Relative Performance Evaluation in CEO Compensation:
A Non-Agency Explanation[*]

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Abstract

We examine the contractual terms that govern relative performance evaluation (RPE) in CEO compensation and compare them to their counterparts in the theoretical literature. We find limited support to theories predicting that RPE is used to filter out noise from performance measures and to tournament theories predicting that RPE is used to reward CEOs for outperforming their peers. We find stronger support to theories predicting that RPE is used to pay CEOs for their talent relative to peers. Based on the observed RPE terms, we introduce a new empirical test to detect RPE and find support to the pay-for-talent explanation.

Relative performance evaluation (RPE) is the practice of paying the CEO based on her performance relative to peers. Several theories have been offered to explain the use of RPE. For example, standard agency models (e.g., Holmstrom, 1982, Gibbons and Murphy, 1990) note that RPE filters out noise from performance measures, leading to more efficient incentive contracts. Other models show that RPE arises in a tournament setting, where, in order to elicit effort, CEOs compete with one another and are compensated based on their performance relative to peers (e.g., e.g., Lazear and Rosen, 1981, Green and Stokey, 1983). Another set of models (e.g., Gibbons and Murphy, 1990) note that RPE arises when CEO talent is not fully observable and relative performance over time reveals CEO talent relative to peers. Firms in this setting tie CEO compensation to relative performance in order to compensate the CEO for their observed talent.

In this study we examine the contractual terms that govern RPE in CEO compensation contracts. We document the features of the contracts and measure their different terms. We then compare the terms in the actual contracts to those implied by the different theories.

Comparing the contractual terms with the ones predicted by agency theory, our evidence is mixed. For example, consistent with agency theory, RPE is more prevalent in industries such as energy and utilities, where common shocks outside CEO control are known to have a large effect on performance (e.g., Bertrand and Mullainathan, 2001). However, most firms in our sample compensate for relative performance in the form of shares of the firm, thereby exposing the CEO to stock-price fluctuations that are partly outside her control. Such practice is not consistent with the notion that firms use RPE in order to filter out systematic risk.

Certain features of the RPE contract are consistent with rewards in tournaments. For example, in 88% of the RPE contracts, the menu of payments depends on the rank performance of the CEO relative to peers – a fundamental feature of tournament rewards (e.g., Lazear and Rosen 1981). However, in a tournament if the CEO of firm 1 competes against the CEO of firm 2 it also means that the

CEO of firm 2 competes against the CEO of firm 1. This is not what we find in the data. There is very little overlap in the pools that CEOs are benchmarked against. In the majority of the cases, if the CEO of firm 1 is ranked against the CEO of firm 2, the CEO of firm 2 is not ranked against the CEO of firm 1. Therefore, with the RPE contract, CEOs do not compete against one another. Rather, each is benchmarked against a different peer. This feature does not fit a tournament setting.

The fact that RPE terms do not fit well with agency theory is puzzling since most of the empirical research on RPE relies on this theoretical foundation.[1] We therefore review the literature on compensation contracts and look for additional considerations which could better fit with our findings.

One strand of the literature emphasizes the effect of CEO perceived talent on CEO compensation. For example, Gibbons and Murphy (1990) show that when firms infer CEO talent from her past performance, they will compensate the CEO for her talent by tying her compensation to her performance relative to peers. It is therefore possible that the observed RPE terms in the data are used to pay the CEO for her perceived talent. Our analysis of the contractual terms indicates that RPE does involve pay-for-talent considerations. For example, RPE awards vest over time, which means that firms award their CEOs only if their CEOs commit to keeping their human capital within the firm. In addition, peer firms assigned to RPE awards highly overlap with peer firms assigned to compensation benchmarks. The latter were found to be driven by talent considerations (e.g., Bizjak, Lemmon, and Naveen, 2008).[2] We also note that the pay-performance relation found in the contracts – a menu of payments depending on the rank of CEO talent relative to peers – is also found as an equilibrium compensation outcome in talent-based compensation models (Gabaix and Landier, 2008, Tervio, 2008).

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[1] See Albuquerque (2009) for a review of the empirical work on the presence of RPE in CEO compensation.
[2] One can argue that talent peers and performance peers should highly overlap even if performance peers are used to eliminate a common shock. The reason is that talent peers are usually CEOs who work in firms that are similar to the firm in question. We agree with this assessment, but interestingly we find that performance peers are not necessarily involved in the same activities as the firm. About a third of all performance peers in our sample do not even belong to the same 2-digit SIC code as the firm.

It is important to note that the talent-based explanation does not mean that RPE does not have any incentive role. In fact, pay for talent has an important role in reducing agency conflicts, especially if talent is partially observed through past performance (e.g., Holmstrom, 1999). Within this framework, CEOs who are compensated for their observed talent will have a natural tendency to work harder. Our findings, however, do suggest that RPE contracts are influenced by pay-for-talent considerations.

Finally, we also find certain features of the RPE contract that can be explained by legal and disclosure requirements (Murphy, 2013). For example, SEC disclosure rules require firms to specify the pay-performance relation using a minimum payment, a target payment, and a maximum payment. In response, many contracts specify a minimum performance payment, a target performance payment and a maximum performance payment, with piece-wise linear pay-performance relations between them.

Empirical studies that examine the use of RPE in executive compensation rely on a linear-model specifications (Holmstrom and Milgrom, 1987). In this specification, CEO compensation is regressed against firm return and industry return. A positive coefficient on firm return and a negative coefficient on industry return is considered evidence of the use of RPE. Using the observed contractual terms of RPE in CEO compensation contracts, we introduce a different empirical specification, which is based on the rank performance of the CEO relative to peers. We show that this new specification has higher explanatory power than the traditional linear-model. Using this new specification we find significant reliance on RPE over the last two decades among public US firms. Moreover, we show that reliance on the linear-model framework could lead to significant biases and under-estimation of RPE if the actual terms are ranked-based. These findings can help explain why, with the linear specification the literature found mixed results regarding the use of RPE.

Using the improved empirical specification, we further examine the talent-based framework. Our conjecture is that, if RPE is used to pay CEOs for their talent, RPE should be stronger in firms and industries where it is easier for the CEO to transfer her talent across firms. In this case it is more

important for the firm to commit to paying the CEO for her relative talent. To capture these labor market frictions, we use a battery of proxies of CEO's firm-specific talent or how costly it is for the CEO to leave the firm for an outside offer. Precisely, our analysis is based on the following cross-sectional variations: whether the CEO is also the founder (having strong firm-specific talent), whether CEO talent is general enough so that she can transfer her talent across firms (Custódio, Ferreira and Matos, 2013), whether firms in the industry tend to promote insiders as their new CEOs (Cremers and Grinstein, 2014), and whether the state in which the firm is headquartered enforces non-compete clauses that restrict managers from leaving the firm for a competitor (Garmaise, 2011). Consistent with our conjecture, all the results indicate that as CEO talent becomes more transferable, firms are more likely to rely on RPE.

This paper contributes to the literature in several ways. First, it provides a new perspective on the effects of CEO talent on the use and incorporation of performance-based compensation and particularly RPE. It extends the literature that examines the possibility that performance-based compensation is also used to retain talent. For example, Oyer (2004) explains the use of option compensation as a way to compensate employees for their future outside opportunities, using stock price as a measure of the overall market conditions affecting outside opportunities.[3] Using the same intuition, when talent is observed through past performance relative to peers, RPE can also be used to compensate the CEO for her future outside opportunities.

Second, the evidence in this paper sheds light on the relevance of RPE in CEO compensation and on the importance of empirically modeling the correct functional form of the pay-performance relation in testing the presence of RPE.[4] The rank-based features of RPE found in the contractual terms suggest that empirical specifications to test the presence of RPE should include rank-based performance

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[3] See also Murphy (1986), who studies the properties and implications of multi-period managerial contracts under two alternative hypotheses: incentives and talent-learning. His findings yield mixed results that generally support the talent-learning hypothesis over the incentive hypothesis.

[4] Past studies find mixed evidence on the presence of RPE. For example, Gibbons and Murphy (1990) find some support for the use of RPE in CEO compensation in a sample of large firms in the 1970s and 1980s, but Aggarwal and Samwick (1999a) find little support for the presence of RPE in a sample of large US firms in the 1990s.

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measures. Such specifications differ from the specifications used in past studies, which assume a linear relation between the distance between CEO performance and that of peers and compensation (see, e.g., Gibbons and Murphy, 1990, Aggarwal and Samwick, 1999b, Bertrand and Mullainathan, 2001, Garvey and Milbourn, 2003, Rajgopal, Shevlin and Zamora, 2006, and Gopalan, Milbourn and Song, 2010). Clearly, the two measures are positively correlated but, nevertheless, they are different. We find that misspecification of the correct model of RPE in the CEO compensation contract can lead to failure in detecting RPE in the data even when RPE exists.[5]

Finally, this paper complements previous studies that examine the contractual terms in executive compensation. Using newly disclosed contractual terms after the SEC disclosure rules, Gong, Li, and Shin (2011) and De Angelis and Grinstein (2011) document that the use of RPE is quite prevalent in US firms. Murphy (1999) and Carter, Ittner, and Zechman (2009) examine contractual terms in US annual bonus plans using survey data and in UK equity grants respectively, and document that RPE in their sample tends to be rank-based. We provide a new explanation for the rank-based form of RPE and use this functional form to introduce a new empirical model to detect the presence of RPE in compensation data.

Our study continues as follows. Section I presents the contractual terms governing RPE. Section II compares these terms to the ones predicted by the theory. In Section III we propose a new empirical methodology to detect RPE and contrast it with linear empirical specifications. With the improved methodology we provide additional analysis of the talent-based explanation. Section IV concludes. In appendices A and B, we illustrate through real-life examples how RPE is incorporated into CEO compensation contracts.

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[5] Another type of potential misspecification is related to the identification of the peer group. See Albuquerque (2009), Gong, Li, and Shin (2011) and Lewellen (2013) who find that more refined peer group classification helps to detect the use of RPE in the data. The ranked-based specification has higher explanatory power than the linear specification even when including more refined industry-size peer group classifications.

I. How is RPE Incorporated in CEO Compensation Contracts?

In this section, we examine RPE terms in CEO compensation contracts in public U.S. firms. Until recently, public U.S. firms were not required to disclose the contractual terms that govern CEO compensation. However, in December 2006, the SEC issued new disclosure requirements concerning CEO compensation. With this new information, we can identify how firms employ RPE in the compensation contract.

We examine the terms of the contracts in two ways. First, we read the proxy statements of all S&P 500 firms in 2007 and summarize the way RPE is implemented in the contracts.[6] We provide extensive information such as the form of the contract, how RPE is measured, the length of time in which the performance is evaluated, the form of compensation for meeting the performance goals, etc. Second, we collect data on the choice of RPE peers from the Incentive Lab database between 2006-2012 and provide information on the characteristics of RPE peers. The Incentive Lab database sample includes the largest 750 public U.S. firms in terms of market capitalization in each year.

A. RPE and Compensation Payoff – Functional Form

Our sample consists of 494 firms that belonged to the Standard and Poor's (S&P) 500 index as of December 2007.[7] We collect information about the RPE terms from firms' proxy statements in fiscal year 2007. We use the Compustat definition of fiscal year 2007, which means that firms are included in our sample if their fiscal year ends between 06/01/2007 and 05/31/2008.

Firms in the sample can grant both performance-based and non-performance-based awards. Performance-based awards are paid conditional on achieving a pre-specified performance goal while non-performance-based awards are granted to the CEO at the discretion of the board. For the

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[6] In appendices A and B, we provide examples of how firms incorporate RPE in the CEO compensation contract. See De Angelis and Grinstein (2011, 2015) for more detailed explanations about the 2006 disclosure rules and the data collection methodology.

[7] There are six firms that belonged to the S&P 500 index for which we are not able to retrieve proxy statements.

performance-based awards, firms disclose the amount that is likely to be paid in the future (referred to as "target payment"). This value is the amount expensed by the company in its financial statements. If the payment is in the form of an equity award, then the amount expensed is evaluated using the fair value for the equity awards. In our sample, 90% of the firms granted some type of performance-based award in 2007. The average value of the award is 4.8 million dollars.

[Insert Table I here]

We summarize the findings regarding the use of RPE in Table I. Panel A shows that 34% of the firms in the sample that grant performance-based awards state explicitly that they tie CEO compensation to firm performance relative to peers (i.e. RPE).[8] On average, RPE users tie 49% of the value of performance-based award to RPE. Among RPE users, there is substantial variation in the use of RPE across firms: the standard deviation of RPE weight is 24% and the range of RPE weight is 90% (minimum is 10%, and maximum is 100%). Similar to Gong et al (2011), we find that the use of RPE tends to be concentrated in equity awards: 56% of RPE firms tend to use RPE solely in equity awards, 32% solely in non-equity awards, and 12% in both equity and non-equity awards (not reported).

We are particularly concerned about whether the contractual terms are actually held once the performance is realized. We therefore examine the actual compensation that the CEO receives in the years 2008-2009 for a subsample of the firms to ensure that the CEO receives compensation according to the RPE terms. We find complete compliance with the terms of the contract.

We note that while all firms that declare use of RPE indeed give compensation based on RPE, there could be other firms that rely on RPE but do not disclose it in the contract because they tie the RPE to a discretionary part of the compensation.[9] We do not capture these firms in our current analysis

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[8] As a comparison, in the UK, Carter et al. (2009) find in their sample that 51% of the firms rely on RPE. On the other hand, in the US, Gong et al. (2011) find that 25% of their sample firms rely on RPE.
[9] The firm could also consider peer performance in the CEO replacement decision. Jenter and Kanaan (2015) show that CEOs are fired after bad firm performance related to factors beyond their control. In other words, their results

because we can only rely on the explicit RPE relation in the contract. To address this concern, in the next section we provide a panel regression analysis where we examine the relation between CEO's entire realized compensation and relative performance evaluation.

A.1.   Rank-based RPE vs. Distance-based RPE

Firms in our sample measure the performance of the CEO relative to peers in two different ways. One way is measuring the distance between CEO performance and the average performance of the peers. The larger the distance between CEO performance and that of its peers, the higher the compensation (see the example of Murphy Oil in the appendix). About 14% of the firms that report RPE rely on the distance measure. The other way by which CEO performance relative to peers is measured is by ranking CEO performance relative to peers - the firm provides a menu of payments depending on the rank of CEO performance and the closer the CEO to the top of the performance distribution among its peers the higher the payment. Panel B shows that the vast majority of the RPE contracts (88% of the sample) is based on the rank of the performance. Only a few firms use both distance-based and rank-based RPE (2% of the sample).

A.2.   Performance measure

In general, firms choose to tie different measures of firm performance to that of peers. Panel C shows that the most common performance measure used in RPE is market-based (i.e., stock price performance compared to index returns, or stock price performance compared to that of a peer group). We observe that 75% of RPE users associate RPE with market-based measures whereas only 36% associate it to accounting-based measures.[10] (These numbers do not add up to one because some firms

suggest that, on average, firms do not filter out peer performance when considering CEO retention decisions. See also Eisfeldt and Kuhnen (2013) who develop a competitive assignment model and study its implications on CEO turnover.

[10] In addition, we also find that on average 70% of the value of the award tied to RPE is associated to stock price performance (see De Angelis and Grinstein, 2011, for more details).

employ both market-based and accounting-based performance measures.) This finding is consistent with Carter et al. (2009) and Gong et al. (2011) who find that most RPE users employ total shareholder returns (TSR) as their measure of performance.

Panel C of Table I shows that among the accounting-based measures, 20% of RPE users tend to use accounting return measures such as return on assets relative to peers (see the example of Weyerhaeuser in the appendix). RPE users tie on average 12% of the value of the award to that measure. A total of 17% of the RPE users use income growth measures compared to peers and they tie on average 11% of the award to these measures. Sales growth measures compared to peers are the third most popular among accounting measures. A total of 9% of RPE users employ these measures and they tie about 5% of the value of the award to that measure.

A.3.   Performance horizon and vesting requirements

Panel D of Table I describes the performance horizon associated with RPE. Firms provide in the proxy statement the performance horizon by which they examine CEO performance against that of peers. We find that on average the performance horizon associated to RPE is 2.6 years. The most common performance horizon associated to RPE is 3 years (63% of RPE users). The CEO cannot receive the award until the end of the performance period, and if the CEO leaves the company beforehand the CEO usually forgoes the award. In addition, when the compensation is in the form of stock, the award itself sometimes vests, usually over a period of three additional years.[11]

A.4.   Performance threshold and cap in RPE

We find that across all firms the functional relation between RPE and compensation is about the same. Across all contracts, the CEO receives no performance compensation if she does not achieve a

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[11] For example, Exelon corporation's equity award, described in appendix A, vests over three years with a third of award vests each year. In addition, Rockwell corporation states that the CEO will not be able to collect the award if he quits before the third year of performance.

threshold performance relative to peers. Then, once the threshold is achieved, the CEO receives a minimum amount. This amount increases monotonically as CEO performance relative to peers increases. Finally, at some performance there is a cap, above which CEO compensation is not going to increase if the maximum performance is met. Firms also report target performance, which is somewhere in between minimum performance threshold and maximum performance cap. The target performance is the expected performance of the CEO.

Since most contracts are based on the rank of the CEO relative to peers, the minimum performance threshold, the target performance and the maximum performance cap are given in the form of a rank.[12] For example, a CEO can start receiving awards if her performance is higher than the performance of 10% of the peers, and her awards will increase if her performance ranking is higher, until reaching the performance that is at the top 90% of all her peers. A higher performance will not provide the CEO with more compensation.

[Insert Figure 1 here]

Figure 1 shows the distribution of the minimum, target, and maximum performance thresholds across the rank-based contracts in our sample. Panel A shows that most firms set the minimum performance threshold at 25% (about 40% of the firms with rank-based RPE contracts). This means that if the CEO performance is better than that of 25% of the peers, the CEO will start receiving an award. Panel A also shows that some firms put the performance threshold at higher levels. Panel B shows that most firms set the target performance at 50% (about 60% of the firms). The maximum performance cap is more dispersed. About 30% of the firm puts it at the 75%, another 20% put it at 90% and another 25% put it at 100%.

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[12] Distance-based RPE can also exhibit non-linear features such as the existence of a minimum performance threshold and a performance cap (see the example of Murphy Oil in the appendix).

In Figure 2, we plot the distribution of minimum and maximum payouts associated with RPE. We report the ratio of these payouts divided by the target payout. In Panel A, we observe that about 70% of RPE users assign a strictly positive payout at the minimum performance threshold. The minimum payouts are usually either 25% of the target payout (23% of RPE users) or 50% of the target payout (25% of RPE users). Regarding the maximum performance thresholds, firms tend to cap the payout at a level that represents 200% of the target payout (59% of RPE users). The median (average) minimum and maximum payout relative to the target payout are 25% (24%) and 200% (209%) respectively.

[Insert Figure 2 here]

B.   *RPE - Peer Group Analysis*

Firms that use RPE define a peer group to benchmark performance against. We investigate the identity of the peers used in RPE. We analyze the peers on several dimensions. First, we examine the extent to which firms use indexes such as industry indexes or market indexes to benchmark CEO performance against. Table II Panel A shows the comparison. Panel A shows that the majority of the firms in the sample (64%) benchmark RPE against a performance peer group, rather than an industry index or a market index. This result suggests that firms are consciously choosing RPE peer firms rather than relying on existing industry indexes.

Panel B shows the overlap between compensation peers and RPE peers in our sample. Compensation peers are the peers used as a benchmark to total CEO compensation. The table shows that the number of performance peers is somewhat smaller than the number of compensation peers. On average, the number of performance peers is about 17, whereas the number of compensation peers is about 22. The average overlap in peers is about 63% (*# Same Peers /# Distinct Peers*) while the median overlap is about 68%. Panel C shows that these statistics are relatively stable across the years.

[Insert Table II Here]

Figure 4 shows the distribution of overlap between compensation peers and RPE peers. The figure shows that about 34% of the firms in the sample use the same peers for RPE and for compensation. The figure also shows a large dispersion in overlap across firms with about 50% of the firms having more than 75% overlap and about 25% of the firms having less than 25% overlap.

Table III shows a comparison of the characteristics of RPE peers and compensation peers. The table shows that the size distribution of peers is very similar. On average, 48.46% of the compensation peers are within 50%-200% market cap range compared to 48.11% of the RPE peers. The fraction of compensation peers that are above 200% in market cap range is 30.90% compared to 29.94% for the RPE peers. The fraction of compensation peers that are less than 50% in market cap range is 20.63% compared to 21.95% in RPE peers.

The industry distribution is somewhat different between the compensation peers and the RPE peers. The fraction of compensation peers that are within the same 4-digit SIC code as the firm is 29.58% compared to 38.46% for the RPE peers. Within the Fama French 12 industry categorization, only 64.21% of the compensation peers are within the same industry as the firm, whereas 77.40% of the RPE peers are within the same industry as the firm.

[Insert Table III Here]

To summarize, there are several features of the RPE contract that are common across firms. First, firms benchmark CEO performance to peers by compensating the CEO based on the *ranking* of the CEO compared to the peer group rather than based on the difference between the actual performance of the CEO relative to peers. Second, the pay-performance relation is non-linear: firms tend to place a threshold performance (usually 25 percentile relative to peers with a payout of 25% of the target payout), below which the CEO receives no award. Then, they place a maximum performance threshold (usually 75 percentile relative to peers with a payout of 200% of the target payout) above which the CEO receives maximum award. The CEO award is increasing monotonically for any performance between the

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threshold performance and the maximum performance, and the payoff function tends to be piece-wise linear and convex between the minimum and maximum performance thresholds. Third, ranking itself is based on stock return for the majority of the sample and that for the majority of the contracts the performance is measured over a three-year period with the compensation vesting until the end of the performance period. In Figure 3, we use the average RPE terms to illustrate a common compensation payoff associated with the use of RPE.

[Insert Figure 3 here]

We also find a strong overlap between compensation peers and RPE peers. About a third of the firms that provide RPE use the same peers as the ones in their compensation group. RPE peers also tend to be within the same size range as compensation peers, with most of them being either similar in size to the firm or larger than the firm. However, unlike compensation peers, RPE peers are more likely to come from the same industry as the firm.

II. Discussion

In this section we compare the results regarding the contractual terms governing CEO compensation to those predicted by the theory.

A. RPE contract as a solution to the agency problem – efficient contracting

Most studies that examine the use of RPE in CEO compensation contracts rely on the models of Holmstrom (1982) and Holmstrom and Milgrom (1987). In these hidden-action agency models, risk-neutral investors write a compensation contract with a risk averse CEO. Both CEO actions and events outside CEO control (such as industry shocks) affect firm performance. Firms observe their own performance and the distribution of performance among other firms. In order to improve the precision of measuring CEO actions, the optimal compensation scheme ties the compensation of the CEO to both the performance of the firm (positively) and the performance of peers (negatively). This feature of the

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model is quite robust to different specifications of the utility function of the CEO and the way actions affect performance. However, the exact functional form of the compensation contract and the exact relation between compensation, performance, and peer performance depends greatly on the utility function of the manager, the relation between effort and firm performance and the relation between peer performance and firm performance. Holmstrom and Milgrom (1987) show that under the assumption of CEO CARA preferences and normal distribution of shocks, the optimal compensation is a linear combination of firm performance and industry performance. The weights assigned to firm performance and average industry performance are positive and negative respectively. Put differently, the higher the performance of the firm, the higher the compensation, but higher industry performance overall implies that at least part of the performance is not attributed to managerial effort and therefore it should bear negatively on the compensation. The higher the precision of industry performance and the higher the correlation of industry performance with the performance of the agent, the larger the (negative) weight on industry performance.

Clearly, the fact that the functional form of the RPE greatly depends on the parameters of the model allows for many different types of RPE contracts with different functional forms. Nevertheless, despite the identification hurdle, many studies have taken the predictions of the model in its linear form and tried to estimate it empirically (e.g., Gibbons and Murphy 1990). The linearity assumption, it turns out, does not hold in our sample. The relation between CEO compensation, firm performance, and industry performance is highly non-linear. The compensation of the CEO changes non-linearly depending on the rank of the performance of the CEO relative to that of peers. As can be seen in Figure 3, the compensation moves monotonically with the performance ranking from 25% of peer to 50% of performance, and then moves monotonically, but at a higher slope from 50% to 75% percentile, and then it reaches a maximum at 75% of performance.

The ranked-performance compensation practice is also somewhat at odds with agency theory. Holmstrom (1982) points to the fact that ranked-based RPE is less informative than distance-based RPE. Therefore, it is more efficient to condition the compensation of the CEO to the distance between CEO performance and that of peers than to the rank of CEO performance and that of peers. To illustrate why this is the case, suppose that the firm observes the performance of one peer. If the compensation contract relies on the ranking of performance, then the CEO will receive one compensation if her performance is higher than that of the peer, and another compensation if her performance is lower than that of the peer. It is easy to see that this compensation scheme can be improved if the firm conditions the compensation not only on the ranking but on whether the peer did much better or much worse or whether the peer did just a little better or a little worse than the CEO.

Perhaps more interestingly, it seems that firms in our sample converge to the same functional form governing the relation between compensation, firm performance and industry performance. This result is despite the fact that CEO utility function and the relation between effort, performance and peer performance is unlikely to be the same across firms and industries. For example, a CEO in the pharmaceutical industry receives the exact same functional form of RPE as a CEO in the energy industry.

Another practice that seems at odds with the predictions of the agency theory is the fact that the majority of CEOs in our sample receive their RPE compensation in the form of shares rather than in cash. The role of RPE is to reduce the noise associated with firm performance not related to CEO efforts. However, giving the compensation in the form of shares implies that the compensation depends on the share price, exposing the CEO to the same noise that RPE was supposed to eliminate.

Lastly, agency theory implies that the peer group should include firms whose performance is informative to firm performance but not to CEO effort. A natural group of this sort is industry peers. Firms that operate in the same industry are often subject to the same shocks such as demand shocks from customers and therefore their performance should have a strong common component. Table 3

Panel B shows that peers are sometimes drawn from the same industry, but not always. Restricting ourselves to 4-digit industry peers, we find that only 38% of the peers come from the same industry. Relaxing the industry definition and using the 3-sigit SIC definition, only 44% of the peers come from the same industry. A coarser definition such as the 2-sigit SIC definition, reveals that about 68% of the peers come from the same industry. Even with very coarse definitions of industries, such as the 12 Fama-French industry sector definition, only 77% of the peers come from the same sector.

B. Solution to an incentive problem – the tournament explanation

A significant line of literature discusses RPE within a tournament setting. In this setting, participants compete with one another and receive their rewards based on their ranked performance relative to peers. Ranked based rewards exist in many different contexts, such as in sports, or in job promotion of individuals within the organization. The seminal study of Lazear and Rosen (1981) shows that such an incentive scheme can provide the right incentives and indeed be optimal when agents are risk neutral. As noted by Holmstrom (1982), the use of tournaments is suboptimal relative to individual contracts when agents are risk averse, but it has the advantage of being relatively simple to implement.

Is the relative performance contract we observe in CEO compensation contracts a part of a tournament scheme among CEOs? Indeed the ranking property is a distinct feature of tournament theory (Lazear and Rosen, 1981). However, other properties of the contract do not square with the tournament setting. In particular, for a tournament to be considered an incentive scheme across organizations, the organizations themselves need to agree among themselves to the rules of the tournament. Put differently, if the CEO of firm 1 competes against the CEO of firm 2 it also means that the CEO of firm 2 competes against the CEO of firm 1. More generally, the incentive scheme of the CEO of firm 1 should include her performance relative to firm 2 and the incentive scheme of the CEO of firm 2 should include her performance relative to firm 1. This is the definition of a tournament and all

theoretical analysis of tournaments is done in this framework. However, this is not what we find in the data. Table IV examines the extent to which benchmarking peers through rank-based evaluation is also shared by the peers themselves. Panel A shows that among around 13 peers on average, only 1.88 peers use the firm in their own RPE. In fact, as Figure 5 shows, about 30% of the firms in our sample do not have any reverse peers.

[Table IV Here]

[Insert Figure 5]

As shown, there is little overlap in the pools that CEOs are benchmarked against. In the majority of the cases, if the CEO of firm 1 is ranked against the CEO of firm 2, the CEO of firm 2 is not ranked against the CEO of firm 1. Therefore, with the RPE contract, CEOs do not compete against one another. Rather, each is benchmarked against a different peer. This feature does not fit a tournament setting.

C. Other frictions

It is possible that there are costs of writing optimal contracts which restrict firms from implementing them. Rather, firms establish a standard compensation scheme that is a second best solution. This would explain why firms decide to implement a particular functional form of the pay-performance relation, (although, the particular rank-based non-linear form observed in the data seems to require some non-trivial assumptions about the functional form and the distribution of the fundamentals of the model).

Murphy (2013) points to legal and tax reasons that distort firm incentives from providing an optimal compensation contract. For example, to the extent that stock compensation imposes lower taxes on the CEO than cash compensation, then perhaps the firm is better off giving the CEO shares rather than cash, even though shares bear significant systematic component of performance which should be eliminated under the agency theory. The fact that there are relatively many peers that the

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firm compares itself to might also suggest that the use of ranked performance rather than distance performance does not entail much information loss.[13] It is also possible that firms resort to one type of contract because it is easier to deal with, both legally and in the time and effort it takes to write the contract, and it is therefore easier to write a common compensation contract rather than tailoring each contract to a specific CEO.

We find that certain features of the contract can be explained by some legal and disclosure requirements. The fact that the firm discloses a threshold compensation, a target compensation, and a maximum compensation, with a piece-wise linear compensation among them could indeed be related to the fact that firms are required by the SEC to disclose minimum, target, and maximum compensation in their contracts. However, while we do believe that disclosure and legal considerations play a role in the design of compensation contracts, we find it hard to explain certain features of the RPE contract using the above justifications. For example, we find firms spending many pages in the proxy report explaining the elaborate method used for the RPE (see examples in the appendix). If firms were facing such high costs of writing the optimal contract, thereby resorting to standardized contracts, they would likely not elaborate so much on the nuances of the second-best contract itself. Moreover, most firms in our sample give at least part of their compensation in the form of cash bonuses (both in the long-term plans and in their cash-based bonuses). To the extent that firms wish to reduce the common component of risk from the compensation, they can divert at least part of the cash compensation to the portion of stock-based compensation that is RPE based.

D. Talent-based explanation

Many theoretical studies have pointed to the role that talent plays in the design of CEO compensation. For example, Rosen (1982) and Gabaix and Landier (2008) argue that the market for CEO

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[13] As the number of peers grows to infinity, there is a one-to-one mapping from the rank of the distribution to the distance.

talent explains the positive relation between CEO compensation and firm size. Oyer (2004) points to the important role of vested options in keeping human capital in the firm. The relation between talent and compensation was also studied when CEO talent is revealed over time through performance. For example, Holmstrom (1999) shows that when talent is revealed through performance, CEOs have incentives to work harder and agency conflicts are alleviated (but not completely).

Perhaps closest to our setting, Gibbons and Murphy (1990) show that RPE in CEO compensation is an efficient way to compensate CEOs for their talent. In their setting, firm performance is determined by CEO talent, common shocks, and noise. Firms learn CEO talent from past performance. In this setting the firm conditions CEO pay on CEO performance relative to the industry. The relative performance is an efficient measure of CEO talent, because it takes away the common shock.

How exactly CEO pay depends on talent depends on the supply of talent, the demand for talent, and the productivity of talent. The studies by Gibbons and Murphy (1990), Rosen (1981) and Holmstrom (1999) assume that the compensation for CEO talent is either exogenous, or depends on the productivity of the CEO (demand side). More recently, models such as Gabaix and Landier (2008) and Tervio (2008) show that when considering both the demand and supply side of CEO talent, the equilibrium compensation of the CEO depends on the distribution of talent across firms. In particular, there is a monotonically increasing relation between the cumulative distribution of CEO talent within the CEO peer pool and the level of CEO compensation.

Certain features of the RPE scheme suggest that the market for CEO talent plays a role in the design of RPE payment. One of the interesting features of performance peers in the sample is that they highly overlap with compensation peers. Compensation peers are peer firms against which salary and total compensation are benchmarked, and these peers are considered the relevant talent pool of candidates for CEO position (e.g., Bizjak, Lemmon, Naveen 2010, Faulkender and Yang, 2010, 2013). Table II shows that, on average, 80% of the performance peers appear also as compensation benchmark

peers and Figure 4 shows that in about 34% of the firms that give RPE, performance peers are similar to compensation peers. This finding suggests that firms in general view talent peers – the CEOs whom the firm competes for talent – as close substitutes to CEO performance peers. One can argue that talent peers and performance peers should highly overlap even if performance peers are used to eliminate a common shock. The reason is that talent peers are usually CEOs who work in firms that are similar to the firm in question. Interestingly, we find that performance peers are not necessarily involved in the same activities as the firm. About a third of all performance peers in our sample do not even belong to the same 2-digit SIC code as the firm.

Another interesting feature of the RPE terms is that they are often part of a long-term incentive plan. A long-term incentive plan provides rewards to CEOs who stay with the firm for a long period of time. The terms of most RPE compensation plans require that the CEO forgoes the reward if the CEO spends less than three years in the position. If the CEO leaves before three years have passed, the RPE reward is terminated and the CEO does not receive any reward. This vesting feature cannot be easily explained with standard agency theory. However, vesting terms are considered an important mechanism to retain CEO talent (Oyer, 2004): To retain the CEO, the firm commits to paying large sums of money provided that the CEO does not leave the firm.

A third interesting feature of the contract is that it consists of a menu of payments which depend on the ranked performance of the CEO relative to peers. This contract is hard to explain using agency models (e.g., Holmstrom 1982). However, this feature is in line with talent-based equilibrium models such as Sattinger (1979), Gabaix and Landier (2008) and Tervio (2008).

III. Panel Regression Analysis

Our findings in section II imply that RPE is used extensively in CEO compensation contracts, and the way it is used is not entirely consistent with agency models. The contract is non-linear, is based on

ranked performance of the CEO and is provided in the form of stock. We also find that certain features of the RPE contract are consistent with a talent-based explanation.

In this section we wish to corroborate these findings on a large panel of CEO compensation data. Our purpose is twofold. First, given the new evidence regarding the functional form of RPE in the contract we wish to examine whether applying this new functional form of RPE in an empirical model improves the accuracy of the model relative to a linear regression model. Second, we wish to examine on a large panel of data the extent to which the talent-based explanation is corroborated by the data.

One might argue that there is no need to resort to regression-based analysis when contracts are available to us. Nevertheless, there are several reasons for the need for a regression analysis. First, CEO performance compensation has two components: predetermined awards and discretionary awards. While we observe the terms of the predetermined awards we do not observe the discretionary awards. De Angelis and Grinstein (2015) show that the discretionary awards are on average about half of total CEO compensation. Ignoring the discretionary component would lead to an incomplete view of the role that RPE plays in compensation contracts. Second, we do not observe the contractual terms of CEO compensation before 2006. A regression model allows us to examine compensation patterns even when the observed contractual terms are not observed. Third, the vast majority of empirical work on executive compensation relies on regression models. In order to compare our findings to previous studies, it is useful to analyze RPE with the same methodology used in prior studies.

A. Database Construction

We retrieve the entire Execucomp database between 1992-2005.[14] The Execucomp database contains compensation information for top executives in firms that belong to S&P 500, MidCap 400, and

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[14] We exclude the years 2006-2012 because the way compensation is disclosed and calculated in those years differs from the rest of the panel. In addition, using the pre-disclosure rule period facilitates comparison with past studies. Our main results hold if we extend our sample period and include 2006-2012.

SmallCap 600 indexes. The database includes also firms that used to belong to these indexes but do not belong to them anymore. We restrict our sample to firms where the CEO was in place for at least a full year (i.e., the tenure of the CEO is greater to or equal to one year). Our sample consists of 18,041 firm-year CEO compensation observations. We use CEO total direct compensation (TDC, variable TDC1 from Execucomp) as our main measure of the annual compensation that the CEO receives in a given year. TDC1 includes the salary, bonuses, value of stock awards, Black-Scholes value of option awards, as well as other awards given to the CEO in a given year. We follow the literature and use the natural log of the compensation as our dependent variable to account for the skewness in the compensation distribution. For performance measures we use the one-year total shareholder return (TSR), the three-year TSR, the return on assets (ROA), which is the annual net income of the firm divided by the total assets.[15] We include the natural log of total assets to control for size and the natural log of CEO tenure to measure the tenure of the CEO. All variables are winsorized at 1% in both tails in order to mitigate the potential effects of outliers. Assets and compensation variables are expressed in 1992 dollars.

[Insert Table V here]

Table V shows summary statistics of firms in our sample. The median log compensation is 7.512, which corresponds to total compensation of $1.8 million in 1992 dollars. The 25 percentile of the distribution of the log compensation corresponds to $0.9 million and the 75 percentile corresponds to $3.7 million. The median annual TSR for a firm is 11% and the median three-year TSR is 38%. The log size of the median firm is 7.061 which corresponds to $1.16 billion in 1992 dollars.

B. Empirical Specification

By and large, all empirical models to detect RPE rely on a linear functional form. Our findings suggest, however, that RPE is highly nonlinear. We therefore wish to contrast the traditional linear

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[15] TSR is defined as the stock return over the fiscal year assuming that the dividend payments are reinvested.

model with models that more accurately depict the contractual form of RPE. We start with the traditional specification to detect RPE, found in the literature (e.g., Gibbons and Murphy, 1990):

$$Log(TDC_{ijkt}) = a_0 + a_1 TSR(ind.)_{jt} + a_2 TSR_{it} + a_3 ROA_{it} + a_4 Log(AT_{it}) + a_5 Log(CEO\ tenure_{it}) + \eta_{ik} + \theta_t + \varepsilon_{it} \qquad (1)$$

where firm is indexed by i, industry is indexed by j, CEO is indexed by k, and time is indexed by t. Industry is defined at the 2-digit SIC code level. $TSR(ind.)_{jt}$ is the equal-weighted average TSR of Execucomp firms that belong to the same industry, excluding the firm i.[16] We also include CEO-firm fixed effects, η_{ik}, and year fixed effects, θ_t, to control for unobserved heterogeneity across CEO-firm pair match and over the years.

Using this specification, the literature tests whether, on average, CEO compensation is paid based on RPE. Holding firm performance constant, a negative coefficient of the industry return, a_1, would suggest that CEO compensation increases as industry performance decreases and would be consistent with the presence of RPE in a distance-based fashion.

We now offer a second specification, based on the functional form of RPE found in the data.

$$Log(TDC_{ijkt}) = b_0 + b_1 CDF(TSR_{ijt}) + b_2 TSR_{it} + b_3 ROA_{it} + b_4 Log(AT_{it}) + b_5 Log(CEO\ tenure_{it}) + \eta_{ik} + \theta_t + \varepsilon_{it} \qquad (2)$$

In (5) we replace the industry performance with the cumulative distribution function of the TSR relative to the TSR of firms that belong to the same 2-digit SIC code ($CDF(TSR_{ijt})$). Our findings are that firms use RPE in a rank-based fashion, which implies that the CDF coefficient, b_1, will be positive. We also include the firm TSR, since it is possible that firms also base CEO compensation on total return.

We also offer a third specification, which allows for both types of RPE, rank-based and distance-based:

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[16] Because the Execucomp universe includes larger firms and thus is likely to be more representative of the actual peer groups, we use the Execucomp universe to compute industry returns and ranking. However, our main results are similar if we use the Compustat universe (instead of the Execucomp one) to compute industry TSR and their cumulative distribution function. In addition, our main results are also similar if we use the peer-group measure proposed by Albuquerque (2009), which is both industry and size based.

$Log(TDC_{ijkt})= c_0 + c_1\,CDF(TSR_{ijt}) + c_2\,TSR(ind.)_{jt} + c_3\,TSR_{it} + c_4\,ROA_{it} + c_5\,Log(AT_{it}) + c_6\,Log(CEO\ tenure_{it})$

$$+\ \eta_{ik} + \theta_t + \varepsilon_{it} \tag{3}$$

We also examine several variants of this specification. First, we use three year TSR performance instead of one year TSR performance horizon. Firms provide three-year performance horizon for the most part, and it might play an important role in the specification. When using the three year performance horizon specification, we restrict our sample to firms where the CEO is at least in the 3rd year of her or his contract (i.e., CEO tenure is greater or equal to 2).

In unreported results, we also study additional specifications to analyze the robustness of these results. We first aim to better capture the functional form observed in the contract. For instance, we cap the distribution at the 75% percentile and at the 25% percentile. (i.e., if the CDF is lower than 0.25 then we replace the CDF with 0 and if the CDF is higher than 0.75 we replace the CDF with 0.75). We also run median regressions and modify industry classification by using the 3 digit and 4 digit SIC code classification. In all these specifications we find similar results.[17]

C.   Main Results

We start with the first specification, where our horizon for CEO performance is one year – as is the case in the literature. Table VI column 1 shows the results using the first specification, the linear regression analysis as being used in the prior literature. The results are consistent with the findings in the literature. Compensation is positively related to firm's stock return and to firm accounting return. The coefficient of the industry return is negative and significant, consistent with Albuquerque (2009) and supporting the presence of RPE.

[Insert Table VI here]

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[17] These results are not reported but available upon request.

Column 2 shows the regression result of the second specification. Like before, the coefficients of the TSR and the ROA are positive and significant. The CDF coefficient (rank of the CEO performance relative to the industry) is strongly significant and in a direction consistent with the use of RPE. The coefficient suggests also economic significance. A 1% increase in the rank of the CEO performance compared to the industry is associated with 0.138% increase in log compensation, (or roughly 0.138% in total compensation). This means that a movement from the 25% of the distribution to the 75% of the distribution (a 50% increase) is associated with about 50%x0.138 = 6.9% increase in compensation.

We note that the second specification has slightly better fit with the data relative to the first specification. The R squared increases from 15.7% to 15.8%. Nevertheless, the fact that the contracts are over three-year performance horizon whereas our specification is over one-year performance horizon could suggest that we can further improve the fit by moving to three-year terms.

It is interesting to contrast the sensitivity of compensation to relative performance with the sensitivity of compensation to absolute performance. The coefficient of the TSR is 0.056. A movement from 25% to 75% of year return (Table V) is associated with 49.5% return. This means that a movement from the 25% to the 75% is associated with 0.056x49.1% = 2.77% increase in compensation. This means that the rank performance is at least as important economically as firm performance in the determination of the awards and the bonuses.

Column 3 in Table VI shows the compensation of the CEO once we also include industry return - the third specification. We observe that the coefficient of the *TSR(ind.)* becomes insignificant while the CDF coefficient is similar both in terms of magnitude and statistical significant to the CDF coefficient from the second specification. This suggests that the variation in the CDF better captures variation in compensation than variation in industry return.

In Columns 4 to 6 in Table VI, we show the results of the three specifications but over a three-year horizon, which better fits with the contractual terms observed in the data. Here also the CDF

coefficient is positive and significant. In addition, the sensitivity of compensation to rank performance increases considerably. In Column 5, the CDF coefficient is 0.263, which implies that a movement from the 25% of the distribution to the 75% of the distribution leads to an increase of 50%x0.26 = 13% in compensation. In contrast, the coefficient of the three-year TSR is 0.052, which implies that a movement from 25% to 75% of three-year return (i.e., an increase of 104% return, see Table V) is associated with only 0.052x104% = 5.4% increase in compensation. Once we also include three-year industry return, the coefficient of the three-year industry return becomes positive and statistically significant. In addition, the difference between the CDF and TSR coefficients is even more pronounced (Column 6). This result is consistent with our argument, because we expect the CEO to receive higher compensation not only when the CEO does better than the industry, but also when industry shocks lead all CEOs to increase productivity. Once the CDF is included in the specification, the industry return coefficient becomes positive and significant. This result might indicate that industry return in the original specification was not significant because it captured two contrasting effects. The first effect is a negative effect of industry return – as predicted by the traditional RPE models. The second effect is the positive effect of industry return on the productivity of CEOs across all firms and therefore on total compensation. The third specification allows us to disentangle the two effects.

We also note that with the three-year performance regression, the CDF-based model fits even better with the data than the return-based model. The R-squared of the CDF-based model is 17.8%, whereas it is 17.2% for the linear specification. The absolute increase is 0.6% which translates into a relative increase of about 3.5%.

Overall, we find that a CDF-based model fits better with the data than the linear regression model. This result is consistent with the patterns that we find in the actual compensation contracts. We will therefore utilize this model in our subsequent analysis.

D. RPE across Sample Periods

Our results so far are based on a regression specification between 1992-2005. It is possible that our results are driven by compensation practices in recent years. We therefore repeat our analysis above, but this time we divide our sample into two seven year periods. The first period is between 1992 and 1998, the second period is between 1999 and 2005. We run regression (5) for each of the periods and show the results in Table VII.

[Insert Table VII here]

The results show that the use of RPE has been stable over time. The coefficient of the CDF is 0.146 in the period 1992-1998, it is 0.109 in the period 1999-2005. Using the three-year performance horizon, the coefficient of the CDF is 0.341 in the period 1992-1998, it is 0.232 in the period 1999-2005. We conclude that the use of RPE is not a recent-period phenomenon but exists in the sample across all periods.

E. The significance of having a more accurate empirical model

Our findings suggest that the linear models used in the literature to detect RPE are less accurate than the ranked-based model we propose. Motivated by the data, the ranked based model has a higher explanatory power of the data and is robust over the years. Nevertheless, the improvement in accuracy might not be as important if linear models do a reasonable job in detecting RPE. To examine the importance of including non-linear specification to detect RPE we employ a simulation analysis.

We run a simulation where we create 1,000 random samples of firm performance and compensation and study how different empirical specifications capture the extent of RPE when the model is not correctly specified. We calibrate the statistical parameters of our simulation in order to approach the statistical characteristics of our sample. Each simulated sample represents 50 industries, with 30 firms per industry over 14 years. Hence each simulated sample consists of 21,000 firm-year

observations, which is size-wise similar to the sample we study in the previous section. We assume that firm performance follows a normal distribution with a mean of 18% and a standard deviation of 53% (consistent with the stock-return summary statistics of our sample - see Table II). We generate three different compensation variables via data generating processes that relate compensation to firm performance and that capture diverse ways to incorporate RPE in the compensation contract. The first data generating process (*DGP #1*) assumes the presence of strong-form distance-based RPE. In contrast, the functional form in *DGP #2* aims to capture the non-linear, rank based RPE – as observed in actual compensation contracts. Specifically, RPE is based on the cumulative distribution function (CDF) of firm performance relative to industry performance and exhibits a performance threshold corresponding to the 25th percentile of the performance distribution and a performance cap at the 75th percentile. In *DGP #3*, RPE depends linearly on the relative ranking of firm performance relative to the industry. In all the specifications, we assume an error term that follows a normal distribution with a mean of 0% and a standard deviation of 49%, which is similar to the distribution of the residuals obtained from the regression specification in Table 3 column 2. We also assume a firm fixed effect that follows a standard normal distribution.

We generate data using the different data generating processes, and then test for RPE using different regression specifications: the first specification assumes that RPE is based on the distance between CEO performance and industry performance (*Spe #1*) and is reminiscent of the original specification employed in Gibbons and Murphy (1990), the second specification assumes that RPE is based on the relative ranking (*Spe #2*), and the third specification allows a combination of both types of RPE (*Spe #3*). Table VIII summarizes our methodology and presents the results of our simulation.

[Insert Table VIII here]

We report the median RPE coefficient and the median RPE coefficient T-statistics for each specification / data-generating process combination. We also report the fraction of RPE coefficients (out

of the 1,000 estimated RPE coefficients) exhibiting a sign consistent with the presence of RPE (as well as the ones exhibiting a sign consistent with the presence of RPE and being significant at 5% using a two-tailed t-test). When RPE is linear and distance-based (*DGP #1*), the traditional specification (*Spe #1*) detects the presence of RPE in 79% of the simulated samples, whereas the ranking-based specification only detects it in 33% of them. In contrast, when RPE is generated similar to the observed contractual terms (*DGP #2*), the median coefficient of industry performance is insignificant in *Spe #1*, suggesting that there is no RPE, (in only 28% of the simulated samples, *Spe #1* detects RPE). In contrast, when using rank-based specification (*Spe #2*), the median CDF coefficient is statistically significant, which indicates the presence of RPE. In addition, in 88% of the simulated samples, *Spe #2* detects RPE. In *DGP #2,* when we include both the CDF and the industry performance (*Spe #3*), the industry performance coefficient is insignificant in most of the simulated samples while the CDF coefficient is significant in most of them. We reach similar conclusions when we assume that the RPE is rank-based (*DGP #3*).

This small illustration suggests that misspecification problems can be important and that the ranking feature of the compensation contract can significantly affect RPE inferences.

F.   Cross-Sectional Analysis

With the improved specification found in the previous section we test in this section the cross-sectional implications of the talent argument. The argument implies that firms will use rank-based RPE in compensation contracts because of the presence of CEO's outside opportunities.   A natural implication is that these outside opportunities should have a stronger impact in firms and industries where CEO talent is more easily transferable and/or where it is less costly for the CEO to leave the firm.

Our first set of cross-sectional tests relies on a dummy variable indicating whether the CEO was also the CEO when the company was founded. We retrieve the founding year of the company from

Corporate Library.[18] In addition to capturing firm-specific skills, this measure also captures agent-specific costs to leave the company (as a result of the loss of utility derived by running the firm one has founded). Hence we expect that outside opportunity considerations to be less important in founder-CEO firms and thus less reliance on rank-based RPE.

The second measure is borrowed from Custódio et al. (2013) and aims to identify whether the CEO tends to be a specialist or a generalist. Custódio et al. (2013) builds a generalist index based on the past occupation of the CEO (if the CEO worked in another firm in a different capacity before becoming CEO). We first classify CEOs as specialist if the annual generalist index of the CEO is below the median of the distribution of this measure in our sample (column 2) and the index is in the first quartile of the distribution (column 3). We expect that firms with specialist CEO to rely less on rank-based RPE.

Our third cross-sectional test relies on an industry-level measure of firm-specific talent proposed by Cremers and Grinstein (2014), which captures the percentage of new CEOs in an industry who have been promoted within the firm (rather than hired from outside). It is obtained from Cremers and Grinstein (2014) for the Fama and French 48 industry classification. We classify industries in the top quartile of the distribution of this measure as industries with more firm-specific talent and we expect that relative talent across firms CEOs of different firms should matter less there.

Our last measure is based on the enforceability of non-compete clauses that restrict managers from joining a competitive firm. According to the talent argument, rank-based RPE should be less prevalent when these clauses are more enforceable since it is less likely that the CEO could join a competitor (and thus CEO's outside opportunities should be less important in the design of her

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[18] The founding year used by the Corporate Library takes into account also the years in which the firm was private. Some studies approximate the founding year with the year the firm went public (this represents the IPO year for most firms). See, for example, Bebchuk, Cremers and Peyer (2011). Using this measure, the sign of the interacted coefficient of interest is consistent with our results; however, its magnitude and significance are lower. The decrease in significance might be explained by noise created by potential measurement errors of the founding year. For instance, in the case of a CEO that became CEO at the IPO, this measure would classify her as a Founder-CEO even though she was not a Founder-CEO.

compensation contract). To measure the enforceability of non-compete clauses, we borrow the state-level index proposed in Garmaise (2011). Garmaise builds an enforceability index across the states of the United States and finds that enforceability is associated to lower executive compensation. Using the state of location of the firm, we classify firms as firms with more noncompetition enforceability when their state-level index is above the median.

For all these measures, we focus on the three-year horizon for RPE in our specification, since it is the one that explains the largest part of the cross sectional variation in compensation (see Table VI). Three-year horizon for RPE is also observed in our analysis of compensation contracts.

Table IX shows the results. Column 1 shows the results where the measure of more firm-specific skills is whether the CEO is a founder. Columns 2 and 3 show the results where CEO specific talent is captured by whether the CEO is classified as a specialist. Column 4 shows the results where the measure of more firm-specific skills is industries with low ratio of insider CEOs. Column 5 shows the results where the measure of more firm-specific skills is firms headquartered in states with high enforceability of non-compete clauses.

[Insert Table IX here]

Column 1 shows that the sensitivity of CEO compensation to rank performance is 73% smaller among founder CEOs, which in consistent with less reliance on RPE in firms in which the CEO is founder. Column 2 shows that CEOs who are specialist tend to have about 42% less sensitivity of compensation to rank performance than CEOs who are generalist. When classifying the specialist using the first quartile, this difference increases: the sensitivity of CEO compensation to rank performance is 75% smaller among specialist CEOs (see column 3). Column 4 shows that firms in industries with less firm-specific skills have a sensitivity of compensation to rank performance that is about 45% weaker than the sensitivity of compensation to rank performance in industries with less firm-specific skills.

We find that firms in states with higher noncompetition enforceability tend to exhibit less sensitivity of compensation to rank performance, however this difference is not significant (see column 5). We suspect that the non-significance is due to the industry composition. In particular California has an index of zero (i.e. non-compete clauses are not enforced), and so in California we would expect more reliance on RPE. But at the same time, firms in California tend to be high-tech firms with high firm-specific talent. In this case we expect less reliance on RPE. To capture both effects, we interact the high enforcement dummy with the dummy used in column 4, to capture insider industries in high enforcement states. Under the talent explanation, we should expect little RPE, since there is high firm-specific talent and firms can use the non-compete clause to retain their CEO. We find strong evidence consistent with this explanation (see results in column 6).

We conclude that firms tend to rely less on rank-based RPE in firms in which CEO talent is more firm-specific and where it is more costly for the CEO to leave the firm. These results are consistent with the notion that the market for CEO talent is an important driver in the decision to use RPE.

IV. Conclusion

In this paper, we document the contractual terms of RPE in CEO compensation contracts and analyze these features against the predictions of agency theory. We find many features of the contract inconsistent with these theories. These results are consistent with other empirical studies that find discrepancies between the contractual terms predicted by agency theory and those found in the data (e.g., Dittman and Maug 2007). We then examine other explanations and find that certain features of the contract can be explained by performance-compensation for CEO talent.

Based on our findings regarding the functional form of RPE in the contract, we propose a new empirical specification to detect RPE in a panel regression framework. We show that this new specification has a better fit with the data than the linear regression framework used in the literature.

We also show that linear-based regressions could lead to underestimation of RPE in the data when compensation contracts have the features observed in the contracts. This improved specification can be used in future studies on CEO compensation to allow for more accurate inferences regarding the use of RPE in compensation contracts.

It is important to note that our finding that talent plays an important role in the design of the RPE contract does not mean that RPE does not have any incentive role. In fact, pay for talent has an important role in reducing agency conflicts, especially if talent is partially observed through past performance (Holmstrom, 1999). Our findings, however, do suggest that when designing the RPE terms, firms seem to focus on pay-for-talent considerations.

Appendix: Examples of the Use of RPE in CEO Compensation Contracts

Appendix A: The Functional Form

Appendix A illustrates via five examples the functional for of RPE when incorporated in CEO compensation contracts. We obtain the information from the firm's proxy statement for fiscal year 2007. Below we copy extracts from the proxy statements of public U.S. firms, and describe how they incorporate RPE in the CEO compensation contracts.

PFIZER (PFE) Proxy statement, March 14, 2008

2007 Grants of Plan-Based Awards Table

Name (a)	Grant Date (b)	Estimated Future Payouts Under Equity Incentive Plan Awards(1)			All Other Stock Awards: Number of Shares of Stock or Units(2) (i) (#)	All Other Option Awards: Number of Securities Underlying Options(3) (j) (#)	Exercise or Base Price of Option Awards (k) ($/Sh)	Grant Date Fair Value of Stock and Option Awards (l) ($)
		Threshold (f) (#)	Target (g) (#)	Maximum (h) (#)				
J. Kindler	2/22/2007					760,000	25.87	3,123,600
		38,800	155,200	310,400				4,469,760

2007 PERFORMANCE SHARE AWARDS

The number of shares that may be earned under the performance share awards granted in February 2007 is based on a prescribed formula comparing Pfizer's total shareholder return, including reinvestment of dividends, over a three-year period, in relation to the pharmaceutical peer group. If total shareholder return is below the threshold level compared to this peer group, then no shares are earned. If the total shareholder return is above the threshold level, but is negative in the absolute, then the number of shares awarded is limited to the target amount. If total shareholder return exceeds the threshold level compared to this peer group, varying numbers of shares (up to the maximum of 200% of target) are earned as follows:

Consistent with its decision in 2006 and to maintain continuity, the Committee selected total shareholder return as the sole performance measure for the 2007 performance share award cycle.

**Performance Share Awards
Relative Performance/Payout Matrix**

Pfizer Relative Performance	Maximum Payout as a % of Target
1 (highest)	200%
2	200%
3	175%
4	150%
5	125%
6	100%
7	75%
8	50%
9 (threshold)	25%
10	0%
11 (lowest)	0%

In the Committee's view, our relative total shareholder return compared with the pharmaceutical peer group remained a strategic priority during this period. The specific individual performance levels listed above were set at these points to ensure that realized value would be received by our executive officers at the competitive median for target performance, in the bottom quartile of the peer group for threshold performance, and in the top quartile for maximum performance.

Description: In 2007, Pfizer granted to its CEO a performance-based equity award that vests conditional on firm's relative performance. RPE is based on the 3-year TSR performance of the firm relative to a pharmaceutical peer group (i.e. self-selected peer group). In addition RPE is rank-based, with a

performance threshold associated with the 9th rank (i.e. about 23rd percentile) with a payout of 25% of the target payout, and a performance cap associated with the 2nd rank (i.e. about 86th percentile) with a payout of 200% of the target payout.

ROCKWELL AUTOMATION (ROK) Proxy statement, December 14, 2007

GRANTS OF PLAN-BASED AWARDS TABLE

The following table provides information about equity and non-equity awards made to the named executive officers in fiscal 2007.

Name	Grant Type	Grant Date	Compensation Committee Approval Date[3]	Estimated Future Payouts Under Non-Equity Incentive Plan Awards[1]			Estimated Future Payouts Under Equity Incentive Plan Awards[2]			All Other Stock Awards[4]: Number of Shares of Stock or Units (#)	All Other Option Awards[5]: Number of Securities Underlying Options (#)	Exercise or Base Price of Option Awards[6] ($ / Sh)	Grant Date Fair Value of Stock and Option Awards ($)
				Threshold ($)	Target ($)	Maximum ($)	Threshold (#)	Target (#)	Maximum (#)				
(a)		(b)		(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)
Keith D. Nosbusch	Incentive Compensation	12/6/2006	12/6/2006	0	1,000,000	2,000,000							
	Performance Shares	12/6/2006	12/6/2006				0	20,400	40,800				1,473,696
	Restricted Shares	12/6/2006	12/6/2006							8,700			553,233
	Stock Options	12/6/2006	12/6/2006								115,400	63.59	2,311,462

[2] These columns show the threshold, target and maximum payouts under performance shares awarded pursuant to our 2000 Long-Term Incentives Plan during fiscal year 2007. The payout in respect of these performance shares will be made in shares of our common stock and/or cash (generally calculated based on the closing price of our common stock on the trading day before the payout), in an amount determined based on the total shareowner return of our common stock, assuming reinvestment of all dividends, compared to the performance of companies in the S&P 500 Index for the period from October 1, 2006 to September 30, 2009, if the individual continues as an employee until the third anniversary of the grant date (subject to provisions relating to the grantee's death, disability, termination of employment or retirement or a change of control of the Corporation). The payouts will be at zero, the target amount and the maximum amount if our shareowner return is equal to or less than the 30th percentile, equal to the 60th percentile and equal to or greater than the 75th percentile of the total shareholder return of companies in the S&P 500 Index, respectively, over the applicable three-year period, with the payout interpolated for results between those percentiles. The potential value of a payout will fluctuate with the market value of our common stock. The grant date fair value of these awards was $72.24 per share computed in accordance with SFAS 123(R) and the assumptions set forth in note 11, Share-Based Compensation, to our audited financial statements included in our annual report on Form 10-K for the fiscal year ended September 30, 2007.

Description: In fiscal year 2007, Rockwell Automation granted to its CEO a performance-based equity award that vests conditional on firm's relative performance. RPE is based on the 3-year TSR performance of the firm relative to the market performance. They use the S&P 500 Index to measure market performance. RPE is rank-based and the target performance is defined at the 60th percentile. In addition, there are a performance threshold associated with the 30th percentile and a payout of zero and a performance cap associated with the 75th percentile and a payout of 200% of the target payout.

MURPHY OIL (MUR) Proxy statement, March 28, 2008

2007 GRANTS OF PLAN-BASED AWARDS TABLE

Name	Grant Date	Estimated Future Payouts Under Non-Equity Incentive Plan Awards			Estimated Future Payouts Under Equity Incentive Plan Awards		
		Threshold ($)	Target ($)	Maximum ($)	Threshold (#)	Target (#)	Maximum (#)
Claiborne P. Deming	02/06/07	893,229	1,429,167	3,572,918	27,500	55,000	82,500

Performance-based restricted stock units awarded in 2007 will vest in three years based on how the Company's total stockholder return compares to the total stockholder return of an index of thirteen energy companies. The same thirteen companies used for compensation peer analysis (as described above) are used for this purpose. The 2007 restricted stock unit awards contain four equally weighted measurement periods: year 1; year 2; year 3; and years 1-3 combined. Achievement of 50% of the group average is required for the payment of 50% of the target shares awarded, and achievement of 150% of the group average for the payment of 150% of the target shares. Phantom dividends are accumulated during the performance period and pay-out only if the underlying units pay out. Restricted stock units do not have any voting rights.

Description: In 2007, Murphy granted to its CEO a performance-based equity award that vests conditional on firm's relative performance. RPE is based on the TSR performance of the firm relative to a peer group (i.e. self-selected peer group). The firm uses four equally weighted measurement periods. RPE is distance-based and the target performance is defined at the average of the peer group performance. There are a performance threshold associated with a performance of half of the mean performance and a payout of 50% of the target payout and a performance cap associated with a performance of 150% of the mean and a payout of 150% of the target payout.

EXELON (EXC) Proxy statement, March 20, 2008

Grants Of Plan Based Awards

Name	Grant Date	Estimated Future Payouts Under Non-Equity Incentive Plan Awards Note (1)			Estimated Future Payouts Under Equity Incentive Plan Awards Note (2)			All Other Stock Awards: Number of Shares or Units	All Other Options Awards: Number of Securities Underlying Options	Exercise or Base Price of Option Awards	Grant Date Fair Value of Stock and Option Awards
		Threshold	Target	Maximum	Threshold	Target	Maximum				
								Note (3)			Note (4)
[a]	[b]	[c] ($)	[d] ($)	[e] ($)	[f] (#)	[g] (#)	[h] (#)	[I] (#)	[j] (#)	[k] ($)	[l] ($)
Rowe	1/22/07	$ 687,500	$ 1,375,000	$ 2,750,000							
					32,500	65,000	130,000				$ 5,674,614
	1/22/07										
	1/22/07								150,000	$ 59.96	1,957,500

2. All NEOs have a long-term performance share target opportunity that is a fixed number of performance shares commensurate with the officer's position. The 2007 Long-Term Performance Share Unit Award Program was based on two measures, Exelon's TSR compounded monthly, for the three-year period ended December 31, 2007, as compared to the TSR for the companies listed in the Dow Jones Utility Index (60% of the award), and Exelon's three-year TSR, as compared to the companies in the Standard and Poor's 500 Index (40% of the award). The threshold TSR Position Ranking, for a 50% of target payout, was the 25th percentile; the target, for a 100% payout, was the 50th percentile; and distinguished, for a 200% payout, was the 75th percentile, with payouts interpolated for performance falling between the threshold, target, and distinguished levels. One third of the awarded performance shares vests upon the award date with the balance vesting in January of the next two years.

Description: In 2007, Exelon granted to its CEO a performance-based equity award that vests conditional on firm's relative performance. RPE is based on the 3-year TSR performance of the firm relative to the performance of two different indexes. They use the S&P 500 Index (with a weight of 40%) and the Dow Jones Utility Index (with a weight of 60%). RPE is rank-based and the target performance is defined at the median. In addition, there are a performance threshold associated with the 25th percentile and a payout of 50% of the target payout and a performance cap associated with the 75th percentile and a payout of 200% of the target payout.

**WEYERHAEUSER (WY) Proxy statement, March 12, 2008**

GRANTS OF PLAN-BASED AWARD

Name	Grant Date (1)	Estimated Future Payouts Under Equity Incentive Plan Awards (2)			All Other Option Awards: No. of Securities Under-lying Options (#)	Exercise or Base Price of Option Awards (3) ($/Sh)	Grant Date Closing Price ($/Sh)	Grant Date Fair Value of Stock and Option Awards ($/Sh)
		Threshold (#)	Target (#)	Max. (#)				
S. R. Rogel	2/14/07	7,000	35,000	70,000	120,000	80.66	81.56	80.66
	2/14/07						81.56	16.95

Performance Share Units

Weyerhaeuser grants performance share units to executive officers to focus participants on long-term, competitive operating excellence, and the creation of economic and shareholder value. Performance is measured over a three-year period by comparison to the performance peer group of basic materials companies described above. The performance share units are earned at the end of the three-year period based on performance results. The performance measure used for earning grants of performance share units in 2007 was RONA Spread. RONA Spread is defined as RONA (see definition in "AIP—AIP Performance Measure and Plan Mechanics" above) minus the benchmark RONA rate (defined as pre-tax cost of dividends plus interest expense) for Weyerhaeuser and its peers. Use of this measure is intended to reflect a long-term measure of performance above a minimum shareholder return relative to peers. The actual number of performance share units earned is based on Weyerhaeuser's performance relative to the performance peers. Threshold performance is the 25th percentile of peers, which equates to a payout of 0.2x the target number of shares. A participant earns none of the target number of performance shares if the Company's performance is below the threshold. Median performance compared to the Company's peers earns the target number of shares, with a maximum earned opportunity of twice the target grant for upper quartile performance. As performance shares are earned, shares of Weyerhaeuser common stock are issued to the participant.

Performance Share Unit Award Opportunity
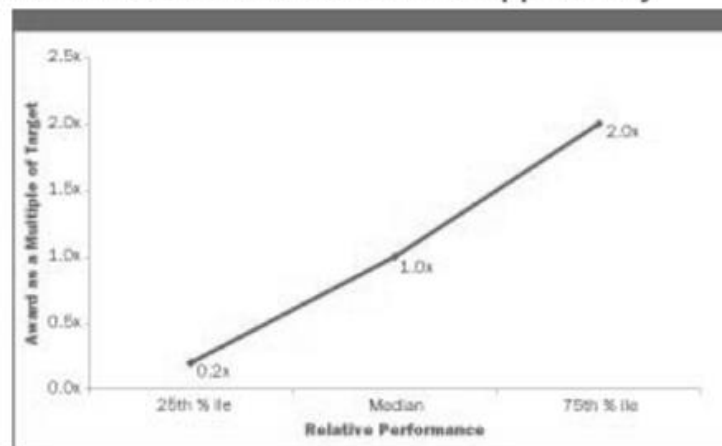
Description: In 2007, Weyerhaeuser granted to its CEO a performance-based equity award that vests conditional on firm's relative performance. RPE is based on the 3-year return on net assets (RONA) spread performance of the firm relative to a peer group of basic material companies (i.e. self-selected peer group). Regarding the definition of the performance measure, they state earlier in their proxy statement that "*RONA is defined as earnings before interest and tax ("EBIT") divided by average net assets.*" RPE is rank-based and the target performance is defined at the median. In addition, there are a performance threshold associated with the 25th percentile and a payout of 20% of the target payout and a performance cap associated with the 75th percentile and a payout of 200% of the target payout.

Appendix B: Comparison of Performance Peer Group and Compensation Peer Group within a Firm

SEAGATE:

Comp PG =18 firms, Perf PG = 27 firms

The selected peer group for PSUs awarded in September 2011 included a broader range of companies than the NEO Peer Group to allow for comparison of our performance against a wider subset of technology companies than the companies with whom we frequently compete for executive talent.

PEPSI CO:

Same PG

The Compensation Committee and Board utilize the same peer group to annually evaluate both executive officer pay levels and Company performance. The peer group is composed of large public consumer products companies in the Food & Beverage, Household & Personal Products and Pharmaceutical sectors that we compete with for executive officer talent and investor dollars. The Compensation Committee annually reviews and validates the peer group with the assistance of the Compensation Committee's independent outside advisor, Mercer Human Resource Consulting, to ensure all peer companies remain an appropriate basis for comparison. The following peer companies were approved by the Board, and are listed in order of 2006 revenue size (from largest to smallest), with PepsiCo shown to display its relative position: The Procter & Gamble Company; Johnson & Johnson; PepsiCo; Kraft Foods Inc.; The Coca-Cola Company; 3M Company; Kimberly-Clark Corporation; Sara Lee Corporation; Anheuser-Busch Companies, Inc.; Colgate-Palmolive Company; General Mills, Inc.; Kellogg Company; H.J. Heinz Company; Campbell Soup Company and The Estee Lauder Companies Inc. As noted by our position in the list, PepsiCo is one of the largest companies in the peer group, with 2006 revenue of $35 billion compared to the peer group median of $16 billion and 75th percentile of $24 billion.

ROCKWELL COLLINS:

Comp PG=10 firms, Perf PG =10 firms, but two different firms in each PG

Peer group of ten companies in the aerospace industry:

- AAR Corporation
- Alliant Techsystems, Inc.
- General Dynamics
- Goodrich Corporation
- Harris Corporation
- L-3 Communications
- Northrop Grumman Corporation
- PerkinElmer, Inc.
- Raytheon Company
- Teledyne Technologies, Inc.

These companies were selected because they are representative of companies that compete with us for business and executive talent. The peer group is reviewed periodically to assure that it continues to meet the needs of the Committee.

Peer performance modifier:
- The modifier is a potential adjustment to the award (otherwise determined based on return on sales and cumulative sales) up or down by 20% depending on the Corporation's total return to shareowners (share price growth plus dividend yield) measured against a group of peer companies.
- The peer performance adjustment will be made as follows:
- If performance is among the top three peer companies, the award based on achievements for return on sales and cumulative sales will be adjusted upward by 20%.
- If performance is among the middle four companies, no adjustment will be made.
- If performance is among the bottom three peer companies, a reduction of 20% will be made to the final award.
- The peer companies are AAR Corporation, Alliant Techsystems, Inc., The Boeing Company, General Dynamics, Goodrich Corporation, L-3 Communications, Lockheed Martin Corporation, Northrop Grumman Corporation, Raytheon Company and Teledyne Technologies, Inc. This peer group differs slightly from the compensation peers listed earlier because it more accurately reflects the relative differences between the Corporation's stock performance and market conditions within the industry and alternative investments for shareowners irrespective of the size of the company. The compensation peer group is more balanced as to size (a few larger and a few smaller companies) to allow for appropriate compensation comparisons.

PACCAR:

Same PG

Industry Compensation Comparison Groups

The Company considers a number of factors when reviewing and determining compensation, including Company performance, individual performance and compensation for executives among peer organizations. The Company utilizes information from industry-published compensation surveys as well as surveys conducted by outside consultants to determine if compensation for the Chief Executive Officer and executive officers is competitive with the market.

The surveys include data from *Fortune*-500 capital goods, manufacturing and other business sector companies, including all of the selected companies (the "Peer Companies") that comprise the index used in the stock performance graph set forth in the Company's Annual Report on Form 10-K and on page 25 of this proxy statement: ArvinMeritor Inc., Caterpillar Inc., Cummins Inc., Dana Corporation, Deere &

Company, Eaton Corporation, Ingersoll-Rand Company Limited, Navistar International Corporation and Oshkosh Truck Corporation. The Peer Companies are chosen because, in the Committee's judgment, they are the most directly comparable to the Company in size and nature of business. The Peer Companies may vary based on the Committee's regular review. The Company believes it is important to include in the surveys both the Peer Companies and other organizations with which the Company competes in the broader market for executive talent.

Long-Term Incentive Cash Awards. Given the cyclical nature of the Company's business, long-term cash incentives are awarded under the LTIP based on a three-year performance period, with a new performance period beginning the first of January every year. Target awards for the 2006-2008 performance cycle range from 60 to 150 percent of base salary.

For the Chief Executive Officer, Vice Chairman and the President, 100 percent of the 2006-2008 award is based on Company performance measured in terms of the Company's rank in three-year compound growth in net income, return on sales and return on capital (weighted equally) when compared to the following nine "Peer Companies": Arvin Meritor Inc, Caterpillar Inc., Cummins Inc., Dana Corporation, Deere & Company, Eaton Corporation, Ingersoll-Rand Company Limited, Navistar International Corporation and Oshkosh Truck Corporation. The Peer Companies are chosen because, in the judgment of the Committee (and the Company's outside consultants), they are the most directly comparable in size and nature of business.

The long-term incentive cash award for Mr. Cardillo for the three year cycle 2006-2008 is based 50 percent on the Company performance goal and 50 percent on a cumulative three-year business unit profit goal. The award for Mr. Gangl for the 2006-2008 cycle is based 50 percent on the Company performance goal, 25 percent on a cumulative three-year business unit profit goal and 25 percent on a business unit growth goal.

The target amount will be earned if the Company's financial performance ranks above at least half of the Peer Companies and performance is at least 100 percent of other goals. The maximum cash award amount will be earned if the Company's financial performance ranks above all of the Peer Companies and performance is at least 150 percent of other goals. No award will be earned if the Company's financial performance ranks below 75 percent of the Peer Companies and performance is below 75 percent of other goals.

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Table I

Examination of the Functional Form of RPE in CEO Compensation Contracts

Table I provides information about the use of RPE in CEO compensation contracts for a sample of 494 S&P500 members in 2007. In Panel A, we report the proportion of firms that grant any type of performance-based awards. Then we report the proportion of firms relying on RPE among firms that grant performance-based awards. In italics, we provide basic statistics about the weight assigned to performance benchmarking for firms that benchmark firm performance. In Panel B, we compare the proportion of firms relying on rank-based versus distance-based measures when benchmarking performance. In Panel C, we report the proportions of firms relying on specific performance measures when benchmarking performance. In Panel D, we provide basic statistics about the performance horizon when benchmarking performance.

Panel A: RPE Usage	
% of firms that grant performance-based awards	90%
% of RPE users among firms that grant performance-based awards	34%
Mean weight among users	*49%*
SD weight among users	*24%*
Median weight among users	*43%*
Min weight among users	*10%*
Max weight among users	*100%*

Panel B: Rank-based and Distance-based Measures when using RPE	
Among RPE users, % of firms that use	
Rank-based performance	*88%*
Distance-based performance	*14%*

Panel C: Performance Measures Associated with RPE	
Among RPE users, % of firms that benchmark performance by:	
Market measure	*75%*
Accounting measure	*36%*
Accounting return measure	*20%*
Income growth measure	*17%*
Sales growth measure	*9%*
Other accounting measures (Margin, Cash flows growth …)	*5%*

Panel D: Performance Horizon Associated with RPE	
Performance horizon associated with performance benchmarking (in years):	
1 year	*17%*
2 years	*15%*
3 years	*63%*
4 years or higher	*4%*
Average performance horizon	*2.57*
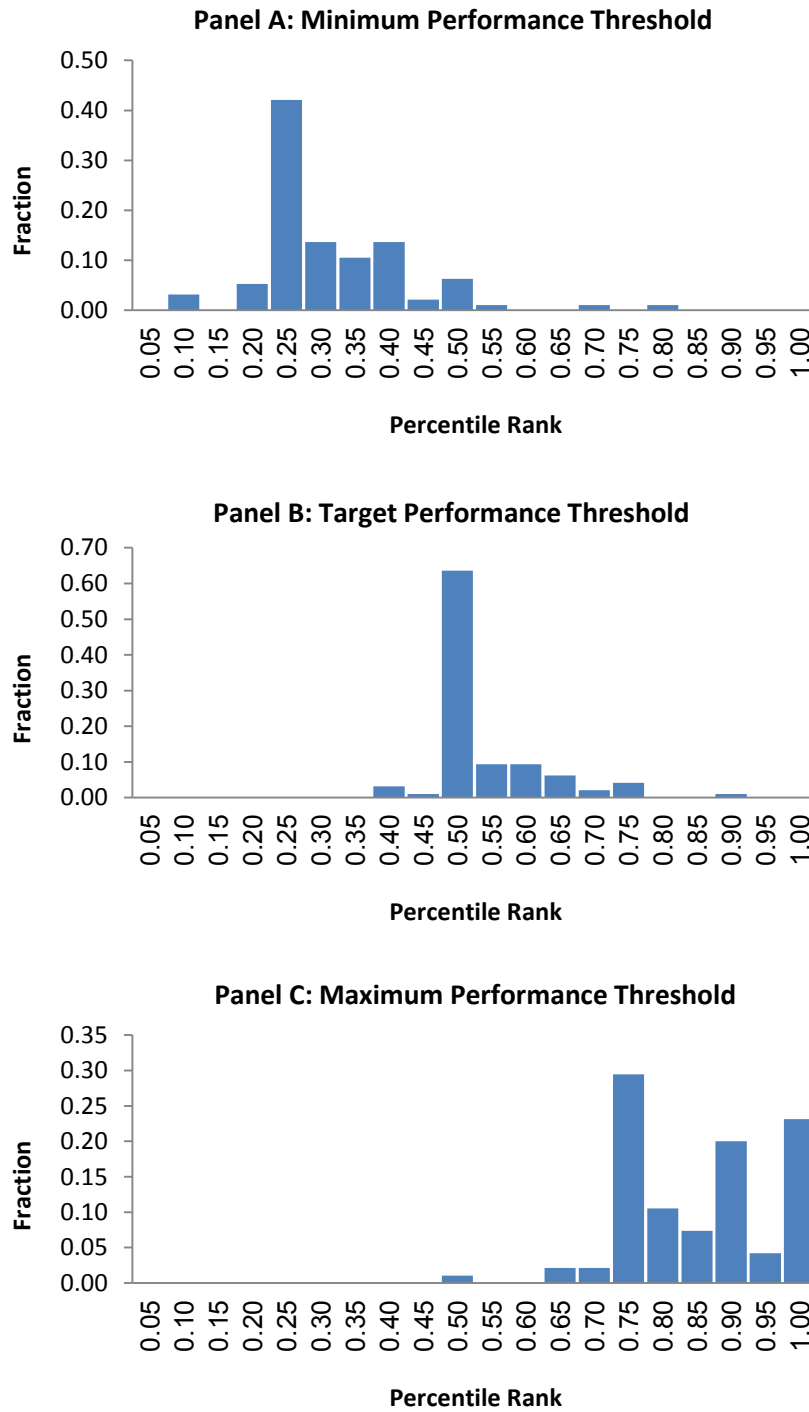
Figure 1. Histograms of the distribution of the performance thresholds when firms use rank-based RPE.

Panel A: Minimum Payout

Minimum Payout / Target Payout

Panel B: Maximum Payout

Maximum Payout / Target Payout

Figure 2. **Histograms of the distribution of the minimum and maximum payouts relative to the target payouts for RPE users.**

Percentile Rank (Firm TSR 3 years relative to peers TSR 3 years)

Figure 3. **Illustration of the compensation payoff under common RPE terms.**

Table II

**Examination of the Choice of Performance Benchmarks and
Comparison with the Compensation Benchmark**

Panel A reports the proportions of firms relying on different types of performance benchmarks for a sample of 494 S&P500 members in 2007. Panel B reports the n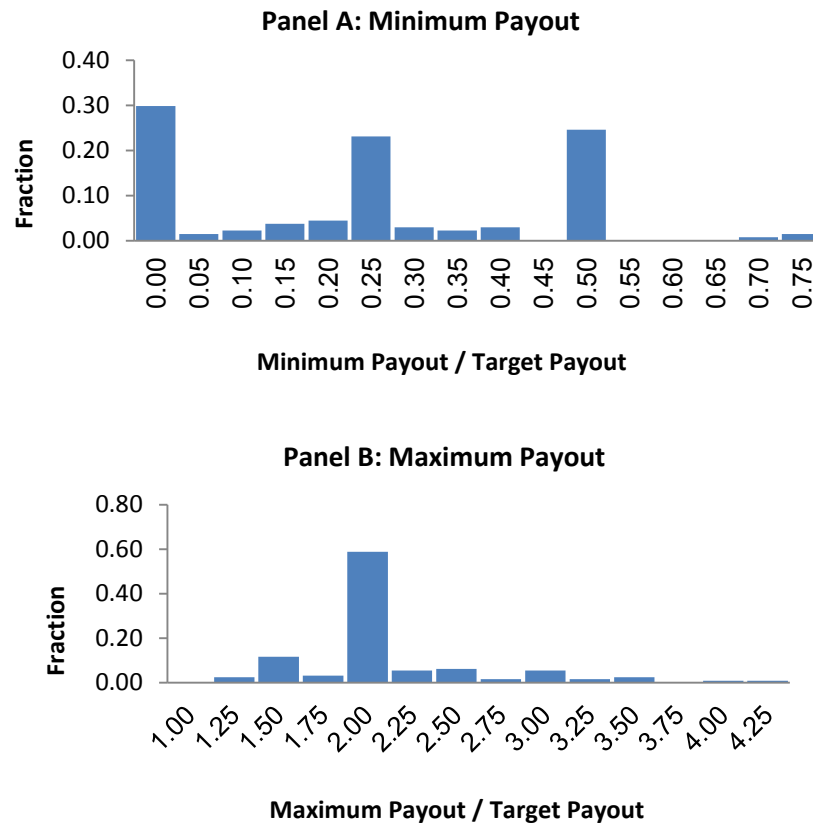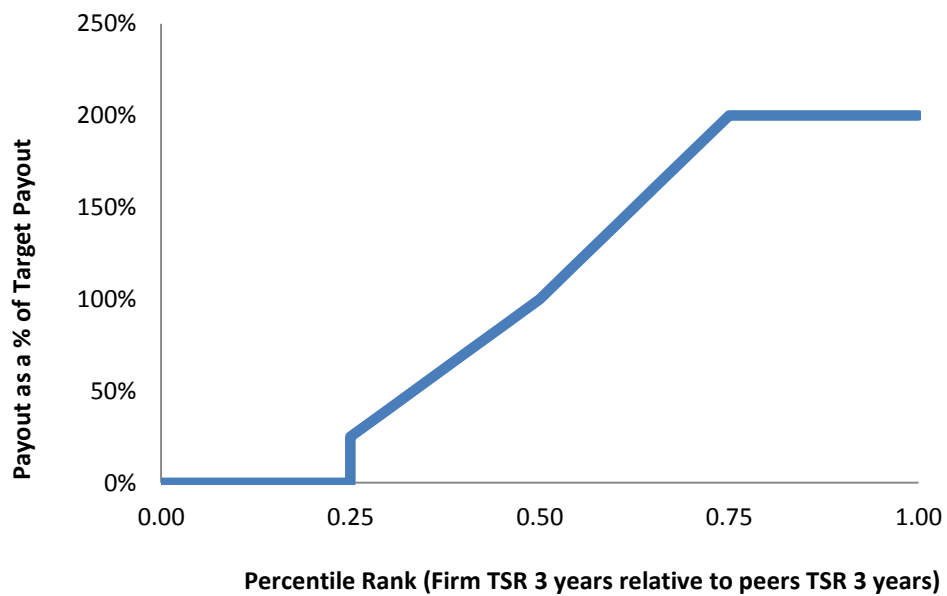umber of self-selected peers in performance peer groups and compares it to the set of peers in the compensation peer group. Panel C reports the mean statistics across years. Results in Panel B and C are based on the Incentive Lab database sample from 2006 to 2012. The sample is restricted to firms that disclose both performance and compensation peers (1251 firm-year observations).

Panel A: The Choice of Performance Benchmarks			
	Market Index	Industry Index	Performance Peer Group
Among RPE users, % of firms that benchmark performance to:	*23%*	*22%*	*64%*
Mean Weight	*19%*	*20%*	*61%*

Panel B: Performance Peer Group and Compensation Peer Group				
	Mean	p25	Median	p75
# Distinct Peers	25.85	15	20	30
# Performance Peers	16.76	10	14	20
# Compensation Peers	22.21	13	17	24
# Same Peers / # Distinct Peers	62.63%	29.41%	68.75%	100.00%
# Same Peers / # Perf. Peers	79.89%	63.64%	95.65%	100.00%
# Perf. Peers/ # Comp. Peers	90.38%	60.00%	100.00%	100.00%

| Panel C: Analysis Across Years – Mean Statistics							
	2006	2007	2008	2009	2010	2011	2012
N (# Firms)	124	157	163	170	190	211	236
# Distinct Peers	21.8	25.6	25.2	27.4	27.4	27.6	24.6
# Performance Peers	15.1	15.9	16.7	16.7	17.2	18.1	16.8
# Compensation Peers	19.0	23.0	22.3	23.8	23.2	23.1	20.6
# Same Peers / # Distinct Peers	65%	62%	66%	62%	61%	61%	64%
# Same Peers / # Perf. Peers	81%	83%	83%	80%	79%	77%	79%
# Perf. Peers/ # Comp. Peers	86%	84%	91%	88%	92%	93%	95%
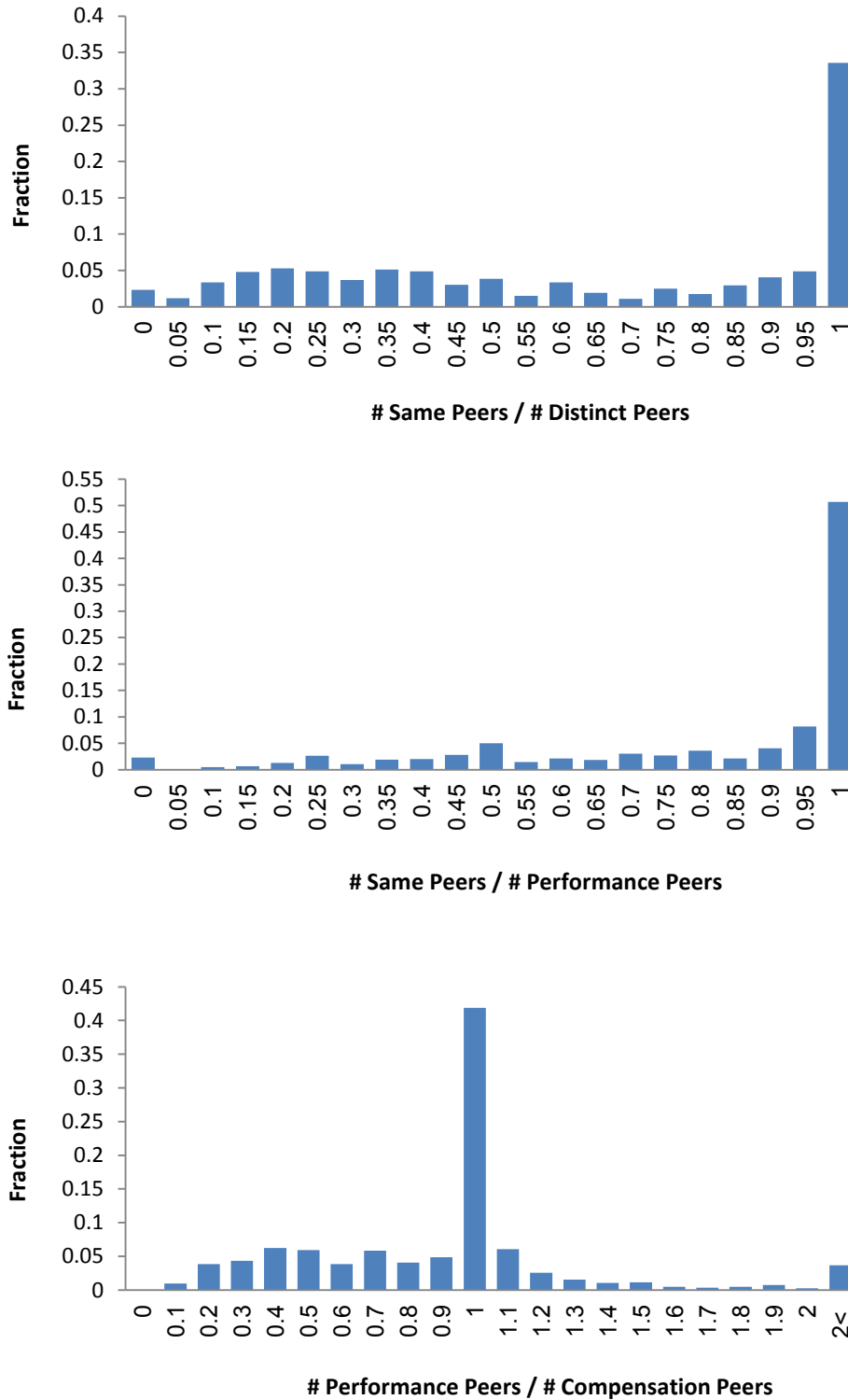
Figure 4. Histograms of the distribution of *# Same Peers / # Distinct Peers, # Same Peers / # Peers,* and *# Performance Peers / # Compensation Peers* in 2006-2012.

Table III
Comparison of Performance Peers and Compensation Peers

Panel A reports firm size characteristics across peers that are in performance peer group (column {1}), and peers that are in the compensation peer group (column {2}). Panel B reports the percentage of peers that are in the same industry as the firm disclosing them as a peer.

Panel A : Percentage of Peers with Similar Size as the Firm

	Performance Peers {1}	Compensation Peers {2}
N	20,964	27,786
N (with Compustat data matched)	15,867	21,636
% of Peers with Market Cap within 50%-200%	48.11%	48.46%
% of Peers with Assets within 50%-200%	49.66%	52.11%
% of Peers with Sales within 50%-200%	52.04%	56.99%
% of Peers with Market Cap > 200%	29.94%	30.90%
% of Peers with Assets > 200%	29.47%	28.58%
% of Peers with Sales > 200%	27.67%	25.76%
% of Peers with Market Cap < 50%	21.95%	20.63%
% of Peers with Assets < 50%	20.87%	19.31%
% of Peers with Sales < 50%	20.29%	17.25%

Panel B : Percentage of Peers in the Same Industry as the Firm

	Performance Peers {1}	Compensation Peers {2}
Industry Classification:		
SIC – 4 digit	38.46%	29.58%
SIC – 3 digit	44.48%	34.16%
SIC – 2 digit	67.59%	54.15%
FF 48	68.08%	54.58%
FF 12	77.40%	64.21%

Table IV
Reverse Matching

Table IV provides information about whether the performance peers report the firm as a performance peer. *# Perf. Peers matched in the database* represent peers that we can reverse-match in the Incentive Lab database and find their incentive contract. *# Perf. Peers that disclose Perf. Peers* represent peers that disclose at least one performance peer. The variable *Reverse Peer* equals one if the performance peer reports the firm as a peer and zero otherwise.

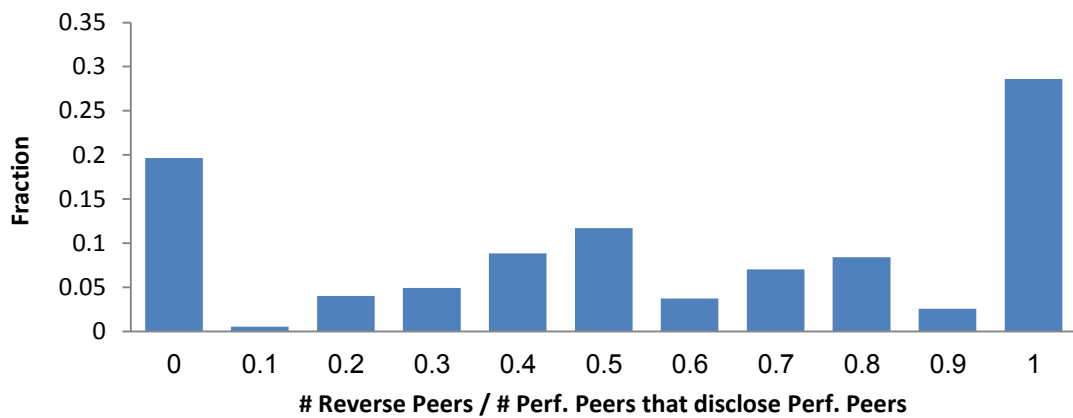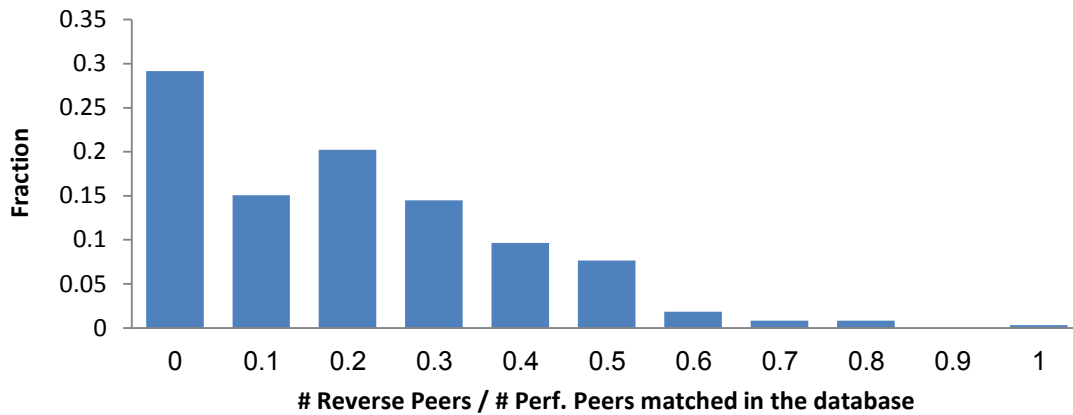|	Mean	p25	Median	p75
# Perf. Peers matched in the database	12.70	7	11	16
# Perf. Peers that disclose Perf. Peers	3.63	1	3	5
# Reverse Peers	1.88	0	1	3
# Non-Reverse Peers	1.75	0	1	2
# Reverse Peers / # Perf. Peers matched in the database	18%	0%	13%	29%
# Reverse Peers / # Perf. Peers that disclose Perf. Peers	55%	25%	55%	100%

Figure 5: **Histogram of *# Reverse Peers / # Performance Peers* in 2006-2012**

Table V

Descriptive Statistics

Table V provides basic statistics of the variables used in this study. The sample is composed of firms present in the Execucomp database. The sample period is from fiscal year 1992 to fiscal year 2005. The sample is restricted to firms where the CEO was in place for at least a full year (i.e., CEO Tenure is greater or equal to 1). *Log TDC* is the natural logarithm of one plus CEO total direct compensation. *TSR* is the stock return assuming that the dividend payments are reinvested. *ROA* is the ratio of net income to total assets. *Log AT* is the natural logarithm of one plus total assets. *Log CEO Tenure* is the natural logarithm of one plus the number of years the CEO has been in position. All variables are winsorized at 1% in both tails. Compensation and asset variables are expressed in 1992 dollars.

	Mean	SD	p25	p50	p75	N
Log TDC	7.512	1.061	6.767	7.453	8.221	18,041
TSR 1 year	0.181	0.534	-0.124	0.113	0.371	18,041
TSR 3 years	0.702	1.405	-0.056	0.375	0.988	17,256
ROA	0.033	0.108	0.012	0.041	0.080	18,041
Log AT	7.239	1.733	5.960	7.061	8.378	18,041
Log CEO Tenure	1.871	0.760	1.386	1.792	2.398	18,041

Table VI

Testing the Presence of RPE in CEO Compensation

Table VI shows results of CEO-firm fixed effect regressions. The dependent and explanatory variables are defined in Table V. Industry performance is based on 2 digit SIC classification. In the 3-year performance horizon specification (i.e., column (4), (5) and (6)) we restrict the sample to CEOs who are at least in the 3rd year of their contract (i.e., CEO Tenure is greater or equal to 2). The constant term is not reported. Robust standard errors clustered at the firm-level are reported in parentheses. The symbols ***, **, and * indicate that the p-value is less than 0.01, 0.05, and 0.10.

	Dependent Variable = Log TDC					
Performance Horizon:		1 year			3 years	
	(1)	(2)	(3)	(4)	(5)	(6)
CDF (TSR 1 year)		0.138***	0.122***			
		(0.027)	(0.032)			
TSR 1 year (ind.)	-0.097***		-0.033			
	(0.029)		(0.034)			
TSR 1 year	0.125***	0.056***	0.066***			
	(0.014)	(0.019)	(0.023)			
CDF (TSR 3 years)					0.263***	0.322***
					(0.031)	(0.034)
TSR 3 years (ind.)				0.024		0.076***
				(0.015)		(0.016)
TSR 3 years				0.085***	0.052***	0.038***
				(0.007)	(0.008)	(0.009)
ROA	0.888***	0.873***	0.876***	0.668***	0.577***	0.544***
	(0.100)	(0.100)	(0.100)	(0.110)	(0.110)	(0.109)
Log AT	0.369***	0.369***	0.369***	0.365***	0.371***	0.368***
	(0.024)	(0.024)	(0.024)	(0.025)	(0.025)	(0.025)
Log CEO Tenure	0.182***	0.183***	0.183***	0.220***	0.227***	0.228***
	(0.031)	(0.031)	(0.031)	(0.045)	(0.045)	(0.045)
CEO-Firm F.E.	Y	Y	Y	Y	Y	Y
Year F.E.	Y	Y	Y	Y	Y	Y
Observations	18,041	18,041	18,041	15,112	15,112	15,112
Within R-squared	0.156	0.157	0.157	0.172	0.178	0.180

Table VII

RPE across Sample Periods

Table VII shows results of CEO-firm fixed effect regressions. The dependent and explanatory variables are defined in Table V. Industry performance is based on 2 digit SIC classification. In the 3-year performance horizon specification (i.e., column (2), (4) and (6)) we restrict the sample to CEOs who are at least in the 3rd year of their contract (i.e., CEO Tenure is greater or equal to 2). The constant term is not reported. Robust standard errors clustered at the firm-level are reported in parentheses. The symbols ***, **, and * indicate that the p-value is less than 0.01, 0.05, and 0.10.

	Dependent Variable = Log TDC			
Period:	[1992-1998]		[1999-2005]	
	(1)	(2)	(3)	(4)
CDF (TSR 1 year)	0.146***		0.109***	
	(0.045)		(0.037)	
TSR 1 year	0.070*		0.052**	
	(0.038)		(0.023)	
CDF (TSR 3 years)		0.341***		0.232***
		(0.046)		(0.043)
TSR 3 years		0.025**		0.059***
		(0.012)		(0.011)
ROA	0.947***	0.677***	0.638***	0.313**
	(0.143)	(0.154)	(0.132)	(0.141)
Log AT	0.321***	0.311***	0.399***	0.379***
	(0.037)	(0.040)	(0.041)	(0.042)
Log CEO Tenure	0.117**	0.247***	0.151***	0.088
	(0.050)	(0.072)	(0.049)	(0.071)
CEO-Firm F.E.	Y	Y	Y	Y
Year F.E.	Y	Y	Y	Y
Observations	7,725	6,424	10,316	8,688
Within R-squared	0.147	0.166	0.061	0.086

Table VIII

RPE Inference: Simulation Analysis

Table VIII presents results from simulation analysis. We create 1,000 random samples of firm performance and compensation. Each simulated sample represents 50 industries, with 30 firms per industry over 14 years. We assume that firm performance; firm fixed effect (F_FE) and the error term (ε) follow a normal distribution. We use these variables to generate the compensation variable using three different data generating processes (DGP). The DGP and the set of statistical parameters are reported below. For each DGP, we report statistics of the RPE coefficients using three different specifications (Spe).

Assumptions:

\# Industries = 50
\# Firms per industry = 30
\# Years = 14

F_FE → N(0,1)
Firm Perf. → N(0.18,0.53)
ε → N(0,0.49)

DGP #1 (*Linear*):   Compensation = 8 - 0.10*Industry Perf. + 0.10*Firm Perf. + F_FE + ε

DGP #2 (*Contract*):   Compensation = 8 + 0.10*Truncated CDF + 0.10*Firm Perf. + F_FE + ε

  where Truncated CDF equals 0 if CDF<0.25, and equals 0.75 if CDF>0.75

DGP #3 (*Rank*):   Compensation = 8 + 0.10*CDF + 0.10*Firm Perf. + F_FE + ε

Spe #1:   Compensation = α + β*Industry Perf. + δ*Firm Perf. + Firm FE + Year FE

Spe #2:   Compensation = α+ γ*CDF + δ*Firm Perf. + Firm FE + Year FE

Spe #3:   Compensation = α+ β*Ind. Perf. + γ*CDF + δ*Firm Perf. + Firm FE + Year FE

| | | Spe #1 | Spe #2 | Spe #3 | |
		β	γ	β	γ
DGP #1	Median	-0.100	0.056	-0.100	0.002
Linear	Median T-stat	-2.784	1.533	-2.364	0.048
	Fraction β<0 or Fraction γ >0	0.995	0.917	0.990	0.513
	Fra. β<0 or γ >0 & significant at 5%	0.793	0.329	0.662	0.025
DGP #2	Median	-0.049	0.120	0.017	0.131
Contract	Median T-stat	-1.359	3.229	0.402	2.954
	Fraction β<0 or Fraction γ >0	0.909	1.000	0.346	0.998
	Fra. β<0 or γ >0 & significant at 5%	0.283	0.877	0.009	0.830
DGP #3	Median	-0.051	0.101	0.000	0.102
Rank	Median T-stat	-1.422	2.723	0.006	2.316
	Fraction β<0 or Fraction γ >0	0.919	0.998	0.496	0.984
	Fra. β<0 or γ >0 & significant at 5%	0.309	0.771	0.025	0.630

Table IX

Cross Sectional Analysis

Table IX shows results of CEO-firm fixed effect regressions. The dependent and explanatory variables are defined in Table V. Industry performance is based on 2 digit SIC classification. We restrict the sample to CEOs who are at least in the 3rd year of their contract (i.e., CEO Tenure is greater or equal to 2). We classify CEOs as Specialist if their annual generalist index (Custódio et al., 2013) is below the median (column 2) or in the first quartile (column 3). We classify the market for CEO talent as more firm-specific in industries where the proportion of insiders among all new CEOs (Cremers and Grinstein, 2014) is in the top quartile (column 4) and when firms are located in states where the noncompetition enforceability index (Garmaise, 2011) is above the median (column 5). The constant term is not reported, and in column 2, 3, 5 and 6 the coefficient for the dummy *More Firm-Specific* is not reported. Robust standard errors clustered at the firm-level are reported in parentheses. The symbols ***, **, and * indicate that the p-value is less than 0.01, 0.05, and 0.10.

	Dependent Variable = Log TDC					
Measure used for More Firm-Specific Talent:	*Firms with founder CEOs*	*Specialist CEOs (GA<Median)*	*Specialist CEOs (GA<Q1)*	*Industries with high ratio of insider CEOs*	*States with high non-compete enforce.*	*States with high non-compete enf. & Ind. with insiders CEOS*
	(1)	(2)	(3)	(4)	(5)	(6)
CDF (TSR 3 years)	0.269***	0.313***	0.306***	0.297***	0.310***	0.304***
	(0.042)	(0.049)	(0.039)	(0.038)	(0.052)	(0.035)
CDF (TSR 3 years) * More Firm-S.	-0.197**	-0.134**	-0.230***	-0.112*	-0.078	-0.205***
	(0.085)	(0.064)	(0.068)	(0.061)	(0.062)	(0.070)
TSR 3 years	0.046***	0.050***	0.050***	0.046***	0.051***	0.046***
	(0.012)	(0.014)	(0.011)	(0.009)	(0.012)	(0.009)
TSR 3 years * More Firm-Specific	0.032	0.006	0.013	0.020	-0.002	0.025
	(0.020)	(0.017)	(0.015)	(0.016)	(0.015)	(0.019)
ROA	0.837***	0.353*	0.508***	0.456***	0.269*	0.499***
	(0.186)	(0.193)	(0.141)	(0.118)	(0.146)	(0.115)
ROA * More Firm-Specific	-0.275	0.371	0.152	0.917***	0.724***	1.300***
	(0.321)	(0.234)	(0.268)	(0.310)	(0.209)	(0.370)
Log AT	0.379***	0.384***	0.379***	0.356***	0.394***	0.361***
	(0.033)	(0.028)	(0.027)	(0.030)	(0.031)	(0.027)
Log AT * More Firm-Specific	0.033	-0.027	-0.030	0.048	-0.053*	0.027
	(0.064)	(0.020)	(0.027)	(0.048)	(0.031)	(0.044)
Log CEO Tenure	0.240***	0.247***	0.224***	0.216***	0.144***	0.223***
	(0.051)	(0.053)	(0.050)	(0.047)	(0.054)	(0.046)
Log CEO Tenure * More Firm-S..	-0.006	-0.040	0.009	0.072	0.140***	0.078
	(0.086)	(0.038)	(0.042)	(0.049)	(0.042)	(0.048)
CEO-Firm F.E. and Year F.E.	Y	Y	Y	Y	Y	Y
Observations	9,829	12,993	12,993	15,072	14,817	14,777
Within R-squared	0.196	0.185	0.185	0.180	0.178	0.177