Rank Order Tournaments and Incentive Alignment: The Effect on Firm Performance

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Abstract

In this article, we study the effectiveness of promotion-based tournament incentives. We simultaneously investigate tournament incentives for the VP and performance- or equity- based (alignment) incentives for the VP and the CEO. We find that tournament incentives, as measured by the pay differential between the CEO and VPs, relate positively to firm performance. We show that the effect of tournament incentives on firm performance is weaker when the firm has a new CEO from outside, when the firm has a succession plan, when the firm is in a homogenous industry, and when the firm has, a large number of VPs. On the other hand, tournament effects are stronger when the CEO is close to retirement. Our analysis is robust to corrections for endogeneity of all our incentive measures as well for several alternate measures of tournament incentives and firm performance.

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"In the Olympics prizes are awarded, not on the basis of absolute performance, but on the basis of relative performance. Similarly, in most organizations, one of the most important rewards is promotion."

Green and Stokey (1983)

Two features are common to the economic organization of typical corporations. The first feature is management by a team consisting of a CEO and a cadre of lower-rung executives (whom we call VPs for convenience). Second, there are two distinct categories of incentive mechanisms, one is output- or performance- based and the other is promotion. As Baker, Jensen and Murphy (1988) argue, since the CEO is at the top of the corporate hierarchy it rules out promotion-based tournament incentives for the CEO and leaves performance-based compensation as the only incentive.[1] A VP, on the other hand, faces both equity-based alignment and promotion-based tournament incentives. The availability of alternate incentive mechanisms implies that both need to be considered while examining the effect of executive compensation on firm performance. To our knowledge, ours is the first study that includes the effect of performance-based incentives of the CEO and both performance- and promotion- based tournament incentives for VPs on firm performance.

There is considerable theoretical and empirical research in finance on performance-based incentives for managers. Promotion-based tournament incentives, however, have received scant attention. The primary objective of our study is to investigate the use and effectiveness of promotion-based tournament incentives. The innovation of our study is that we simultaneously investigate the effects of performance-based incentives of the CEO and performance- and

[1] Corporate CEOs may be affected by an external tournament in which they compete with other CEOs, (e.g. Agrawal, Knoeber, and Tsoulouhas (2006) and Malmendier and Tate (2005)). In our analysis, we include industry homogeneity as a measure of intra-industry managerial mobility and a binary indicator for insider versus outsider successions to consider the effect of such tournaments and the benefits and costs of CEO appointments from outside and from within (e.g. Weisbach (1988), Parrino (1997), and Huson, Maletesta, and Parrino (2004)).

promotion- based tournament incentives of the VPs on firm performance. In keeping with the labor economics literature, we measure promotion-based incentives using the difference or gap in compensation between the CEO and VPs and denote this differential as "rank-order-tournament" or simply "tournament". We measure performance-based incentives by the sensitivity of managers' equity holdings in the firm to the firm's stock price and term this incentive "alignment." Using a large sample of nearly 18,000 firm-year observations over the period 1993 – 2004, we find significant evidence that performance-based incentives for the CEO and both performance- and tournament incentives for VPs relate positively to firm performance, which we proxy with *Firm q* (market-to-book value of assets) and *ROA* (return on assets) among others. We further show that these positive relations hold for several alternative measures of firm performance and tournament incentives and are robust to corrections for the endogeneity between incentives and firm performance measures.

In order to focus more directly on the effect of tournament incentives on firm performance, we consider several scenarios/events where tournament effects are likely to be either stronger or weaker. An event affects the relation between tournament incentives and firm performance through its impact on the two components of a tournament, size of the tournament prize (the compensation gap between CEO and VP) and/or a VP's probability of winning the prize through promotion. In our empirical analysis, the size of the prize (compensation gap) is fixed/given and therefore, an event will affect the relation between tournament and performance through the impact on a VP's probability of winning the prize/promotion.

For instance, we find that tournament effects on firm performance are weaker as the number of VPs in a firm increases because the probability of promotion for an individual VP decreases. Similarly, in firms with a designated successor, other incumbent VPs have a lower

probability of winning the tournament. Consequently, we find that tournament incentives have a weaker effect on firm performance when the firm has a succession plan in place. We also expect tournament effects to have a smaller impact on firm performance when the firm has a new CEO, since the tournament for the position of the outgoing CEO has just ended. Consistent with this argument, we find that, hiring a new CEO from *outside* the firm weakens tournament effects. The weakening of the tournament effect is however, significantly diminished, i.e. tournament effects are not as weak, when the new CEO is promoted from *within* the firm. Likewise, tournament effects are expected to be stronger when there is an outgoing CEO. In support of this argument, we find some evidence that tournament incentives are more effective when the incumbent CEO is close to retirement.

Intra-industry managerial mobility is also likely to influence tournament effects. To examine this possibility, we consider the effects of industry homogeneity. We conjecture that the incentive effects of tournaments should be weaker in industries that comprise of similar firms for two reasons. First, in homogenous industries, managers (VPs) will be better able to transfer their firm-specific investment in human capital to other firms in the industry making it easier for them to change jobs. Second, in such industries, the likelihood of hiring managers from outside is also greater, which reduces the probability of promotion for incumbent VPs.[2] Consistent with these arguments we find that tournament effects on firm value are significantly weaker in more homogenous industries. Taken together, these findings on the effectiveness of tournaments under various scenarios indicate that tournament incentives may be of considerable importance in the analysis of the effect of executive compensation on firm performance.

[2] Parrino (1997) argues that it is easier for managers to transfer their skills in homogenous industries and finds that intra-industry mobility of CEOs is higher in these industries.

In analyzing tournament incentives, we account for the performance-based alignment incentives of the CEO. Our analysis recognizes that VPs face both tournament and alignment incentives. Baker, Jensen and Murphy (1988) note the prevalence of hybrid incentive scheme for VPs. They further note that in most models of optimal compensation, the owner/principal, who offers the contract to the agent, owns 100 percent of the firm's equity. This assumption usually does not hold in the case of the CEO who sets the salary structure for VPs (Murphy (1999)). Relaxing the assumption of 100 percent ownership by the principal brings in concepts of "fairness" in the setting of executive pay, which may break the optimality of performance-based contracts.[3] Garvey and Swan (1992) formalize this notion in a model of a CEO who (i) wants "good relations" with subordinates (Murphy (1999)), (ii) has low pay-performance sensitivity (Jensen and Murphy (1990)), and (iii) faces high personal costs in firm bankruptcy (Gilson (1989)). The authors show that the optimal compensation scheme in such a setting is a hybrid of rank-order tournament incentives and output-based rates. By providing empirical evidence on the joint effectiveness of alignment and tournament incentives, we contribute to this literature on hybrid incentive schemes.

Studying tournament and alignment incentives together is important also because, depending on the situation, both tournaments and alignment suffer from certain drawbacks. Tournaments may lead to collusion among employees (Milgrom and Roberts (1992)) since rewards depend only on relative performance. Thus, employees may collude and collectively decide to shirk, which may be difficult to observe. Tournaments may also induce some employees to sabotage the work of others in order to get ahead leading to possible inefficiencies.

[3] In a recent working paper, Rajgopal and Srinivasan (2006) address the "fairness" issue by examining determinants of pay dispersion among the top executives in a firm to compare three alternate theories; the pay-equity view, tournament theory, and agency theory. In a related paper, Bebchuk, Cremers, and Peyer (2007) examine the fraction of total senior executive compensation that accrues to the CEO and its relation to Tobin's q.

While incentive alignment mechanisms may not suffer from these disadvantages, they are subject to other constraints. Rational investors in an efficient market will immediately incorporate the effect of any innovation in managerial pay into stock prices. This will almost immediately bid up the share price and subsequently any improvement in firm performance due to higher alignment may not result in higher returns (Milgrom and Roberts (1992)). Moreover, when the number of employees is large, it may be costly to write precise performance-based contracts for all. Furthermore, a contract that is optimal for an employee at a point in time may not be so in the next period. Thus, performance-based contracts need to be reset every period for them to be optimal at all times, which makes them even more costly to implement. Given these shortcomings of tournament and alignment incentives, it is reasonable to expect to see both mechanisms in play in the cross-section of firms.

Our work also relates to two other strands of literature on incentive mechanisms-tournaments and contracting. Lazear and Rosen (1981) were the first to present tournaments as an important incentive mechanism. In a tournament, the best relative performer is promoted to the next level in the hierarchy, while the others are passed over. Promotion to the next level carries with it a higher pay and, therefore, workers have the incentive to expend higher effort and increase the probability of promotion. Milgrom and Roberts (1992) argue that corporate tournaments are an effective incentive mechanism for several reasons. First, promotion incentive is the only candidate mechanism in those situations where there is little or no information about the absolute performance of the employee. For example, the individual divisions of a multi-division firm may operate in different industries, which make it difficult to compare absolute performance across divisions. Promotion-based incentives can be an effective mechanism in such a firm. Second, tournaments are more effective when there are possibilities of systematic shocks

that affect the individual's performance. For instance, if increased competition from imported goods affects the performance of all sales personnel, relative performance may be a better incentive mechanism than absolute performance. Finally, the intuitive basis of performance incentive contracts lies in tying employees' future earnings to current performance (e.g. Becker and Stigler (1974) and Lazear and Rosen (1981)). However, if performance is not verifiable, employers can misrepresent the output level achieved. Pure rank-order tournaments solve this problem because prizes in a tournament are committed in advance, which precludes employers from reneging on promised payouts. Our finding that tournaments affect firm performance positively offers support to the predictions of tournament theories.

Our work also adds to the labor economics literature on the determinants of tournaments (e.g. Ehrenberg and Bognanno (1990) and Bognanno (2001)). We propose and empirically investigate several factors that affect tournament prizes, not considered by prior studies in this area. Specifically, we include industry characteristics, CEO succession planning, CEO retirement, CEO entrenchment, promotion from within versus without, multi-division versus focused firms, and difficulty in signal extraction. We find that many of these new factors significantly affect the size of the tournament prizes.

Finally, our findings on performance-based incentives contribute to the large body of empirical work based on the principal-agent framework pioneered by Jensen and Meckling (1976) and Holmstrom (1979), which proposes that making executive compensation dependent on the output of the firm. A significant portion of the existing empirical research on compensation-based incentives and firm performance focuses on the incentives of CEOs, in particular those features of the compensation contract that align the interests of the CEO with shareholders' interests. However, Holmstrom and Kaplan (2003) argue that corporate boards

should require all key executives to hold "meaningful" amounts of firm equity in order to align manager and shareholder interests further. We contribute to this literature by jointly analyzing the performance-based incentives of both CEOs and VPs and by explicitly controlling for endogeneity between CEO and VP alignments with firm performance.

In the next Section, we describe our sample and variables. In Section II we discuss our findings on the determinants of tournaments. Section III contains our findings on the effect of tournaments and managerial alignment on firm performance and includes a discussion and our empirical treatment of the endogeneity issues. In Section IV, we discuss our findings on several special scenarios under which tournament effects are either stronger or weaker. In Section V, we present the findings of a number of tests that relate to the robustness of our results to alternate specifications as well as alternative measures of variables of interest. Section VI contains concluding remarks.

I. Data Sources, Variable Construction, and Sample Description

A. Data Sources

We obtain CEO and VP compensation data from the December 2005 release of Standard and Poor's (S&P) ExecuComp database, which covers about 1,500 firms per year that are in the S&P 500, S&P Mid-Cap 400, and S&P Small-Cap 600 indices. We define CEO as the person who is identified as the Chief Executive Officer of the firm in ExecuComp (CEOANN = CEO), and classify all other executives as VPs. Our sample period is from 1993 to 2004 and includes all firm-years that have an identifiable CEO, and at least three VPs.[4] We obtain stock returns and firm characteristics data from ExecuComp, Center for Research in Security Prices (CRSP) and

[4] Eliminating the restriction of having at least three VPs increases our final sample by 348 and does not significantly alter any of our results.

Compustat Industrial and Segment files. In addition to compensation and firm related data, we require several CEO- and VP- related variables for our analysis. These include age and experience of the CEO, whether the incumbent CEO is an insider or outsider, whether the new CEO is an insider or outsider, and the number and designation of VPs. ExecuComp provides some of this data. Specifically, ExecuComp provides data on CEO age and whether the CEO (incumbent or new) is from inside or outside the firm for about 50 percent of the CEOs and on CEO experience for about 90 percent of our sample. We manually obtain information on missing CEO age, CEO experience, and whether the CEO is an insider from other sources which include firm *Proxy statements*, the *International Directory of Company Histories*, *Marquis Who's Who publication*, *Forbes Surveys*, and the *Standard and Poor's Register of Corporations, Directors, and Executives*. For VP level data, such as whether one of the VPs is a President, Chief Financial Officer (CFO), or Chief Operating Officer (COO), we manually classify the designation of every VP for each firm-year in our sample based on their titles reported in ExecuComp. Our final sample contains complete data on all variables for 2,367 unique firms, 4,202 CEOs, 25,461 VPs, and 17,987 firm-years.[5]

B. Measures of Tournament Incentives

We classify the incentive features of executive compensation into two categories, "tournament" and "alignment". Consistent with prior studies the compensation gap between the CEO and the VPs is our primary measure of tournaments (e.g. Bognanno (2001) and Bloom (1999)). Executive compensation comprises of two components; (i) short-term compensation in the form of salary, bonus, and other fixed annual payments, and (ii) long-term compensation in the form of stock and option grants, and other long-term incentive payouts. Total compensation

[5] We are unable to identify whether 178 (out of 4,202) CEOs in our sample are insiders or outsiders. Consequently, our sample is reduced by 499 firm-years to 17,488 observations in tests that use this variable.

is the sum of short-term and long-term compensation. We compute three measures of tournament incentives; *Total Gap* based on total compensation, *ST Gap* based only on short-term compensation, and *LT Gap* based only on long-term compensation. Specifically,

Log (Total Gap) = Log (Total compensation of CEO – Median value of total compensation of all VPs in the firm-year)

Log (ST Gap) = Log (Short-term compensation of CEO – Median value of short-term compensation of all VPs in the firm-year)

Log (LT Gap) = Log (Long-term compensation of CEO – Median value of long-term compensation of all VPs in the firm-year)

There are instances where the CEO's compensation is less than the median or average VP's compensation resulting in a negative gap. We follow prior studies (e.g. Hartman (1984), Slemrod (1990), and Cassou (1997)) and monotonically transform all observations by adding a constant equal to the absolute value of the minimum gap to each observation. This enables us to use the log transformation even for negative gap observations.[6] We also utilize alternative methods to address the negative gap issue and discuss them in detail in the robustness tests section.

While *Log (Total Gap)*, *Log (ST Gap)*, and *Log (LT Gap)* are the tournament measures for which we report our results, we repeat all analyses and report our findings for several alternative tournament measures. These include, (i) *Gini coefficient* of executive compensation, (ii) Normalized rank or Cumulative Density Function (CDF) of gaps, (iii) Compensation gap between the CEO and the *highest* paid VP, and (iv) Compensation gap between the CEO and the *mean* VP.

[6] Short-term, long-term and total gaps are negative in 551, 2,022, and 770 firm-years. Consequently, we add 271, 1,040, and 810 thousand dollars to all observations for *ST Gap*, *LT Gap*, and *Total Gap* respectively, prior to the log transform.

The *Gini coefficient* is commonly used in the macroeconomics literature to measure income disparity (e.g. Donaldson and Weymark (1980), La Porta et al. (1998), Bloom (1999), and Biais and Perotti (2001)).[7] The formal definition of the *Gini coefficient* is;

$$Gini\ Coefficient = 1 + \frac{1}{n} - \frac{2}{n^2 \bar{y}}\left(y_1 + 2y_2 + ...ny_n\right)$$

Where, n is the number of executives including the CEO, $y_1, y_2 ... y_n$ is the compensation paid to each of the n executives in decreasing order of size, and $\bar{y}$ is their mean compensation. Therefore, the *Gini coefficient* in our analysis is a general measure of income disparity in the top echelon of a firm's hierarchy and is computable even for observations with negative gaps. By construction, the *Gini coefficient* takes values between zero and one; a coefficient closer to zero reflects lower income disparity while a coefficient closer to one reflects higher income disparity. The second tournament measure, *CDF Gap*, is the cumulative density function of the dollar value of compensation gaps between the CEO and the median VP across firms for each year in the sample. Like the *Gini Coefficient*, *CDF Gap* also assumes values between zero and one, where a value of zero implies that the firm has the lowest gap and one indicates the highest gap for that year. The last two measures of tournament are simply variants of our primary tournament measure, and use the highest paid and the mean VP's compensation instead of the median.

C. Alignment Incentive Measures

Alignment incentives arise from the structure of the compensation contract and depend on an executive's ownership in the firm's equity. In keeping with the literature (e.g. Aggarwal and Samwick (2003)), we define *Alignment* as the sum of stock and option sensitivities to a $100 change in shareholders' wealth. Specifically,

[7] See Chakravarty (1988) for the uses of the *Gini Coefficient*.

CEO Alignment = Percentage of shares held by CEO + [delta of options * number of options held by CEO / total number of shares outstanding].

We use the percentage of stock ownership at the beginning of the year for each executive to obtain the stock based sensitivity of an executive's equity portfolio. For option holdings, we use the number of options held by the manager at the beginning of the year, which represent option grants made in prior years. The proxy statement does not provide the exercise prices for these options but provides their intrinsic value. Following Murphy (1999), we determine an average exercise price for all previously granted options based on their year-end intrinsic value. Further, we treat all options that are held at the beginning of the year as a single grant with a five-year time to maturity.[8] We obtain the risk-free rate using data from the five-year treasury bills constant maturity series available from the Federal Reserve Bank's official website, and the dividend yield on the stock from ExecuComp. We estimate stock volatility as the annualized standard deviation of the previous 60 monthly total stock returns to shareholders using data from CRSP. We drop observations with less than 12 usable monthly returns. Using the above information, we compute the average delta of prior option grants using the modified Black-Scholes formula. For VPs, we compute the alignment variable described above for each VP and define *VP Alignment* as the median value of alignment for all VPs in a particular firm-year.

D. Summary Statistics for Managerial Incentives

We present summary statistics for managerial compensation, tournament and alignment measures in Table 1. Panels A and B present the compensation values for the CEO and median VP respectively. CEO compensation is significantly greater than median VP compensation, which is consistent with the existence of tournaments. For example, the mean total compensation

[8] We use an average term of five years for maturity of options. Kaplan and Winton (2006) argue that the average tenure of the CEO has reduced over the years. Using either four, six or seven years as the maturity period in our analysis does not significantly alter any of our findings.

of the CEO is in excess of $4.3 million and exceeds the total compensation of the median VP ($1.22 million) by over $3 million. Panel C provides descriptive statistics for tournament and incentive alignment measures. The skewness in *LT Gap* (mean = $1.98 million, median = $0.58 million) is likely because long-term compensation tends to vary significantly over the years, even for the same manager while short-term compensation, is reasonably steady each year. We use the log of the standard deviation among the VPs' total compensation (σ *VP Total Comp*) to control for the possibility of a tournament among VPs.[9] Average *CEO Alignment* is $3.52, which is considerably larger than the average *VP Alignment* which is equal to $0.25, per $100 of shareholder equity. We report Spearman rank correlations for alignment and tournament variables in Table 2. The correlation between *CEO Alignment* and *VP Alignment* is positive and the correlations among all tournament variables are also positive.

E. Measures of Firm Performance and Other Variables

Our primary measures of firm performance are, return on assets (*ROA*) and *Firm q*, defined as the ratio of the firm's net income to total assets and the ratio of the sum of market value of equity and the book value of debt to total assets, respectively.[10] Further, we repeat our analysis and report findings for two additional measures of operating performance based on Loughran and Ritter (1997). These are, (i) *OIBD to Capital*, which is the ratio of firm's operating income before depreciation to net fixed assets and (ii) *ROE*, which is the ratio of net income to book value of equity. Panel A of Table 3 presents summary statistics for all firm performance measures. We also note here that all our performance measures are positively correlated with each other.

[9] This variable captures the possible tournament among VPs where "lower" VPs seek promotion to "higher" VPs (e.g. Gibbs (1994) and Milgrom and Roberts (1992)).

[10] Palia (2001), Anderson and Reeb (2003), and Bebchuk and Cohen (2005) are among many studies that use *Firm q* and *ROA* as measures of firm performance.

Panel B of Table 3 presents summary statistics of variables relating to CEO and VP characteristics. The median CEO in our sample is fifty-five years old and has been the CEO of the firm for five years. Sixty-seven percent of the CEOs in our sample also hold the position of Chair of the board. The median firm has five VPs. We define *Succession Plan* as a dummy variable that is equal to one if either one of the following two conditions is satisfied. First, the firm has a VP whose title is either *President* or *Chief Operating Officer* and who is not the Chair. Second, the difference in short-term compensation between the CEO and the next-highest paid VP is less than 10 percent *and* the compensation of the highest paid VP is at least 20 percent greater than the second highest paid VP.[11] Approximately 48 percent of the firms in our sample satisfy the first condition and about 14 percent meet the second. Overall, 52 percent of our sample has a designated successor. We construct an indicator variable *CFO is VP* that is equal to one if any of the VPs in the firm-year is the CFO. We define *Retiring CEO* as a dummy variable that equals one when *CEO Age* is greater than 62 years; 17 percent of the CEOs in our sample fall in the retiring category. *New CEO* is a dummy variable that equals one in the CEO's first year of service as CEO and is zero otherwise. Next, as in Parrino (1997), we define a CEO who has been with the firm for at least one year prior to becoming the CEO as an insider.[12] The dummy variable *Incumbent CEO is Insider* is equal to one if the incumbent CEO is such an insider. Finally, we create a dummy variable *New CEO is Insider* by multiplying *New CEO* by *Incumbent CEO is Insider*.

[11] This is a modified version of the variable in Naveen (2006), who does not impose any restriction on the difference in compensation between the highest and the next highest paid VP. Our results remain unchanged when we use either or both conditions to define succession plan.

[12] In order to obtain this information we first obtain the company joining date for the CEO and then compare this with the date that this executive becomes the CEO. Both these dates are available for 2,134 CEOs from ExecuComp. We use other sources outlined in Section II to fill in the missing data for 1,890 of the remaining 2,068 CEOs.

Panel C of Table 3 presents summary statistics for firm and industry characteristics that we use in our analysis. *Firm Size* is the log of the firm's net sales for the year and *Stk. Return Volatility* is the variance of 60 monthly returns prior to the sample year, on the firm's stock. The variable *No. of Segments* is obtained from the Compustat Segment files and represents the number of business segments in each firm-year; the median value for this variable is two.[13] We use the method in Parrino (1997) to construct the variable *Industry Homogeneity*, which measures the similarity between firms within an industry after isolating the effects of the market.[14] *Capital to Sales* is net fixed assets to sales and *Leverage* is the ratio of the firm's long-term debt to its total assets. Finally, the definitions of variables *R&D to Capital*, *Advertising to Capital*, and *Dividend Yield* are as the names suggest.

II. Determinants of Tournaments

In this section, we present our findings on the determinants of tournaments. In our analysis, we include factors such as, *CEO Age*, *CEO Experience*, *Firm Size*, and *No. of VPs*, which appear in prior research (e.g. Bognanno (2001)), as well as some that are new to our study. The new determinants of tournaments include *Succession Plan*, *New CEO*, *New CEO is Insider*, *Incumbent CEO is Insider*, *CEO is Chair*, *VP is CFO*, *Retiring CEO*, *No. of Segments*, *Industry Homogeneity*, *Stock Return Volatility*, and *Median Industry Gap*. We estimate a firm-level fixed-effects OLS specification to investigate the effect of the above determinants on the three main measures of tournaments, namely, *Log (Total Gap)*, *Log (ST Gap)*, and *Log (LT Gap)* and

[13] For 152 (1,056) firms (firm-years), there is no information on the number of segments.

[14] First, we classify all firms in the CRSP monthly returns file into a 2-digit historical SIC industry code and then regress each firm's prior 60 monthly returns on an equally weighted monthly industry index and an equally weighted market return. For each firm, we then compute the partial correlation coefficient between the firm's returns and the equally weighted industry returns while holding market returns constant. *Industry Homogeneity* is the average partial correlation coefficient from these regressions for all firms within an industry. We use a 5-year rolling estimation period for each year in the sample.

present our findings in Table 4. In all our analyses, we use heteroskedasticity-robust standard errors clustered by firm (Petersen (2007)) to compute statistical significance.

Our findings on the conventional determinants of tournaments are generally in keeping with those in the literature (e.g. Bognanno (2001)). The age of the CEO is negatively related to total and long-term gaps and unrelated to short-term gap. The CEO's experience relates (weakly) positively to *Log* (*ST Gap*) but is unrelated to the other two tournament measures. The relation between *Firm Size* and tournament levels is positive, which is consistent with two sets of findings in the literature. First, there are tournaments at every level of the organization and, as Lambert, Larcker and Weigelt (1993) document, the size of the prize increases with the hierarchy level, implying that the largest tournament exist between the CEO and VPs. Second, Murphy (1999) documents that executive pay increases with firm size. These two findings taken together suggest a positive relation between *Firm Size* and compensation gaps. Next, we find a positive relation between *No. of VPs* and *Total* and *LT Gap.* The greater the number of VPs, the lower is the probability of promotion for an individual VP. In order to offset the reduction in promotion probability, the size of the prize needs to be increased.

The coefficients on the new determinants offer interesting insights into the use of tournaments in firms. First, the coefficient on *Succession Plan* is negative for all the three gap measures, indicating that tournaments are less likely in firms with a designated successor. This finding appears reasonable since there is unlikely to be a tournament in a firm that has already decided on the next CEO.[15] Similarly, if a firm has a history of promoting from within, the probability of promotion for all VPs is ex-ante higher and, therefore the prize associated with the

[15] Because of the way we construct the *Succession Plan* variable, for some of the firms (less than 5 percent) that we designate as having a succession plan, the negative relation with gaps may be by construction. However, we have repeated our tests where the dummy variable *Succession Plan* is one *only* when there is a President or a COO among the VPs (the first of our two conditions) and find identical results. This stricter definition of succession applies to over 95 percent of the firms that we designate as having a succession plan.

CEO's position is likely to be smaller. Consistent with this hypothesis, the coefficient on *Incumbent CEO is Insider* is negative in the total and long-term gap regressions. We interact *Incumbent CEO is Insider* with the dummy *New CEO* and find that total and long-term gaps are negatively related to the interaction term. The coefficient estimate on *New CEO* is positive for total and long-term gaps, which indicates that when the firm has a new CEO from outside, compensation gaps are higher. The findings thus far generally indicate that tournament prizes are higher when the probability of winning the prize is smaller and vice versa.

Next, we find that the coefficients on retiring CEO are positive, but statistically significant only in the case of short-term gap, which provides weak evidence for the conjecture that when the incumbent CEO is close to retirement, tournaments are more likely to be in operation. Mian (2001) documents that only about 5 percent of the CFOs are promoted to the position of CEO or president, indicating that the position of the CFO is usually a terminal one. Consequently, when the CFO is one of the VPs, the probability of promotion is greater for the other VPs and a smaller prize is sufficient as the tournament incentive. Thus, tournament gaps should relate negatively to the dummy variable *CFO is VP*. We however, find a positive coefficient on *CFO is VP*. We find no evidence to support the prediction that when the CEO is not also the chairperson of the board, tournaments should be more pervasive.

Murphy (1999) documents that firms benchmark executive compensation to pay levels of similar firms in the industry. For each firm-year, we construct a variable *Median Industry Gap* which is the median gap for firms in the same two-digit SIC code as the firm and are in the same firm size quartile. We find a statistically significant and positive relationship between *Log* (*Median Industry Gap)* and all our three measures of tournament. Nalebuff and Stiglitz (1983) and Zabojnik and Bernhardt (2001) posit that firms are more likely to use tournament incentives

when extracting managerial effort from an output signal is more difficult. The three variables, *Stk. Return Volatility*, *No. of Segments*, and *Industry Homogeneity*, all capture aspects of this signal extraction problem. We find little evidence for the prediction that when managerial effort is difficult to determine, tournaments are more likely to exist. *Industry Homogeneity* is also an indirect measure for the probability that the CEO can be drawn from outside the firm.

III. Effect of Tournament and Alignment on Firm Performance

In this section, we describe our findings on the effects of compensation incentives on firm performance. It is possible that unobserved variables affect our independent variables, tournament and alignment incentives, as well as the dependent variable, firm performance. Unobservable managerial ability is such a variable that likely affects both executive compensation and firm performance. In addition to being unobservable, managerial ability may vary over time because of on-the-job learning (e.g. Baker, Gibbs, and Holmstrom (1994)). Further, even if true managerial ability is constant over time, shareholders' perception of managerial ability, which determines managerial compensation, may vary over time as shareholders update their priors on ability. In our empirical analysis, we consider both these issues and treat them as follows. First, assuming that unobserved heterogeneity is time-constant, we estimate a firm-level fixed-effects model. If, however, omitted variables vary over time, Wooldridge (2002, p. 299) shows that fixed-effects alone are insufficient since they make the estimates inconsistent. Thus, in order to include the possibility of time-varying omitted variables such as managerial ability, we also employ an instrumental variables two-stage least squares (2SLS) approach with firm fixed-effects.

A. Results from OLS Fixed Effect Regressions

We report our findings on the incentive effects of tournaments and alignment on firm performance from estimating a firm-fixed-effects model in Table 5. The first column in the table has *ROA* as the dependent variable and *Log* (*Total Gap)* as the measure of tournament incentives. The coefficient on *Log* (*Total Gap)* is positive (0.429) and significant (t-value = 4.74). The coefficients on both *CEO Alignment* and *VP Alignment* are also positive and statistically significant at the one percent level. In the second column, we report results for *Firm q*, the alternative firm performance measure. The coefficients on *Log* (*Total Gap*) as well as the alignment measures are positive and statistically significant. In the last two columns of this table, we estimate the model by replacing *Log* (*Total Gap*) with *Log* (*ST Gap*) and *Log* (*LT Gap*) as tournament measures. The coefficient on *Log* (*ST Gap*) is positive and significant in both specifications. The coefficient on *Log* (*LT Gap*), however is significant in the *Firm q* regression, but is not significant at conventional levels (t-value = 1.41) when *ROA* is dependent variable. These findings from estimating the firm-fixed effects model offer considerable support to the conjecture that alignment effects in the case of CEO and both tournament and alignment effects in the case of VPs positively affect firm performance.

Among the control variables, the coefficient estimate on *Log (*σ *VP Comp)* is positive and significant in the *Firm q* specifications. Greater variability in VP compensation indicates the possibility of a tournament among VPs, in which lower level VPs are competing for promotion to a senior VP level. Our findings indicate that a tournament among VPs also improves firm value. The coefficient on *Log (CEO Age)* is negative and statistically significant in all the regressions implying that older CEOs are associated with a lower firm performance. The coefficient on *Industry Homogeneity* is positive in all the four regressions. A possible

explanation for this finding is that setting performance benchmarks and therefore monitoring is easier in industries where firms are more similar. As a result, managers of firms in homogenous industries expend relatively more effort, which results in improved firm performance. The signs of the coefficients on the remaining control variables are generally similar to those found in prior literature.

B. Instrumental Variables Estimation

We next consider the scenario where the relation between managerial compensation and firm performance may be endogenous. The endogeneity may be due to unobservable and observable firm characteristics that arise out of differences in the contracting environment.[16] Since, both tournament and alignment incentive measures are related to managerial compensation we treat all tournament and alignment variables as endogenous. In order to address endogeneity, we first identify instrumental variables for incentives that are otherwise uncorrelated with firm performance, the dependent variable.

The instruments in our analysis include *Log* (*Industry Total Gap*), *Log* (*Industry ST Gap*), *Log* (*Industry LT Gap), Industry CEO Alignment*, and *Industry VP Alignment*, for tournament, CEO, and VP alignments. These instruments are median values of the incentive measures for firms in the same two-digit SIC code and in the same size quartile as the firm. The underlying economic rationale for these instruments is from Murphy (1999), who documents that the level and structure of managerial compensation varies by firm size and industry. Since tournament and alignment incentives are based on managerial compensation, median values for firms that are in the same industry and of similar size are natural choices for instrumental variables. In order to

[16] This argument is consistent with Palia (2001). Other studies that recognize and address the endogeneity between managerial ownership and firm performance include Aggarwal and Samwick (2006), and Coles, Lemmon, and Meschke (2005).

obtain additional heterogeneity, we also include *No. of VPs* and *CFO is VP* as instruments.[17] As reported in Table 4, *No. of VPs* and *CFO is VP* are determinants of tournaments (e.g. Bognanno (2001), Chan (1996), Prendergast (1999), and Mian (2001)). We then test these instrumental variables for their relevance (correlated with the endogenous variables) and validity (orthogonal to the residuals or exogenous to the dependent variable) using several statistical tests.[18] Based on our analyses, we find that median industry gaps, median industry CEO and VP alignments, *No. of VPs*, and *CFO is VP* satisfy the relevance and validity criteria necessary for appropriate instruments. We also investigate the robustness of our results to the choice of instruments by using an alternate set of instruments and discuss the findings of this analysis in Section V.

In the first three columns of Table 6, we report results from estimating the first stage of the 2SLS specification and present all the test statistics related to endogeneity and instrumental variable selection in the bottom panel of the table. First, the difference in Sargan C statistic rejects the null that tournament and alignment variables in the estimated specifications are jointly exogenous to firm performance. The coefficients on individual instruments, *Industry CEO Alignment*, *Industry VP Alignment*, *Industry Total Gap*, *No. of VPs* and *CFO is VP* for *Total Gap* are all statistically significant in the appropriate first-stage regressions. These findings indicate that our instruments are individually relevant. Further, the Shea partial R squared values and the F-statistic provide significant support for the joint relevance of all our instruments in the first stage. Note that we have an overidentified specification since the number of instruments is

[17] We choose a subset of tournament determinants as instruments instead of using all the determinants to obtain a parsimonious set of instruments that satisfy the relevance and validity criterion. Thus, the first stage equations for tournament variables in the 2SLS estimates in Tables 6 and 7 are different from the determinants of tournaments regressions in Table 4. We thank Jeffrey Wooldridge for clarifying this issue.

[18] As noted by Angrist and Krueger (2001), testing the validity and relevance of instruments is critical because correlation between instruments and the omitted variables (invalid instruments) can potentially lead to a bias in the resulting IV estimates that is greater than the bias in OLS estimates. Further, weak instruments (irrelevance) can also induce bias in the estimated endogenous variables, leading to problems of inference (e.g. Bound, Jaeger, and Baker (1995)).

greater than the number of endogenous variables. To test the validity of instruments we use the Hansen-Sargan test of overidentifying restrictions. For both *ROA* and *Firm q* regressions, the Hansen J statistic (2.00 and 1.18, respectively) is unable to reject the null hypothesis (p-values of 0.37 and 0.55, respectively) that the instruments are valid and orthogonal to the residuals. These statistics show that our instruments are valid and that their exclusion from the main estimated equation is appropriate.

The last two columns in Table 6 present second-stage results on the relation between incentives and firm performance. The coefficient on *Log* (*Total Gap*) is 1.115 in the *ROA* regression and is significant with a t-value of 3.66. *Log* (*Total Gap*) is also significantly positively related to *Firm q* (coefficient = 0.133, t-value = 3.39). The coefficients on *CEO* and *VP Alignment* are positive and significant in both *ROA* and *Firm q* regressions. We replace *Log* (*Total Gap*) with *Log* (*ST Gap*) and *Log* (*LT Gap*) as tournament measures and report results from the 2SLS estimation in Table 7. In the second stage analysis, we find that the coefficient on *Log* (*ST Gap*) is positive and significant at the one percent level in both *ROA* and *Firm q* regressions. While the coefficient estimate of *Log* (*LT Gap*) is positive for both *ROA* and *Firm q*, the level of statistical significance is lower (t-value = 1.74) in the *ROA* specification. *CEO* and *VP Alignment* remain positive and significant determinants of *ROA* and *Firm q*. Further, the Anderson-Rubin statistic shows that the endogenous variables are jointly significant in the second stage. As with total gap, our instruments in these regressions pass the relevance and validity criteria reported in the bottom panel of Table 7. The 2SLS analysis, therefore, also offers significant support for the positive effect of tournament and alignment incentives on firm performance.

IV. Effectiveness of Tournament Incentives in Special Scenarios

The results in the previous section establish a significantly positive relation between measures of tournament incentives and firm performance. In this section, we consider "special scenarios" where tournament incentives are likely to be either more or less effective. In order to detect whether the effect of tournament incentives is stronger or weaker, we construct interaction variables by interacting each special scenario variable with tournament measures. We then estimate the firm fixed-effects model of Table 5 in which these interaction terms are also included. The coefficients on the interaction variables form the basis of our inferences in this section. We consider tournament incentives to be more (less) effective in a special case if the coefficient on the interaction term for that special case is positive (negative). Given the specification of our tests, these conditional analyses of special cases affect firm performance primarily through their impact on the probability of promotion to the job of the CEO. If the event increases the probability of promotion, tournament effects will be stronger, that is, the coefficient on the interaction term will be positive. We discuss these special cases in detail below.

The results from estimating the firm fixed-effects model for *ROA* and *Firm q* with the three measures of tournament incentives are reported in Table 8. Results for the tournament variable *Log (Total Gap)* are in the first two columns, for *Log (ST Gap)* in the next two columns, and for *Log (LT Gap)* in the last two columns. We omit reporting the intercept term and control variables in the table for brevity and expositional convenience.

A. Number of VPs

As the number of VPs in a firm increases, an individual VP has a lower probability of promotion to the CEO's position. Thus, for a given level of the tournament gap (the prize), when there are many VPs, an individual VP may exert lower effort. In other words, when the number

of VPs is large, tournaments incentives are likely to be less effective. We find that the coefficient on the interaction of *No. of VPs* with the tournament measures is negative and significant in all the six specifications in Table 8. For example, in the *ROA* regression in the first column, the coefficient on the interaction of *No. of VPs* and *Log (Total Gap)* is -0.056 with a t-value of -6.05.

B. CEO Succession Plans

As reported in Section I, about 52 percent of the firms in our sample have a designated successor. In these firms, the probability of promotion for any of the other VPs is likely to be insignificant. In other words, tournament incentives are not likely to be in operation. We find that the coefficient estimate on the *Succession Plan* interaction variable is negative and statistically significant in all the six specifications, implying that having a designated successor reduces the effectiveness of tournament incentives.

C. CEO is near Retirement

When the incumbent CEO is near retirement, tournament incentives should be stronger because each VP is vying for the CEO's position. Further, when the incumbent CEO is close to retirement, promotion is likely to be sooner, thus increasing the expected present value of the prize. The coefficient on the interaction variable for *Retiring CEO* is positive and significant in all the three specifications where we proxy firm performance by *Firm q*. Therefore, there is some evidence to suggest that tournament incentives are stronger when the CEO is near retirement.

D. New CEOs

Contrary to having a CEO close to retirement, a new CEO indicates that the previous tournament for the CEO's job has ended and the next tournament is in its infancy. As a result, tournament incentives are likely to be less important when a firm has just acquired a new CEO. However, the effectiveness of tournaments also depends on whether the new CEO is an insider

or an outsider. If the new CEO is an insider, the firm is more likely to have a policy of promoting from within, implying that the probability of promotion for existing VPs is higher in such firms. Similarly, if the new CEO is an outsider, the probability of promotion for an existing VP is likely to be lower. Since the impact of the new CEO case depends upon whether the new CEO is an insider or an outsider, we construct three indicator variables, *New CEO*, *Incumbent CEO is Insider*, and the interaction of the two (*New CEO is Insider*).

The results support our predictions on the effectiveness of tournament incentives in the special case of new CEOs. We find that the coefficient on the interaction term with *New CEO* is negative and significant in all the six specifications. Note that the coefficient estimate on *New CEO* represents the marginal effect of tournaments on firm performance when there is a new CEO from *outside* the firm. Thus, tournaments are less effective when there is a new CEO and she is an outsider. The coefficient on the *New CEO is Insider*, the interaction term, on the other hand, is positive and statistically significant in all specifications. The significantly positive coefficient on the *New CEO is Insider* supports the hypothesis that tournament incentives are less negative in firms that promote from within. Since we cannot observe whether a firm has such a policy, we include a dummy variable that equals one for firms where the incumbent CEO is an insider. The underlying assumption is that such firms are more likely to have a policy of promoting from within. The coefficient on the term for *Incumbent CEO Insider* is, however, not significant in any of the regressions.

E. Firm belongs to a Homogenous Industry

To allow for the possibility that managers can be drawn from outside the firm, we interact tournament with *Industry Homogeneity* to capture the effect of outside hires from other similar firms in the industry. We expect that tournament effects on firm performance will be weaker in

more homogenous industries for two reasons. First, tournaments are likely to be less effective when the firm is in a more homogenous industry, because managers have access to job opportunities elsewhere in the industry (Parrino (1997)). By the same logic, firms will have access to a larger managerial pool to recruit from and, therefore, will have a lower need for tournaments. In the three specifications for *Firm q*, the coefficient on the interaction term for *Industry Homogeneity* is negative and significant. Thus, there is some evidence to support our hypothesis that tournament incentives are likely to less effective in more industries where outside hires are more likely.

F. Other Scenarios

We consider other scenarios when tournament effects are likely to be either stronger or weaker. The first is the case when one of the VPs is also the CFO. In this case, since a CFO is likely to be a terminal position (Mian (2001), the probability of promotion for the others is greater and, consequently, tournament effects should come into play more. We do not document any relation for the interaction term with *CFO is VP*. If the CEO is not also the chairperson of the board, it is likely that his/her position is less secure, which may imply stronger promotion incentives for VPs. Therefore, the coefficient on the *Chair* interaction term should be negative. Our findings do not support this hypothesis.

In order to consolidate the effect of all binary special scenarios, we construct a composite variable, which is defined as (1 - *Succession Plan*) + (*Retiring CEO*) + (*Incumbent CEO is Insider*) + (1 - *New CEO*) + (*CFO is VP*) + (1 - *Chair*). Note that all the individual terms in the definition of this variable are consistent with a predicted positive effect of tournament on firm performance. We then define a dummy variable that equals one if the composite is greater than three and zero otherwise. Thus, this dummy variable represents observations that meet at least

four of the six scenarios where tournament incentives should be more effective. In unreported results, we find that the interaction term on this dummy variable is positive and statistically significant at the five percent level (or 1 percent) in all six specifications in Table 8.

V. Robustness and Economic Significance

In this section, we first report our findings on the determinants of tournaments and the effectiveness of alignment and tournaments (with total compensation) using alternate measures of tournament and firm performance. The additional reported tournament measures include: *Gini Coefficient (Total Comp)*, *CDF (Total Gap)*, *Log (Total Gap with Max VP Comp.)*, and *Log (Total Gap with Mean VP Comp)*. The alternate measures of firm performance are the ratio of operating income before depreciation to net fixed assets (*OIBD to Capital*) and return on equity (*ROE*). We then present analyses that shed some light on the economic significance of tournament incentives.

A. Robustness of Findings

A.1. Determinants of Alternate Tournament Measures

Table 9 present results for the determinants of tournaments using the four alternate tournament measures. As with our main reported measure (in Table 4), the positive relation between *No. of VPs* and tournament incentives continues to hold for all alternate measures except for *Log (Total Gap with Max VP Comp)*, where the relation is negative.[19] The median industry values of alternate tournament variables relate positively to the alternate measures. All the alternative tournament measures except the *Gini Coefficient* relate negatively to *Succession Plan*. Since *Succession Plan* and the *Gini Coefficient* are computed using at least two VPs in

[19] This could be because as the number of VPs increases, there is an increase in the range of VP compensation, which may reduce the gap between CEO pay and the highest paid VP.

addition to the CEO, we suspect that there could be some spurious effect arising due to some overlap in the construction of these two variables. To investigate this further, we eliminate the second condition used in the construction of *Succession Plan*. We construct a dummy variable *Succession Plan Designation* that takes on a value of one if any of the VPs in the firm is either a "President" or a "Chief Operating Officer", and zero otherwise (i.e. only the first condition in our original variable). In unreported results, we find that *Succession Plan Designation* is negatively related to the *Gini Coefficient* as well as to the other tournament measures. We find no significant relation between any of our alternate measures and *CFO is VP* and *Retiring CEO*. As in Table 4, we find that the relation between *New CEO* and tournament incentives is positive, in all but one specification. The negative relations between *Incumbent CEO is Insider*, *New CEO is Insider*, and tournament incentives are statistically significant and remain robust to all measures of tournament.

A.2. Firm Performance and Alternate Measures of Tournament

We first re-estimate the fixed-effects regressions on firm performance (Table 5) using alternate tournament measures and present our findings in Table 10. In Panel A, with *ROA* as the measure of firm performance, we find that *CEO Alignment*, *VP Alignment*, and three of the four alternate measures of tournaments are positive and statistically significant at the one percent level. We find that the *Gini Coefficient (Total Gap)* is negatively related to *ROA*, but the result is only weakly significant. Panel B in Table 10 presents results on the relation between alternate tournament measures and *Firm q*. Here, we find that all measures of alignment and tournament are positive and statistically significant at the one percent level. Next, we repeat the 2SLS analyses and present our findings in Table 11. In these tests, we use instruments for each of the four different tournament measures in addition to the instruments *CFO is VP* and *No. of VPs*. As

before, these new instruments are industry medians of the respective tournament measures. For brevity, we report only some of the statistics to show that our instruments are valid and relevant. We find that all the tournament variables relate significantly positively to both *ROA* and *Firm q*. Further, we find that *CEO* and *VP Alignments* relate positively to *ROA* and *Firm q*, in all specifications except one**.**

A.3. Additional Corrections for Negative Gaps

In our reported results thus far, we correct for negative tournament measures, that is, when the CEO earns less than the median VP, either by adding a constant dollar amount to each gap, or using alternate measures such as the *Gini Coefficient*, or the CDF of gaps. We now construct alternate measures of tournament incentives that address the issue of negative gaps in other ways. First, we use the inverse hyperbolic sine (IHS) transformation of the compensation gap as an alternate to the log transformation.[20] The IHS is a modified version of the Box-Cox transformation and unlike the natural log or the Box-Cox transformation, is defined for all real values.[21] We construct the IHS transformation for all compensations gaps as $\sinh^{-1}(x) = \log(x + (x^2 + 1)^{1/2})$, where x is the amount (in 000s of dollars) of *Total*, *ST*, and *LT Gap*. Additionally, we also use the dollar amount of the compensation gaps without any transformation. As a third tournament measure, we use the coefficient of variation among CEO and VP compensation. Finally, we use the ratio of the CEO's compensation to the median VP's compensation. In all these alternate specifications, we find that tournament incentives are significantly positively related to *ROA* and *Firm q*. Finally, we re-examine all our results presented in Tables 5 and 6 by

[20] Pence (2006) uses the IHS as an alternate to the log transformation in her analysis to estimate the effect of tax incentives such as individual retirement accounts on household saving. Her analysis compares the change in the level of wealth over time of households that both eligible and ineligible for the tax incentive where, the change in wealth can assume economically significant negative values.

[21] See Burbidge, Magee, and Robb (1988), for statistical properties of the IHS transform.

dropping observations that have a negative gap.[22] Our results are qualitatively similar to the reported results.

A.4. Alternative Measures of Firm Performance

We re-examine the fixed-effects regressions and 2SLS regressions using alternate performance measures, *OIBD to Capital* and *ROE*, and report our findings in Table 12. We find that *Log (Total Gap)* and *Log (ST Gap)* relate positively to both alternate measures of performance in fixed-effects as well as the 2SLS specifications. The coefficient estimate on *Log (LT Gap)* is always positive but statistically significant only in the *OIBD to Capital* regressions. We follow the methodology outlined in Faleye, Mehrotra, and Morck (2006) and construct another measure of firm performance, *Total Factor Productivity* (*TFP*) using the Cobb-Douglas production for the firm's output.[23] We estimate the fixed-effects regression specifications (Table 5) using *TFP* instead of *Firm q* and *ROA*. In unreported results we find that *Log (Total Gap)* and *Log (ST Gap)* continue to remain positive and statistically significant but the coefficient on *Log (LT Gap)* is not significantly different from zero.

A5. Alternate Instruments

To verify the sensitivity of our results to the choice of instruments, we construct two additional instruments. First, we compute *Bachelors* which is the percentage of full-time employees in an industry with a bachelors degree or higher. Our second measure *CEO Reputation* is in the spirit of Milbourn (2003) and Rajgopal, Shevlin and Zamora (2005) and we construct a proxy for CEO reputation by the number of articles returned by the *Dow Jones News*

[22] Some studies such as Diamond and Hausman (1984) drop observations with non-positive values of the dependent variables when the variable is log transformed.

[23] Specifically, we assume that a firm's sales in year t, Y_{it} are generated by the function; $Y_{it} = AL_{it}^{\alpha}K_{it}^{\beta}$, where L_{it} is the number of employees, K_{it} is net property plant and equipment, and A, α, and β are parameters. We estimate a logarithmic transformation of the above specification and employ the residuals from industry-year wise regressions as a measure of TFP.

retrieval service in nine selected publications.[24] We replace *CFO is VP* and *No. of VPs* with *Bachelors* and *CEO Reputation* as instruments in the specifications reported in Tables 6 and 7. In unreported results we find that all our existing results are robust to these alternate instruments. The instruments are also relevant. However, with total gap as the tournament measure (specification in Table 6), we reject exogeneity of the instruments at the 5 percent level.

A6. Other Robustness Checks

Conventional IV estimators obtained from the 2SLS procedure although consistent may be inefficient in the presence of arbitrary heteroskedasticity (Hansen (1982)). To address this issue we re-estimate all the 2SLS analyses using the Generalized Method of Moments (GMM) estimator to allow for efficient estimation (Baum, Schaffer, and Stillman (2003)). In unreported results, we find that the coefficient estimates and statistical significance from the GMM estimation are almost identical to those reported in Tables 6 and 7. To account for differences among CEO characteristics rather than firm-level heterogeneity, we repeat all our analyses for determinants of the gap (reported in Table 4) and the effect of incentives on firm performance (reported in Tables 5, 6, and 7) using CEO fixed-effects. All our earlier findings remain robust to this change in specification.

Taken together, our results indicate that tournament incentives relate positively to firm performance and these findings are robust to several alternate measures of tournament incentives as well as firm performance.

B. Economic Significance

The earlier tests offer evidence that there is a significant relation between firm

[24] While Milbourn (2003) uses this construct as an estimate of CEO reputation, Rajgopal, Shevlin and Zamora (2005) use this as a proxy for CEO talent which in turn reflects the CEO's outside employment opportunities. We manually collect the number of cites returns for each CEO-firm-year, for each of the CEOs in our sample. Details of the publications and an example of our search are in the data appendix.

performance and tournament and alignment incentives. We now offer findings from two analyses that measure the importance of these incentives in terms of how they affect shareholder wealth. In the first set of tests, we consider and compare the marginal effects on the equity value of the typical firm from increasing the alignment and tournament incentives of its CEO and VPs. In the second, we investigate returns to portfolios that differ in levels of alignment and tournament incentives.

B.1. Marginal Effects of Tournament and Alignment Incentives on Firm Equity Value

Consider a firm with (sample) median values for all relevant variables. Assume that $100,000 are available for payment to either the CEO or $20,000 to each of the five VPs as short-term or long-term compensation. We compute the marginal effect of these possible payment schemes on firm equity value and *ROA* using the estimates from the *Firm q* and *ROA* regressions in Table 5. When the payment is in the form of short-term compensation to the CEO (VP), there is a positive (negative) impact on firm value through an increase (decrease) in *ST Gap* and no effect due to alignment. When the payment is in the form of long-term compensation to the CEO, there is a positive impact due to increases in *LT Gap* and *CEO Alignment*. When the payment is in the form of long-term compensation to the VP, there is a negative effect because *LT Gap* is lower but a positive effect because *VP Alignment* is higher. We present the effect of all these possibilities on the market value of firm equity and *ROA* in Table 13.[25]

We find that the market value of equity for the typical firm increases by about $11.06 million or 0.55% when the CEO's short-term compensation increases by $100,000, which is 10.87% of the CEO's short-term compensation. If the $100,000 is paid as long-term compensation (an increase of 11.29% in the CEO's long-term compensation) to the CEO, there is a $3.44 million increase in the market value of equity; $3.29 million due to the *LT Gap* effect

[25] In all these computations we make appropriate adjustments to account for the addition of a constant to the gaps.

and \$0.15 million dollar due to the alignment effect. An increase in the VPs' compensation reduces tournament gap but increases VP alignment when the increase is in the form of long-term compensation. The tournament effect however, dominates the alignment effect since we see a decrease in the market value of the firm's equity even for an increase in VP compensation. The decrease is lower when VPs' pay is greater through long-term compensation. All the above market value of equity numbers should be treated with caution since the impact on the market value of equity reflects the market's anticipation of a continued increase in gap. Further, these computations are based on a representative firm and do not capture the considerable heterogeneity among firms.

B.2.Portfolio Returns

Using a modified version of the procedure used by Gompers, Ishi, and Metrick (2003), we divide our sample of firms into portfolios that differ in terms of magnitudes of tournament and alignment incentives. To isolate the effects of the two types of incentives, we use the double-sorting procedure suggested by Badrinath, Kale and Noe (1995). We first divide our sample of firms into five quintile portfolios (A_1 to A_5) based on *CEO Alignment* levels. We then divide each of these five alignment portfolios into five quintile portfolios based on *ST Gap* (A_{11}, ..., A_{15}; A_{21}, ..., A_{25}; ..., A_{55}). We then combine the lowest *ST Gap* portfolios from each of the five alignment portfolios (A_{11}, A_{21}, A_{31}, A_{41}, and A_{51}) into one portfolio TA_1. Analogously, we combine higher tournament level portfolios from each of the five alignment portfolios to form portfolios TA_2, TA_3, TA_4, and TA_5. In the five portfolios TA_1 – TA_5, the *CEO Alignment* levels are similarly distributed but the portfolios differ in terms of *ST Gap*. These portfolios allow us to focus on the effects of tournament incentives while controlling for *CEO Alignment*.

We use the Fama and French (1993) and Carhart (1997) four-factor model to estimate monthly portfolio excess returns for each of these five portfolios. We find that an equally weighted portfolio that is long in the highest quintile of *ST Gap* and short in the lowest quintile of *ST Gap* (after controlling for *CEO Alignment*) generates a excess return of 0.928 percent per month over the 12-year sample period, with 8 of the 12 years exhibiting positive and statistically significant excess returns. When we use value-weighted portfolios, the overall excess return is 0.338 percent per month with half the years exhibiting positive excess returns. We next reverse the double-sorting procedure described above to form five portfolios that differ in *CEO Alignment* but are similar in terms of *ST Gap*. The analysis of the returns to these portfolios allows us to investigate the effects *CEO Alignment* while controlling for *ST Gap*. We report the findings in Table 14B. The excess returns for the entire period are 0.847 percent and 0.584 percent with equally-weighted and value-weighted portfolios, respectively.

VI. Conclusion

The primary motivation for our study is to examine how promotion incentives based on the differential compensation between CEOs and their potential successors from within the firm affect firm performance. Thus, while alignment with shareholders induces all managers to maximize the value of a firm's equity, tournaments induce lower level managers to exert greater effort and increase their probability of promotion to CEO. Our argument rests on the premise that while CEO alignment is an important consideration for firm performance, the incentive structures of other top-level managers are also important. What induces CEOs to exert effort is the incentive alignment owing to their ownership in firm specific equity. For lower level managers however, the motivation is due to two sources; how and how much they are currently

paid, and how much they can expect to be paid in case of a promotion to the position of CEO. The latter is essentially the prize in a rank order tournament, which we study using compensation differentials between the CEO and the next level of managers.

We show that total, short-term and long-term compensation gaps between the CEO and median VP compensation affect *Firm q and ROA* positively, which provides evidence on the effectiveness of tournament incentives. The positive relation between tournament incentives and firm performance obtains for many alternate specifications for measures of tournaments and firm performance. We then investigate the effectiveness of tournaments in special situations. We show that tournaments are less effective when the number of VPs is large, when the firm has a succession plan, when the new CEO is an outsider, or when the firm operates in a more homogenous industry. When the incumbent CEO is close to retirement, we find that tournament incentives are stronger. Our analyses of tournaments include alignment incentives and we find that alignment incentives also affect performance positively. Overall, our analysis indicates that a rank-order tournament that provides promotion incentives to managers is an important incentive mechanism for motivating corporate managers.

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Data Appendix

This Appendix defines the variables used in the study. The data items taken from COMPUSTAT are denoted as Data #. All returns data are from the Center for Research in Security Prices (CRSP). The Compensation related variables are from Compustat's ExecuComp. Other data sources include *Proxy statements, the International Directory of Company Histories, Marquis Who's Who publication, Forbes Surveys,* and the *Standard and Poor's Register of Corporations, Directors, and Executives.*

Variable	Source	Definition
Compensation and Alignment		
Short-term compensation (ST Comp)	ExecuComp	Salary + Bonus + Other annual payments
Long-term compensation (LT Comp)	ExecuComp	Restricted stock grants + Options granted + Long-term incentive payouts + Total other annual payments.
Total Compensation (Total Comp)	ExecuComp	Short-term compensation + Long-term compensation
CEO Alignment (per $100 of SH equity) - For CEO	ExecuComp	(Shares owned at the beginning of the year + Average delta of prior option grants * # of options) / Number of shares outstanding *100.
VP Alignment (per $100 of SH equity) - Median value of VPs	ExecuComp	(Shares owned at the beginning of the year + Average delta of prior option grants * # of options) / Number of shares outstanding *100.
Tournament Variables		
Total Gap	ExecuComp	CEO's Total comp – Median VP's Total comp
Short-term gap (ST Gap)	ExecuComp	CEO's ST Comp – Median VP's ST Comp
Long-term gap (LT Gap)	ExecuComp	CEO's LT Comp – Median VP's LT Comp
Log (Total Gap)	ExecuComp	Log (Total Gap + 810)
Log (ST Gap)	ExecuComp	Log (ST Gap + 271)
Log (LT Gap)	ExecuComp	Log (LT Gap + 1,040)
Gini Coefficient (Total Comp) (ST, LT)	ExecuComp	$1+\frac{1}{n}-\frac{2}{n^2\bar{y}}\left(y_1+2y_2+....ny_n\right)$ where y_i is the Total Comp (ST, LT) of all managers in decreasing amounts.
CDF Total Gap (ST, LT)	ExecuComp	(Rank of firm's Total Gap (in the year) minus 1) / (Number of firms minus 1)
Log (Total Gap based on Max VP)		Log (CEO's Total Comp – Highest paid VP's Total Comp)
Log (Total Gap based on Mean VP)		Log (CEO's Total Comp – Mean VP's Total Comp)
σ VP Comp	ExecuComp	Standard Deviation among VPs' Total Comp.
Firm Performance Measures		
Firm q	Compustat	(Market value of equity + Book value of debt) / Book value of total assets (Data 6-Data 60 + Data 25*Data 199) / Data 6
Return on assets (ROA)	ExecuComp	ROA
OIBD to Capital	Compustat	Operating income before depreciation / Net fixed assets (OIBD / Data 8)
Return on equity (ROE)	ExecuComp	ROE
Total Factor Productivity	CRSP and Compustat	Residuals from a regression of log (Sales) on log (Employees) and log (Property, plant, and equipment). The regressions are run by industry-year.

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Other Variables		
CEO Age	ExecuComp, Proxies, Other	Age of CEO
CEO Experience	ExecuComp, Proxies, Other	Number of years as CEO
No. of VPs	ExecuComp	Number of VPs in a firm-year.
Chair	ExecuComp	Dummy = 1 if CEO is also Chair, 0 otherwise.
Succession Plan	ExecuComp	Dummy = 1 if any VP is either President or COO *or* (CEO's ST Comp is at most 10% more than highest paid VP *and* highest paid VP's ST Comp is at least 20% more than next highest paid VP), 0 otherwise.
Succession Plan Designation	ExecuComp	Dummy = 1 if any VP is either President or COO, 0 otherwise.
CFO is VP	ExecuComp	Dummy =1 if one of the VPs is the CFO, 0 otherwise.
Retiring CEO	ExecuComp, Proxies, Other	Dummy = 1 if CEO's age is greater than 62, 0 otherwise.
New CEO	ExecuComp	Dummy = 1 if CEO became CEO in that year, 0 otherwise.
CEO is Insider	ExecuComp, Proxies, Other	Dummy = 1 if CEO has been with the firm for at least 1 year prior to becoming CEO, 0 otherwise.
New CEO is Insider	ExecuComp, Proxies, Other	New CEO * CEO is Insider
No. of Segments	Compustat Segment data	Number of business segments in which firm operates.
Industry homogeneity	CRSP	Mean Partial correlation between firm's returns and an equally weighted industry index, for all firms in the same 2-digit SIC industry code, holding market return constant (see Parrino (1997)). Estimated based on 60 monthly returns prior to sample year.
Firm Size	COMPUSTAT	Log (Sales)
Firm Risk	CRSP	Variance of 60 monthly returns preceding sample year.
Capital to Sales	Compustat	Net fixed assets / Sales; Data 8 / Sales
Leverage	Compustat	Book value of debt / Total assets; (Data 9 + Data 34) / Data 6
R&D to Capital	Compustat	Research & development expenditure to Net fixed assets Data 46 / Data 8
Advertising to Capital	Compustat	Advertising expenditure to Net fixed assets; Data 45 / Data 8
Dividend Yield	ExecuComp	The dividends per share by ex-date divided by close price for the fiscal year.
Log (Industry Total Gap) (ST, LT)	ExecuComp	Log (Median total gap for firms in the same 2-digit SIC and same size quartile) (ST, LT)
Industry CEO Alignment	ExecuComp	Median CEO Alignment for firms in the same 2-digit SIC and same size quartile.
Industry CEO Alignment	ExecuComp	Median VP Alignment for firms in the same 2-digit SIC and same size quartile.
Bachelors	www.bls.gov	Ratio of full time employees with a Bachelors' degree or higher degree to the total number of full-time employees in the industry-year.
CEO Reputation	Factiva	The number of times in the sample year a combination of the CEO's name and company appears in the following list of publications; (i) The Wall Street Journal, (ii) Asian Wall Street Journal, (iii) Wall Street Journal Europe, (iv) Wall Street Journal Sunday (v) Financial Times, (vi) New York Times, (vii) Washington Post, (viii) USA Today, and (ix) International Herald Tribune. For e.g. "(Microsoft Corp or Microsoft) and (William Gates or William H. Gates or William Gates or Bill Gates or Will Gates or William H. Gates III)"

Table 1: Summary Statistics for Managerial Compensation, Alignment, and Tournament Variables

The Table presents summary statistics for compensation of the Chief Executive Officer (CEO) and the other executives in the firm-year as listed by ExecuComp. The sample period is from 1993 through 2004 and contains 17,987 firm-year observations. *Total short-term compensation* is the sum of Salary, Bonus, and Other Annual Payments in any given year. L*ong-term compensation* is the sum of Restricted Stock Grants, Option grants, Long-term incentive payouts and All other total payments received during the year. *Total compensation* is the sum of S*hort-term compensation* and L*ong-term compensation. CEO (VP) Alignment* represents the sum of stock and option sensitivity of the CEO's (VP's) equity portfolio. σ VP Comp. is the standard deviation of Total VP compensation among all the VPs for any firm-year. *Gini Coefficient* is computed as $1+\frac{1}{n}-\frac{2}{n^2\bar{y}}\left(y_1+2y_2+....ny_n\right)$ where n is the number of executives including the CEO and $y_1, y_2 ... y_n$ represent the compensation paid to each of the n executives, in decreasing order of size. Total, ST, and LT Gap based on Median (Mean and Max) VP is the difference between the CEO's compensation and the median (Mean and Highest paid) VP's compensation for Total, ST, and LT compensations, respectively. All variables are winsorized at the 1 and 99 percentile levels.

	Mean	Median	Lower Quartile	Upper Quartile
Panel A: Compensation and Alignment for CEO				
Short-term compensation ($ 000)	1,334.69	919.60	560.55	1,559.48
Long-term compensation ($ 000)	3,043.69	886.07	198.09	2,678.24
Total compensation ($ 000)	4,378.38	1,978.45	985.58	4,331.32
Panel B: Compensation and Alignment for "Median" VP				
Short-term compensation ($ 000)	518.83	383.13	264.50	593.28
Long-term compensation ($ 000)	686.87	248.67	75.40	681.07
Total compensation ($ 000)	1,224.60	689.58	405.00	1,313.95
Panel C: Tournament Incentive Measures				
Total Gap based on Median VP Comp ($ 000)	2,765.54	1,205.00	494.40	2,948.71
ST Gap based on Median VP Comp ($ 000)	778.72	513.36	261.07	956.85
LT Gap based on Median VP Comp ($ 000)	1,975.55	579.27	79.81	1,938.84
Gini Coefficient of Total Compensation	0.32	0.31	0.23	0.39
CDF of Total Gap based on Median VP	0.50	0.51	0.26	0.75
Total Gap based on Max VP Comp ($ 000)	1,405.30	596.54	87.08	1,751.61
Total Gap based on Mean VP Comp ($ 000)	2,605.54	1,140.78	442.75	2,794.90
σ VP Comp ($ 000)	791.12	341.15	157.59	792.02
CEO Alignment ($ per $100 of SH wealth)	3.52	1.24	0.44	3.24
VP Alignment ($ per $100 of SH wealth)	0.25	0.15	0.06	0.32

Table 2: Spearman's Rank Correlation Matrix

Table 2 presents the Spearman's rank correlation matrix among the alignment and tournament variables. The sample period is from 1993 through 2004 and contains 17,987 firm-year observations. *CEO (VP) Alignment* represents the sum of stock and option sensitivity of the CEO's (VP's) equity portfolio. σ VP Comp is the standard deviation of Total VP compensation among all the VPs for any firm-year. *Gini Coefficient* is computed as $1+\frac{1}{n}-\frac{2}{n^2\bar{y}}\left(y_1+2y_2+....ny_n\right)$ where n is the number of executives including the CEO and $y_1, y_2 ... y_n$ represent the compensation paid to each of the n executives, in decreasing order of size. Total, ST, and LT Gap based on Median (Mean and Max) VP is the difference between the CEO's compensation and the median (Mean and Highest paid) VP's compensation for Total, ST, and LT compensations, respectively. * denotes statistical significance at the 5 percent level or less. All variables are winsorized at the 1 and 99 percentile levels.

	CEO Align	VP Align	Total Gap (Median VP)	ST Gap (Median VP)	LT Gap (Median VP)	σ VP Total Comp	Gini Coeff (Total Comp)	CDF Total Gap Med VP	Total Gap (Max VP)
VP Align	0.196*	1							
Total Gap (Median VP)	-0.093*	-0.083*	1						
ST Gap (Median VP)	-0.088*	-0.106*	0.565*	1					
LT Gap (Median VP)	-0.086*	-0.069*	0.976*	0.399*	1				
σ VP Comp	-0.033*	-0.036*	0.599*	0.363*	0.584*	1			
Gini Coeff (Total Comp)	-0.032*	-0.068*	0.508*	0.285*	0.502*	0.426*	1		
CDF Total Gap Med VP	-0.206*	-0.173*	0.668*	0.570*	0.618*	0.373*	0.557*	1	
Total Gap (Max VP)	-0.092*	-0.077*	0.811*	0.452*	0.792*	0.085*	0.306*	0.570*	1
Total Gap (Mean VP)	-0.096*	-0.084*	0.991*	0.561*	0.967*	0.536*	0.483*	0.668*	0.860*

Table 3: Summary Statistics for Performance Measures and Other Variables

The Table presents summary statistics for the dependent variable and other variables used in the study. The sample period is from 1993 through 2004. *ROA* = Net Income / Total assets. *Firm q* = (Market value of equity + Book value of debt) / Total assets. *OIBD to Capital* = Operating income before depreciation / Net fixed assets. *ROE* = Net income / Equity. TFP is the residual from a regression of the firm's sales on employees and fixed assets. *CEO Age* is the age of the CEO as of the sample year. *CEO experience* is the number of years the CEO has held the position of CEO in the firm. *No. of VPs* is the number of VPs for each-year in the ExecuComp database. The following dummy variables are set equal to 1 if the respective condition holds, and zero otherwise. *Chair* is equal to 1 if the CEO also holds the position of Chairperson. *Succession Plan* is 1 if the firm has a succession plan as defined in the data appendix. *CFO is* VP takes on a value of 1 when any one of the VPs is the CFO. *Retiring CEO* is 1 if the CEO is more than 62 years of age. *New CEO* is 1 in the CEO's first year of service as CEO and *Incumbent CEO is Insider* is equal to 1 if the incumbent CEO is an insider. *New CEO is Insider* equals 1 if the firm has a new CEO who is from inside the firm. *Firm Size* is Log (Sales). *Stk. Ret. Volatility is* the variance of 60 monthly returns prior to the sample year. *No. of Segments* is the number of business segments of the firm in the Compustat Segment database. *Industry Homogeneity* is the average partial correlation coefficient of all firms in the same 2-digit SIC code with the industry return, holding market return constant. *Leverage* is computed as Long-term debt / Total assets. *Capital to Sales*= Net fixed assets / Sales. *R&D to Capital* is the ratio of research and development expenditure / Net fixed assets. *Advertising to Capital* is the ratio of advertising expenditure / Net fixed assets. *Dividend Yield is* the dividend yield as reported in ExecuComp. All variables are winsorized at the 1 and 99 percentile levels.

Variable	N	Mean	Median	Lower Quartile	Upper Quartile
Panel A. Firm Performance Measures					
ROA (%)	17,987	3.17	4.04	1.18	7.85
Firm q	17,987	1.98	1.48	1.15	2.19
OIBD to Capital	17,714	0.99	0.54	0.25	1.14
ROE (%)	17,602	7.97	11.93	5.31	17.38
Total Factor Productivity (TFP)	17,987	0.01	-0.01	-0.23	0.22
Panel B. CEO and VP Characteristics					
CEO Age	17,987	54.74	55.00	50.00	60.00
CEO Experience	17,987	7.59	5.00	2.00	10.00
No. of VPs	17,987	5.31	5.00	4.00	6.00
Chair	17,987	0.67	1.00	0.00	1.00
Succession Plan	17,987	0.52	1.00	0.00	1.00
CFO is VP	17,987	0.67	1.00	0.00	1.00
Retiring CEO	17,987	0.17	0.00	0.00	1.00
New CEO	17,987	0.11	0.00	0.00	0.00
Incumbent CEO is Insider	17,488	0.75	1.00	0.00	1.00
New CEO is Insider	17,488	0.08	0.00	0.00	0.00
Panel C. Firm and Industry Characteristics					
Firm Size	17,987	7.10	7.03	6.08	8.11
Stk. Ret. Volatility (% /month)	17,987	1.71	1.11	0.61	2.18
No. of Segments	16,931	2.78	2.00	1.00	4.00
Industry Homogeneity	17,987	0.22	0.20	0.13	0.30
Leverage	17,987	0.23	0.22	0.08	0.35
Capital to Sales	17,987	0.46	0.22	0.12	0.48
R&D to Capital	17,987	0.23	0.00	0.00	0.12
Advertising to Capital	17,987	0.06	0.00	0.00	0.00
Dividend Yield (%/ year)	17,987	1.30	0.59	0.00	2.14

Table 4: Determinants of Tournaments-Fixed Effects Regressions

The sample period is from 1993 through 2004. *Total Gap* is the difference between the CEO's total compensation and the Median VP's total compensation for any given firm-year. *ST (LT) Gap* is the difference between the CEO's ST (LT) compensation and the Median VP's ST (LT) compensation for any given firm-year. *CEO Age* is the age of the CEO as of the sample year. *CEO experience* is the number of years the CEO has held position as CEO in the firm. *Firm Size* is Log (Sales). *No. of VPs* is the number of VPs for each-year in the ExecuComp database. The following dummy variables are set equal to 1 if the respective condition holds, and zero otherwise. *Succession Plan* is 1 if the firm has a succession plan as defined in the data appendix. *New CEO* is 1 in the CEO's first year of service as CEO and *Incumbent CEO is Insider* is equal to 1 if the incumbent CEO is an insider. *New CEO is Insider* equals 1 if the firm has a new CEO who is from inside the firm. *Retiring CEO* is 1 if the CEO is at least 62 years of age. *CFO is VP* takes on a value of 1 when any one of the VPs is the CFO. *Chair* is equal to 1 if the CEO also holds the position of Chairperson. *Median Industry Gap* is the respective median gap for all firms in the same 2-digit industry and size quartile. *Stk. Ret. Volatility is* the variance of 60 monthly returns prior to the sample year. *No. of Segments* is the number of business segments of the firm in the Compustat segment database. *Industry Homogeneity* is the average partial correlation coefficient of all firms in the same 2-digit SIC code with the industry return, holding market return constant. All variables are winsorized at the 1 and 99 percentile levels. All specifications contain year dummies and firm fixed-effects. t-values based on heteroskedasticity robust standard errors, clustered by firm are in parentheses. The symbols ***, **, and * denote significance at the 1%, 5%, and 10% respectively.

Dependent Var. →	**Log (Total Gap)**	**Log (ST Gap)**	**Log (LT Gap)**
Predictor Var. ↓			
Constant	3.211*** (4.59)	2.101*** (2.66)	3.095*** (4.73)
Log (CEO Age)	-0.410** (-2.54)	-0.066 (-0.33)	-0.436*** (-3.09)
Log (CEO Experience)	0.006 (0.25)	0.045* (1.83)	-0.016 (-0.69)
Firm Size	0.070** (2.45)	0.067** (2.27)	0.043 (1.55)
No. of VPs	0.031*** (4.21)	-0.011 (-1.58)	0.043*** (5.59)
Succession Plan	-0.086*** (-4.26)	-0.155*** (-7.82)	-0.031 (-1.50)
New CEO	0.305*** (5.05)	-0.005 (-0.10)	0.338*** (5.52)
Incumbent CEO is Insider	-0.105** (-2.45)	-0.108*** (-2.96)	-0.038 (-0.87)
New CEO is Insider	-0.320*** (-5.02)	-0.072 (-1.39)	-0.344*** (-5.47)
Retiring CEO	0.003 (0.11)	0.059** (2.32)	-0.029 (-0.91)
CFO is VP	0.041* (1.84)	0.049*** (2.78)	0.024 (1.04)
Chair	0.030 (0.93)	0.006 (0.19)	0.029 (0.92)
Log (Median Industry Gap)	0.714*** (15.42)	0.666*** (15.17)	0.753*** (14.69)
Stk. Ret. Volatility	-1.497 (-0.85)	-4.538*** (-2.61)	-0.357 (-0.21)
No. of Segments	-0.017** (-2.09)	-0.010 (-1.50)	-0.016** (-1.96)
Industry Homogeneity	0.078 (0.36)	0.187 (0.79)	0.142 (0.64)
Within R-squared	0.13	0.12	0.12
No. of Obs. (Year dummies)	16,460 (Yes)	16,460 (Yes)	16,460 (Yes)
No. of Firms (Firm fixed-effects)	2,166 (Yes)	2,166 (Yes)	2,166 (Yes)

Table 5: Effects of Tournament and Alignment Incentives on Firm Performance – Fixed-effects Regressions

The Table reports fixed-effect OLS regressions of *Firm q* and *ROA* on tournament and alignment. The sample period is from 1993 through 2004. The dependent variables are firm performance measured as *ROA* = Net income / Total assets and *Firm q* = (Market value of equity + Book value of debt) / Total assets. *Total Gap* is the difference between the CEO's Total comp. and the Median VP's Total comp. for any given firm-year. *ST (LT) Gap* is the difference between the CEO's ST (LT) comp. and the Median VP's ST (LT) comp. for any given firm-year. *CEO (Median VP) Alignment* represents the stock price sensitivity of the CEO's (VP's) stock and option portfolio at the beginning of the year. *σ VP Comp* is the standard deviation of the total compensation among all the VPs for any firm-year. *CEO Age* is the age of the CEO as of the sample year. *Industry Homogeneity* is the average partial correlation coefficient of all firms in the same 2-digit SIC code with the industry return, holding market return constant. *Firm Size* is Log (Sales). *Stk. Ret. Volatility* is the variance of 60 monthly returns prior to the sample year. *Capital to Sales* is Net fixed assets / Sales. *Leverage* is computed as Long-term debt / Total assets. *R&D to Capital* is the ratio of Research and development expenditure to Net fixed assets. *Advertising to Capital* is the ratio of Advertising expenditure to Net fixed assets. *Dividend Yield is* the dividend yield as reported in ExecuComp. All variables are winsorized at the 1 and 99 percentile levels. All specifications contain year dummies and firm fixed-effects. t-values based on heteroskedasticity robust standard errors, clustered by firm are in parentheses. The symbols ***, **, and * denote significance at the 1%, 5%, and 10% respectively.

Using →	**Log (Total Gap)**		**Log (ST Gap) and Log (LT Gap)**	
Dependent Var. →	*ROA*	*Firm q*	*ROA*	*Firm q*
Predictor Var. ↓				
Constant	-20.428*** (3.13)	5.631*** (6.77)	-23.313*** (3.52)	5.409*** (6.51)
Log (Total Gap)	0.429*** (4.74)	0.059*** (4.68)		
Log (ST Gap)			1.050*** (6.82)	0.068*** (3.88)
Log (LT Gap)			0.119 (1.41)	0.040*** (3.66)
CEO Alignment	0.128*** (4.67)	0.015*** (3.76)	0.134*** (4.79)	0.016*** (3.79)
Median VP Alignment	2.429*** (5.63)	0.151*** (2.93)	2.417*** (5.56)	0.150*** (2.91)
Control Variables				
Log (σ VP Comp)	0.021 (0.21)	0.110*** (9.33)	0.036 (0.36)	0.110*** (9.33)
Log (CEO Age)	-2.657*** (2.74)	-0.281** (2.43)	-3.007*** (3.08)	-0.296** (2.56)
Industry Homogeneity	5.419*** (2.97)	0.463* (1.91)	5.250*** (2.90)	0.455* (1.88)
Firm Size	9.139*** (6.32)	-0.650*** (3.25)	9.097*** (6.30)	-0.650*** (3.24)
Firm Size Squared	-0.491*** (5.32)	0.029** (2.07)	-0.498*** (5.41)	0.028** (2.04)
Stk. Ret. Volatility	-70.667*** (3.28)	-9.906*** (4.35)	-65.560*** (3.07)	-9.619*** (4.21)
Capital to Sales	-3.255*** (6.58)	-0.328*** (4.49)	-3.162*** (6.32)	-0.324*** (4.42)
Leverage	-19.314*** (14.72)	-1.027*** (6.66)	-19.006*** (14.66)	-1.011*** (6.54)
R&D to Capital	-3.372*** (4.05)	0.053 (0.57)	-3.444*** (4.15)	0.049 (0.53)
Advertising to Capital	0.063 (0.05)	0.109 (0.70)	0.044 (0.03)	0.110 (0.71)
Dividend Yield	-0.500*** (7.13)	-0.110*** (11.34)	-0.458*** (6.50)	-0.107*** (11.14)
Within R-squared	0.15	0.13	0.15	0.13
No. of Obs.(Year dummies)	17,987 (Yes)	17,987 (Yes)	17,987 (Yes)	17,987 (Yes)
No. of Firms (Firm fixed-effects)	2,367 (Yes)	2,367 (Yes)	2,367 (Yes)	2,367 (Yes)

Table 6: Effect of Tournament and Alignment Incentives on Firm Performance–2SLS with Total Gap

The Table reports fixed-effect 2SLS regressions of ROA and Firm Q on tournament and alignment based on Total Gaps. The sample period is from 1993 through 2004. The dependent variables are firm performance measured as *ROA* = Net Income / Total assets and *Firm q* = (Market value of equity + Book value of debt) / Total assets. *Total Gap* is the difference between the CEO's Total comp. and the median VP's Total comp. for any given firm-year. *CEO (Median VP) Alignment* represents the stock price sensitivity of the CEO's (Median VP's) stock and option portfolio. *σ VP Comp* is the standard deviation of the total compensation among all the VPs in each firm-year. *CEO Age* is the age of the CEO as of the sample year. *Industry Homogeneity* is the average partial correlation coefficient of all firms in the same 2-digit SIC code with the industry return, holding market return constant. *Firm Size* is log (Sales). *Stk. Ret. Volatility is* the variance of 60 monthly returns prior to the sample year. *Capital to Sales* is Net fixed assets / Sales. *R&D to Capital* is the ratio of Research and development expenditure to Net fixed assets. *Advertising to Capital* is the ratio of Advertising expenditure to Net fixed assets. *Dividend Yield is* the dividend yield as reported in ExecuComp. *No. of VPs* is the number of VPs for each-year in the ExecuComp database. *CFO is VP* is a dummy variable equal to 1 if any of the VPs in the firm-year is the CFO, 0 otherwise. *Industry Total Gap* is the median value of *Total Gap* for all firms in the same size quartile and 2-digit SIC code as the firm. *Industry CEO (VP) Alignment* is the median value of CEO and VP alignments for all firms in the same size quartile and 2-digit SIC code as the firm. All variables are winsorized at the 1 and 99 percentile levels. All specifications contain year dummies and firm fixed-effects. t-values based on heteroskedasticity robust standard errors, clustered by firm are in parentheses. The symbols ***, **, and * denote significance at the 1%, 5%, and 10% respectively. Statistics from tests for relevance and validity of instruments are reported in the bottom panel. Difference in Sargan C statistic tests the exogeneity of the endogenous variables. F-statistics of joint significance of the instruments in the first stage test, Shea partial R squared, and the Anderson-Rubin F statistic for the joint significance of the endogenous variables in the second stage provide tests of instrument relevance. The Hansen J statistic tests the exogeneity of instruments for validity.

	First Stage			**Second Stage**	
Dependent Var. →	*Total Gap*	*CEO Alignment*	*VP Alignment*	*ROA*	*Firm q*
Constant	3.179*** (4.31)	-3.518 (-0.84)	1.266*** (6.35)		
Endogenous Variables					
Log (Total Gap)				1.115*** (3.66)	0.133*** (3.39)
CEO Alignment				0.235*** (3.05)	0.019** (2.13)
Median VP Alignment				12.909*** (7.83)	0.755*** (4.43)
Control Variables					
Log (σ VP Comp)	0.089*** (5.55)	0.059 (1.47)	-0.003 (-0.83)	0.086 (0.77)	0.110*** (8.30)
Log (CEO Age)	-0.471*** (-3.95)	3.944*** (4.22)	0.013 (0.46)	-2.544** (-2.34)	-0.247** (-2.00)
Industry Homogeneity	0.077 (0.41)	1.966** (2.22)	0.118* (1.77)	4.054** (2.00)	0.389 (1.54)
Firm Size	0.072 (0.65)	-1.770*** (-3.62)	-0.196*** (-5.23)	11.903*** (7.70)	-0.489** (-2.41)
Firm Size Squared	-0.003 (-0.32)	0.061* (1.73)	0.008*** (3.46)	-0.621*** (-6.39)	0.021 (1.48)
Stk. Ret. Volatility	-0.934 (-0.52)	-4.263 (-0.62)	-0.550 (-1.15)	-65.322*** (-3.07)	-9.547*** (-4.19)
Capital / Sales	-0.039 (-0.56)	-0.279 (-1.11)	-0.049*** (-4.38)	-2.598*** (-4.91)	-0.290*** (-3.85)
Leverage	-0.203** (-2.08)	0.474 (1.16)	0.089*** (3.06)	-19.861*** (-14.8)	-1.049*** (-6.72)
R&D to Capital	0.041 (1.00)	-0.212 (-1.21)	-0.002 (-0.11)	-3.366*** (-4.08)	0.052 (0.57)
Adv. to Capital	0.062 (0.50)	-0.752 (-1.58)	0.049* (1.93)	-0.354 (-0.25)	0.081 (0.52)
Dividend Yield	-0.035*** (-3.36)	-0.129*** (-3.30)	-0.012*** (-4.97)	-0.299*** (-3.83)	-0.097*** (-9.55)

(Continued)

Table 6: Effect of Tournament and Alignment Incentives on Firm Performance–2SLS with Total Gap (Continued)

	First Stage			Second Stage	
Dependent Var. →	*Log(Total Gap)*	*CEO Align.*	*VP Align.*	*ROA*	*Firm q*
Instrumental Variables					
No. of VPs	0.020*** (2.75)	-0.125*** (-3.94)	-0.045*** (-22.2)		
CFO is VP Dummy	0.053** (2.50)	-0.067 (-0.73)	-0.005 (-0.92)		
Log (Industry Total gap)	0.701*** (14.4)	0.045 (0.56)	0.013*** (2.58)		
Industry CEO Alignment	0.009 (1.43)	0.426*** (7.82)	0.003** (2.11)		
Industry VP Alignment	0.005 (1.04)	-0.093** (-2.06)	0.012** (2.46)		
Within R-squared	0.13	0.12	0.10	0.06	0.10
No. of Obs.	17,987	17,987	17,987	17,987	17,987
No. of Firms	2,367	2,367	2,367	2,367	2,367
Year dummies and Firm fixed effects	Yes	Yes	Yes	Yes	Yes
Tests of Endogeneity, Relevance and Validity of Instruments					
Difference in Sargan C (χ^2)				62.61***	21.26***
Shea Partial R^2	0.07	0.07	0.06		
F statistic	44.54***	14.95***	102.00***		
Anderson – Rubin F statistic				22.97***	9.26***
Hansen J statistic (p-val)				2.00 (0.37)	1.18 (0.55)

Table 7: Effects of Tournament and Alignment Incentives on Firm Performance – 2SLS with ST and LT Gap

The Table reports fixed-effects 2SLS regressions of *ROA* and *Firm q* on tournament and alignment based on short-term and long-term gaps. The sample period is from 1993 through 2004. The dependent variables are firm performance measured as *ROA* = Net Income / Total assets and *Firm q* = (Market value of equity + Book value of debt) / Total assets. *ST (LT) Gap* is the difference between the CEO's total comp. and the median VP's total comp. for any given firm-year. *CEO (Median VP) Alignment* represents the stock price sensitivity of the CEO's (Median VP's) stock and option portfolio. *σ VP Comp* is the standard deviation of the total compensation among all the VPs in each firm-year. *CEO Age* is the age of the CEO as of the sample year. *Industry Homogeneity* is the average partial correlation coefficient of all firms in the same 2-digit SIC code with the industry return, holding market return constant. *Firm Size* is log (Sales). *Stk. Ret. Volatility is* the variance of 60 monthly returns prior to the sample year. *Capital to Sales* is Net fixed assets / Sales. *R&D to Capital* is the ratio of Research and development expenditure to Net fixed assets. *Advertising to Capital* is the ratio of Advertising expenditure to Net fixed assets. *Dividend Yield is* the dividend yield as reported in ExecuComp. *No. of VPs* is the number of VPs for each-year in the ExecuComp database. *CFO is VP* is a dummy variable equal to 1 if any of the VPs in the firm-year is the CFO, 0 otherwise. *Industry ST (LT) Gap* is the log of the median value of short-term (long-term) gap for all firms in the same size quartile and 2-digit SIC code as the firm. *Industry CEO (VP) Alignment* is the median value of CEO and VP alignments for all firms in the same size quartile and 2-digit SIC code as the firm. All variables are winsorized at the 1 and 99 percentile levels. All specifications contain year dummies and firm fixed-effects. t-values based on heteroskedasticity robust standard errors, clustered by firm are in parentheses. The symbols ***, **, and * denote significance at the 1%, 5%, and 10% respectively. Statistics from tests for relevance and validity of instruments are reported in the bottom panel. Difference in Sargan C statistic tests the exogeneity of the endogenous variables. F-statistics of joint significance of the instruments in the first stage test, Shea partial R squared, and the Anderson-Rubin F statistic for the joint significance of the endogenous variables in the second stage provide tests of instrument relevance. The Hansen J statistic tests the exogeneity of instruments for validity.

	First Stage				**Second Stage**	
Dependent Var. →	*Log (ST Gap)*	*Log (LT Gap)*	*CEO Align.*	*VP Align.*	*ROA*	*Firm q*
Constant	1.710*** (2.62)	3.813*** (5.42)	-4.594 (-1.09)	1.248*** (6.15)		
Endogenous Variables						
Log (ST Gap)					2.998*** (5.98)	0.178*** (3.66)
Log (LT Gap)					0.490* (1.74)	0.069** (2.42)
CEO Alignment					0.283*** (3.25)	0.022** (2.39)
Median VP Alignment					11.511*** (6.96)	0.672*** (3.88)
Control Variables						
Log (σ VP Comp)	0.022** (2.34)	0.096*** (6.07)	0.054 (1.36)	-0.002 (-0.81)	0.075 (0.66)	0.112*** (8.66)
Log (CEO Age)	0.205 (1.52)	-0.644*** (-6.35)	3.968*** (4.25)	0.013 (0.46)	-3.512*** (-3.02)	-0.313** (-2.45)
Industry Homogeneity	0.103 (0.49)	0.121 (0.64)	2.025** (2.29)	0.119* (1.78)	3.704* (1.84)	0.371 (1.47)
Firm Size	-0.010 (-0.11)	0.133 (1.12)	-1.686*** (-3.44)	-0.196*** (-5.21)	11.616*** (7.46)	-0.508** (-2.49)
Firm Size Squared	0.006 (0.85)	-0.008 (-0.89)	0.053 (1.51)	0.008*** (3.44)	-0.637*** (-6.54)	0.020 (1.44)
Stk. Ret. Volatility	-4.763*** (-3.04)	0.003 (0.0015)	-4.252 (-0.62)	-0.551 (-1.15)	-50.935** (-2.43)	-8.793*** (-3.78)
Capital / Sales	-0.086* (-1.67)	0.004 (0.092)	-0.281 (-1.12)	-0.049*** (-4.37)	-2.403*** (-4.32)	-0.281*** (-3.75)
Leverage	-0.311*** (-3.42)	-0.082 (-0.95)	0.479 (1.18)	0.089*** (3.06)	-18.875*** (-14.2)	-1.003*** (-6.38)
R&D to Capital	0.094*** (2.63)	0.004 (0.097)	-0.210 (-1.20)	-0.001 (-0.10)	-3.564*** (-4.32)	0.042 (0.46)
Adv. to Capital	0.051 (0.32)	0.017 (0.13)	-0.743 (-1.57)	0.050* (1.96)	-0.338 (-0.24)	0.087 (0.57)
Dividend Yield	-0.038*** (-4.65)	-0.031*** (-3.38)	-0.129*** (-3.31)	-0.012*** (-4.95)	-0.187** (-2.36)	-0.092*** (-9.03)

(Continued)

Table 7: Effects of Tournament and Alignment Incentives on Firm Performance – 2SLS with ST and LT Gap
(Continued)

	First Stage				Second Stage	
Dependent Var. →	*ST Gap*	*LT Gap*	*CEO Align.*	*VP Align.*	*ROA*	*Firm q*
Instrumental Variables						
No. of VPs	-0.018*** (-2.74)	0.033*** (4.35)	-0.126*** (-3.96)	-0.045*** (-22.2)		
CFO is VP Dummy	0.065*** (3.76)	0.030 (1.41)	-0.066 (-0.72)	-0.005 (-0.92)		
Log (Industry ST gap)	0.690*** (16.6)	-0.107*** (-2.91)	-0.037 (-0.31)	0.007 (0.96)		
Log (Industry LT gap)	-0.086** (-2.56)	0.759*** (14.0)	0.188 (1.58)	0.010** (2.08)		
Industry CEO Alignment	0.001 (0.25)	0.009* (1.78)	0.428*** (7.91)	0.003** (2.15)		
Industry VP Alignment	0.003 (0.41)	-0.002 (-0.32)	-0.092** (-2.04)	0.012** (2.46)		
Within R^2	0.11	0.12	0.12	0.10	0.06	0.10
No. of Obs.	17,987	17,987	17,987	17,987	17,987	17,987
No. of Firms	2,367	2,367	2,367	2,367	2,367	2,367
Year dummies and Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Tests of Endogeneity, Relevance and Validity of Instruments						
Difference in Sargan C (χ^2)					78.59***	21.86***
Shea Partial R^2	0.07	0.07	0.07	0.06		
F statistic	62.02***	40.06***	13.30***	85.67***		
Anderson – Rubin F statistic					26.03***	9.55***
Hansen J statistic (p-val)					0.53 (0.77)	0.66 (0.72)

Table 8: Effects of Tournament and Alignment Incentives on Firm Performance –Sub-Sample Analysis

The Table reports fixed-effect regressions of *ROA* and *Firm q* on tournament and alignment with interaction terms for sub-samples. The sample period is from 1993 through 2004. The dependent variables are firm performance measured as *ROA* = Net Income / Total assets and *Firm q* equal to (Market value of equity + Book value of debt) / Total assets. *Total gap* is the difference between the CEO's total comp. and the Median VP's total comp. for any given firm-year. *ST (LT) gap* is the difference between the CEO's ST (LT) comp. and the Median VP's ST (LT) comp. for any given firm-year. *CEO (VP) Alignment* represents the stock price sensitivity of the CEO's (VP's) stock and option portfolio. The interaction variables are as follows. *No. of VPs* is the number of VPs for each firm-year in the ExecuComp database. The following dummy variables are set equal to 1 if the respective condition holds, and zero otherwise. *Succession Plan* is 1 if the firm has a succession plan as defined in the data appendix. *Retiring CEO* is 1 if the CEO is older than 62 years of age. *New CEO* is 1 in the CEO's first year of service as CEO and *Incumbent CEO is Insider* is equal to 1 if the incumbent CEO is an insider. *New CEO is Insider* equals 1 if the firm has a new CEO who is from inside the firm. *Industry Homogeneity* is the average partial correlation coefficient between the firm and the industry return, holding market return constant, of all firms in the same industry. *CFO is VP* takes on a value of 1 when any one of the VPs is the CFO. *Chair* is equal to 1 if the CEO also holds the position of Chairperson. All models include the following control variables, *Log (CEO Age), Industry Homogeneity*, *Firm Size, Stk. Ret. Volatility*, *Firm Size Square*d, *Capital to Sales, R&D to Capital, Adv. to Capital, Leverage, and Dividend Yield.* All variables are winsorized at the 1 and 99 percentile levels. All specifications contain year dummies and firm fixed-effects. t-values based on heteroskedasticity robust standard errors, clustered by firm are in parentheses. The symbols ***, **, and * denote significance at the 1%, 5%, and 10% respectively.

Tournament Measure →	*Log (Total Gap)*		*Log (ST Gap)*		*Log (LT Gap)*	
Dependent Var. →	**ROA**	**Firm q**	**ROA**	**Firm q**	**ROA**	**Firm q**
Log (Total Gap)	0.640***	0.161***				
	(3.07)	(5.40)				
Log (ST Gap)			1.782***	0.150***	0.933***	0.061***
			(4.87)	(3.13)	(6.05)	(3.32)
Log (LT Gap)			0.140*	0.045***	0.315	0.139***
			(1.67)	(4.10)	(1.59)	(5.08)
CEO Alignment	0.109***	0.013***	0.118***	0.013***	0.114***	0.013***
	(3.92)	(2.97)	(4.19)	(3.00)	(4.01)	(2.99)
Median VP Alignment	1.975***	0.137**	2.019***	0.137**	1.965***	0.136**
	(4.39)	(2.57)	(4.45)	(2.53)	(4.34)	(2.54)
Log (σ VP Comp)	0.348***	0.129***	0.338***	0.126***	0.339***	0.128***
	(3.30)	(10.1)	(3.21)	(9.91)	(3.21)	(9.99)
Interaction of Gap with ↓						
No. of VPs	-0.056***	-0.003***	-0.059***	-0.003***	-0.056***	-0.003***
	(-6.05)	(-2.80)	(-5.73)	(-2.88)	(-5.84)	(-2.79)
Succession Plan	-0.139***	-0.008***	-0.152***	-0.009***	-0.127***	-0.007**
	(-6.37)	(-2.94)	(-6.22)	(-2.84)	(-5.68)	(-2.54)
Retiring CEO	0.041	0.014***	0.031	0.017***	0.039	0.015***
	(1.14)	(2.78)	(0.78)	(2.91)	(1.02)	(2.69)
New CEO	-0.388***	-0.028***	-0.452***	-0.030***	-0.375***	-0.026***
	(-5.52)	(-4.52)	(-5.52)	(-4.33)	(-5.21)	(-4.20)
Incumbent CEO Insider	-0.031	-0.004	-0.028	-0.000	-0.023	-0.002
	(-0.67)	(-0.67)	(-0.53)	(-0.073)	(-0.47)	(-0.37)
New CEO is Insider	0.307***	0.015**	0.395***	0.018**	0.306***	0.015**
	(4.09)	(2.23)	(4.53)	(2.37)	(4.00)	(2.16)
Industry Homogeneity	0.780	-0.365***	-1.688	-0.283*	1.010	-0.359***
	(1.07)	(-3.47)	(-1.47)	(-1.96)	(1.53)	(-3.49)
CFO is VP	0.019	0.000	0.016	-0.000	0.011	-0.000
	(0.86)	(0.056)	(0.67)	(-0.069)	(0.48)	(-0.021)
Chairman	0.029	0.001	0.029	0.001	0.031	0.002
	(0.88)	(0.29)	(0.79)	(0.26)	(0.92)	(0.38)
Within R^2	0.16	0.13	0.16	0.13	0.16	0.14
No. of Obs.	17,488	17,488	17,488	17,488	17,488	17,488
No. of Firms	2,314	2,314	2,314	2,314	2,314	2,314
Controls, Year dummies, and Firm fixed effects.	Yes	Yes	Yes	Yes	Yes	Yes

Table 9: Determinants of Alternative Tournament Measures

The sample period is from 1993 through 2004. *Gini Coefficient Total Comp.* = $1+\frac{1}{n}-\frac{2}{n^2\bar{y}}\left(y_1+2y_2+....ny_n\right)$ where n is the number of executives including the CEO, and y_1, y_2,..y_n represent the total compensation paid to each of the n executives, in decreasing order of size. CDF ($ Total Gap) is the cumulative density function of the total gap for each year. *Total Gap* with Max (Mean) VP Comp. is the difference between the CEO's total comp. and the highest paid (mean) VP's total comp. for each firm-year. *CEO Age* is the age of the CEO as of the sample year. *CEO experience* is the number of years the CEO has held position as CEO in the firm. *Firm Size* is log (Sales). *No. of VPs* is the number of VPs for each-year in the ExecuComp database. The following dummy variables are set equal to 1 if the respective condition holds, and zero otherwise. *Succession Plan* is 1 if the firm has a succession plan as defined in the data appendix. *New CEO* is 1 in the CEO's first year of service as CEO and *Incumbent CEO is Insider* is equal to 1 if the incumbent CEO is an insider. *New CEO is Insider* equals 1 if the firm has a new CEO who is from inside the firm. *Retiring CEO* is 1 if the CEO is at least 62 years of age. *CFO is VP* takes on a value of 1 when any one of the VPs is the CFO. *Chair* is equal to 1 if the CEO also holds the position of Chairperson. *Median Industry Gap* is the respective median gap for all firms in the same 2-digit industry and size quartile. *Stk. Ret. Volatility is* the variance of 60 monthly returns prior to the sample year. *No. of Segments* is the number of business segments of the firm in the Compustat segment database. *Industry Homogeneity* is the average partial correlation coefficient of all firms in the same 2-digit SIC code with the industry return, holding market return constant. All variables are winsorized at the 1 and 99 percentile levels. All specifications contain year dummies and firm fixed-effects. t-values based on heteroskedasticity robust standard errors, clustered by firm are in parentheses. The symbols ***, **, and * denote significance at the 1%, 5%, and 10% respectively.

Dependent Var. →	***Gini Coeff. (Total Comp)***	***CDF ($ Total Gap)***	***Log (Total Gap with Max VP Comp)***	***Log (Total Gap with Mean VP Comp)***
Predictor Var. ↓				
Constant	-0.037 (-0.63)	-0.581*** (-3.90)	2.210 (1.62)	2.804*** (3.38)
Log (CEO Age)	0.003 (0.23)	-0.077** (-2.13)	-0.091 (-0.48)	-0.269 (-1.58)
Log (CEO Experience)	0.001 (0.49)	0.002 (0.33)	-0.020 (0.75)	-0.018 (-0.73)
Firm Size	0.002 (0.53)	0.056*** (7.99)	-0.064** (-2.04)	0.067** (2.22)
No. of VPs	0.026*** (31.83)	0.007*** (4.22)	-0.044*** (-4.98)	0.011 (1.52)
Succession Plan	0.008*** (4.07)	-0.024*** (-5.43)	-0.155*** (-6.71)	-0.290*** (-7.84)
New CEO	0.055*** (8.68)	0.101*** (6.98)	0.104 (1.43)	0.286*** (4.35)
Incumbent CEO is Insider	-0.007 (-1.52)	-0.030*** (-2.89)	-0.125*** (-2.96)	-0.118** (-2.56)
New CEO is Insider	-0.046*** (-6.92)	-0.112*** (-7.28)	-0.206** (-2.66)	-0.348*** (-4.92)
Retiring CEO	0.001 (0.30)	0.003 (0.39)	-0.005 (-0.17)	0.036 (1.14)
CFO is VP	-0.003 (-1.20)	0.010* (1.94)	-0.012 (-0.52)	0.028 (1.28)
Chair	0.008*** (2.79)	0.016** (2.31)	0.048 (1.55)	0.041 (1.30)
Median Industry Value	0.565*** (29.25)	0.131*** (17.10)	0.885*** (6.70)	0.729*** (12.55)
Stk. Ret. Volatility	-0.054 (-0.37)	-0.309 (0.91)	0.985 (0.64)	-0.541 (-0.31)
No. of Segments	-0.001 (-0.94)	-0.004** (-2.39)	-0.017** (-2.09)	-0.020** (-2.41)
Industry Homogeneity	0.029 (1.22)	0.022 (0.41)	-0.013 (-0.05)	-0.006 (0.03)
Within R-squared	0.24	0.11	0.03	0.09
No. of Obs. (firms)	16,460 (2,166)	16,460 (2,166)	16,460 (2,166)	16,460 (2,166)

Table 10: Effects of Tournament and Alignment Incentives on Firm Performance - Fixed Effects Regressions using Alternate Total Gap Measures

The Table reports fixed-effect regressions of *ROA* and *Firm q* on tournament and alignment with alternate tournament measures. The sample period is from 1993 through 2004. *Gini Coefficient Total Compensation* = $1+\frac{1}{n}-\frac{2}{n^2\bar{y}}\left(y_1+2y_2+....ny_n\right)$ where n is the number of executives for firm I in year t, including the CEO, and y_1, y_2,..y_n represent the total compensation paid to each of the n executives, in decreasing order of size. CDF ($ Total Gap) is the cumulative density function or normalized rank of the total gap for each year in the sample. . *Total Gap* with Max (Mean) VP Compensation is the difference between the CEO's total compensation and the highest paid (mean) VP's total compensation for any given firm-year. *CEO (VP) Alignment* represents the stock price sensitivity of the CEO's (VP's) stock and option portfolio. *σ VP Comp*. is the standard deviation of the total compensation among all the VPs for any firm-year. All models include the following control variables, *Log (CEO Age), Industry Homogeneity, Firm Size, Firm Size Square*d, *Stk. Ret. Volatility*, *Capital to Sales, R&D to Capital, Adv. to Capital, Leverage, and Dividend Yield.* All variables are winsorized at the 1 and 99 percentile levels. All specifications contain year dummies and firm fixed-effects. t-values based on heteroskedasticity robust standard errors, clustered by firm are in parentheses. The symbols ***, **, and * denote significance at the 1%, 5%, and 10% respectively.

Using Tournament Measure →	**Gini Coeff. (Total Comp)**	**CDF ($ Total Gap)**	**Log (Total Gap with Max VP Comp)**	**Log (Total Gap with Mean VP Comp)**
Panel A. Firm performance measured by ROA				
Tournament Measure	-1.507*	2.635***	0.210**	0.394***
	(1.90)	(6.41)	(2.47)	(4.16)
CEO Alignment	0.122***	0.130***	0.122***	0.125***
	(4.52)	(4.76)	(4.48)	(4.59)
Median VP Alignment	2.336***	2.448***	2.443***	2.443***
	(5.42)	(5.68)	(5.64)	(5.66)
Log (σ VP Comp)		-0.089	0.133	0.093
		(0.90)	(1.36)	(0.97)
Panel B. Firm performance measured by Firm q				
Tournament Measure	0.528***	0.311***	0.031***	0.059***
	(5.26)	(6.10)	(2.69)	(4.63)
CEO Alignment	0.015***	0.015***	0.014***	0.015***
	(3.64)	(3.77)	(3.56)	(3.68)
Median VP Alignment	0.156***	0.153***	0.153***	0.153***
	(2.98)	(2.96)	(2.96)	(2.97)
Log (σ VP Comp)		0.098***	0.126***	0.120***
		(8.23)	(10.10)	(10.09)

Table 11: Effects of Tournament and Alignment Incentives on Firm Performance – 2SLS Regressions using Alternate Total Gap Measures

The Table reports 2SLS fixed-effect regressions of *ROA* and *Firm q* on tournament and alignment with alternate tournament measures. The sample period is from 1993 through 2004. The dependent variables are firm performance measured as *ROA* = Net Income / Total assets and *Firm q* = (Market value of equity + Book value of debt) / Total assets. *Gini Coefficient Total Compensation* = $1+\frac{1}{n}-\frac{2}{n^2\bar{y}}\left(y_1+2y_2+....ny_n\right)$ where n is the number of executives for firm I in year t, including the CEO, and y_1, y_2,..y_n represent the Total compensation paid to each of the n executives, in decreasing order of size. *CDF (Total Gap)* is the cumulative density function or normalized rank of the total gap for each year in the sample. *CEO (VP) Alignment* represents the stock price sensitivity of the CEO's (VP's) stock and option portfolio. *σ VP Comp*. is the standard deviation of the total compensation among all the VPs for any firm-year. All models include the following control variables: *Log (CEO Age), Industry Homogeneity, Firm Size, Firm Size Squared, Stk. Ret. Volatility, Capital to Sales, Leverage, R&D to Capital, Advertising to Capital,* and *Dividend Yield*. All variables are winsorized at the 1 and 99 percentile levels. All specifications contain year dummies and firm fixed-effects. t-values based on heteroskedasticity robust standard errors, clustered by firm are in parentheses. The symbols ***, **, and * denote significance at the 1%, 5%, and 10% respectively. Anderson-Rubin F statistic is for the joint significance of the endogenous variables in the second stage and provides tests of instrument relevance. The Hansen J statistic tests the exogeneity of instruments for validity.

Using Tournament Measure →	**Gini Coeff. (Total Comp)**	**CDF ($ Total Gap)**	**Log (Total Gap with Max VP Comp)**	**Log (Total Gap with Mean VP Comp)**
Panel A. Firm performance measured by ROA				
Tournament Measure	4.260* (1.73)	6.352*** (4.48)	2.834*** (4.86)	1.387*** (3.62)
CEO Alignment	0.231*** (2.94)	0.252*** (3.29)	0.256*** (3.14)	0.231*** (2.94)
Median VP Alignment	14.451*** (6.34)	12.420*** (7.54)	12.049*** (6.98)	13.110*** (7.88)
Log (σ VP Comp)		-0.177 (-1.27)	1.024*** (5.25)	0.295*** (2.71)
Anderson-Rubin F Stat	18.86***	22.97***	26.46***	22.55***
Hansen J Stat (p-val)	3.99 (0.14)	1.68 (0.43)	1.80 (0.41)	2.08 (0.35)
Panel B. Firm performance measured by Firm q				
Tournament Measure	1.929*** (6.50)	0.749*** (4.17)	0.243*** (3.48)	0.141*** (3.07)
CEO Alignment	0.016 (1.62)	0.021** (2.32)	0.021** (2.36)	0.019** (2.10)
Median VP Alignment	1.529*** (5.86)	0.697*** (4.05)	0.663*** (3.78)	0.766*** (4.47)
Log (σ VP Comp)		0.079*** (4.67)	0.195*** (8.50)	0.133*** (10.40)
Anderson-Rubin F Stat	15.42***	9.26***	9.24***	8.13***
Hansen J Stat (p-val)	5.03* (0.08)	0.99 (0.61)	0.64 (0.73)	1.20 (0.55)

Table 12: Effects of Alignment and Tournament Incentives on Firm Performance – Fixed Effects and 2SLS Fixed Effects Regressions using Alternate Performance Measures (OIBD to CAP and ROE)

The Table reports fixed-effect 2SLS regressions of *OIBD to Capital* and *ROE* on tournament and alignment. The sample period is from 1993 through 2004. *OIBD to Capital* = Operating Income before depreciation / Net fixed assets. *ROE* = Net income / Total equity. *Total gap* is the difference between the CEO's total comp. and the Median VP's total comp. for any given firm-year. *ST (LT) gap* is the difference between the CEO's ST (LT) comp. and the Median VP's ST (LT) comp. for any given firm-year. *CEO (Median VP) alignment* represents the stock price sensitivity of the CEO's (VP's) stock and option portfolio. *σ VP Comp*. is the standard deviation of the total compensation among all the VPs for any firm-year. All models include the following control variables: *Log (CEO Age), Industry Homogeneity, Firm Size, Firm Size Squared, Stk. Ret. Volatility, Capital to Sales, Leverage, R&D to Capital, Advertising to Capital,* and *Dividend Yield*. All variables are winsorized at the 1 and 99 percentile levels. All specifications contain year dummies and firm fixed-effects. t-values based on heteroskedasticity robust standard errors, clustered by firm are in parentheses. The symbols ***, **, and * denote significance at the 1%, 5%, and 10% respectively. Anderson-Rubin F statistic is for the joint significance of the endogenous variables in the second stage and provides tests of instrument relevance. The Hansen J statistic tests the exogeneity of instruments for validity.

Using Performance Measure →	**OIBD to Capital**		**ROE**	
Panel A. Fixed Effects Regressions				
Log (Total Gap)	0.046*** (4.60)		1.137*** (4.80)	
Log (ST Gap)		0.096*** (5.27)		2.744*** (7.10)
Log (LT Gap)		0.019** (2.30)		0.253 (1.17)
CEO Alignment	0.009*** (2.91)	0.009*** (3.06)	0.257*** (3.15)	0.273*** (3.27)
Median VP Alignment	0.186*** (4.03)	0.186*** (4.05)	6.536*** (5.77)	6.508*** (5.70)
Log (σ VP Comp)	0.031*** (2.71)	0.032*** (2.78)	0.106 (0.39)	0.144 (0.53)
Panel B. 2SLS with Fixed Effects Regressions				
Log (Total Gap)	0.167*** (3.51)		2.829*** (3.35)	
Log (ST Gap)		0.278*** (3.91)		8.713*** (6.21)
Log (LT Gap)		0.084** (2.56)		1.011 (1.14)
CEO Alignment	0.018 (1.46)	0.022* (1.80)	0.252 (1.13)	0.400 (1.53)
Median VP Alignment	0.914*** (5.76)	0.787*** (5.13)	39.283*** (8.34)	35.501*** (7.51)
Log (σ VP Comp)	0.026** (2.16)	0.028** (2.25)	0.364 (1.15)	0.314 (0.97)
Anderson-Rubin F Stat	9.13***	8.32***	23.77***	25.53***
Hansen J Stat (p-val)	5.29* (0.07)	4.64* (0.09)	1.82 (0.40)	0.12 (0.94)

Table 13: Marginal Effects of Tournament and Alignment Incentives on Firm Equity Value

We assume that there is one CEO and five VPs. One millions dollars can be paid:- (i) entirely to the CEO as Short-term compensation, (ii) entirely to the CEO as long-term comp.,(iii) as $200,000 to each of the five VPs as short-term comp., (iv) $200,000 to each of the five VPs as long-term comp. We compute the effect of each of these four possible payment schemes on *Firm q* and thereby on the market value of equity of the typical firm. *Firm q* is defined as (Market Value of equity + Book value of debt) / Total assets. *ROA* = Net income / Total assets. *CEO (VP) Alignment* represents the stock price sensitivity of the CEO's (VP's) stock and option portfolio. ST (LT) Gap is the difference between the CEO's ST (LT) comp. and the Median VP's ST (LT) comp. for any given firm-year. Percentages of the mean values for the respective variables are in parentheses.

	$ 100,000 is paid			
	Entirely to CEO as		**As $20,000 to each VP as**	
	Short-term compensation	Long-term compensation	Short-term compensation	Long-term compensation
Change in Compensation	10.87%	11.29%	5.22%	8.04%
Change in MV of Firm Equity ($ mn.)				
From change in CEO Alignment	0.00	0.15 (0.01%)	0.00	0.00
From change in VP Alignment	0.00	0.00	0.00	0.32 (0.02%)
From change in ST Gap	11.06 (0.55%)	0.00	-2.21 (-0.11%)	0.00
From change in LT Gap	0.00	3.29 (0.16%)	0.00	-0.66 (-0.03)
Total Change in MV of Equity	**11.06 (0.55%)**	**3.44 (0.17%)**	**-2.21 (-0.11%)**	**-0.34 (-0.02%)**
Change in ROA (%)				
From change in CEO Alignment	0.0000	0.0009 (0.02%)	0.0000	0.0000
From change in VP Alignment	0.0000	0.0000	0.0000	0.0390 (0.10%)
From change in ST Gap	0.1300 (3.22%)	0.0000	-0.0260 (-0.64%)	0.0000
From change in LT Gap	0.0000	0.0078 (0.20%)	0.0000	-0.0016 (-0.04%)
Total Change in ROA	**0.1300 (3.22%)**	**0.0087 (0.23%)**	**-0.0260 (-0.64%)**	**0.0023 (0.06%)**

Table 14A: Fama – French Carhart – 4 Factor Model: ST GAP after controlling for CEO Alignment

The Table reports the results of a four-factor equally weighted monthly returns for portfolios of firms sorted first by *CEO Alignment* quintiles and then by ST dollar gap quintiles. The rows in each Panel report excess returns in percent per month when we buy the portfolio in the highest quintile of *ST Gap* and sell short the portfolio with the lowest *ST gap* after controlling for *CEO Alignment*. The portfolios are reset every year. The explanatory variables are RMRF, SMB, HML, and UMD or momentum factor are suppressed and only intercepts are reported. The sample period is from 1993 to 2004. All excess returns that are significant at the 5 percent level or below are underlined.

	Equally Weighted						Value Weighted					
Year	**Q1**	**Q2**	**Q3**	**Q4**	**Q5**	**Q5 - Q1**	**Q1**	**Q2**	**Q3**	**Q4**	**Q5**	**Q5 - Q1**
1993	0.303	0.117	0.580	0.394	0.574	**0.271**	-0.365	-0.373	-0.503	0.382	0.301	**0.666**
	(0.71)	(0.30)	(1.94)	(1.75)	(2.72)		(-0.86)	(-1.58)	(-1.95)	(1.47)	(2.68)	
1994	-0.536	-0.185	-0.006	0.243	0.570	**1.106**	-0.529	-0.649	-0.312	0.163	0.231	**0.760**
	(-1.84)	(-0.77)	(-0.02)	(1.12)	(2.40)		(-1.24)	(-2.19)	(-0.77)	(0.98)	(1.50)	
1995	-0.524	-0.386	-1.034	-0.166	0.516	**1.040**	-0.559	-0.410	-0.125	0.735	-0.627	**-0.068**
	(-0.77)	(-0.97)	(-3.73)	(-0.28)	(1.52)		(-0.44)	(-0.63)	(-0.18)	(1.54)	(-3.13)	
1996	-0.226	-0.530	-0.139	0.499	0.681	**0.907**	0.490	-1.289	-0.320	-0.333	0.376	**-0.114**
	(-0.94)	(-1.71)	(-0.34)	(2.27)	(2.93)		(1.21)	(-2.39)	(-0.91)	(-1.66)	(1.69)	
1997	-0.198	-0.288	-0.047	0.356	0.604	**0.802**	1.149	-0.503	-0.549	-0.528	0.547	**-0.603**
	(-0.43)	(-0.66)	(-0.09)	(0.70)	(2.62)		(2.54)	(-0.66)	(-0.88)	(-1.00)	(1.72)	
1998	0.771	0.820	0.105	0.371	0.270	**-0.502**	2.776	-1.055	-0.904	0.548	0.116	**-2.660**
	(0.88)	(1.45)	(0.15)	(1.19)	(1.03)		(2.29)	(-0.92)	(-1.36)	(1.72)	(0.40)	
1999	0.305	0.469	0.538	0.567	1.018	**0.713**	-0.499	-0.473	-1.059	-0.947	0.493	**0.992**
	(0.80)	(2.48)	(1.61)	(1.47)	(2.45)		(-0.40)	(-0.57)	(-2.28)	(-1.55)	(1.68)	
2000	1.192	1.052	1.328	1.636	2.124	**0.932**	-1.041	0.299	-1.204	-1.181	1.858	**2.899**
	(1.18)	(1.70)	(1.66)	(1.89)	(3.95)		(-0.62)	(0.21)	(-0.78)	(-0.96)	(3.11)	
2001	0.998	0.317	0.406	0.786	1.090	**0.092**	0.386	-1.024	-0.473	0.251	0.356	**-0.030**
	(2.10)	(0.89)	(0.77)	(1.85)	(1.80)		(0.49)	(-0.95)	(-0.83)	(0.50)	(0.83)	
2002	0.924	0.662	0.864	1.083	1.137	**0.213**	0.597	-0.697	-0.507	-0.346	0.650	**0.054**
	(2.27)	(1.66)	(2.64)	(4.61)	(2.62)		(0.83)	(-1.42)	(-0.68)	(-0.85)	(2.13)	
2003	-1.217	-1.021	-0.745	0.124	-0.128	**1.089**	0.003	-1.709	-0.858	0.553	-0.074	**-0.077**
	(-3.58)	(-3.01)	(-2.19)	(0.37)	(-0.52)		(0.00)	(-2.75)	(-1.32)	(1.19)	(-0.22)	
2004	-0.982	-0.208	0.358	0.589	1.317	**2.299**	-0.551	-0.594	-0.453	-0.274	0.362	**0.913**
	(-3.47)	(-0.92)	(1.09)	(1.65)	(3.02)		(-1.01)	(-1.59)	(-1.41)	(-0.76)	(1.32)	
Overall	-0.081	0.085	0.253	0.451	0.848	**0.928**	0.117	-0.665	-0.617	0.451	0.456	**0.338**

Table 14B: Fama – French Carhart – 4 Factor Model: CEO Alignment after controlling for ST Gap

The Table reports the results of a four-factor equally weighted monthly returns for portfolios of firms sorted first by ST GAP then by *CEO Alignment* quintiles. The rows in each Panel report excess returns in percent per month when we buy the portfolio in the highest quintile of *ST Gap* and sell short the portfolio with the lowest *ST gap* after controlling for *CEO Alignment*. The portfolios are reset every year. The explanatory variables are RMRF, SMB, HML, and UMD or momentum factor are suppressed and only intercepts are reported. The sample period is from 1993 to 2004. All excess returns that are significant at the 5 percent level or below are underlined.

	Equally Weighted						Value Weighted					
Year	**Q1**	**Q2**	**Q3**	**Q4**	**Q5**	**Q5 - Q1**	**Q1**	**Q2**	**Q3**	**Q4**	**Q5**	**Q5 - Q1**
1993	0.131	0.097	0.494	0.576	0.666	**0.535**	0.084	0.229	0.076	0.063	-0.213	**-0.297**
	(0.57)	(0.41)	(0.90)	(1.05)	(1.46)		(0.36)	(1.58)	(0.24)	(0.12)	(-0.47)	
1994	-0.465	-0.015	0.100	0.266	0.194	**0.658**	-0.145	0.171	-0.026	0.202	0.480	**0.625**
	(-2.81)	(-0.08)	(0.83)	(0.97)	(0.67)		(-0.78)	(0.58)	(-0.11)	(0.61)	(1.80)	
1995	-0.523	0.167	-0.357	-0.216	-0.679	**-0.156**	-0.537	-0.174	0.314	-0.037	-0.023	**0.514**
	(-1.51)	(0.26)	(-0.44)	(-0.34)	(-1.35)		(-1.15)	(-0.33)	(0.40)	(-0.07)	(-0.03)	
1996	-0.614	-0.155	0.266	0.326	0.462	**1.076**	-0.249	0.173	0.083	0.050	1.175	**1.425**
	(-3.55)	(-0.63)	(0.85)	(1.57)	(1.07)		(-1.14)	(0.78)	(0.22)	(0.13)	(5.13)	
1997	-0.491	-0.194	0.250	0.151	0.709	**1.200**	0.169	-0.052	-0.211	-0.156	1.651	**1.482**
	(-1.09)	(-0.39)	(0.74)	(0.55)	(1.67)		(0.70)	(-0.21)	(-0.46)	(-0.27)	(2.25)	
1998	0.088	-0.193	0.435	0.785	1.224	**1.137**	0.672	-1.080	0.285	-0.162	1.821	**1.149**
	(0.09)	(-0.37)	(0.95)	(1.74)	(2.94)		(1.72)	(-1.45)	(0.43)	(-0.25)	(1.29)	
1999	-0.023	0.875	0.258	0.880	0.907	**0.931**	-0.504	0.558	0.206	0.606	-0.380	**0.124**
	(-0.12)	(2.05)	(0.60)	(2.41)	(2.39)		(-0.77)	(1.42)	(0.33)	(1.16)	(-0.24)	
2000	-0.137	0.816	2.015	2.826	1.793	**1.930**	0.871	0.395	-0.664	0.830	-0.542	**-1.413**
	(-0.20)	(0.89)	(2.57)	(3.28)	(2.81)		(1.22)	(0.46)	(-0.72)	(0.50)	(-0.38)	
2001	0.099	0.500	0.668	1.108	1.211	**1.111**	0.072	0.148	-0.079	0.682	0.293	**0.221**
	(0.32)	(1.19)	(1.11)	(2.09)	(2.71)		(1.32)	(0.31)	(-0.18)	(0.72)	(0.38)	
2002	0.651	0.550	0.776	1.322	1.367	**0.716**	0.048	-0.071	0.132	0.348	0.855	**0.807**
	(1.88)	(1.99)	(1.83)	(4.06)	(4.29)		(0.28)	(-0.18)	(0.41)	(0.66)	(1.41)	
2003	-0.839	-0.589	-0.677	-0.128	-0.746	**0.093**	0.001	-0.212	-0.639	0.152	-0.354	**-0.355**
	(-3.38)	(-2.65)	(-2.43)	(-0.39)	(-2.39)		(0.01)	(-1.45)	(-1.30)	(0.25)	(-0.71)	
2004	-0.183	0.312	0.330	0.185	0.440	**0.623**	-0.531	0.691	0.558	0.204	0.467	**0.997**
	(-0.65)	(0.99)	(2.10)	(0.44)	(1.58)		(-2.57)	(1.73)	(3.43)	(0.46)	(1.04)	
Overall	-0.128	0.084	0.312	0.568	0.719	**0.847**	-0.006	0.119	-0.027	0.568	0.578	**0.584**