**Tournament Incentives and Institutional Ownership**

Chia-Feng Yu1, Paul Brockman2\*, Chee Cheong1, Ralf Zurbruegg1

**Abstract:**

This study examines the impact of internal tournament competition on corporate ownership structure. We posit that institutional investors are sophisticated and understand the incentive-alignment mechanism of internal tournaments, thereby being attracted to buying and holding tournament-oriented firms. We first formalize this insight in a model and then test its empirical implications using 25 years of market data. We find strong support for our hypothesis that internal tournament incentives leads to higher institutional ownership and that these findings are robust to alternative measures of tournament competition and to potential endogeneity issues. Overall, this study uncovers a novel linkage between corporate tournaments and institutional ownership.

**Keywords:** Corporate Tournaments, CEO Pay Gap, Institutional Holding.

**JEL Classification Numbers:** G34, J33, M51.

1. Adelaide Business School, The University of Adelaide, SA 5005, Australia.
2. Corresponding Author. College of Business and Economics, Lehigh University, 407A Rauch Business Center, 621 Taylor Street, Bethlehem, PA, USA 18015. Email: pab309@lehigh.edu. Phone: (610) 758-2914
3. **Introduction**

Previous research shows that internal tournaments are widely used by corporations to better align managerial incentives with corporate investors (e.g., Baker et al., 1994; Gibbons and Waldman, 1999; Bognanno, 2001; Conyon et al., 2001; Mobbs and Raheja, 2012). The use of corporate tournaments can help investors to evaluate the effectiveness of managerial performance by eliminating some of the market shocks that are common across corporations. Consistent with this hypothesized benefit, previous studies have shown that the implementation of internal tournaments improves firm performance (Kale, et al., 2009; Ridge et al., 2015), encourages managerial risk-taking (Kini and Williams, 2012), stimulates firm-level innovation (Shen and Zhang, 2017), and shapes cash holding policy (Phan et al., 2017). No study to date, however, has examined the impact of internal tournaments on the firm’s ownership structure. Since sophisticated (i.e., institutional) investors are more likely to recognize the beneficial incentive-alignment properties of tournaments than unsophisticated (i.e., individual) investors, we posit that tournament-oriented firms will attract greater institutional interest and ownership.

In this study, we construct a simple model that captures the salient features of internal tournaments and their impact on ownership structures. We then test and confirm our main hypothesis that sophisticated investors prefer a corporate setting that encourages internally-competitive tournaments. These findings have important implications for the design of managerial incentives and corporate governance, as well as for gaining a better understanding of the determinants of institutional ownership.

Identifying the causes and effects of institutional ownership is especially important given the proliferation of institutional investors over the past few decades. By December 1996, large institutions held discretionary control over more than half of the U.S. equity market (Gompers and Metrick, 2001). According to the Bloomberg Report in April 2017, institutions own about 78% of the market value of the U.S. broad-market Russell 3000 index, and 80% of the large-cap S&P 500 index. In dollar terms, that is about $21.7 trillion and $18 trillion, respectively. Previous research has identified a long list of beneficial effects associated with institutional ownership. These benefits include: easier access to external financing (Schain and Stiebale, 2016), stronger corporate governance (Edmans, 2014), greater firm transparency (Boone and White, 2015), lower cost of capital (Attig et al., 2013), more favorable analyst recommendations (Chen and Cheng, 2006), better stock market performance (Gompers and Metrick, 2001), greater informational efficiency (Boehmer and Kelly, 2009), less managerial myopia with respect to R&D investments (Bushee 1998), and an expanded capacity for innovation (Aghion et al., 2013). In view of these beneficial effects, it is important to understand the firm characteristics that attract institutional interest. The main objective of this study is to show that internal tournament competition is a significant determinant of institutional ownership.

To lay the theoretical foundation for our main hypothesis regarding the impact of corporate tournaments on institutional ownership, we develop a model that incorporates a corporate tournament into an otherwise standard stock market framework. In particular, we consider a corporate tournament with a constant-absolute-risk-aversion-normal (CARA-Normal) stock market setup (Huang and Litzenberg, 1988; Vives, 2008), where the interplay between a representative sophisticated trader (institutional investor), a representative naive trader (retail investor), and a mass of noise traders determines equilibrium in the stock market. Our analysis shows that institutional ownership increases with greater corporate tournament competition. Similar to Lazear and Rosen (1981) and Nalebuff and Stiglitz (1983), we argue that greater corporate tournament competition increases the effort that CEO contestants (i.e., senior management) exert in performing their duties. As such efforts will consequently benefit the firm’s performance, sophisticated investors recognize the incentive-aligning value of internal tournaments and increase their ownership stake in such firms.

We then proceed to empirically test the implications of our theoretical model. Following prior studies (Bebchuk et al., 2011; Cremers and Palia, 2011; Chen et al., 2013), we utilize *CEO Pay Gap* to capture corporate tournament competition within a firm. *CEO Pay Gap* is defined as the ratio of a CEO’s compensation relative to the total compensation of the top five highest paid executives within the firm. We test our model’s predictions using 1,955 firms (15,845 firm-year observations) contained within the ExecuComp database between 1992 and 2016. We start by presenting univariate test results that show firms whose *CEO Pay Gap* is in the lowest quintile of our sample have, on average, 6.1% less institutional holdings than firms in the highest quintile. We then examine the relationship between *CEO Pay Gap* and institutional holdings in a multivariate panel regression setting, and find that an increase in *CEO Pay Gap* from the lowest quintile to the highest quintile results in a proportional rise in institutional ownership of 5.6%. Given that institutional investors in our sample invest an average of $5.67 billion per firm, a 5.6% increase is equivalent to an additional $318 million investment.

We also show that our baseline results are robust to various endogeneity concerns. We employ 2-stage least squares (2SLS) to deal with this, using instrumental variables (IV) that are correlated to corporate tournament measures but unlikely to be associated with the residuals in the second stage regressions. For robustness, we use two different types of IVs in separate 2SLS regressions. The first IV is an industry-median CEO pay gap IV that has been used in the related literature (Kale, Reis, and Venkateswaran, 2009; Shen and Zhang, 2018), and the second IV is a geographical measure that is based on capturing the median CEO Pay Gap of peer firms within the same state as that of the focus firm, but not in the same 2-digit SIC industry. The latter IV takes advantage of the heterogeneity of state income taxes across states which can correspondingly impact the value of tournament incentives a firm offers. Regardless of which IV we use, the coefficients of the instrumented corporate tournament measure is positive and statistically significant, further confirming that institutional investors prefer to invest in companies with greater corporate tournament incentives.

Our empirical analyses conclude with several additional tests. We begin by using the number of Vice Presidents as an alternative measure of corporate tournament competition (Kale, Reis, and Venkateswaran, 2009; Kini and Williams, 2012). Our results remain statistically significant and consistent with our baseline regressions, including when we use an instrumental variable approach.

 Next, we examine a subset of our data and select years in which the internal tournaments within firms are more, or less, likely to lead to a payoff, thereby increasing the value of them. We expect that tournament competition will be of relatively more value in the years prior to a CEO stepping down than after a new CEO is appointed. The reason being that once a new CEO is appointed, expectations of further CEO turnover within the firm for the immediate future is unlikely. This will diminish the value of tournament incentives for the CEO contestants within the firm as the prize, of becoming a CEO in the near-term, has been substantially reduced. This will have an impact on the effort they expend on the projects that they manage. Sophisticated (institutional) investors are therefore less likely to take notice of, and be less sensitive to, tournament incentives within these firm. This leads us to posit that the relationship between *CEO pay Gap* and institutional ownership will be weaker following CEO turnover than preceding it.

We also perform another subsample test that examines if tournament incentives have a greater impact on institutional holdings when CEO turnover is anticipated. In particular, we expect the intensity of tournament competition to be stronger when the CEO is of retirement age and that there are vice presidents that potentially can replace the incumbent. In such a situation, there is an incentive for CEO contestants to exert more effort in managing their projects, thereby potentially increasing the value of the firm. We posit that this will, therefore, attract greater institutional ownership.

Our final test is based on an implication of our theoretical model which suggests that the relationship between tournament incentives and institutional holdings is more pronounced when capital expenditure is especially high. High capital expenditures have the effect of “leveraging up” the impact of managerial efforts and actions on corporate performance; that is, productive managerial efforts and actions will have greater impact on the firm’s performance in a high capital-intensive environment than in a low capital-intensive environment. Using the ratio of capital expenditures over total assets as a proxy for capital intensity, we test and confirm our hypothesis that internal tournaments play a significantly more important role in capital-intensive environments than in low-capital settings (i.e., the relationship between tournaments and institutional ownership is especially strong for capital-intensive firms).

Our study contributes to two main strands of literature. First, this paper contributes to the burgeoning literature on tournaments. Previous studies show that tournament incentives have a significant influence on corporate decisions and valuations. For example, tournament incentives are positively related to firm performance (Kale et al., 2009), disclosure policies (Haß et al., 2015), innovation decisions (Shen and Zhang, 2017), and cash holdings (Phan et al., 2017). While the existing literature examines tournament implications mostly from within the firm, no study to date has examined the impact of internal tournaments on the firm’s ownership structure. We fill this gap by investigating how tournament competition can preferentially attract sophisticated investors over unsophisticated investors.

Second, our study contributes to the literature on the determinants of institutional ownership. Prior research has shown that firms can increase their base of institutional investors through their corporate policies related to financial disclosure (Bushee and Noe, 2000), dividends (Allen et al.*,* 2000), advertising (Grullon et al., 2004), carve-outs (Perotti and Rossetto, 2007), corporate governance (Chung and Zhang, 2011), investments (Strobl, 2014), share repurchases (Bhattacharya and Jacobsen, 2016), and corporate hedging (Massa and Zhang, 2018). We add to these prior findings by identifying a new and effective policy tool in the firm’s toolkit for attracting institutional investor interest – designing internal tournament competitions.

The rest of this paper is organized as follows. Section 2 presents the theoretical framework. Section 3 presents the data and some descriptive statistics while Section 4 reports the empirical analyses. Section 5 considers some additional tests and Section 6 offers a brief conclusion.

# Theoretical framework and hypothesis development

*2.1 Conceptualization of corporate tournaments*

To lay the theoretical foundation for our hypothesis, we develop a simple model that incorporates a corporate tournament (Lazear and Rosen, 1981; Connelly et al., 2014) within an otherwise standard CARA-normal stock market framework (Huang and Litzenberger 1988; Vives, 2008). We model the corporate tournament *a la* Lazear and Rosen (1981). There are three stages, $t$= 0*,* 1, and 2. At $t$= 0, a firm has two CEO contestants, each of whom manages a project. The firm conducts a corporate tournament and sets the rewards, $w\_{H}$and $w\_{L}$, for the winner and loser of the corporate tournament, respectively. That is, these two CEO contestants compete against each other for the CEO position and the one with better (poorer) performance will (not) be promoted to CEO and receive $w\_{H}$ ($w\_{L}$). We denote $∆w≡w\_{H}-w\_{L}$as the CEO pay gap, which measures the strength of tournament incentives. For notational simplicity, we follow the prior studies on tournaments (e.g., Lazear and Rosen, 1981; Hvide, 2002; Gurtler and Krakel, 2010; Connelly et al., 2014) and assume that CEO contestants are risk-neutral.[[1]](#footnote-1)

Project $i$ yields an *ex ante* unknown project value $\tilde{V}\_{i}$, which will be realized at $t$= 2. We assume that $\tilde{V}\_{i}=\tilde{μ}\_{i}+\tilde{ε}\_{i}$, where $\tilde{μ}\_{i}$ and $ε\_{i} $are the fundamental and random components of the project’s value, respectively. The prior distributions are commonly known to be $\tilde{μ}\_{i}$ $\~ N\left(\overbar{μ}, σ^{2}\right)$ and $ε\_{i} \~ N\left(0, σ\_{ε}^{2}\right),$ where $\overbar{μ}>0$, $σ>0$, and $σ\_{ε}>0$. However, CEO contestants can exert personal effort to shape the fundamental component of a project’s value. Specifically, at the beginning of $t$= 1, CEO contestant $i$($i$= 1*,* 2) privately chooses a level of effort, $e$, that will be exerted on the project that they are managing. The realized project value is the performance benchmark used for promotion and, therefore, by exerting more effort the contestant is able to improve the potential value of the project and the likelihood of being promoted. There is also a personal cost of exerting effort, which is $\frac{k}{2}∙e\_{i}^{2}$, where $k>0$. The CEO contestant’s effort choice will therefore have a fundamental impact on the project’s value, i.e., the realization of $\tilde{μ}\_{i}$ will be $e\_{i}∙I\_{i}$, where $I\_{i}$ is the capital level of project $i$. This means that labor input and capital are complements in enhancing productivity, consistent with Romer (2011). For simplicity, we assume that projects have a predetermined and identical physical capital level, i.e., $I\_{1}=I\_{2}=I$, where$ I>0$. At $t$= 2, project values are realized. If $V\_{i}>V\_{j}$, CEO contestant $i$is promoted to the CEO position and receives $w\_{H}$, and CEO contestant $j$receives $w\_{L}$.[[2]](#footnote-2)

The decision problem for CEO contestant $i$($i$= 1*,* 2) at the beginning of $t$= 1 is, therefore, to choose an effort level that maximizes his/her expected payoff, net of the contestant’s personal cost:

$$\max\_{e\_{i}} Pr\left(V\_{i}>V\_{j}\right)∙w\_{H}+Pr⁡\left(V\_{i}<V\_{j}\right)∙w\_{L} - \frac{k}{2}∙e\_{i}^{2}. (1)$$

*2.2 Modelling the stock market*

At the end of $t$ = 1, the stock of the firm is traded in a securities exchange. We model the stock market as a standard CARA-normal setup, consisting of a representative sophisticated (institutional) investor, a representative uninformed (retail) investor, and a mass of noise traders.

The institutional investor is assumed to be sophisticated in the sense that this investor has the expertise and skills to process the information content embedded in tournament incentives. As such, although this investor cannot directly observe the effort choices of CEO contestants, the institutional investor can rationally infer their effort choice from the observation of tournament incentives within the firm. Based on the institutional investor’s knowledge of tournament incentives and the implications that arise from it, the institutional investor chooses investment position $x\_{I}$ in the stock to maximize expected utility:

$$\max\_{x\_{S}} E\_{S}\left[U\_{S}\left(x\_{S}∙\left(\tilde{V}\_{1}+\tilde{V}\_{2}-P\right)\right)\right], (2)$$

where $U\_{S}$ is the exponential utility function with the risk-aversion coefficient $r\_{S}$ and $E\_{S}$ is the expectation based on the institutional investor’s sophisticated knowledge.

In contrast, the retail investor is assumed to be naïve in the sense of lacking expertise and skills required to process the information content embedded in tournament incentives. As such, this uninformed investor is either ignorant of the tournament incentives or does not fully understand the implication that tournament incentives encourage managers to exert greater effort on the projects that they oversee. Thus, the naïve trader holds on to the prior belief of the project value distributions.[[3]](#footnote-3) The retail investor then chooses the position $x\_{N}$ to maximize expected utility:

$$\max\_{x\_{N}} E\left[U\_{N}\left(x\_{N}∙\left(\tilde{V}\_{1}+\tilde{V}\_{2}-P\right)\right)\right], (3)$$

where $U\_{N}$ is the exponential utility function with the risk-aversion coefficient $r\_{N}$ and $E$ is the expectation based on the prior belief of the project value distribution. Noise traders are subject to a random shock and therefore demand a random total amount $z∼N\left(0,σ\_{z}^{2}\right)$. The following market clearing condition determines the equilibrium in the stock market:

$$ x\_{S}+x\_{N}+z=0. (4)$$

*2.3 Model solution*

 *Tournament Competition.* As we assume the error terms of the project value are normally distributed and also that the CEO contestants are identical, the optimal effort choices for CEO contestants can be solved as (cf. Lazear and Rosen, 1981, p.846):

$$ e\_{1}=e\_{2}= e^{\*}=\frac{∆w∙I}{2∙k∙\sqrt{π}∙σ\_{ε}}. (5)$$

 Equation (5) indicates that optimal effort levels increase with tournament incentives. The sophisticated institutional investor observes ∆w and rationally infers its implications for effort choices through Equation (5), whereas the naïve retail investor is ignorant of ∆w and its implications on managerial effort.

 *Stock Market Equilibrium.* Solving the optimal trading strategies for the institutional investor and the retail investor yields:[[4]](#footnote-4)

$$ x\_{S}^{\*}=\frac{E\_{S}\left[\tilde{V}\_{1}+\tilde{V}\_{2}\right]-P}{r\_{S}∙Var\_{S}\left[\tilde{V}\_{1}+\tilde{V}\_{2}\right]}=\frac{\frac{∆w∙I}{k∙\sqrt{π}∙σ\_{ε}}-P}{2∙r\_{S}∙σ\_{ε}^{2}} \left(6\right)$$

$$ x\_{N}^{\*}=\frac{E\left[\tilde{V}\_{1}+\tilde{V}\_{2}\right]-P}{r\_{N}∙Var\left[\tilde{V}\_{1}+\tilde{V}\_{2}\right]}=\frac{2∙\overbar{μ}-P}{2∙r\_{N}∙σ\_{ε}^{2}}. \left(7\right)$$

 By substituting Equations (6) and (7) into the market clearing condition (4), we obtain the equilibrium stock price:

$$ P^{\*}=\frac{r\_{N}∙(σ^{2}+σ\_{ε}^{2})∙\frac{∆w∙I}{k∙\sqrt{π}∙σ\_{ε}}+2∙r\_{S}∙σ\_{ε}^{2}∙\overbar{μ}+2∙r\_{S}∙r\_{N}∙(σ^{2}+σ\_{ε}^{2})∙z}{r\_{N}∙(σ^{2}+σ\_{ε}^{2})+r\_{S}∙σ\_{ε}^{2}}. (8)$$

To determine the relationship between tournament incentives and institutional holdings we substitute Equation (8) into Equation (6) to obtain:

$$ x\_{S}^{\*}=\frac{∆w∙I}{2∙k∙\sqrt{π}∙σ\_{ε}∙\left[r\_{N}∙(σ^{2}+σ\_{ε}^{2})+r\_{S}∙σ\_{ε}^{2}\right]}+K, \left(9\right)$$

where $K=-\frac{\overbar{μ}+\left(r\_{N}∙(σ^{2}+σ\_{ε}^{2})\right)z}{r\_{N}∙(σ^{2}+σ\_{ε}^{2})+r\_{S}∙σ\_{ε}^{2}}$.

Simple comparative statics yield:

$$\frac{dx\_{S}^{\*}}{d∆w}=\frac{I}{2∙k∙\sqrt{π}∙σ\_{ε}∙\left[r\_{N}∙(σ^{2}+σ\_{ε}^{2})+r\_{S}∙σ\_{ε}^{2}\right]}>0. (10)$$

Equation (10) implies that there should be a positive association between tournament competition and institutional holdings, providing us with our formal hypothesis that *greater tournament incentives increase institutional ownership of the firm*. The intuition behind this being that greater corporate tournament competition induces more effort input from CEO contestants, which will inevitably benefit the firm. Because the institutional investor, as a sophisticated trader, appreciates this, they are incentivized to hold more stock of the firm.

# Sample and descriptive statistics

Our initial sample comprises all firms contained within the ExecuComp database from 1992 to 2016. For each firm, we also collect annual institutional holdings data from the Thomson Reuters Ownership (13f) database, financial data from the Compustat North America database, corporate governance data from Institutional Shareholder Services and stock prices from the Centre for Research in Security Prices (CRSP). Due to differences in the regulatory environment, we exclude financial firms (SIC code 6000-6799) and utility firms (SIC 4900-4999) from our sample.

As our primary proxy for corporate tournament competition we use *CEO Pay Gap.* We introduce a secondary proxy, the number of Vice Presidents that a firm has, later as a robustness test. We follow the prior literature (Bebchuk et al., 2011; Cremers and Palia, 2011; Chen et al., 2013) and define *CEO Pay Gap* as the ratio of CEO total compensation relative to the sum of the total compensation of the top five highest-paid executives within the firm (including the CEO). To compute *CEO Pay Gap*, we use the annual compensation information of executives reported in the firms’ proxy statements. If there are fewer than three executives or insufficient (missing) compensation information for the whole executive team for any given firm-year, we delete that firm-year observation.

To test our hypothesis that there is a positive relationship between corporate tournament competition (i.e., *CEO Pay Gap*) and institutional ownership (*Inst. Holdings*), we use an OLS panel regression model:

|  |  |
| --- | --- |
| $$Inst. Holdings\_{it}=α+β\_{1}CEO Pay Gap\_{it}+ γ'X\_{ikt}+ε\_{it}$$ | (11) |

where the dependent variable, *Inst. Holdings*, is measured as the ratio of firm *i*’s total institutional ownership over total shares outstanding for the year *t*. This is regressed against *CEO Pay Gap* and a vector *X*, representing our *k* number of control variables. We utilize eleven firm and managerial characteristics as control variables. Specifically, we proxy for *Firm Size* using the natural logarithm of total assets, and *Sales Growth* is used as a proxy for a firm’s growth potential. Return on assets (*ROA*) and shareholders’ previous year stock return (*Returns*) are used as measures of firm performance. We also include three different measures of firm risk. These include *Leverage*, measured as long-term debts to total assets of the firm; the standard deviation of the return on assets (*σROA*); and the standard deviation of operating cash flows (*σOCF*). Capital expenditure (*Capex*) and Research and Development expenditures (*R&D*) are used as proxies for firm capital intensity levels. We use discretional accruals (*Accruals*) to proxy for earnings quality (Jones, 1991; Dechow et al., 1995; Bergstresser and Philippon, 2006). Lastly, we employ a dummy variable, *Entrenched*, to capture firms that have a high entrenchment index to proxy for corporate governance (Bebchuk, et al., 2009). We use this to mitigate the concern that the *CEO Pay Gap* of a firm is driven by CEO entrenchment (Bebchuk et al., 2011). Appendix I includes a full description of how each variable is constructed.

Table 1 presents the descriptive statistics and correlation matrix of the variables of interest and control variables using our final sample of 15,845 firm-year observations (consisting of 1,955 unique firms).[[5]](#footnote-5) On average, 72% of all outstanding shares are held by institutional holders in our sample, highlighting the importance of institutional investors in the capital market. Both mean and median *CEO Pay Gap* are 0.40, indicating that the management team (less the CEO) receives 60% of the total compensation package, with the CEO receiving 40%. These percentages suggest a strong corporate tournament incentive for top executives to exert maximal effort within the firm. Focusing on the correlation matrix, there are no serious multi-collinearity issues among the variables on a pairwise basis. There is a positive correlation (0.112) between *CEO Pay Gap* and *Inst. Holdings*, indicating that corporate tournaments are positively associated with institutional ownership (*p*-value<0.01).

# Empirical evidence

Table 2 presents a univariate test of the relationship between *CEO Pay Gap* and *Inst. Holdings*. We split *CEO Pay Gap* into quintiles. The first quintile consists of firms with the lowest *CEO Pay Gap* while the fifth quintile has the highest *CEO Pay Gap*. On average, the highest *CEO Pay Gap* quintile has 6.11% higher *Inst. Holdings* than the lowest *CEO Pay Gap* quintile. The mean and median differences are statistically significant at the 1% level. This result provides preliminary, model-free evidence that corporate tournament competition attracts institutional investors.

Our main regressions of *CEO Pay Gap* on *Inst. Holdings* are presented in Table 3. Column (1) shows the primary relationship that *CEO Pay Gap* has on *Inst. Holdings*. In Column (2) we add the 11 control variables to the regression. Confirming the evidence from the univariate tests in Table 2, the coefficients of *CEO Pay Gap* remain positive and statistically significant in both regressions. Based on regression (2), an increase in *CEO Pay Gap* from the lowest to the highest quintile results in a 5.6% proportional rise in institutional ownership.[[6]](#footnote-6) Given that institutional investors in our sample invest, on average, $5.67 billion per firm, this represents an additional $318 million dollar investment from institutional investors into the firm.

As a preliminary means of addressing endogeneity, Columns (3) and (4) show the results based on the use of lagged *CEO Pay Gap* as an exogenous variable to mitigate the concern that an unidentified variable in year *t* is correlated with both *CEO Pay Gap* and *Inst. Holdings* at year *t*. Using the lagged value also limits the possibility that *Inst. Holdings* at year *t* can affect lagged *CEO Pay Gap* (Fang et al., 2009; Jayaraman & Milbourn, 2012). Consistent with our previous results, the coefficients of lagged *CEO Pay Gap* are also positive and statistically significant at the 1% level plus does not substantially change the size of the coefficient. Taken together, these results support our hypothesis that the strength of tournament competition influences institutional ownership levels.

To more formally address possible endogeneity issues, we apply an instrumental variable (IV) approach using two independent IVs in two separate regressions. The first IV that we consider is an *Industry* IV that is based on the prior literature. Both Kale, Reis, and Venkateswaran (2009) and Shen and Zhang (2018) use industry medians to instrument differences between the pay of the CEO and other senior management. They argue it meets the relevancy condition of a valid IV as Kale et al. (2009) highlight that executive compensation varies by firm size and industry. In addition, Shen and Zhang (2018) state that an individual firm is likely to be a “compensation-taker,” adjusting the top management team’s (TMT) compensation when peer firms change their executive pay (DiPrete, Eirich, and Pittinsky, 2010). In other words, the tournament incentives of a firm will be significantly influenced by industry trends. At the same time, it is also argued that the portion of the firm’s *CEO Pay Gap* that is correlated with the industry median level of CEO pay gap is less likely to be correlated with unknown factors that are affecting the firm’s institutional ownership, thus meeting the exclusion condition for a valid IV.

Therefore, based on Kale et. al. (2009) and Shen and Zhang (2018), we create an *Industry* IV that is calculated as the median CEO pay gap for firms in the same SIC division and is in same size quartile as the focus firm. In the first-stage regression, we use the *Industry* IV to predict a firm’s *CEO Pay Gap*. Subsequently, the fitted values of the first-stage regression are then used as the instrumented *CEO Pay Gap* for the second-stage of the 2SLS regression.

Columns (1) and (2) of Table 4 presents the two-stage least squares regression (2SLS) results from using the *Industry* IV as an instrument for *CEO Pay Gap*. We lag all our independent variables by one period in these regressions. Column (1) shows that the *Industry* IV is significant and positively related to *CEO Pay Gap*, thereby showing that it meets the relevancy condition. In Column (2) we find that the coefficient for the instrumented variable in the second-stage regression is also significant, at the 1% level, and positively related to *Inst. Holdings*.

In Columns (3) and (4), we repeat the 2SLS process using a completely different IV. Our *Geographic* IV is based on the median *CEO Pay Gap* of firms in the same size quartile and are within the same state where the focus firm is headquartered, but not in the same 2-digit SIC industry.[[7]](#footnote-7) Since state income taxes differ across states, this will have an impact on the after-tax values of the tournament incentives that firms offer. The state of California, for example, has double-digit income tax brackets; in contrast, there is no personal income tax in Florida. We therefore expect that tournament incentives will vary across states to partly offset the impact that state taxes have on the after-tax value of tournament incentives, thereby meeting the relevancy condition for a valid IV. In addition, to ensure it meets the exclusion condition, by using only firms from outside of the focus firm’s industry to calculate the median *CEO Pay Gap*, it is even more unlikely (relative to our *Industry* IV) that the focus firm will influence the tournament incentives of firms not in the same industry, as they are not in direct competition with each other.

Our results from using the *Geographic* IV show that this variable meets the relevancy condition as the coefficient of the *Geographic* IV is positive and significant at the 1% level in the first stage regression. In addition, the instrumented corporate tournament measure is statistically significant and positive at the 1% level in the second stage regression, indicating that institutional investors prefer to invest in companies with higher corporate tournament incentives.

1. **Additional analyses**

*5.1 An alternative proxy for corporate tournament competition*

We next consider an alternative proxy for corporate tournament competition, the number of Vice Presidents (*VP*) in the firm, as suggested by Main, O’Reilly, and Wade (1993), Kale, Reis, and Venkateswaran (2009), and Kini and Williams (2012). The higher the number of VPs in a firm, the larger the *CEO Pay Gap* is likely to be in order to compensate for the lower probability of winning a CEO tournament (Main, O’Reilly, and Wade, 1993). Main et al. (1993) find a positive relationship between the number of VPs and dollar-denominated CEO pay gaps, and this is also true for our sample. For example, the dollar-denominated CEO pay gap in our sample is almost double the size when the number of VPs increase from 2 to 4.[[8]](#footnote-8)

In Columns (1) and (2) of Table 5 we show the results from re-running our baseline regressions (i.e., Table 3) when we replace *CEO Pay Gap* with the contemporaneous and the lagged number of VPs, respectively. We find that the coefficient for *VP* is positive and significant (insignificant) for the contemporaneous (lagged) values. However, the coefficient for *VP* is also significant for the lagged values when we apply an instrumental variable approach. Columns (3) and (4) show the first and second stage results when using the median number of VPs in the industry of the focus firm within the same size quartile as an IV (*Industry-VP*). Columns (5) and (6) provide the results when applying an IV, *Geographic-VP*, that is based on the median number of VPs firms have within the same state as the focus firm and are in the same size quartile. In each case, the first-stage coefficients are significant and have the right signs. In the second-stage regressions the coefficients for the instrumented variables are also positive and significant, confirming that as the number of VPs within a firm rises, so does the proportion of institutional investors holding shares in the firm.

*5.2 Tournament intensity*

Next, we examine a subset of our data and select years in which the payoffs from tournament competition are more (or less) likely to be materialized. This should have an impact on the importance of tournament incentives within the firm and therefore the value of it for the sophisticated (institutional) investor. We expect that after there has been a change in the CEO, the value of tournament incentives within the firm will diminish. The reason being that contestants for the position (i.e., other senior management) have a reduced incentive to exert additional effort in their role when they know the payoff, of becoming the new CEO, is unlikely to occur in the immediate future. Hence, we expect the intensity of tournament competition to be lower, and *CEO Pay Gap* to have a weaker effect, on institutional ownership in the post-appointment period relative to before the CEO turnover occurs.

Panel A of Table 6 presents the regression results of *CEO Pay Gap* on *Inst. Holdings* during a 3-year, pre- and post-CEO turnover period. Consistent with our expectation, the coefficient on *CEO Pay Gap* prior to CEO turnover is positive and significantly larger than the coefficient on *CEO Pay Gap* after the CEO turnover (0.1795 versus 0.1202, respectively). The difference in *CEO Pay Gap* coefficients in the two regressions is statistically significant at the 1% level (χ2 = 15.31).[[9]](#footnote-9) Panel B of Table 6 shows the results from using a shorter time frame of 2 years for the pre- and post-CEO turnover period. These results are consistent with those in Panel A; specifically, the coefficient on *CEO Pay Gap* prior to CEO turnover is positive and significantly larger (χ2 = 3.82) than the coefficient on *CEO Pay Gap* after the CEO turnover. Overall, these results in Table 6 also provide further support for our hypothesis that tournament competition has a positive impact on ownership demand from sophisticated (institutional) investors.

Our next subsample analysis focuses on the impact of CEO retirement. All else equal, we expect that the intensity of corporate tournaments will increase as the CEO approaches retirement, particularly if there are younger VP’s within the firm that can take over. If institutional investors are attracted by corporate tournament competition, then the impending retirement of a CEO should act as a positive signal for additional institutional interest. We therefore posit a stronger relationship between internal tournaments and institutional ownership when the sitting CEO is likely to be replaced in the near term. In columns (1) and (2) of Panel A in Table 7 we present the regressions *of CEO Pay Gap* on *Inst. Holdings* for a subset retirement-CEO firms and non-retirement-CEO firms. We classify retirement-CEO firms as those firms that have a CEO of retirement age (age 60 years or older) and where possible internal replacements exist (measured by the average age of the remaining TMT being below 60 years of age). We lag all our independent variables. We find that the sensitivity of *CEO Pay Gap* on *Inst. Holdings* is higher for the retirement-CEO subsample than the non-retirement-CEO subsample larger (χ2 = 3.46). Overall, consistent with our expectation, we find that there is a higher sensitivity between *CEO Pay Gap* and institutional ownership when the payoff from tournaments (i.e., CEO turnover) is more likely to occur.

*5.3 The impact of capital expenditure*

 Finally, we extend our theoretical model to explicitly -consider the impact that capital expenditure can have in intensifying the relationship between *CEO Pay Gap* and institutional ownership. By differentiating equation (10) with respect to *I*, we arrive at:

$$\frac{d^{2}x\_{S}^{\*}}{d∆wdI}=\frac{1}{2∙k∙\sqrt{π}∙σ\_{ε}∙\left[r\_{N}∙(σ^{2}+σ\_{ε}^{2})+r\_{S}∙σ\_{ε}^{2}\right]}>0. (11)$$

Equation (11) implies that the effort CEO contestants exert, and the capital the firm invests in for the projects it executes, are complements in enhancing project value. Hence, when greater corporate tournament competition induces more effort input from CEO contestants, this value creation should be greater for firms that invest in more capital. Therefore, firms with high capital expenditures are effectively “leveraging up” the impact of managerial efforts and actions on corporate performance.

Using the ratio of capital expenditure over total assets (*CAPEX*) as a proxy for capital intensity, we split our sample into low and high capital intensive firms based on whether they are below, or above, the median of the ratio, respectively. Panel B of Table 7 provides the results from the regressions of low and high *CAPEX* firms. As expected, regression analyses reveal that the impact oftournament incentiveson institutional holdings is amplified for high capital-intensive firms. The coefficient for *CEO Pay Gap* is significantly lower, at the 5% significance level (χ2 = 3.46), for low *CAPEX* firms relative to high *CAPEX* firms (0.1053 versus 0.1514, respectively).

*5.4 Further analyses*

A number of further tests are also conducted that we do not tabulate. These include changes to how we measure the dependent variable, *CEO Pay Gap*.Specifically, our results hold if we remove all firms that have five or less VP’s (11% of our sample) and when we use different measures of dollar-denominated CEO Pay Gap (as opposed to the proportionally-based pay gap measure we focus on). Our results also hold for various sub-sample periods. This includes when we account for FAS 123R taking effect in June 2005. FAS 123R replaces the previous FAS 123 that requires all firms to expense employee stock options at fair market values, thereby removing the accounting benefits associated with stock option grants. This new accounting standard may influence CEO total compensation and the benefits from tournament incentives that a firm offers. However, we find our results do not change when we split our data before and after FAS 123R is introduced.

# Conclusion

This study extends the corporate tournament literature by investigating how tournament incentives influence institutional investors. We first construct a model that captures the salient features of internal tournaments and their impact on ownership structures. Utilising a large sample, we find strong support for our model prediction, i.e. that firms can influence institutional holdings by changing the strength of tournament incentives. Our findings are robust to alternative measures of tournament competition and to potential endogeneity issues. Overall, this study uncovers a novel linkage between corporate tournaments and institutional ownership.

# Bibliography

Aghion, P., Van Reenen, J., & Zingales, L. (2013). Innovation and institutional ownership. *American Economic Review*, 103(1), 277-304.

Allen, F., Bernardo, A., and I. Welch. (2000). A Theory of Dividends Based on Tax Clienteles. *Journal of Finance*, 55, 2499-2536.

Attig, N., Cleary, S., El Ghoul, S., & Guedhami, O. (2013). Institutional investment horizons and the cost of equity capital. *Financial Management*, 42(2), 441-477.

Baker, G., Gibbs, M., & Holmstrom, B. (1994). The wage policy of a firm. *The Quarterly Journal of Economics*, 109(4), 921-955.

Bebchuk, L., Cohen, A. and Ferrell, A. (2009). What Matters in Corporate Governance? *The Review of Financial Studies*, 22 (2), 783-827.

Bebchuk, L.A., Cremers, K.J.M. and Peyer, U.C. (2011) The CEO pay slice, *Journal of Financial Economics*, 102(1), 199-221.

Bergstresser, D. and Philippon, T. (2006). CEO incentives and earnings management, *Journal of Financial Economics*, 80, 511-529

Beyer, A., Cohen, D. A., Lys, T. Z., & Walther, B. R. (2010). The financial reporting environment: Review of the recent literature. *Journal of Accounting and Economics*, 50(2), 296-343.

Bhattacharya, U., & E. Jacobsen, S. (2016). The share repurchase announcement puzzle: Theory and evidence. *Review of Finance*, 20(2), 725-758.

Boehmer, E., & Kelley, E. K. (2009). Institutional investors and the informational efficiency of prices. *The Review of Financial Studies*, 22(9), 3563-3594.

Bognanno, M. L. (2001). Corporate tournaments. *Journal of Labor Economics*, 19(2), 290-315.

Boone, A. L., & White, J. T. (2015). The effect of institutional ownership on firm transparency and information production. *Journal of Financial Economics*, 117(3), 508-533.

Bushee, B. J. (1998). The influence of institutional investors on myopic R&D investment behavior. *Accounting Review*, 305-333.

Bushee, B. J., & Noe, C. F. (2000). Corporate disclosure practices, institutional investors, and stock return volatility. *Journal of Accounting Research*, 171-202.

Chen, X., & Cheng, Q. (2006). Institutional holdings and analysts' stock recommendations. *Journal of Accounting, Auditing & Finance*, 21(4), 399-440.

Chen, Z., Huang, Y. and Wei, K.C.J. (2013). Executive pay disparity and the cost of equity capital, *Journal of Financial and Quantitative Analysis*, 48(3), 849-885.

Chhaochharia, V. and Grinstein, Y. (2009). 'CEO compensation and board structure', *Journal of Finance*, 64(1), 231-261

Chung, K. H., & Zhang, H. (2011). Corporate governance and institutional ownership. *Journal of Financial and Quantitative Analysis*, 46(1), 247-273.

Coles, J.L., Daniel, N.D. & Naveen, L. (2014). Co-opted boards, *Review of Financial Studies*, 27(6), 1751-1796.

Coles, J.L., Daniel, N.D. and Naveen, L. (2006). Managerial incentives and risk-taking, *Journal of Financial Economics*, 79(2), 431-468.

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.

Conyon, M., Peck, S. and G. Sadler. (2001). Corporate tournaments and executive compensation: Evidence from the U.K. *Strategic Management Journal*, 22, 805-815.

Cremers, M. and Palia, D. (2011). Tenure and CEO pay, <http://depot.som.yale.edu/icf/papers/fileuploads/2701/original/2011\_ICF\_WPS\_Tenure\_and\_CEO\_Pay\_Cremers.pdf>

Dechow, P.M., Sloan, R.G. and Sweeney, A.P. (1995). Detecting Earnings Management, *Accounting Review*, 70(2), 193-225

DiPrete, T. A., Eirich, G. M., & Pittinsky, M. (2010). Compensation benchmarking, leapfrogs, and the surge in executive pay. *American Journal of Sociology*, 115(6), 1671-1712.

Edmans, A. (2014). Blockholders and corporate governance. *Annual Review of Financial Economics*, 6(1), 23-50.

Fang, V., T. Noe and S. Tice (2009). Stock market liquidity and firm value. *Journal of Financial Economics*, 94(1): 150-169.

Gibbons, R., and M. Waldman. (1999). Careers in organizations: Theory and evidence. In: Handbook of Labor Economics, Vol. 3a, (eds.) O. Ashenfelter and D. Card, 2384-2420. Amsterdam: Elsevier.

Gompers, P. A., & Metrick, A. (2001). Institutional investors and equity prices. *The Quarterly Journal of Economics*, 116(1), 229-259.

Grullon, G., Kanatas, G., & Weston, J. P. (2004). Advertising, breadth of ownership, and liquidity. *The Review of Financial Studies*, 17(2), 439-461.

Gurtler, O., and M. Krakel. (2010). Optimal tournament contracts for heterogeneous workers. *Journal of Economic Behavior & Organization*, 75, 180-191.

Haß, L. H., Müller, M. A., & Vergauwe, S. (2015). Tournament incentives and corporate fraud. *Journal of Corporate Finance*, 34, 251-267.

Huang, C. F., & Litzenberger, R. H. (1988). Foundations for financial economics. North-Holland.

Hvide, H. (2002). Tournament Rewards and Risk Taking. *Journal of Labor Economics*, 20, pp. 877-898.

Jayaraman, S. and Milbourn, T. T. (2012). The role of stock liquidity in Executive compensation, *Accounting Review*, 87(2), 537-563.

Jones, J.J. (1991). Earnings Management During Import Relief Investigations, *Journal of Accounting Research*, 29, 193-228.

Kale, J.R., Reis, E. and Venkateswaran, A. (2009). Rank-order tournaments and incentive alignment: the effect on firm performance. *Journal of Finance*, 64, 1479–1512.

Kini, O. and Williams, R. (2012). Tournament incentives, firm risk, and corporate policies. *Journal of Financial Economics*, 103, 350-376.

Lazear, E., and S. Rosen. (1981). Rank order tournaments as optimum labor contracts, *Journal of Political Economy*,89, 841-864.

Main, B. G., O'Reilly III, C. A., & Wade, J. (1993). Top executive pay: Tournament or teamwork? *Journal of Labor Economics*, 11(4), 606-628.

Massa, M., and L. Zhang. (2018). Does corporate hedging attract foreign institutional investors? Evidence from international firms. *Journal of International Business Studies*, 49(5), 605-632.

Mobbs, S., and C. Raheja. (2012). Internal managerial promotions: Insider incentives and CEO succession. *Journal of Corporate Finance*, 18, 1337-1353.

Nalebuff, B., and J. Stiglitz. (1983). Prizes and incentives: Towards a general theory of compensation and competition. *Bell Journal of Economics* 14, 21-43.

Perotti, E., and S. Rossetto. (2007). Unlocking Value: Equity Carve Outs as Strategic Real Options. *Journal of Corporate Finance*, 13, 771-792.

Phan, H. V., Simpson, T., & Nguyen, H. T. (2017). Tournament-Based Incentives, Corporate Cash Holdings, and the Value of Cash. *Journal of Financial and Quantitative Analysis*, 52(4), 1519-1550.

Ridge, J. W., Aime, F., & White, M. A. (2015). When much more of a difference makes a difference: Social comparison and tournaments in the CEO's top team. *Strategic Management Journal*, 36(4), 618-636.

Romer, D. (2011). Advanced Macroeconomics. 4 Edition. McGraw-Hill.

Schain, J. P., & Stiebale, J. (2016). Innovation, institutional ownership, and financial constraints (No. 219). DICE Discussion Paper.

Shen, C. H. H., & Zhang, H. (2018). Tournament Incentives and Firm Innovation. *Review of Finance*, 22(4), 1515-1548.

Strobl, G. (2014). Stock-based managerial compensation, price informativeness, and the incentive to overinvest. *Journal of Corporate Finance*, 29, 594-606.

Vives, X. (2008). Information and Learning in Markets: The Impact of Market Microstructure. Princeton University Press.

**Table 1: Descriptive statistics and correlation matrix**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|   | Variables | Mean | Median | SD | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
| *Dependent variable:*  |   |   |   |   |   |   |   |   |   |   |   |   |   |   |  |
| 1 | Inst. Holdings | 0.718 | 0.736 | 0.188 | 1.000 |  |  |  |  |  |  |  |  |  |  |  |  |
| *Independent variable:* |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 2 | CEO Pay Gap | 0.401 | 0.402 | 0.111 | 0.112a | 1.000 |  |  |  |  |  |  |  |  |  |  |  |
| *Control Variables* |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 3 | Ln (Total Assets) | 7.464 | 7.307 | 1.493 | 0.037a | 0.127a | 1.000 |  |  |  |  |  |  |  |  |  |  |
| 4 | Sales Growth | 0.095 | 0.073 | 0.213 | 0.061a | -0.010 | -0.032a | 1.000 |  |  |  |  |  |  |  |  |  |
| 5 | ROA | 0.104 | 0.100 | 0.086 | 0.062a | 0.053a | 0.058a | 0.230a | 1.000 |  |  |  |  |  |  |  |  |
| 6 | Returns | 0.170 | 0.117 | 0.466 | 0.047a | 0.038a | -0.007 | 0.331a | 0.230a | 1.000 |  |  |  |  |  |  |  |
| 7 | Leverage | 0.184 | 0.168 | 0.160 | -0.031a | 0.084a | 0.273a | -0.033a | -0.129a | -0.062a | 1.000 |  |  |  |  |  |  |
| 8 | σROA | 0.018 | 0.011 | 0.023 | -0.052a | -0.056a | -0.172a | -0.057a | -0.210a | -0.098a | -0.016b | 1.000 |  |  |  |  |  |
| 9 | σOCF | 0.049 | 0.044 | 0.025 | -0.004 | -0.035a | -0.184a | 0.039a | 0.349a | 0.084a | -0.203a | 0.269a | 1.000 |  |  |  |  |
| 10 | Capex | 0.052 | 0.038 | 0.044 | -0.052a | -0.047a | 0.023a | 0.085a | 0.108a | 0.072a | 0.046a | 0.044a | 0.169a | 1.000 |  |  |  |
| 11 | R&D | 0.032 | 0.008 | 0.048 | 0.015c | -0.078a | -0.163a | 0.055a | -0.112a | 0.029a | -0.266a | 0.198a | 0.109a | -0.135a | 1.000 |  |  |
| 12 | Disc. Accrual | 0.397 | 0.074 | 0.971 | 0.028a | 0.013c | 0.009 | 0.048a | -0.014d | 0.006 | -0.001 | 0.013 | 0.034a | 0.017b | 0.080a | 1.000 |  |
| 13 | Entrenched | 0.123 | 0.000 | 0.328 | 0.159a | 0.047a | -0.007 | -0.030a | -0.020b | -0.046a | 0.002 | -0.017b | -0.012 | -0.038a | -0.038a | 0.024a | 1.000 |

This table presents the descriptive statistics and correlation matrix of the main variables of interest (*CEO Pay Gap* and *Inst. Holdings*) and control variables. Appendix I provides a detailed description of the variables. The sample size is 15,845. a, b and c denote significance (correlation) at the 1%, 5% and 10% levels, respectively.

**Table 2: Institutional ownership sorted by *CEO Pay Gap* quintiles**

|  |  |
| --- | --- |
|  | *Inst. Holdings* |
|  |  | Mean | Median | Obs. |
| *CEO Pay Gap* | 1 (low) | 0.6782 | 0.6926 | 3,169 |
| 2 | 0.7089 | 0.7241 | 3,169 |
| 3 | 0.7292 | 0.7450 | 3,169 |
| 4 | 0.7349 | 0.7459 | 3,169 |
| 5 (high) | 0.7392 | 0.7614 | 3,169 |
| Mean / Median difference | 1 (low) -5 (high) | -0.0611 | -0.0688 |  |
| T-test  | 1 (low) -5 (high) | -12.58\*\*\* |  |  |
| Mann-Whitney-test | 1 (low) -5 (high) |  | 12.66\*\*\* |  |

This table reports the average and median *Inst. Holdings* sorted by the size of the firm’s *CEO Pay Gap*. The number in the T-test (Mann\_Whitney-test) rows are the differences of mean (median) *Inst. Holdings* between the lowest *CEO Pay Gap* quintile and highest *CEO Pay Gap* quintile, with the symbols representing *t*-test significance. \*\*\*, \*\* and \* denote significance at the 1%, 5% and 10% levels, respectively.

**Table 3: Baseline regressions**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Regression: | (3.1) | (3.2) | (3.3) | (3.4) |
| *Dependent variable:* | Inst. Holdings | Inst. Holdings | Inst. Holdings | Inst. Holdings |
| *Independent variables:* | Contemporaneous | Contemporaneous | One year lagged | One year lagged |
| CEO Pay Gap |  0.1405 |  0.1320 |  0.1347 |  0.1308 |
|   | (11.9113)\*\*\* | (11.0511)\*\*\* | (11.4557)\*\*\* | (10.7792)\*\*\* |
|  |  |  |  |  |
| Ln (Total Assets) |  | -0.0031 |  | -0.0049 |
|   |  | (-1.1370) |  | (-1.9236)\* |
| Sales Growth |  |  0.0285 |  |  0.0138 |
|   |  | (3.2190)\*\*\* |  | (1.5862) |
| ROA |  |  0.1801 |  |  0.1926 |
|   |  | (4.8087)\*\*\* |  | (5.2722)\*\*\* |
| Returns |  |  0.0113 |  |  0.0108 |
|   |  | (3.4985)\*\*\* |  | (3.0840)\*\*\* |
| Leverage |  |  0.0466 |  |  0.0555 |
|   |  | (4.7027)\*\*\* |  | (5.0214)\*\*\* |
| σROA |  | -0.2347 |  | -0.1165 |
|  |  | (-1.9943)\*\* |  | (-1.0098) |
| σOCF |  | -0.2693 |  | -0.2845 |
|   |  | (-3.7377)\*\*\* |  | (-3.5405)\*\*\* |
| Capex |  |  0.0376 |  |  0.0427 |
|  |  | (1.1615) |  | (1.4101) |
| R&D |  |  0.2672 |  |  0.3244 |
|   |  | (6.5381)\*\*\* |  | (7.5814)\*\*\* |
| Disc. Accrual |  | -0.0060 |  | -0.0052 |
|   |  | (-4.9437)\*\*\* |  | (-3.6684)\*\*\* |
| Entrenched |  |  0.0200 |  |  0.0209 |
|  |  | (4.9554)\*\*\* |  | (5.6019)\*\*\* |
| Constant |  0.6659 |  0.6710 |  0.6821 |  0.6948 |
|   | (71.8409)\*\*\* | (23.8808)\*\*\* | (87.2051)\*\*\* | (27.1411)\*\*\* |
|  |  |  |  |  |
| Observations: | 15,845 | 15,845 | 12,773 | 12,773 |
| Adj R-squared: | 0.2693 | 0.2838 | 0.2617 | 0.2760 |
| Year Fixed Effects: | Yes | Yes | Yes | Yes |
| Industry Fixed Effects: | Yes | Yes | Yes | Yes |

This table reports panel least squares regressions of *Inst. Holdings* on *CEO Pay Gap* and one-year lagged *CEO Pay Gap*. Appendix I provides a detailed description of the variables. T-statistics are presented in brackets. Robust standard errors are used throughout. \*\*\*, \*\* and \* denote significance at the 1%, 5% and 10% levels, respectively.

**Table 4: Two-stage least squares regressions**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Regression: | (4.1) | (4.2) | (4.3) | (4.4) |
| Two-Stage Least Squares | 1st Stage | 2nd Stage | 1st Stage | 2nd Stage |
| *Dependent variable:* | CEO Pay Gap | Inst. Holdings | CEO Pay Gap | Inst. Holdings |
| *Independent variables:* | One year lagged | One year lagged | One year lagged | One year lagged |
| Industry IV |  0.7929 |   |  |  |
|  | (38.2493)\*\*\* |   |  |  |
| Geographical IV |  |  |  0.0951 |  |
|  |  |  | (3.8973)\*\*\* |  |
| Instrumented CEO Pay Gap |  |  0.7343 |  |  1.5202 |
|  | (6.2586)\*\*\* |  | (2.9220)\*\*\* |
|  |  |  |  |  |
| Ln (Total Assets) | -0.0017 | -0.0066 |  0.0049 | -0.0117 |
|   | (-2.5107)\*\* | (-2.1499)\*\* | (4.6552)\*\*\* | (-2.4046)\*\* |
| Sales Growth | -0.0080 |  0.0327 | -0.0081 |  0.0426 |
|   | (-1.6043) | (3.1386)\*\*\* | (-1.6996)\* | (3.0163)\*\*\* |
| ROA |  0.0665 |  0.1335 |  0.0813 |  0.0668 |
|   | (6.3619)\*\*\* | (3.2557)\*\*\* | (7.5812)\*\*\* | (1.1990) |
| Shareholder Return |  0.0093 |  0.0054 |  0.0104 | -0.0031 |
|   | (4.3361)\*\*\* | (1.2475) | (4.4876)\*\*\* | (-0.4365) |
| Leverage |  0.0321 |  0.0231 |  0.0385 | -0.0055 |
|   | (5.3364)\*\*\* | (2.1892)\*\* | (6.0435)\*\*\* | (-0.2821) |
| σROA | -0.0378 | -0.2130 | -0.0411 | -0.1761 |
|  | (-0.8677) | (-1.6972)\* | (-0.9557) | (-1.1472) |
| σOCF | -0.0458 | -0.2460 | -0.0629 | -0.1906 |
|   | (-1.1549) | (-2.8632)\*\*\* | (-1.5589) | (-1.7455)\* |
| Capex | -0.0919 |  0.1000 | -0.0922 |  0.2011 |
|  | (-3.1823)\*\*\* | (2.0769)\*\* | (-3.2323)\*\*\* | (2.5333)\*\* |
| R&D | -0.1105 |  0.3436 | -0.1177 |  0.4170 |
|   | (-5.5209)\*\*\* | (8.9666)\*\*\* | (-5.9072)\*\*\* | (5.4602)\*\*\* |
| Discretionary Accrual |  0.0007 | -0.0061 | -0.0001 | -0.0068 |
|   | (1.1557) | (-4.5382)\*\*\* | (-0.1549) | (-3.6718)\*\*\* |
| E-Index |  0.0087 |  0.0133 |  0.0114 |  0.0025 |
|  | (4.5341)\*\*\* | (2.8874)\*\*\* | (5.7979)\*\*\* | (0.2632) |
| Constant |  0.0691 |  0.4815 |  0.2811 |  0.2470 |
|   | (7.0659)\*\*\* | (10.6106)\*\*\* | (21.2170)\*\*\* | (1.5532) |
|  |  |  |  |  |
| Observations: | 15845 | 15845 | 14678 | 14678 |
| Period Fixed Effects: | Yes | Yes | Yes | Yes |
| Industry Fixed Effects: | Yes | Yes | Yes | Yes |

This table reports the two-stage least squares regressions of *Inst. Holdings* on *CEO Pay Gap*. An *Industry* based CEO Pay Gap measureis utilised as an instrumental variable in the first column. A *Geographic* based CEO pay gap measure is utilized as an instrumental variable in the third column. Appendix I provides a detailed description of the variables. Robust standard errors are used throughout. T-statistics are presented in brackets. \*\*\*, \*\* and \* denote significance at the 1%, 5% and 10% levels, respectively.

**Table 5: Alternative measure for corporate tournaments**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Regression: | (5.1) | (5.2) | (5.3) | (5.4) | (5.5) | (5.6) |
| Two-Stage Least Squares |  |  | 1st Stage | 2nd Stage | 1st Stage | 2nd Stage |
| *Dependent variable:* | Inst. Holdings | Inst. Holdings | VP | Inst. Holdings | VP | Inst. Holdings |
|  |  |  |  |  |  |  |
| VP |  0.0031 |  |  |  |  |  |
|  | (2.8670)\*\*\* |  |  |  |  |  |
| VP (t-1) |  |  0.0008 |  |  |  |  |
|  |  | (0.5452) |  |  |  |  |
| *Industry-VP* IV |  |  |  0.4400 |  |  |  |
|  |  |  | (9.3472)\*\*\* |  |  |  |
| *Geographic-VP* IV |  |  |  |  |  0.1529 |  |
|  |  |  |  |  | (4.9831)\*\*\* |  |
| Instrumented VP |  |  |  |  0.1392 |  |  0.0749 |
|  |  |  |  | (9.4194)\*\*\* |  | (2.0418)\*\* |
|  |  |  |  |  |  |  |
| Observations: | 15,845 | 12,773 | 15,845 | 11,764 | 14,678 | 10,882 |
| Adj R-squared: | 0.2784 | 0.2702 | 0.1988 | NA | 0.1804 | NA |
| Control variables | Yes | Yes | Yes | Yes | Yes | Yes |
| Year Fixed Effects: | Yes | Yes | Yes | Yes | Yes | Yes |
| Industry Fixed Effects: | Yes | Yes | Yes | Yes | Yes | Yes |

This table reports the panel least squares regressions of *Inst. Holdings* on *VP* and lagged *VP*. *Industry-VP* is utilized as an instrumental variable in columns (3) and (4). For columns (5) and (6), *Geographic-VP* is utilized as an instrumental variable. Appendix I provides a detailed description of the variables. T-statistics are presented in brackets. Robust standard errors are used throughout. \*\*\*, \*\* and \* denote significance at the 1%, 5% and 10% levels, respectively.

**Table 6: Pre- and post-CEO turnover**

**Panel A: 3-years before and 3-years after CEO turnover**

|  |  |  |
| --- | --- | --- |
| Regression: | (6.1) | (6.2) |
|  | 3yrs Pre-CEO Turnover | 3yrs Post-CEO Turnover |
| *Dependent variable:* | Inst. Holdings | Inst. Holdings |
|  |  |  |
| CEO Pay Gap |  0.1795 |  0.1202 |
|  | (4.7588)\*\*\* | (3.2593)\*\*\* |
|  |  |  |
| Observations: | 3,053 | 2,918 |
| Adj R-squared: | 0.0738 | 0.0756 |
| Control variables: | Yes | Yes |
| Industry Fixed Effects: | Yes | Yes |
|  |  |  |
| (6.1) – (6.2) Difference in *CEO Pay Gap* coefficients  | χ2 test = 15.31\*\*\* |

**Panel B: 2-year before and one year after CEO turnover**

|  |  |  |
| --- | --- | --- |
| Regression: | (6.3) | (6.4) |
|  | 2yr Pre-CEO Turnover | 2yr Post-CEO Turnover |
| *Dependent variable:* | Inst. Holdings | Inst. Holdings |
|  |  |  |
| CEO Pay Gap |  0.1403 |  0.1079 |
|  | (2.8862)\*\*\* | (2.8037)\*\*\* |
|  |  |  |
| Observations: | 2,195 | 2,229 |
| Adj R-squared: | 0.0681 | 0.0720 |
| Control variables: | Yes | Yes |
| Industry Fixed Effects: | Yes | Yes |
|  |  |  |
| (6.3) – (6.4) Difference in *CEO Pay Gap* coefficients  | χ2 test = 3.82\* |

Panel A (Panel B) reports the panel least squares regressions of *Inst. Holdings* on *CEO Pay Gap* three (one) years before and after CEO turnover. Appendix I provides a detailed description of the variables. T-statistics are presented in brackets. Robust standard errors are used throughout. We use seemingly unrelated regression analysis to generate χ2 test statistics of the differences in coefficients between subsamples. \*\*\*, \*\* and \* denote significance at the 1%, 5% and 10% levels, respectively.

**Table 7: The impact of CEO age and capital intensity.**

**Panel A: Firms with and without retirement-age CEOs**

|  |  |  |
| --- | --- | --- |
| Regression: | (7.1) | (7.2) |
|  | Near-Retirement-CEOwith Young-VPs | Non-Retirement-CEO |
| *Dependent variable:* | Inst. Holdings | Inst. Holdings |
|  |  |  |
| CEO Pay Gap (t-1) |  0.1764 |  0.1247 |
|  | (7.5249)\*\*\* | (7.9584)\*\*\* |
|  |  |  |
| Observations: | 1,872 | 9,490 |
| Adj R-squared: | 0.2502 | 0.2676 |
| Control variables: | Yes | Yes |
| Year Fixed Effects: | Yes | Yes |
| Industry Fixed Effects: | Yes | Yes |
|  |  |  |
| (7.1) – (7.2) Difference in CEO Pay Gap coefficients  | χ2 test = 3.46\* |

**Panel B: High vs low CAPEX firms**

|  |  |  |
| --- | --- | --- |
| Regression: | (7.3) | (7.4) |
|  | High CAPEX | Low CAPEX |
| *Dependent variable:* | Inst. Holdings | Inst. Holdings |
|  |  |  |
| CEO Pay Gap (t-1) |  0.1514 |  0.1056 |
|  | (10.5114)\*\*\* | (6.1055)\*\*\* |
|  |  |  |
| Observations: | 6443 | 6330 |
| Adj R-squared: | 0.2779 | 0.2905 |
| Control variables: | Yes | Yes |
| Year Fixed Effects: | Yes | Yes |
| Industry Fixed Effects: | Yes | Yes |
|  |  |  |
| (7.3) – (7.4) Difference in CEO Pay Gap coefficients  | χ2 test = 6.44\*\* |

Panel A reports the panel regressions for non-retirement and retirement-CEO subsamples. Panel B reports the results based on splitting the sample between high and low CAPEX firms. All independent variables are lagged by one period. Appendix I provides a detailed description of the variables. T-statistics are presented in brackets. Robust standard errors are used throughout. We use seemingly unrelated regression analysis to generate χ2 test statistics of the differences in coefficients between subsamples. \*\*\*, \*\* and \* denote significance at the 1%, 5% and 10% levels, respectively.

**Appendix I: Variable Definitions**

This appendix provides a detailed description of the construction of all the variables used in the tables.

|  |  |
| --- | --- |
| **Variable** | **Definition** |
| CAPEX | The ratio of capital expenditure over total assets. Capital expenditure cover funds used to purchase additional property, plant and equipment, excluding business acquisitions (mergers and acquisitions). This variable is winsorized at the 1st and 99th percentiles. |
| CEO Pay Gap | The ratio of CEO total compensation over the sum of total compensation of the CEO plus the next four highest-paid executives. This variable is winsorized at the 1st and 99th percentiles. |
| Disc. Accrual | The difference between total accrual and non-discretional accrual. We follow the method of Dechow et al. (1995) to compute total accruals. To estimate non-discretional accruals, we use Jones (1991) model of accruals.  |
| Entrenched | A dummy variable that is equal to one if the firm is highly entrenched (an E-Index score (Bebchuk, Cohen and Ferrel, 2009) greater than 4), and otherwise equal to zero.  |
| Geographic IV | The median CEO Pay Gap of firms within the same state and being in the same size quartile (measured by total assets) but not in the same 2-digit SIC as the focus firm. |
| Geographic-VP IV | The median CEO Pay Gap of firms within the same state and being in the same size quartile (measured by total assets) but not in the same 2-digit SIC as the focus firm. |
| Inst. Holdings | Total share ownership held by institutional investors. This variable is winsorized at the 1st and 99th percentiles. |
| Industry IV | The median CEO Pay Gap of firms with the same SIC division and being in the same size quartile (measured by total assets) as the focus firm. |
| Industry-VP IV | The median number of VPs of firms with the same SIC division and being in the same size quartile (measured by total assets) as the focus firm. |
| Leverage | Long-term debt divided by total assets. This variable is winsorized at the 1st and 99th percentiles. |
| Ln (Total Assets) | The natural logarithm of total assets. This variable is winsorized at the 1st and 99th percentiles. |
| R&D | Research and development expense divided by total assets. This variable is winsorized at the 1st and 99th percentiles. |
| ROA | The pre-tax operating income after depreciation divided by the prior year’s total assets. This variable is winsorized at the 1st and 99th percentiles. |
| Sales Growth | The change in sales over the last financial year. This variable is winsorized at the 1st and 99th percentiles. |
| Return | Shareholders’ prior year stock return. This variable is winsorized at the 1st and 99th percentiles. |
| VP | The number of vice presidents in the firm for any given year. This variable is winsorized at the 1st and 99th percentiles. |
| σROA | The standard deviation of the previous eight quarters of Return on Assets (ROA). This variable is winsorized at the 1st and 99th percentiles. |
| σOCF | The standard deviation of the previous eight quarters of the ratio of operating cash flows to total assets. This variable is winsorized at the 1st and 99th percentiles. |

1. The intuition behind our results carries over to a setting where players are risk-averse. [↑](#footnote-ref-1)
2. Because the effort choices are not observable and verifiable, the rewards must be based on the realized project values. Also, it is possible that the loser of the tournament would leave the firm. If that is the case, the reward, $w\_{L}$, can be considered the loser’s outside option value. [↑](#footnote-ref-2)
3. This assumption is consistent with Beyer et al. (2010), who argue that some investors may have limited or no knowledge of managers’ incentives and firms’ operating environment. Our result holds more generally if we impose some learning for the retail investor. All is required is that the retail investor has less perfect knowledge about the potential value of tournament incentives than the institutional investor. For simplicity, we assume the naïve trader holds on to the prior belief of the project value distributions. [↑](#footnote-ref-3)
4. Note that $E\_{S}\left[\tilde{V}\_{1}+\tilde{V}\_{2}\right]=2∙e^{\*}=\frac{∆w∙I}{k∙\sqrt{π}∙σ\_{ε}}$ because the institutional investor observes ∆w and rationally infers its implications for effort choices through Equation (5) and $E\left[\tilde{V}\_{1}+\tilde{V}\_{2}\right]=2∙\overbar{μ}$ because the retail investor holds on to the prior belief of the project value distribution. [↑](#footnote-ref-4)
5. To mitigate outlier effects, all continuous variables are winsorized at the 1st and 99th percentiles. [↑](#footnote-ref-5)
6. The difference in *CEO Pay Gap* between the lowest (0.248) and the highest quintile (0.553) is 0.305. This is synonymous with a 4.02% increase in institutional holdings (coefficient of *CEO Pay Gap* (0.1320) x 0.305 = 0.0402), or a 5.6% proportional increase from the average percentage of institutional holdings (0.718 from Table 1) of a firm (0.0402 / 0.718 = 5.6%). [↑](#footnote-ref-6)
7. We obtain addresses of firm headquarters from the Compustat North America database. [↑](#footnote-ref-7)
8. The CEO dollar pay gap for our sample is, on average, $1.7 million for firms with 2 VPs and $2.8 million when firms have 4 VPs. [↑](#footnote-ref-8)
9. We use seemingly unrelated regression analysis to generate χ2 test statistics of the differences in coefficients between subsamples. [↑](#footnote-ref-9)