEOs, other executives and the remaining employees may be related to incentivizing productivity. Overall, the relation between the CEO pay ratio, executive pay structure, and hierarchical pay with

corporate culture and firm performance remains an open empirical question, which this study investigates.

### **III. Methodology and Results**

To explore the impact of executive incentives prior to becoming CEO on relative CEO compensation, we use Compustat's ExecuComp database covering current and former S&P 1500 firms. These data allow us to analyze and understand the information provided by disclosure of a firm's ratio of pay for the CEO relative to median employee as well as executive incentives prior to CEO appointment and the resulting link to eventual compensation relative to other employees. We merge these datasets to Equilar data on the median employee pay, CEO pay, and CEO pay ratio, which measures the ratio of CEO pay to median employee pay for Russell 3000 companies beginning with the recent requirement for firms to disclose this information. Given that the SEC required to disclose the ratio only beginning with the 2018 proxy filing season, the sample is limited to, at most, three years for firms in our sample, since only a few firms disclose this information voluntarily the year prior to the mandate. Control variables, including stock returns and accounting information are collected from CRSP and Compustat. Using these data, we can also control for the effects related to firm and CEO characteristics. Overall, by employing the resulting dataset, we hope to learn about the role executive incentives play in levels and structures of relative CEO compensation compared to other executive and non-executive employees. Table 1 summarizes the sample of 6,189 firm-year observations beginning in 2017 and ending in 2019.

The mean (median) executive compensation for the sample is \$7,547,337 (\$5,193,846), while the median employee compensation for the sample is \$82,200 (\$64,730), resulting in an average ratio of 161 (76). The mean (median) total assets is \$19,208 (\$2,783) thousand and the

mean (median) book to market ratio is 0.65 (0.66). The sample of firms is relatively complex, with leverage of 28% of assets, and the mean (median) number of segments equal to 3 (2).

The average CEO in the sample is 58 years old with a tenure of approximately 10 years and cash compensation accounting for approximately one quarter of the CEO's pay. The mean tournament structure variables suggest that CEOs' pay accounts for 28.5% of all executive compensation at the firm (as a percentage of top five executives). Moreover, CEO makes 2.3 times more than the average non-CEO executive, with the mean (median) executive pay gap of \$2,714.5 (\$1,965.4) thousand. About 38% of CEOs in the sample also serve on the board of directors.

#### ***A. Univariate Comparison of Firm Characteristics by CEO Pay Ratio***

Next, we examine the univariate correlations and present the results in Table 2, which documents that CEO pay ratios are positively correlated with firm size (sales and market capitalization), ROA, leverage, firm age, and firm complexity, but negatively correlated with CEO tenure. This is consistent with our findings in multivariate results of our regression analyses where non-CEO executives and average workers are encouraged by the pay gap to improve the firm performance. We also observe that all tournament structure variables are positively and significantly correlated with each other. Finally, the median employee pay is negatively correlated with firm revenue, ROA, book-to-market, firm age, complexity, and (not surprisingly) CEO pay ratio, while it is positively linked to market capitalization.<sup>5</sup>

To begin our analysis of the ratio of CEO and median employee pay, we perform a univariate comparison of the sample by bifurcating on the median CEO pay ratio to compare above and below median firms. The results in Table III suggest the firms are different in nearly every

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<sup>5</sup> Since the median employee pay is the denominator of CEO pay ratio (ratio between the pay of the CEO and that of median employee at the firm), we should observe a negative relation as we observe the positive link between CEO pay ratios and variables that measure firm characteristics.

way. Firms with above median CEO pay ratios have median employee pay of \$60,130 compared to \$103,811 for low ratio firms. Moreover, CEO pay is approximately three times larger at high ratio firms, while the ratio is more than seven times as large for firms with above median ratios. Interestingly, when low CEO pay ratio and high CEO pay ratio firms are compared across measures of firm outcomes, the latter outperforms at statistically significant levels. Firms with higher pay ratios are larger and more profitable, with more segments and higher Herfindahl measures, while using more leverage and stock options. Firms with high CEO pay ratios also have higher residual compensation and tournament incentives. Given the differences in firm traits, we now proceed to multivariate analysis to account for these differences in characteristics.

**B. *Multivariate Analysis of CEO Pay Ratios and Tournament Incentives***

We investigate the role of tournament structure incentives in relative compensation of CEOs and other non-executive employees using the following pooled ordinary least squares multivariate regression model:

$$\begin{aligned}
 \text{CEO Pay Ratio}_{it} = & \lambda_0 + \lambda_1 \text{Tournament Incentives}_{it-1} + \lambda_2 \text{Log(Sales)}_{it-1} + \lambda_3 \text{Leverage}_{it-1} \quad (1) \\
 & + \lambda_4 \text{Firm Segments}_{it-1} + \lambda_5 \text{Market-to-Book}_{it-1} + \lambda_6 \text{ROA}_{it-1} \\
 & + \lambda_7 \text{CEO Director}_{it-1} + \lambda_8 \text{Herfindahl}_{it-1} \\
 & + \lambda_9 \text{Executive Experience}_{it-1} + \sum \text{Year}_{t-1} + \sum \text{Industry}_i + \mu_{it}
 \end{aligned}$$

For our primary empirical analysis, tournament incentives include the (1) Executive Pay Gap, dollar difference between the CEO and firm’s next three highest paid executives, (2) Executive Pay Ratio (Mean), the ratio of the CEO’s pay to the mean of the next four highest paid executives, (3) Executive Pay Ratio (Median), the ratio of the CEO’s pay to the median of the next four highest paid executives, and (4) Executive Pay Slice, the percentage of the top five highest paid executive’s compensation that the CEO receives. Table 4 presents the results.

In Panel A, Column 1 documents a positive (0.00419) and significant ( $p$ -value  $< 0.001$ ) relation between the executive pay gap and the ratio of the CEO to median employee pay. The coefficient implies that one unit standard deviation increase in executive pay gap will lead to an increase of 4.6% of standard deviation of CEO pay ratio or an increase of 16.8% in its mean, which is an economically large increase. Columns 2 through 4 document similarly positive and significant ( $p$ -values  $< 0.0129$ ) relations for the remaining tournament incentive variables. Column 5 relates all tournament incentive variables and demonstrates the relation is the strongest for the executive pay gap, with the economic magnitude being even larger after accounting for the impact of other tournament structure measures. Panel B performs similar analysis utilizing log transformations of tournament incentives variables and continues to document similarly positive and significant relations between tournament incentives and the CEO pay ratio, with the executive pay gap being the most significant. While it is common to add one to variables when employing log transformations, it is worth noting that to employ the log transformation for the executive pay gap, we have to add more than one. This is due to the negative values in instances where CEO compensation is lower than that of other executives, often resulting from CEOs taking very small or no compensation for a time. This leads to larger coefficients for the executive pay gap, however the findings and conclusions are unchanged.

Next, recognizing the similarities across tournament structure measures, we seek to analyze the shared components of tournament incentives compared to the individual measures to discern whether the executive pay gap simply measures facets of each tournament structure variable together. To do so, we standardize each variable and perform principal component analysis of the four tournament structure measures. One step in principal component analysis is to review the correlations across the measures, which we already noted are positive and significant, with all



exceeding 0.55 and three correlations exceeding 0.90. The initial factor procedure estimates the principal factors using squared multiple correlations with prior communality estimates resulting in 0.88, 0.32, 0.96, and 0.95, respectively for the pay slice, pay gap, mean pay ratio and median pay ratio. This suggests the pay gap has the least in common with the others, potentially explaining some of the differences across variables within the prior analysis. The resulting first factor has a proportion of 1.0096 and is therefore the only one retained. It contains a factor pattern of 0.94, 0.56, 9.99, and 0.97 for pay slice, pay gap, mean ratio, and median ratio, respectively. When scoring the standardized coefficients, the first factor leads to 0.14, 0.02, 0.61, and 0.24 for the pay slice, gap, mean ratio, and median ratio, respectively. Four similar methods were also considered and offer similar results. Table 5 presents the analysis.

Overall, the results and conclusions are consistent with those of the prior analysis. The tournament structure principal component is not significant throughout and the sign alternates. Despite its presence, each individual tournament incentive measure continues to be positive and significant until all are included in the final model, at which point the executive pay gap is the only variable that continues to be significant. Panel B demonstrates similar analysis using tournament incentives after log transformations are performed. The results persist and conclusions remain unchanged. The analysis supports the prior models, which document positive and significant relations between tournament incentives and CEO pay ratios, largely driven by the executive pay gap, suggesting the dollar difference between CEOs and other executives is the most predictive measure of the ratio of CEO compensation to that of the median firm employee's compensation.

### ***C. CEO Pay Ratios and Median Employee Pay***

Next, we explore whether tournament incentives are informative regarding the ratio of CEO pay to that of the median employee after controlling for the level of pay of the median

employee (Panel A) and CEO (Panel B) in Table 6. The results of Panel A demonstrate that tournament incentives continue to be positively and significantly linked to the CEO pay ratio, even after accounting for the negative link between median employee pay and the CEO pay ratio. Moreover, the economic magnitude continues to be at least as large, suggesting tournament incentives capture a corporate pay structure distinct from the level of compensation. Columns 1 to 4 show a positive (coefficients = 0.0048; 7.650; 7.694; 145.5, respectively) and significant (p-values < 0.001) link with each measure of tournament structure and the ratio of pay between CEOs and median employees. The results indicate each measure of tournament structure is positively and significantly related to the ratio of pay between CEOs and median employees. Still, the executive pay gap seems to have the most prominent relation. Panel B provides similar results, confirming the relations are not driven by the level of CEO compensation either. Column 1 shows a positive (coefficient = 0.00306) and significant (p-values < 0.01) relation between executive pay gap and the ratio of CEO to median employee pay. The results for other measures of tournament incentives suggest that the link with CEO pay ratio may be largely driven by the level of CEO compensation, indicating that, unlike executive pay gap, these tournament incentives measures may not provide sufficiently new information. Consequently, we focus on the executive pay gap for the remaining analysis. In additional untabulated analysis, we observe similar results when incorporating each component together in the same analysis. These results suggest tournament incentives remain significant predictors of the CEO pay ratio, even beyond the link with the individual pay level components of the ratio.

#### ***D. CEO Pay Ratios and Excess Compensation***

Given the robust link between tournament incentives and the ratio of pay between CEOs and non-executive employees, we now investigate the connection of expected and residual

compensation with tournament incentives and the CEO pay ratio. Table 7 presents the results. Column 1 analyzes the connection between CEO pay ratio and excess compensation, which is the residual of total and expected compensation following an approach similar to Core et al. (2008) to estimate the expected compensation a CEO would receive on average based on the firm's size, performance, and other relevant characteristics. The results show a positive (coefficient = 0.00478) and significant (p-value < 0.001) relation between our measure of excess compensation and the CEO pay ratio. The one difference between the measure employed in Column 1 and that of Core et al. (2008) is that tenure is excluded from the model to utilize a larger sample for analysis. Column 2 performs the same analysis utilizing the residual compensation that does incorporate CEO tenure and continues to document a positive (coefficient = 0.00398) and significant (p-value < 0.001) relation between excess compensation and the CEO pay ratio. Column 3 repeats this analysis accounting for the level of CEO compensation and provides similar results, documenting a positive (coefficient = 0.00220) and significant relation between excess compensation and the CEO pay ratio. The results in column 4 are similarly positive; however, the p-value is no longer statistically significant. Finally, Column 5 incorporates tournament incentives and documents that the relation between excess compensation and the CEO pay ratio is no longer significant, while the relation between the executive pay gap and the CEO pay ratio continues to be positive and significant. These findings suggest that the CEO pay ratio is not driven by overpaid CEOs as much as by non-CEOs who are compensated relatively lower and incentivized by the hierarchical structure of pay. Overall, these results continue to document the important relation between tournament incentives, as measured by the executive pay gap, and the ratio of pay between CEOs and median firm employees.

### ***E. Analysis of CEO Pay Ratios and Firm Performance***

Having established a link between tournament incentives and the CEO pay ratio, we now investigate the implications for firm performance. Table 8 presents the analysis of performance and efficiency for firms with high executive pay gaps and high CEO pay ratios. To compare high and low gap and ratio firms, we bifurcate the sample by median pay gaps and ratios. We investigate return-on-assets, profit margin, total asset turnover, equity multiplier, and the buy-and-hold return of the firm in columns 1 through 5, respectively. The results in column 1 suggest that, while high ratios of CEO to median employee pay are positively (coefficient = 0.0104) and significantly (p-value = 0.0687) related to firm accounting performance, the interactive impact of high CEO pay ratios and high executive pay gaps is economically larger (coefficient = 0.0221) and even more significant. These findings suggest that firms with higher CEO pay ratios have 1% higher ROA, while the interactive impact of both CEO high pay ratios and executive pay gaps has ROA over 2.2%.

We further investigate the relation between executive pay gap and CEO pay ratio and firm performance by decomposing the return on assets into total asset turnover and profit margin. Columns 2 and 3 show a positive (coefficients = 0.102; 0.0815, respectively) and significant (p-values < 0.05) link with high executive pay gaps and components of firm performance, namely profitability and efficiency. Similarly, firm profitability is positively linked to the ratio of CEO and median employee pay in column 2. Moreover, in both columns 2 and 3, we observe a positive interactive effect of high executive pay gaps and CEO pay ratios with profit margins, as well as total asset turnover. This implies that incentives generated via a larger pay dispersion throughout the firm's hierarchy are linked with not only better performance and profitability but also higher efficiency. Finally, columns 4 and 5 examine firm capital structure and stock performance, illustrating that the interaction of high CEO pay ratios and executive pay gaps are also linked to

higher firm leverage and better stock market performance. Taken together, these results suggest that firms with both high executive pay gaps and high CEO pay ratios could create a culture of incentives and hierarchical pay structures that lead to more efficient and profitable firms that employ riskier capital structures, resulting in higher accounting and stock performance. Overall, the findings in Table 8 imply that corporate performance benefits from the combination of high executive pay gaps and high CEO pay ratios via more efficient operations and superior profitability.

Next, in order to better understand the mechanism driving firm accounting performance, we examine the role the level of median employee pay plays. Ziano, Lembregts, and Pandelaere (2022) conduct five experiments with U.S. American and French participants to show people use median salaries more than ratios of CEO to median employee pay to assess fairness of compensation. As a result, in Table 9, we bifurcate the sample at the median to separately look at firms with high and low median employee pay and perform similar analyses to those presented in Table 8. Columns 1 and 2 examine return-on-assets for firms compensating their employees above and below median levels, while columns 3 and 4 perform similar analyses of return-on-equity. Columns 5 and 6 analyze firm profit margins. The results in column 1 indicate that firms with highly (i.e., above median) paid median employees have positive (coefficient = 0.0277) and significant ( $p$ -value < 0.1) links between return-on-assets and both the CEO pay ratio and the interaction of the pay ratio with the executive pay gap. This suggests the firms with more highly paid employees benefit from the tournament incentives of hierarchical pay. On the other hand, column 2 shows this relation does not exist for firms with below median employee compensation. The results are similar in columns 3 and 4 for return-on-equity, while columns 5 and 6 also present similar relations for firm profit margins, indicating that firms where employees are paid higher but

also potentially face compensation tournaments exhibit higher return-on-equity as well as higher profitability. Overall, this analysis suggests that firms with hierarchical pay structures and higher paid employees are able to more effectively motivate them to create a culture that contributes to firm performance.

Finally, we seek to explore the mechanism explaining how performance is linked to hierarchical pay. First, we examine investments in research and development and acquisitions, as well as selling, general and administrative (SG&A) expenses. Table 10 presents the results. Columns 1 and 2 analyze research and development, while columns 3 and 4 present the results assessing acquisitions, before the final two columns analyze SG&A expenses. Column 1 indicates that research and development is not significantly different for firms with stronger hierarchical pay structures and highly paid employees. On the other hand, column 2 suggests those firms with lower paid employees coupled with strong hierarchical pay structures have significantly lower research and development. This could be consistent with rent extraction or firms reallocating investments away from research toward employees at the top of the firm. Moreover, in columns 3 and 4, we perform a similar analysis with acquisitions and observe that firms with highly paid employees and hierarchical pay structures invest significantly more in acquisitions, while those with lower paid employees do not. In the final two columns of the table, we find that the higher accounting performance is not driven by lower SG&A expenses. Instead, we find that firms with below median compensation for their median employee also have higher SG&A expenses, as opposed to cutting all costs. These results suggest that firms with higher paid employees and hierarchical pay structure invest relatively higher volumes in acquisitions, while other firms invest less in research and development. Overall, these findings indicate firms can effectively motivate employees within high investment firms, seeking to improve firm performance and growth.

#### **IV. Conclusion**

The size of the CEO compensation has been discussed extensively in both academic literature and financial press, especially when this compensation is compared to the pay of an average employee. On one hand, the role of a CEO is undeniably important and their decisions have far-reaching and long-lasting consequences. On the other hand, the impact of the pay dispersion is also significant when it comes to employee morale. We investigate this situation through the lens of tournament incentives assessing whether pay competition can be applied not only to executives but also non-executive employees as well as what impact such pay structures have on firm performance. Relatively recent mandate by the SEC to disclose the CEO pay ratio, ratio between the pay of the CEO and that of the firm's median employee, allows us to analyze a number of the U.S. firms and expand our understanding of relative compensation, tournament incentives, and firm performance.

We find that the CEO pay ratio is positively related to tournament incentives, suggesting that when CEOs are paid more than other executives, it is also true relative to non-executive employees. This result is consistent with the idea that firms employ hierarchical pay structures not only within C-suite but also throughout the firm, potentially with the goal of developing a culture of competition across all employees that may be seeking to advance careers and gain promotion. Our findings also suggest the executive pay gap is most closely related to the CEO pay ratio. This relation persists after accounting for the level of median employee pay, the level of CEO compensation as well as excess CEO compensation, implying the executive pay gap offers information regarding the hierarchical pay structure beyond other measures of compensation and incentives. Moreover, given that the CEO pay ratio does not seem to be the result of excess compensation, the findings suggest the positive relation between the executive pay gap and the

CEO pay ratio is not driven by overpaid CEOs but more likely to be tied to other undercompensated employees at the firm.

Finally, we assess the implications of the link between tournament incentives and CEO pay ratio on the firm performance. We find that firms with high CEO pay ratios and high executive pay gaps exhibit significantly higher accounting and stock market performance, as well as more efficient and profitable operations that rely on more leverage. The results are driven by median employees who are paid at higher than median levels. These firms also invest significantly more in acquisitions, while firms with lower paid employees have significantly lower research and development. The finding suggests hierarchical pay structures set by the firms to emphasize tournament incentives, when coupled with relatively higher pay for employees, can benefit stockholders through improved operational efficiency and profitability. Overall, these findings inform compensation structures within firms by both linking tournament incentives within the C-suite to the hierarchical pay structure with non-executive employee compensation, as well as relating hierarchical pay throughout the firm (both within the top executives and outside thereof) with the performance of the firm.

This research contributes to the understanding of internal labor markets, specifically the role of tournament incentives within a firm as a way to motivate employees outside of C-suite to produce at the optimal level. Our findings suggest corporate culture emphasizing hierarchical pay can be set from the top down and have positive impact on the firm performance. Shareholders benefit when firms consistently incentivize well-paid employees with hierarchical compensation structures both across the C-suite (e.g., the executive pay gap) and throughout the rest of the firm (e.g., the CEO pay ratio). By assembling one of the broadest samples of corporate incentives to date, we offer evidence consistent with tournament theory throughout firms. Our findings can



improve the assessment of firms' cost-benefit analysis of incentivizing competition for promotion, not simply for the CEO position but throughout the firm. This also informs firm decisions to bear costs of high pay dispersion that can receive negative media attention, given that firms may benefit through better accounting and stock performance. Through this study, we have documented that tournament incentives and comparisons throughout the firm are central to understanding the relation between CEO pay and that of other non-executive employees, offering novel insight into the literature on executive incentives and labor markets more broadly. The study suggests that corporate performance is linked to this connection and therefore offers important insight for the shareholders. Having additional understanding of firm compensation and incentives helps inform the culture and how it ties to other corporate outcomes, which are important for not only shareholders but stakeholders as well.

## References

- Adcroft, A., Teckman, J., 2009. The impact of salary dispersion and performance bonuses in NFL organizations. *Management Decision*.
- Ataay, A., 2019. The Effects of Pay Dispersion Between Executives and Employees of an Organization on Firm Performance: Evidence from Turkey. In *The Cross-Disciplinary Perspectives of Management: Challenges and Opportunities*. Emerald Publishing Limited.
- Axelsson, J., Ulander, E., 2017. Does pay dispersion affect firm performance?: A study of publicly traded Swedish firms.
- Bebchuk, L. A., Cremers, K. J. M., Peyer, U. C., 2011. The CEO pay slice. *Journal of Financial Economics* 102(1), 199-221.
- Bebchuk, L. A., Fried, J. M., 2010. Paying for long-term performance. *University of Pennsylvania Law Review*, 1915-1959.
- Becker, B. E., Huselid, M. A., 1992. The incentive effects of tournament compensation systems. *Administrative Science Quarterly*, 336-350.
- Bertrand, M., 2009. CEOs. *Annual Review of Economics*. 121-149.
- Blank, B., Hadley, B., Minnick, K., Rivolta, M. L., 2022. A game of thrones—Dynamics of internal CEO succession and outcome. *European Financial Management*, 28(1), 280-324.
- Bloom, M., 1999. The performance effects of pay dispersion on individuals and organizations. *Academy of Management Journal*, 42: 25-40.
- Bloom, M., Michel, J. G., 2002. The relationships among organizational context, pay dispersion, and managerial turnover. *Academy of Management Journal*, 45:33-42.
- Bloom, R., 2017. The Median Employee to CEO Pay Ratio Disclosure Requirement. *Compensation & Benefits Review* 49, 34-37.
- Bolton, G. E., Ockenfels, A., 2000. ERC: A theory of equity, reciprocity, and competition. *American economic review*, 90(1), 166-193.
- Boone, A. L., Starkweather, A., White, J. T., 2021. Spinning the CEO Pay Ratio Disclosure. Available at SSRN 3481540.
- Brown, J., 2011. Quitters never win: The (adverse) incentive effects of competing with superstars. *Journal of Political Economy*, 119(5), 982-1013.
- Brown, K. C., Harlow, W. V., Starks, L. T., 1996. Of tournaments and temptations: An analysis of managerial incentives in the mutual fund industry. *The Journal of Finance*, 51(1), 85-110.
- Brown, M., 1999. Does Pay Structure Matter? A Comparison of a Flat and Hierarchical Pay Structure. *ACA Journal*, 8(2), 64-71.
- Burns, N., Minnick, K., Starks, L., 2017. CEO tournaments: A cross-country analysis of causes, cultural influences, and consequences. *Journal of Financial and Quantitative Analysis*, 52(2), 519-551.

- Chen, J., Hughson, E. N., Stoughton, N., 2018. Strategic mutual fund tournaments. *Available at SSRN 2023805*.
- Cheng, Q., Ranasinghe, T., Zhao, S., 2017. Do high CEO pay ratios destroy firm value? *Robert H. Smith School Research Paper No. RHS 2861680*.
- Chi, W., Liao, H., Wang, L., Zhao, R. and Ye, Q., 2019. Incentives to move up: Effects of pay gaps between levels on employee performance. *Human Resource Management Journal*, 29(2), 238-253.
- Coles, J. L., Li, Z., Wang, A. Y., 2018. Industry tournament incentives. *Review of Financial Studies*, 31(4), 1418-1459.
- Conyon, M. J., Read, L., 2000. The CEO-to-employee pay gap: evidence from UK firms. *Available at SSRN 2840487*.
- Connelly, B. L., Haynes, K. T., Tihanyi, L., Gamache, D. L. and Devers, C. E., 2016. Minding the gap: Antecedents and consequences of top management-to-worker pay dispersion. *Journal of Management*, 42(4), 862-885.
- Connelly, B. L., Tihanyi, L., Crook, T. R., Gangloff, K. A., 2014. Tournament theory: Thirty years of contests and competitions. *Journal of Management*, 40(1), 16-47.
- Cooper, D. J. and Kagel, J. H., 2016. Other-regarding preferences. *The handbook of experimental economics*, 2, 217.
- Cornelißen, T., Himmler, O., Koenig, T., 2011. Perceived unfairness in CEO compensation and work morale. *Economics Letters*, 110(1), 45-48.
- Cowherd, D. M., Levine, D. I., 1992. Product quality and pay equity between lower-level employees and top management: An investigation of distributive justice theory. *Administrative Science Quarterly*, 37: 302-320.
- Crawford, S., Nelson, K. K., Rountree, B., 2018. Mind the Gap: CEO-Employee Pay Ratios and Shareholder Say-on-Pay Votes. *Available at SSRN 2529112*.
- Cullen, Z., Perez-Truglia, R., 2022. How Much Does Your Boss Make? The Effects of Salary Comparisons. *Journal of Political Economy* 130(3) 766-822.
- Cvijanovic, D., Gantchev, N., Hwang, S., 2018. Changing of the guards: does succession planning matter? *Working paper*.
- Dittmann, I., Montone, M., Zhu, Y., 2023. Wage gap and stock returns: do investors dislike pay inequality? *Journal of Corporate Finance*, 78, 102322.
- Dye, R. A. 1984. The trouble with tournaments. *Economic Inquiry*, 22: 147-149.
- Edmans, A., Gabaix, X., Sadzik, T., Sannikov, Y., 2012. Dynamic CEO Compensation. *Journal of Finance* 67, 1603-1647.
- Edmans, A., Gosling, T., Jenter, D., 2021. CEO compensation: Evidence from the field. *London Business School Working Paper*.
- Ehrenberg, R. G., Bognanno, M. L., 1990. Do tournaments have incentive effects?. *Journal of political Economy*, 98(6), 1307-1324.

- Faleye, O., Reis, E., Venkateswaran, A., 2013. The determinants and effects of CEO-employee pay ratios. *Journal of Banking & Finance* 37, 3258-3272.
- Fama, E. F., Jensen, M. C., 1983. Agency problems and residual claims. *The Journal of Law and Economics*, 26(2), 327-349.
- Fee, C. E., Hadlock, C. J., Pierce, J. R., 2006. Promotions in the internal and external labor market: Evidence from professional football coaching careers. *The Journal of Business*, 79(2), 821-850.
- Fredrickson, J. W., Davis-Blake, A., Sanders, W. M. G., 2010. Sharing the wealth: Social comparisons and pay dispersion in the CEOs top team. *Strategic Management Journal*, 31: 1031-1053.
- Frick, B., 2003. Contest theory and sport. *Oxford Review of Economic Policy*, 19: 512-529.
- Frydman, C., Saks, R.E., 2010. Executive Compensation: A New View from a Long-Term Perspective, 1936–2005. *Review of Financial Studies* 23, 2099-2138.
- Gabaix, X., Landier, A., 2008. Why has CEO Pay Increased So Much? *Quarterly Journal of Economics* 123, 49-100.
- Goethals, G. R., & Darley, J. M., 1977. Social comparison theory: An attributional approach. *Social comparison processes: Theoretical and empirical perspectives*, 259-278.
- Gompers, P., Ishii, J., Metrick, A., 2003. Corporate governance and equity prices. *Quarterly Journal of Economics*, 118(1), 107-156.
- Gomez-Mejia, L., Trevino, L. J., Mixon, F. G., 2009. Winning the tournament for named professorships in management. *International Journal of Human Resource Management*, 20: 1843-1863.
- Gordon, R.J., Dew-Becker, I., 2007. Selected issues in the rise of income inequality. *Brookings Papers on Economic Activity* 2007, 169-190.
- Gupta, N., Conroy, S. A., Delery, J. E., 2012. The many faces of pay variation. *Human Resource Management Review*, 22: 100-115.
- Green, J., Stokey, N., 1983. A Comparison of Tournaments and Contracts, *Journal of Political Economy*, 91, 349–64.
- Grund, C., Westergaard-Nielsen, N., 2008. The dispersion of employees' wage increases and firm performance. *Industrial and Labor Relations Review*, 61: 485-501.
- Heyman, F., 2005. Pay inequality and firm performance: evidence from matched employer–employee data. *Applied Economics*, 37(11), 1313-1327.
- Jensen, M. C., Meckling, W. H., 1976. Theory of the Firm: Managerial Behavior, Agency Costs and Ownership Structure. *Journal of Financial Economics*, 3(4), 305-360.
- Jenter, D., Matveyev, E., Roth, L., 2016. Good and Bad CEOs. *London School of Economics Working Paper*.
- Kale, J. R., Reis, E. Venkateswaran, A., 2009. Rank-order tournaments and incentive alignment: The effect on firm performance. *The Journal of Finance*, 64(3), 1479-1512.
- Kaplan, S. N., 2008. Are U.S. CEOs Overpaid? *Academy of Management Perspectives* 22, 5-20.

- Kaplan, S. N., Rauh, J., 2009. Wall Street and Main Street: What Contributes to the Rise in the Highest Incomes? *Review of Financial Studies* 23, 1004-1050.
- Kaplan, S. N., Rauh, J., 2013. It's the Market: The Broad-Based Rise in the Return to Top Talent. *Journal of Economic Perspectives* 27, 35-56.
- Kelly, K., Seow, J. L., 2016. Investor Reactions to Company Disclosure of High CEO Pay and High CEO-to-Employee Pay Ratio: An Experimental Investigation. *Journal of Management Accounting Research* 28, 107-125.
- Kini, O., Williams, R., 2012. Tournament incentives, firm risk, and corporate policies. *Journal of Financial Economics*, 103(2), 350-376.
- Knoeber, C. R., 1989. Real game of chickens: Contracts, tournaments, and the production of broilers. *Journal of Law, Economics and Organization*, 5: 271-292.
- Knoeber, C. R., Thurman, W. N., 1994. Testing the theory of tournaments: An empirical analysis of broiler production. *Journal of Labor Economics*, 12: 155-179.
- Lazear, E. P., Rosen, S., 1981, Rank-Order Tournaments as Optimum Labor Contracts. *Journal of Political Economy*, 89(5), 841-864.
- Lee, K. W., Lev, B., Yeo, G. H. H., 2008. Executive pay dispersion, corporate governance, and firm performance. *Review of Quantitative Finance and Accounting*, 30(3), 315-338.
- Levitt, S. D., Dubner, S.J., 2014. *Think like a freak*. Harper Audio.
- Li, Z., Daspit, J. J., Marler, L. E., 2022. Executive pay dispersion: Reconciling the differing effects of pay inequality and pay inequity on firm performance. *The International Journal of Human Resource Management*, 33(15), 3056-3084.
- Loh, J., 2016. Could the Pay Ratio Disclosure Backfire: Examining the Effects of the SEC's Pay Ratio Disclosure Rule. *Tex. A&M L. Rev.* 4, 417.
- Ma, M., Pan, J., Stubben, S. R., 2020. The Effect of Local Tournament Incentives on Firms' Performance, Risk-Taking Decisions, and Financial Reporting Decisions. *The Accounting Review*, 95(2), 283-309.
- Malcomson, J. M., 1984. Work incentives, hierarchy, and internal labor markets. *Journal of Political Economy*, 92(3), 486-507.
- McConnell, J. J., Qi, Q., 2018. Does CEO succession planning create shareholder value? *Working paper*.
- Mobbs, S., Raheja, C. G., 2012. Internal managerial promotions: Insider incentives and CEO succession. *Journal of Corporate Finance*, 18(5), 1337-1353.
- Mueller, H. M., Ouimet, P. P., Simintzi, E., 2017a. Within-Firm Pay Inequality. *Review of Financial Studies* 30, 3605-3635.
- Mueller, H. M., Ouimet, P. P., Simintzi, E., 2017b. Wage Inequality and Firm Growth. *American Economic Review* 107, 379-83.
- Murphy, K. J., 1999. Chapter 38 Executive compensation. In: *Handbook of Labor Economics*. Elsevier, pp. 2485-2563.

- Murphy, K. J., Jensen, M. C., 2018. The politics of pay: The unintended consequences of regulating executive compensation. *USC Law Legal Studies Paper*.
- Murphy, K. J., Zabojnik, J., 2004. New developments in human-capital theory - CEO pay and appointments: A market-based explanation for recent trends. *American Economic Review* 94, 192-196.
- Naveen, L., 2006. Organizational Complexity and Succession Planning, *Journal of Financial and Quantitative Analysis*, 41(3), 661-683.
- Nishi, A., Shirado, H., Rand, D. G., Christakis, N. A., 2015. Inequality and visibility of wealth in experimental social networks. *Nature*, 526(7573), 426-429.
- Pan, Y., Pikulina, E. S., Siegel, S., Wang, T. Y., 2022. Do equity markets care about income inequality? Evidence from pay ratio disclosure. *The Journal of Finance*, 77(2), 1371-1411.
- Paulo, S., Le roux, P., 2016. The 'pay ratio' provision of the Dodd-Frank Act 2010 and presentation of the Paulo–Le Roux Index. 2016 14.
- Parrino, R. J., 2016. SEC adopts rule to implement Dodd-Frank CEO pay ratio disclosure requirement. *Journal of Investment Compliance* 17, 122-130.
- Perez-Truglia, R., 2020. The effects of income transparency on well-being: Evidence from a natural experiment. *American Economic Review*, 110(4), 1019-54.
- Piketty, T., 2015. About Capital in the Twenty-First Century. *American Economic Review* 105, 48-53.
- Price, B. M., 2003. How green was my valley? An examination of tournament theory as a governance mechanism in Silicon Valley law firms. *Law and Society Review*, 37: 731-764.
- Rosen, S., 1986. Prizes and Incentives in Elimination Tournaments, *American Economic Review*, 76, 701–15.
- Rouen, E., 2020. Rethinking measurement of pay disparity and its relation to firm performance. *The Accounting Review*, 95(1), 343-378.
- Shi, W., Zhang, Y., Hoskisson, R. E., 2017. Ripple effects of CEO awards: Investigating the acquisition activities of superstar CEOs' competitors. *Strategic Management Journal*, 38(10), 2080-2102.
- Shorter, G. W., 2013. The "Pay Ratio Provision" in the Dodd-Frank Act: Legislation to Repeal it in the 113th Congress. *Congressional Research Service*.
- Siegel, P. A., Hambrick, D. C., 2005. Pay disparities within top management groups: Evidence of harmful effects on performance of high-technology firms. *Organization Science*, 16: 259-274.
- Quigley, T. J., Hambrick, D. C., 2015. Has the “CEO effect” increased in recent decades? A new explanation for the great rise in America's attention to corporate leaders. *Strategic Management Journal* 36, 821-830.
- Wills, T. A., 1981. Downward comparison principles in social psychology. *Psychological bulletin*, 90(2), 245.

- Yermack, D., 1996. Higher market valuation of companies with a small board of directors. *Journal of financial economics*, 40(2), 185-211.
- Ziano, I., Lembregts, C., Pandelaere, M., 2022. People weigh salaries more than ratios in judgments of income inequality, fairness, and demands for redistribution. *Journal of Economic Psychology*, 89, 102495.

**Table 1 – Summary Statistics**

Table 1 presents summary statistics for the sample, including firm and executive characteristics. Executive compensation details are presented in thousands of US dollars. Data come from Compustat for financial and accounting information, CRSP for stock performance, and Equilar for CEO Pay ratio and median employee compensation information, while ExecuComp contains information on executive characteristics and compensation. More detailed definitions for variables are included in the Appendix.

Variable	N	Mean	Std. Dev.	Percentile		
				25th	Median	75th
Median Employee Compensation	6,178	82,200	63,975	45,050	64,730	100,926
CEO Compensation	6,189	7,547	30,000	2,707	5,194	9,238
CEO to Median Employee Pay Ratio	6,189	161	592	36	76	157
Corporate Revenue	6,168	6,256	21,137	403	1,261	4,102
Firm Assets	6,169	19,208	108,618	964	2,783	8,884
Log (Sales)	6,167	7.11	1.91	6.00	7.14	8.32
Market-to-Book Ratio	6,158	2.19	2.45	1.13	1.54	2.40
Return-on-Assets	6,168	0.014	0.170	0.007	0.029	0.067
Book-to-Market Ratio	6,152	0.65	0.29	0.42	0.66	0.90
Market Capitalization	6,161	11,790.25	41,288.90	874.60	2,377.07	7,314.22
Leverage	6,148	0.28	0.25	0.08	0.25	0.41
R&D Ratio	3,227	4.34	86.50	-	0.02	0.13
Salary	4,238	708	435	415	633	950
Stock Awards	4,238	2,606	4,412	381	1,257	3,250
CEO Ownership	3,992	1.2	3.9	0.1	0.2	0.7
CEO Age	4,234	58.0	7.6	53.0	58.0	62.0
Exercisable CEO Unexercised Options	4,201	7,456.4	40,041.1	-	-	2,056.8
Unexercisable CEO Unexercised Options	4,201	1,287.3	5,723.3	-	-	446.8
Total CEO Pension Value	4,201	2,186.7	7,428.4	-	-	118.8
Cash Percentage of Compensation	4,196	0.29	0.21	0.14	0.23	0.37
CEO Tenure	2,131	10.42	8.80	4.06	8.09	14.01
Salary and Bonus Compensation	4,238	834.3	996.4	437.7	683.0	1,000.0
Equity Compensation	4,196	2,845.5	4,875.9	348.5	1,275.6	3,600.2
Stock Performance	5,870	17.2	571.1	(0.3)	0.2	1.8
Firm Age	5,911	25.6	19.6	11.0	22.0	33.0
Size and Industry Adjusted ROA	6,168	(0.019)	0.163	(0.022)	-	0.025
Size and Industry Adjusted Return	5,870	14.3	560.3	(0.3)	-	0.6
Firm Mean Compensation	2,557	2,714.5	3,439.8	1,216.4	1,965.4	3,212.3
Executive Pay Ratio (Mean)	2,528	2.3	3.2	0.9	1.5	2.9
Executive Pay Ratio (Median)	2,522	2.4	3.2	1.0	1.6	3.1
Pay Gap	2,614	2,180.6	6,463.6	(240.6)	716.4	3,656.5
Pay Slice	2,306	0.285	0.193	0.135	0.224	0.413
CEO Director	6,189	0.377	0.485	-	-	1.000
Firm Segments	5,496	3.0	1.9	2.0	2.0	4.0
Herfindahl	4,213	0.264	0.227	0.103	0.196	0.354
Executive Experience	4,123	0.379	0.485	-	-	1.000
Firm Complexity	5,473	(0.122)	0.614	(0.524)	(0.154)	0.231



**Table 2 – Correlation Matrix**

Table 2 provides correlations for firm and executive characteristics for the sample of firm and executive characteristics, including the ratio of CEO to median employee pay using listwise deletion. Variable definitions are included in the Appendix. P-values are presented in parentheses below the coefficients. \*, \*\*, and \*\*\* indicate significance at the 0.10, 0.05, and 0.01 levels, respectively.

	Median Employee Pay	CEO Pay	CEO Pay Ratio	Log (Sales)	Return-on-Assets	Book-to-Market Ratio	Market Capitalization	Leverage	CEO Tenure	Stock Performance	Firm Age	Executive Pay Ratio (Mean)	Pay Gap	Pay Slice	Executive Experience
CEO Pay	0.015 (0.244)	1.000													
Pay Ratio	-0.149*** (0.000)	0.892*** (0.000)	1.000												
Log (Sales)	-0.310*** (0.000)	0.138*** (0.000)	0.171*** (0.000)	1.000											
ROA	-0.336*** (0.000)	0.017 (0.176)	0.051*** (0.000)	0.412*** (0.000)	1.000										
Book/Market	-0.126*** (0.000)	-0.039*** (0.002)	-0.047*** (0.000)	0.083*** (0.000)	0.027** (0.036)	1.000									
Market Cap	0.043*** (0.001)	0.122*** (0.000)	0.072*** (0.000)	0.412*** (0.000)	0.087*** (0.000)	-0.118*** (0.000)	1.000								
Leverage	-0.006 (0.639)	0.029** (0.022)	0.046*** (0.000)	0.166*** (0.000)	-0.003 (0.828)	-0.035*** (0.006)	0.014 (0.279)	1.000							
CEO Tenure	-0.042* (0.053)	-0.033 (0.125)	-0.054** (0.013)	-0.038* (0.077)	0.066*** (0.002)	-0.029 (0.176)	0.001 (0.975)	-0.136*** (0.000)	1.000						
Stock Returns	-0.001 (0.936)	0.004 (0.746)	0.009 (0.508)	0.011 (0.386)	0.000 (0.988)	-0.017 (0.198)	-0.005 (0.704)	0.037*** (0.005)	-0.035 (0.108)	1.000					
Firm Age	-0.130*** (0.000)	0.034*** (0.008)	0.042*** (0.001)	0.358*** (0.000)	0.149*** (0.000)	0.017 (0.180)	0.204*** (0.000)	-0.025* (0.051)	0.031 (0.149)	-0.003 (0.790)	1.000				
Mean Ratio	0.005 (0.792)	0.007 (0.728)	0.006 (0.764)	0.025 (0.205)	0.017 (0.399)	-0.062*** (0.002)	0.001 (0.951)	0.044** (0.028)	-0.058** (0.036)	0.128*** (0.000)	0.024 (0.228)	1.000			
Pay Gap	-0.002 (0.928)	0.022 (0.262)	0.020 (0.297)	0.140*** (0.000)	0.011 (0.571)	-0.021 (0.287)	-0.065*** (0.001)	0.065*** (0.001)	-0.088*** (0.001)	0.069*** (0.000)	0.070*** (0.000)	0.627*** (0.000)	1.000		
Pay Slice	-0.033 (0.110)	-0.007 (0.728)	-0.006 (0.777)	0.076*** (0.000)	0.026 (0.207)	-0.024 (0.248)	0.001 (0.973)	0.030 (0.145)	-0.122*** (0.000)	0.016 (0.460)	0.089*** (0.000)	0.888*** (0.000)	0.613*** (0.000)	1.000	
Experience	-0.002 (0.875)	0.091*** (0.000)	0.059*** (0.000)	0.103*** (0.000)	-0.063*** (0.000)	0.021 (0.180)	0.029* (0.060)	0.052*** (0.001)	-0.203*** (0.000)	-0.003 (0.867)	-0.073*** (0.000)	0.004 (0.839)	-0.020 (0.310)	-0.077*** (0.000)	1.000
Complexity	-0.339*** (0.000)	0.106*** (0.000)	0.127*** (0.000)	0.859*** (0.000)	0.336*** (0.000)	0.182*** (0.000)	0.345*** (0.000)	0.207*** (0.000)	-0.039* (0.081)	0.006 (0.674)	0.395*** (0.000)	0.013 (0.532)	0.104*** (0.000)	0.070*** (0.001)	0.083*** (0.000)

**Table 3 – Univariate Comparison by CEO Pay Ratio**

Table 3 summarizes firm and executive characteristics for the sample by the ratio of CEO to median employee pay. Samples are bifurcated at the CEO Pay Ratio Median of 76. Executive compensation details are presented in thousands of US dollars. Variable definitions are included in the Appendix. Robust two-tailed t-statistics are presented in parentheses below the coefficients. \*, \*\*, and \*\*\* indicate significance at the 0.10, 0.05, and 0.01 levels, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
	Low Pay Ratio		High Pay Ratio		Difference	
	N	Mean	N	Mean	(2) – (4)	T-Statistic
Median Employee Pay	3,094	103,811	3,075	60,130	(43,681)	28.76***
CEO Pay	3,100	3,472,640	3,080	11,700,000	8,227,360	10.81***
CEO Pay Ratio	3,100	37	3,080	285	247	16.77***
Corporate Revenue	3,089	1,401	3,070	11,153	9,752	18.59***
Firm Assets	3,089	4,739	3,071	33,804	29,065	10.59***
Net Income	3,089	90.94	3,070	914.13	823.19	15.07***
Log (Sales)	3,088	6.02	3,070	8.21	2.19	54.93***
Return-on-Assets	3,089	(0.02)	3,070	0.05	0.06	14.86***
Book-to-Market Ratio	3,083	0.67	3,060	0.63	(0.04)	5.58***
Market Capitalization	3,087	3,791.19	3,065	19,872.39	16,081.20	15.56***
Leverage	3,077	0.24	3,062	0.32	0.07	11.56***
R&D Ratio	1,478	9	1,744	1	(8)	2.56**
Salary	1,656	533	2,576	820	287	23.79***
Stock Awards	1,656	1,280.5	2,576	3,401.8	2,121.3	16.38***
CEO Ownership	1,567	1.6	2,428	1.1	(0.5)	3.85***
CEO Age	1,656	57.5	2,576	58.4	0.9	3.53***
Exercisable Unexercised Options	1,642	3,826.0	2,556	10,156.1	6,330.1	4.7***
Unexercisable Options	1,642	814.4	2,556	1,578.3	763.9	4.27***
Total CEO Pension Value	1,642	729.3	2,556	3,149.6	2,420.2	10.43***
CEO Compensation (Execucomp)	1,642	2,639.54	2,556	6,400.25	3,760.71	21.28***
Cash Percentage of Compensation	1,639	0.36	2,555	0.24	(0.11)	17.41***
CEO Tenure	735	11.6	1,401	10.0	(1.5)	3.82***
Salary and Bonus Compensation	1,656	606.1	2,576	982.7	376.7	12.3***
Equity Compensation	1,639	1,398.1	2,555	3,747.1	2,349.0	16.19***
Stock Performance	2,918	5.706	2,944	28.627	22.921	1.54
Firm Age	2,938	21.0	2,964	30.2	9.2	18.51***
Size and Industry Adjusted ROA	3,089	(0.039)	3,070	0.001	0.040	9.78***
Size and Industry Adjusted Return	2,918	4.2	2,944	24.3	20.1	1.37
Firm Mean Compensation	963	1,802.8	1,590	3,263.6	1,460.9	10.62***
Executive Pay Ratio (Mean)	952	2.0	1,575	2.5	0.5	3.82***
Executive Pay Ratio (Median)	950	2.1	1,570	2.6	0.6	4.2***
Pay Gap	1,004	809.0	1,609	2,984.9	2,175.9	8.51***
Pay Slice	846	0.260	1,458	0.296	0.036	4.38***
CEO Director	3,100	0.271	3,080	0.495	0.224	18.6***
Firm Segments	2,551	2.5	2,936	3.4	0.8	16.4***
Herfindahl	1,648	0.221	2,559	0.292	0.072	10.1***
Executive Experience	1,579	0.318	2,538	0.416	0.099	6.37***
Firm Complexity	2,538	(0.446)	2,926	0.159	0.605	41.78***
Residual Compensation (With Tenure)	444	389.168	860	2,165.416	1,776.248	4.61***
Excess Comp (Without Tenure)	988	452.028	1,580	1,954.162	1,502.134	6.81***

**Table 4 – Multivariate Analysis of CEO Pay Ratio**

Table 4 presents multivariate analysis of CEO pay ratio and tournament structure after accounting for the impact of firm and executive characteristics. Panel A presents standard tournament structure measures in the raw values, while Panel B analyzes CEO pay ratio and tournament structure after transforming the tournament structure variables. Variable definitions are included in the Appendix. Robust p-values are presented in parentheses below the coefficients. \*, \*\*, and \*\*\* indicate significance at the 0.10, 0.05, and 0.01 levels, respectively.

***Panel A: Analysis of Executive Pay Gap and Tournament Structure Incentives***

	(1)	(2)	(3)	(4)	(5)
	Ratio of CEO to Median Employee Pay				
Executive Pay Gap	0.00419*** (<0.001)				0.00642*** (<0.001)
Median Executive Pay Ratio		4.676*** (0.00914)			1.639 (0.920)
Mean Executive Pay Ratio			4.360** (0.0128)		-2.014 (0.920)
Executive Pay Slice				99.33*** (0.00952)	-10.27 (0.890)
Log (Sales)	59.86*** (<0.001)	61.63*** (<0.001)	61.80*** (<0.001)	63.53*** (<0.001)	61.33*** (<0.001)
Market-to-Book Ratio	5.015 (0.196)	4.693 (0.247)	4.759 (0.240)	5.461 (0.232)	5.527 (0.224)
Return-on-Assets	-103.6 (0.195)	-111.2 (0.181)	-111.1 (0.180)	-103.7 (0.261)	-106.2 (0.249)
Leverage	40.03 (0.120)	46.43* (0.0802)	46.32* (0.0804)	39.62 (0.181)	34.40 (0.244)
CEO Director	-31.97*** (0.00671)	-23.50* (0.0552)	-22.33* (0.0658)	-38.44** (0.0100)	-37.76** (0.0113)
Firm Segments	-9.064*** (0.00929)	-9.281*** (0.00955)	-9.322*** (0.00912)	-10.62*** (0.00505)	-10.49*** (0.00545)
Herfindahl	33.85 (0.314)	37.05 (0.293)	36.95 (0.293)	33.66 (0.368)	36.65 (0.326)
Executive Experience	5.274 (0.649)	1.816 (0.880)	1.728 (0.886)	-0.846 (0.948)	0.453 (0.972)
Observations	2,329	2,243	2,248	2,050	2,048
R-squared	0.321	0.314	0.314	0.310	0.317
Year and Industry Fixed Effects	Yes	Yes	Yes	Yes	Yes

**Table 4 – Multivariate Analysis of CEO Pay Ratio (Continued)**

*Panel B: Analysis of Log Transformed Tournament Structure Measures*

	(1)	(2)	(3)	(4)	(5)
	Ratio of CEO to Median Employee Pay				
Log (Executive Pay Gap)	4,181*** (<0.001)				6,202*** (<0.001)
Log (Median Executive Pay Ratio)		35.20*** (0.00626)			-2.993 (0.966)
Log (Mean Executive Pay Ratio)			36.04*** (0.00483)		-5.554 (0.946)
Log (Executive Pay Slice)				130.3** (0.0128)	4.001 (0.979)
Log (Sales)	59.93*** (<0.001)	61.43*** (<0.001)	61.59*** (<0.001)	63.57*** (<0.001)	61.51*** (<0.001)
Market-to-Book Ratio	5.038 (0.194)	5.129 (0.205)	5.178 (0.200)	5.477 (0.230)	5.542 (0.223)
Return-on-Assets	-104.0 (0.194)	-112.5 (0.175)	-113.4 (0.171)	-104.1 (0.260)	-106.0 (0.250)
Leverage	39.98 (0.120)	44.83* (0.0913)	44.46* (0.0935)	39.78 (0.179)	34.75 (0.240)
CEO Director	-31.80*** (0.00694)	-33.42** (0.0145)	-33.56** (0.0133)	-38.22** (0.0112)	-35.95** (0.0171)
Firm Segments	-9.060*** (0.00932)	-9.184** (0.0103)	-9.233*** (0.00978)	-10.59*** (0.00519)	-10.52*** (0.00536)
Herfindahl	33.94 (0.313)	39.70 (0.259)	40.07 (0.254)	33.96 (0.364)	36.15 (0.333)
Executive Experience	5.337 (0.645)	3.809 (0.752)	3.797 (0.752)	-0.657 (0.960)	0.237 (0.985)
Observations	2,329	2,243	2,248	2,050	2,048
R-squared	0.321	0.315	0.315	0.310	0.316
Year and Industry Fixed Effects	Yes	Yes	Yes	Yes	Yes

**Table 5 – CEO Pay Ratio, Executive Pay Gap, and Tournament Incentives**

Table 5 presents multivariate analysis of CEO pay ratio and tournament structure after performing principal component analysis and accounting for the primary principal component and impact of firm and executive characteristics. Panel A presents standard tournament structure measures in the raw values, while Panel B analyzes CEO pay ratio and tournament structure after transforming the tournament structure variables. Variable definitions are included in the Appendix. Robust p-values are presented in parentheses below the coefficients. \*, \*\*, and \*\*\* indicate significance at the 0.10, 0.05, and 0.01 levels, respectively.

*Panel A: Analysis of Pay Ratio and Executive Pay Gap with Principal Components of Tournament Incentives*

	(1)	(2)	(3)	(4)	(5)
	Ratio of CEO to Median Employee Pay				
Executive Pay Gap	0.00448*** (<0.001)				0.00631*** (<0.001)
Median Executive Pay Ratio		5.866*** (0.00473)			-0.664 (0.967)
Mean Executive Pay Ratio			5.776*** (0.00649)		5.752 (0.773)
Executive Pay Slice				104.8** (0.0158)	-39.98 (0.599)
Tournament Incentives	-2.176 (0.701)	0.275 (0.961)	0.541 (0.924)	-3.757 (0.550)	-4.950 (0.430)
Log (Sales)	62.12*** (<0.001)	63.97*** (<0.001)	64.03*** (<0.001)	63.70*** (<0.001)	61.52*** (<0.001)
Market-to-Book Ratio	6.076 (0.179)	5.480 (0.227)	5.496 (0.226)	5.851 (0.200)	5.833 (0.199)
Return-on-Assets	-95.81 (0.294)	-95.30 (0.298)	-94.44 (0.303)	-97.26 (0.292)	-100.7 (0.273)
Leverage	27.54 (0.343)	33.42 (0.251)	33.52 (0.250)	33.58 (0.259)	27.93 (0.346)
CEO Director	-32.37** (0.0134)	-25.33* (0.0529)	-24.78* (0.0580)	-37.38** (0.0151)	-36.65** (0.0167)
Firm Segments	-10.75*** (0.00428)	-10.97*** (0.00368)	-10.99*** (0.00362)	-10.76*** (0.00464)	-10.62*** (0.00500)
Herfindahl	47.12 (0.204)	47.10 (0.205)	47.11 (0.205)	42.00 (0.263)	45.08 (0.228)
Executive Experience	-4.711 (0.713)	-7.350 (0.567)	-7.331 (0.568)	-6.574 (0.613)	-5.206 (0.688)
Observations	2,023	2,023	2,023	1,992	1,992
R-squared	0.321	0.317	0.316	0.312	0.319
Year and Industry Fixed Effects	Yes	Yes	Yes	Yes	Yes

**Table 5 – CEO Pay Ratio, Executive Pay Gap, and Tournament Incentives (Continued)**

*Panel B: Principal Component Analysis and Log Transformed Tournament Measures*

	(1)	(2)	(3)	(4)	(5)
	Ratio of CEO to Median Employee Pay				
Log (Executive Pay Gap)	4,463*** (<0.001)				6,095*** (<0.001)
Log (Median Executive Pay Ratio)		47.72*** (0.00309)			0.212 (0.998)
Log (Mean Executive Pay Ratio)			50.21*** (0.00230)		14.74 (0.858)
Log (Executive Pay Slice)				133.2** (0.0242)	-59.33 (0.701)
Tournament Incentives	-2.167 (0.702)	-3.721 (0.542)	-3.970 (0.515)	-3.186 (0.611)	-4.179 (0.505)
Log (Sales)	62.21*** (<0.001)	63.82*** (<0.001)	63.89*** (<0.001)	63.72*** (<0.001)	61.68*** (<0.001)
Market-to-Book Ratio	6.109 (0.176)	6.110 (0.178)	6.114 (0.177)	5.862 (0.199)	5.920 (0.193)
Return-on-Assets	-96.31 (0.291)	-98.80 (0.281)	-98.18 (0.284)	-97.69 (0.290)	-100.9 (0.272)
Leverage	27.50 (0.344)	31.82 (0.275)	31.75 (0.276)	33.68 (0.257)	27.75 (0.349)
CEO Director	-32.14** (0.0139)	-39.10*** (0.00885)	-40.14*** (0.00741)	-36.57** (0.0185)	-34.52** (0.0260)
Firm Segments	-10.75*** (0.00428)	-10.83*** (0.00414)	-10.88*** (0.00396)	-10.72*** (0.00481)	-10.60*** (0.00511)
Herfindahl	47.23 (0.202)	49.40 (0.184)	50.12 (0.177)	42.46 (0.258)	45.30 (0.226)
Executive Experience	-4.648 (0.717)	-4.651 (0.718)	-4.452 (0.729)	-6.447 (0.620)	-5.110 (0.693)
Observations	2,023	2,023	2,023	1,992	1,992
R-squared	0.321	0.317	0.317	0.312	0.319
Year and Industry Fixed Effects	Yes	Yes	Yes	Yes	Yes

**Table 6 – Pay Gap, Tournament Structure and CEO Pay Ratio Components**

Table 6 presents multivariate analysis of CEO pay ratio and tournament structure after considering the level of total compensation (Panel A) and median employee compensation (Panel B) and performing principal component analysis and accounting for the primary principal component, transforming the tournament structure variables and accounting for the impact of firm and executive characteristics. Variable definitions are included in the Appendix. Robust p-values are presented in parentheses below the coefficients. \*, \*\*, and \*\*\* indicate significance at the 0.10, 0.05, and 0.01 levels, respectively.

**Panel A: Pay Gap, Tournament Structure and Median Employee Pay**

	(1)	(2)	(3)	(4)	(5)
	Ratio of CEO to Median Employee Pay				
Executive Pay Gap	0.00479*** (<0.001)				0.00515*** (<0.001)
Executive Pay Ratio (Median)		7.650*** (<0.001)			1.113 (0.943)
Executive Pay Ratio (Mean)			7.694*** (<0.001)		-0.597 (0.975)
Executive Pay Slice				145.5*** (<0.001)	51.48 (0.482)
Median Employee Pay	-0.00193*** (<0.001)	-0.00195*** (<0.001)	-0.00195*** (<0.001)	-0.00194*** (<0.001)	-0.00191*** (<0.001)
Tournament Incentives	-1.518 (0.781)	0.440 (0.936)	0.685 (0.900)	-5.914 (0.326)	-6.937 (0.250)
Log (Sales)	61.46*** (<0.001)	63.50*** (<0.001)	63.59*** (<0.001)	63.74*** (<0.001)	61.90*** (<0.001)
Market-to-Book Ratio	16.68*** (<0.001)	15.93*** (<0.001)	15.94*** (<0.001)	16.81*** (<0.001)	16.54*** (<0.001)
Return-on-Assets	-258.7*** (0.00357)	-259.5*** (0.00357)	-258.6*** (0.00369)	-265.6*** (0.00310)	-262.8*** (0.00335)
Leverage	13.82 (0.621)	19.98 (0.476)	20.15 (0.472)	17.93 (0.530)	14.21 (0.618)
CEO Director	-28.41** (0.0237)	-23.73* (0.0593)	-23.17* (0.0651)	-40.63*** (0.00519)	-39.60*** (0.00630)
Firm Segments	-12.27*** (<0.001)	-12.49*** (<0.001)	-12.51*** (<0.001)	-12.44*** (<0.001)	-12.30*** (<0.001)
Herfindahl	38.52 (0.281)	37.27 (0.298)	37.32 (0.297)	32.14 (0.373)	34.59 (0.336)
Executive Experience	3.077 (0.803)	0.166 (0.989)	0.115 (0.993)	0.580 (0.963)	2.399 (0.848)
Observations	2,026	2,026	2,026	1,992	1,992
R-squared	0.371	0.367	0.367	0.364	0.369
Year and Industry Fixed Effects	Yes	Yes	Yes	Yes	Yes

**Table 6 – Multivariate Analysis of CEO Pay Ratio (Continued)**

**Panel B: Pay Gap, Tournament Structure and CEO Pay**

	(1)	(2)	(3)	(4)	(5)
	Ratio of CEO to Median Employee Pay				
Executive Pay Gap	0.00306*** (0.00540)				0.00521*** (<0.001)
Executive Pay Ratio (Median)		2.573 (0.259)			-6.160 (0.702)
Executive Pay Ratio (Mean)			2.472 (0.290)		6.692 (0.735)
Executive Pay Slice				31.06 (0.559)	-38.41 (0.630)
Log (Total Compensation)	26.51*** (0.00232)	33.98*** (<0.001)	34.34*** (<0.001)	34.40*** (<0.001)	27.20*** (0.00721)
Tournament Structure Principal Component	-5.526 (0.335)	-4.120 (0.473)	-4.032 (0.482)	-5.760 (0.358)	-7.003 (0.264)
Log (Sales)	52.72*** (<0.001)	51.30*** (<0.001)	51.19*** (<0.001)	51.19*** (<0.001)	51.83*** (<0.001)
Market-to-Book Ratio	5.058 (0.265)	4.360 (0.337)	4.357 (0.337)	4.542 (0.323)	4.870 (0.288)
Return-on-Assets	-79.45 (0.383)	-77.16 (0.398)	-76.79 (0.400)	-86.78 (0.346)	-87.89 (0.339)
Leverage	20.17 (0.488)	23.15 (0.426)	23.16 (0.426)	23.40 (0.431)	21.07 (0.477)
CEO Director	-37.60*** (0.00681)	-36.56*** (0.00872)	-36.47*** (0.00889)	-38.01** (0.0119)	-36.13** (0.0166)
Firm Segments	-10.76*** (0.00421)	-10.92*** (0.00372)	-10.93*** (0.00370)	-10.78*** (0.00444)	-10.67*** (0.00478)
Herfindahl	54.45 (0.143)	56.09 (0.132)	56.23 (0.131)	53.21 (0.156)	53.59 (0.152)
Executive Experience	2.079 (0.871)	0.620 (0.961)	0.624 (0.961)	-0.639 (0.961)	1.418 (0.913)
Observations	2,027	2,027	2,027	1,993	1,993
R-squared	0.321	0.319	0.319	0.316	0.320
Year and Industry Fixed Effects	Yes	Yes	Yes	Yes	Yes



**Table 7 – CEO Pay Ratio, Excess Compensation, and Tournament Structure**

Table 7 presents multivariate analysis of CEO pay ratio and residual compensation before and after accounting for the role of tournament structure and the impact of firm and executive characteristics. Variable definitions are included in the Appendix. Robust p-values are presented in parentheses below the coefficients. \*, \*\*, and \*\*\* indicate significance at the 0.10, 0.05, and 0.01 levels, respectively.

	(1)	(2)	(3)	(4)	(5)
	Ratio of CEO to Median Employee Pay				
Excess Compensation	0.00478*** (<0.001)		0.00220* (0.0958)		0.00588 (0.636)
Residual Compensation (With Tenure)		0.00398*** (<0.001)		0.0000672 (0.963)	-0.00845 (0.484)
Executive Pay Gap					0.00306* (0.0856)
Log (Total Compensation)			27.76*** (0.00138)	49.36*** (<0.001)	52.89*** (<0.001)
Tournament Incentives					-0.854 (0.909)
Log (Sales)	60.99*** (<0.001)	63.93*** (<0.001)	51.71*** (<0.001)	47.38*** (<0.001)	41.30*** (<0.001)
Market-to-Book Ratio	4.951 (0.209)	-5.030 (0.433)	3.878 (0.325)	-4.860 (0.445)	-4.011 (0.599)
Return-on-Assets	-99.97 (0.222)	157.1 (0.211)	-92.95 (0.255)	134.4 (0.282)	151.7 (0.323)
Leverage	44.39* (0.0890)	28.22 (0.396)	40.65 (0.119)	21.75 (0.510)	6.865 (0.859)
CEO Director	-27.46** (0.0246)	-87.54* (0.0632)	-39.69*** (0.00190)	-105.2** (0.0251)	-131.8** (0.0230)
Firm Segments	-9.042** (0.0105)	-12.28** (0.0115)	-9.203*** (0.00907)	-12.93*** (0.00740)	-15.88*** (0.00299)
Herfindahl	37.15 (0.274)	76.65 (0.107)	43.78 (0.197)	97.39** (0.0404)	110.6** (0.0419)
Executive Experience	7.791 (0.509)	-1.333 (0.935)	8.987 (0.446)	-3.240 (0.841)	-4.322 (0.817)
Observations	2,297	1,169	2,297	1,169	1,000
R-squared	0.318	0.359	0.321	0.369	0.380
Year and Industry Fixed Effects	Yes	Yes	Yes	Yes	Yes

**Table 8 – Multivariate Analysis of CEO Pay Ratio**

Table 8 presents multivariate analysis of CEO pay ratio and executive pay gap on firm performance and efficiency. Variable definitions are included in the Appendix. Robust p-values are presented in parentheses below the coefficients. \*, \*\*, and \*\*\* indicate significance at the 0.10, 0.05, and 0.01 levels, respectively.

	(1) Return-on- Assets	(2) Profit Margin	(3) Total Asset Turnover	(4) Equity Multiplier	(5) Buy and Hold Abnormal Return
High Ratio * High Gap	0.0221*** (0.00422)	0.0642* (0.0856)	0.0955** (0.0429)	5.309** (0.0383)	11.17* (0.0845)
High Executive Pay Gap	0.00630 (0.491)	0.102** (0.0441)	0.0815** (0.0444)	-3.915 (0.113)	-9.528** (0.0493)
High CEO Pay Ratio	0.0104* (0.0687)	0.0457* (0.0662)	-0.00430 (0.903)	-5.949*** (0.00196)	-9.604 (0.124)
Tournament Incentives	0.00266* (0.0695)	0.0103* (0.0563)	0.00851 (0.469)	0.181 (0.748)	-0.597 (0.791)
Log (Total Compensation)	-0.00646** (0.0279)	-0.0367* (0.0515)	-0.0813*** ( $<0.001$ )	-0.0659 (0.938)	2.224 (0.108)
Log (Sales)	0.00769*** ( $<0.001$ )	0.0373** (0.0104)	0.0578*** ( $<0.001$ )	1.516*** (0.00949)	-0.381 (0.796)
Market-to-Book Ratio	0.0150*** ( $<0.001$ )	-0.0587*** (0.00294)	0.0456*** ( $<0.001$ )	-0.381 (0.381)	0.189 (0.858)
Return-on-Assets	0.419*** ( $<0.001$ )	3.676*** ( $<0.001$ )	0.778*** ( $<0.001$ )	-12.68 (0.146)	-0.750 (0.972)
Leverage	0.00870 (0.268)	-0.133** (0.0480)	-0.0700 (0.440)	-5.612** (0.0485)	-4.968 (0.471)
CEO Director	-0.000444 (0.916)	0.00891 (0.617)	0.0156 (0.567)	2.223 (0.128)	-0.777 (0.830)
Firm Segments	-0.000571 (0.458)	-0.00518* (0.0997)	-0.0191*** (0.00546)	0.375 (0.298)	-0.283 (0.757)
Herfindahl	0.00544 (0.533)	0.0245 (0.632)	0.0908 (0.180)	4.618 (0.197)	-4.292 (0.623)
Executive Experience	0.000261 (0.944)	0.0463* (0.0670)	-0.0790*** ( $<0.001$ )	0.744 (0.547)	-0.159 (0.959)
Observations	1,775	1,971	1,971	1,977	1,786
R-squared	0.393	0.377	0.590	0.046	0.019
Year and Industry Fixed Effects	Yes	Yes	Yes	Yes	Yes

**Table 9 – Multivariate Analysis of CEO Pay Ratio**

Table 9 presents multivariate analysis of CEO pay ratio and executive pay gap on firm accounting performance and profitability by whether or not the firm has above or below median compensation for the firm's median employee. Variable definitions are included in the Appendix. Robust p-values are presented in parentheses below the coefficients. \*, \*\*, and \*\*\* indicate significance at the 0.10, 0.05, and 0.01 levels, respectively.

Median Employee Pay Subsample:	(1)	(2)	(3)	(4)	(5)	(6)
	Return-On-Assets		Return-On-Equity		Profit Margin	
	High	Low	High	Low	High	Low
High Ratio * High Gap	0.0277** (0.0226)	0.00484 (0.621)	0.253* (0.0906)	0.130 (0.401)	0.0846* (0.0901)	-0.00616 (0.413)
High Pay Gap	0.0158 (0.188)	-0.0204 (0.222)	0.0575 (0.625)	-0.0522 (0.776)	0.0694 (0.261)	-0.0149 (0.109)
High CEO Pay Ratio	0.0154* (0.0738)	-0.00327 (0.679)	0.0413 (0.721)	-0.228 (0.386)	0.0312 (0.332)	0.00197 (0.766)
Tournament Incentives	0.00397 (0.128)	0.00197 (0.235)	0.0601 (0.310)	-0.00485 (0.912)	0.0225 (0.101)	0.000373 (0.801)
Log (Total Comp)	-0.00856* (0.0950)	-0.00151 (0.589)	-0.0482 (0.334)	-0.0603 (0.311)	-0.0566** (0.0215)	0.000764 (0.809)
Log (Sales)	0.0116*** (<0.001)	0.00310 (0.131)	0.0219 (0.691)	0.116 (0.172)	0.0681*** (0.00717)	-0.000573 (0.977)
Market-to-Book Ratio	0.0131*** (<0.001)	0.0178*** (<0.001)	-0.0679 (0.134)	0.00916 (0.864)	-0.0611** (0.0224)	-0.00935*** (0.000921)
Return-on-Assets	0.391*** (<0.001)	0.416*** (<0.001)	5.077** (0.0307)	-0.0970 (0.971)	4.620*** (<0.001)	1.071*** (<0.001)
Leverage	0.00127 (0.944)	0.00248 (0.779)	-0.989** (0.0218)	-0.981 (0.212)	-0.387** (0.0377)	-0.00705 (0.600)
CEO Director	-0.00138 (0.836)	-0.00218 (0.688)	-0.142 (0.246)	0.0610 (0.644)	-0.0673* (0.0908)	0.00517 (0.317)
Firm Segments	-0.00154 (0.237)	-0.000722 (0.466)	-0.0100 (0.514)	0.0579 (0.272)	-0.0102 (0.119)	0.00127 (0.220)
Herfindahl	0.00993 (0.552)	0.000396 (0.969)	-0.128 (0.718)	0.485* (0.0927)	0.111 (0.404)	-0.0103 (0.258)
Executive Experience	-0.00114 (0.851)	0.000628 (0.886)	0.0677 (0.458)	-0.272 (0.272)	0.0549 (0.169)	0.00239 (0.547)
Observations	929	845	1,004	972	1,004	972
R-squared	0.375	0.521	0.332	0.039	0.454	0.648

**Table 10 – Multivariate Analysis of CEO Pay Ratio**

Table 10 presents multivariate analysis of CEO pay ratio and executive pay gap on firm investments and expenses by whether or not the firm has above or below median compensation for the firm's median employee. Variable definitions are included in the Appendix. Robust p-values are presented in parentheses below the coefficients. \*, \*\*, and \*\*\* indicate significance at the 0.10, 0.05, and 0.01 levels, respectively.

Median Employee Pay Subsample:	(1)	(2)	(3)	(4)	(5)	(6)
	Research and Development		Acquisitions		SG&A Expenses	
	High	Low	High	Low	High	Low
High Ratio * High Gap	-0.00610 (0.546)	-0.0121* (0.0655)	0.0155* (0.0725)	-0.00684 (0.493)	-0.00758 (0.630)	0.0556** (0.0432)
High Pay Gap	0.00205 (0.844)	-0.00758 (0.469)	0.00921 (0.113)	-0.00621 (0.594)	-0.0159 (0.296)	0.0654 (0.105)
High CEO Pay Ratio	-0.00271 (0.758)	-0.00814 (0.150)	0.0170** (0.0121)	-0.0101 (0.279)	-0.00438 (0.747)	0.00374 (0.861)
Tournament Incentives	0.000821 (0.771)	-0.000645 (0.402)	-0.000170 (0.934)	0.00122 (0.644)	-0.000480 (0.901)	-0.00660 (0.113)
Log (Total Comp)	0.00119 (0.683)	0.000773 (0.615)	0.00233 (0.320)	0.00361 (0.258)	-0.00220 (0.683)	-0.0334*** (0.00910)
Log (Sales)	-0.00277 (0.265)	-0.00114 (0.454)	-0.00337 (0.138)	-0.00198 (0.350)	-0.0165*** ( $<0.001$ )	-0.0161** (0.0165)
Market-to-Book Ratio	0.0202*** ( $<0.001$ )	0.00716*** (0.00117)	-0.0000576 (0.971)	-0.00792*** ( $<0.001$ )	0.0389*** ( $<0.001$ )	0.0401*** ( $<0.001$ )
Return-on-Assets	-0.277*** ( $<0.001$ )	-0.0701* (0.0617)	-0.00896 (0.785)	0.0341 (0.353)	-0.370*** ( $<0.001$ )	-0.0487 (0.747)
Leverage	-0.0588*** (0.00169)	-0.0250*** (0.00152)	0.0344*** (0.00358)	0.0462*** ( $<0.001$ )	-0.121*** (0.000169)	-0.0671* (0.0541)
CEO Director	0.00139 (0.838)	0.00586** (0.0366)	-0.000996 (0.812)	-0.00991* (0.0573)	0.00557 (0.580)	0.00225 (0.871)
Firm Segments	-0.00317** (0.0161)	-0.0000244 (0.974)	0.000797 (0.429)	-0.00109 (0.368)	-0.00255 (0.224)	-0.00302 (0.264)
Herfindahl	-0.0349** (0.0243)	-0.000699 (0.908)	-0.000651 (0.966)	0.0153 (0.364)	0.0402 (0.191)	0.0113 (0.761)
Executive Experience	0.00328 (0.575)	0.00338 (0.120)	0.00000439 (0.999)	-0.000930 (0.849)	0.00212 (0.791)	0.00581 (0.607)
Observations	506	604	935	902	760	903
R-squared	0.628	0.441	0.120	0.143	0.642	0.471

### Appendix: Variable Definitions

Variable	Measurement	Data Source
BHAR	Buy and hold annual return calculated following Lyon, Barber, & Tsai (1999) such that each firm's return is adjusted using the relevant portfolio return according to 14 size reference portfolios and 10 book-to-market ratio reference portfolios for 24 and 36 months, where portfolio mean returns are computed monthly and compounded over the relevant time period. Firm market value of equity (i.e., size) is computed in June of each year to rank firms into NYSE deciles, the smallest of which is further divided into quintiles since approximately half of firms fall into the smallest decile. Book-to-market ratio is computed by taking the book value of equity from the prior period balance sheet year end and classified according to NYSE decile portfolios.	CRSP
Book-to-Market Ratio	The ratio of the book value of equity to the market capitalization	Compustat Annual
Cash compensation	The sum of salary and bonus compensation the CEO receives in thousands of dollars	ExecuComp
CEO Director	Binary equal to 1 if the CEO also serves on the board of directors	ExecuComp
Equity compensation	The total value of the CEO's equity compensation for the year	ExecuComp
Excess Compensation	The residual from Core et al. (2008) model for expected compensation, using total compensation without tenure included in the model to enlarge sample size	ExecuComp
Executive Pay Gap	Dollar difference between the pay of the CEO and that of the firm's next three highest paid executives, listed in thousands of dollars	ExecuComp
Executive Pay Ratio (Mean)	Ratio of the CEO's pay to the mean pay of the next four highest paid executives	ExecuComp
Executive Pay Ratio (Median)	Ratio of the CEO's pay to the median pay of the next four highest paid executives	ExecuComp
Executive Pay Slice	Percentage of the top five highest paid executive's compensation that the CEO receives	ExecuComp
Firm age	The length of time the firm has been listed as a publicly traded firm	CRSP
Herfindahl (HHI industry concentration)	The Herfindahl Hirschman Index (HHI) is the sum of the squares of the sales-based market share percentages of all the firms in an industry that have sales data on Compustat.	Compustat Annual
Leverage	The ratio of the firm's book value of debt to assets	Compustat Annual
Log (Executive Pay Gap)	Log of 1,000,000 plus the dollar difference between the pay of the CEO and the average of the firm's next three highest paid executives	ExecuComp
Market-to-Book Ratio	The ratio of the market value of assets (i.e., the sum of market capitalization and debt) to the book value of total assets	Compustat Annual
Market capitalization	The product of shares outstanding and stock price listed in thousands of USD	Compustat Annual
Median Employee Pay	The firm's median employee compensation	Equillar
CEO Pay Ratio	Ratio between the pay of the CEO and that of the firm's median employee	Equillar
Prior Executive Experience	Binary equal to 1 when the newly appointed CEO has prior CEO experience	ExecuComp
R&D ratio	The ratio of firm research and development expenses to sales	Compustat Annual
Residual Compensation	The residual from Core et al. (2008) model for expected compensation, using total compensation	ExecuComp
Return-on-assets (ROA)	The ratio of EBITDA to total assets	Compustat Annual
Sales	Firm sales, in millions of USD	Compustat Annual
Segments	The number of firm geographic and business segments	Compustat Annual
Tenure	The CEO's tenure at the current firm	ExecuComp
Tournament Incentives	The first factor from the principal component analysis of all four tournament incentive measures (i.e., pay gap, pay slice, median pay ratio and mean pay ratio).	ExecuComp
Total compensation (TDC1)	Total compensation paid to the new or departing CEO in thousands of dollars (TDC1)	ExecuComp