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

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Abstract

We offer a novel explanation for the use of performance-based compensation in CEO contracts: the provision of competitive compensation to retain talent. Under mild assumptions regarding distribution of talent at the tail (Gabaix and Landier, 2008), the functional form of the pay-performance relation is approximated with relative-performance evaluation (RPE) based on CEO performance rank relative to talent peers. We examine RPE terms in CEO compensation contracts and find support for these predictions: Firms converge to similar rank-based RPE contracts, RPE peers overlap with talent peers, and RPE prevails when CEO talent is transferable.

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CEO compensation contracts are in general tied to performance. A typical CEO in large US firms receives on average 75% of his pay in the form of performance-based compensation.[1] The consensus in the literature is that the high level of performance-based compensation is mainly explained by the need to align CEO incentives with those of the shareholders (Murphy, 1985, Mehran, 1995, Murphy, 1999).[2] In this study, we explore a different role of performance-based compensation. Rather than providing incentives, performance-based compensation provides competitive compensation and ensures the firm to retain talent.

We follow Gabaix and Landier (2008) intuition that compensation levels should be determined by CEO talent, and that more talented CEOs are assigned to larger firms. We add to their setting the assumption that CEO talent is not known in advance and is revealed through CEO performance. To retain the CEO and avoid costly renegotiation, firms can commit to compensating the CEO depending on talent, which in turn depends on their past performance. Within their setting, the contract can be implemented using relative performance evaluation (RPE) based on the rank of CEO talent relative to talent peers.

We test these implications in the data. First, we directly examine the terms of CEO compensation contracts and identify the functional form associated with RPE as well as the choice of performance peers. Second, we examine the overlap between RPE peers and talent peers. Third, we study the pay-for-rank-performance sensitivity across talent pools. Overall, the evidence indicates that retention objectives and the market for CEO talent are important considerations in the design of performance-based compensation contract.

Our explanation resembles that of Oyer (2004), who shows that option compensation can serve as a commitment device by management to ensure that employees do not leave the firm when

[1] The average (median) ratio of salary to total compensation for Execucomp CEOs in 2012 is 25% (18%).
[2] Within this framework, more recent studies have been studying different frictions that interfere with optimal incentives, such as lack of interest in writing optimal contracts (e.g., Bebchuk and Fried, 2004), effect of tax regulations or disclosure rules on deviations from optimal incentives (e.g., Perry and Zenner, 2001).

they face lucrative outside opportunities. However, we deviate from Oyer in two important aspects. First, unlike Oyer, we allow CEO talent to vary across firms. Since talent is a central feature in determining the level of compensation to CEOs (Gabaix and Landier, 2008, Kaplan and Rau, 2013), CEO compensation should vary not only based on general economic conditions, but on the relative performance of the firm relative to peers. Second, unlike Oyer, we do not restrict the set of possible contracts to depend only on firm performance. Instead, we allow the set of possible contracts to depend also on performance of other firms.

Our explanation provides several unique empirical predictions that contrast with ones from the standard agency literature. First, contracts will have similar functional form across different firms and industries. In our setting, the compensation contract depends on the *ranking* of CEO performance relative to other CEOs. Second, the contract should be flexible enough to allow an increase and decrease of the compensation based on common economic conditions, without affecting the ranking property of the compensation. One way to implement this contract is by giving the CEO shares in the company (rather than cash), based on the ranking of the CEO relative to peers. Since the compensation depends not only on the number of shares, but also on share price, CEO compensation will change due to both CEO performance ranking and common performance shocks. We show that the general functional form of the contract should be convex and similar across sectors even when they differ in their production functions.

We examine actual RPE terms in CEO compensation contracts. We gather data on CEO compensation contracts of US public firms and identify the functional form associated with RPE as well as the choice of performance peers. We find that, for the vast majority of the sample, RPE is based on the rank of firm performance relative to peers. In addition, RPE contracts tend to converge to similar terms across industries and firms. The functional form of the contracts is convex in general, and is similar across firms and industry sectors. In addition, RPE tends to be present in equity awards and the target payments are in shares, allowing the compensation to vary depending on stock price.

We further explore the motivation behind the use of RPE, by examining the overlap between RPE peers and CEO compensation peers. Compensation peers have been studied in the past (e.g., Bizjak, Lemmon and Naveen, 2008, Faulkender and Yang, 2010, 2013) and are considered the relevant pool against which firms compete for CEO talent (e.g., Murphy, 1999). In general, the RPE peer group might not consist of similar firms as the compensation peers. For example, if RPE is used to remove noise from performance, then the relevant RPE peers are those that are affected by the same shock as the firm. These peers should not necessarily be the talent peers.

We find a strong overlap between RPE peers and compensation peers. In general, the RPE peer pool is smaller than the compensation peer pool. The average compensation peer pool size is around 22 peers compared with about 17 peers in the RPE group. The RPE peer group tends to be a subset of the compensation peer group. On average, about 80% of the RPE peers come from the same pool as the compensation peers. The size distribution of the RPE peers is quite similar to the size distribution of the compensation peers, although there is a stronger representation of firms from the same industry across RPE peers than across compensation peers. This large overlap supports the predictions that the RPE pool is a modified talent pool, only with firms where peer performance is more comparable to the firm performance.

Next, we examine the predictions of the argument in a panel regression framework. Our data consists of a panel of the entire Execucomp database (14 years of data, around 18,000 observations). We find a strong positive relation between the ranking of CEO performance and compensation. We find it in the first half of the sample (1992-1998), and in the second half of the sample (1999-2005). We also expect rank-based RPE to be stronger in firms and industries where it is easier for the CEO to transfer her talent across firms. We measure the transferability of CEO talent in three ways. First, we identify founder CEOs. These CEOs have more firm-specific skills and are therefore less likely to transfer their talent. Second, we use a recent measure proposed by Custodio, Ferreira and Matos (2013) that identify CEOs that tend to be generalist. These CEOs are likely to have more transferable

skills. Third, we identify industries in which new CEOs tend to be outsiders rather than insiders (Cremers and Grinstein, 2013) and thus are more likely to have transferable talents. We find that, in general, firms whose CEO talent is more transferable are more likely to rely on rank-based RPE. Consistent with these results, firms also tend to assign larger weight to RPE in the contract in industries where CEO talent is less firm specific (De Angelis and Grinstein, 2011).

We also explore alternative explanations of our results. It is possible that firms use RPE as a form of incentive compensation where, instead of providing more efficient measurement of CEO effort, they form a tournament between the CEO and her peers to elicit effort (e.g., Lazear and Rosen, 1981, Green and Stokey, 1983). While we cannot completely rule out this possibility, we note that the peers in our sample do not overlap in general: if firm A has firm B as its peer, it does not necessarily mean that firm B has firm A as its peer as well. In fact, only about 18% of the selected peers report the original company as its competitor. Therefore, we believe that the conditions needed for a tournament are not met in the sample.

This paper contributes to the literature in several ways. First, it provides new perspectives on the effects of CEO's outside opportunities on the use and incorporation of performance-based compensation and particularly RPE.[3] Previous studies show that CEO's outside opportunities can explain why firms compensate their CEO for their absolute rather than their relative performance (Himmelberg and Hubbard, 2000, Oyer, 2004). These models were motivated by the lack of evidence supporting the presence of RPE in compensation contracts even though standard agency models predict that RPE leads to more efficient contractual terms (Holmstrom, 1979, 1982). One feature of these models is that they do not incorporate talent into the reservation utility of the CEO. We argue that once talent is included and inferred from CEO past performance relative to peers, rank-based RPE arises naturally in the compensation contract.[4]

[3] See also Murphy (1986) for evidence consistent with a talent-based argument.
[4] Talent can also explain decisions to replace CEOs in addition to compensating them. See for example Eisfeldt and Kuhnen (2013).

Second, the evidence in this paper sheds light on the relevance of RPE in the last two decades and on the importance of empirically modeling the correct functional form of the pay-performance relation in testing the presence of RPE.[5] 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 measures. Such specification differs 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 illustrate the importance of distinguishing rank-based RPE from distance-based RPE by running a simulation. We generate a random sample of firm and peer performance; and then specify CEO compensation based on ranking of CEO performance relative to peers. We then run a regression over these generated data but with a misspecified relation between compensation and performance. That is, we assume that CEO compensation is based on the difference between CEO performance and industry performance. We find that this misspecification has a substantial effect on the results. The misspecified regression fails to detect RPE in the data even though RPE exists under the data-generating process.[6]

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

[5] 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 CEO compensation in a sample of large US firms in the 1990s.

[6] 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. Our results are robust to including more refined industry-size peer group classifications.

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 and show its implications on inferring the presence of RPE in compensation data.

Our study continues as follows. Section I presents the retention argument and its implications on the design of CEO compensation contract. In Section II, we discuss the contractual terms governing RPE. Section III contains the panel regression analysis. Section IV provides the simulation analysis and additional tests. Section V concludes. In the Appendix, we illustrate through real-life examples how RPE is incorporated into CEO compensation contracts.

I. RPE for Retention

We build on the intuition of Oyer (2004) that managerial reservation wage changes over time and that firms incur costs if they need to renegotiate contracts in order to keep the manager in the firm. In this framework, Oyer shows that there is a benefit to writing a long-term contract that embeds the effect of changing market conditions on CEO reservation wage.

In Oyer's model, reservation wages depend on industry conditions. Since Oyer does not allow firms to contract over industry conditions, the second best outcome is to condition the contract on firm performance. To the extent that reservation wages move with industry performance and that firm performance moves with industry performance, firms could be better-off providing long-term equity-based compensation in order to commit to paying the future reservation wages and avoid renegotiation.

We depart from Oyer's framework in two ways. First, we assume that reservation wages are not only affected by industry conditions but also by the talent of the CEO relative to the industry. We base this assumption on the realization that CEOs are not similar across firms and that more talented CEOs will have higher reservation wages than less talented CEOs (e.g., Rosen, 1981, Gabaix and

Landier, 2008). Second, we assume that firms can contract compensation on industry conditions.[7] We argue that once these two assumptions are put in place, long-term RPE will arise naturally.

Consider the following thought exercise. Consider a two-period economy (dates 0, 1, 2) with a continuum of firms and managers. As in Gabaix and Landier (2008), we assume that the factors affecting profits are managerial talent and firm size and that the marginal impact of talent is increasing with firm size. At date 0, each manager is randomly assigned to one firm. At date 0, all firms have the same size and thus profit is a direct function of managerial talent. Firms can therefore determine CEO talent relative to other firms in the economy based on CEO performance in the first period and the performance of its peers.

Once firms observe CEO performance and infer CEO talent they decide on their size for the second period. We consider an equilibrium where CEOs stay in their own firm after firms decide on their size.[8] Since it is efficient to allocate more capital to firms with more talented CEOs (see e.g., Rosen, 1982), firms whose CEO performs better in period 1 will become larger at date 1. Thus, talent rank will perfectly determine size rank at date 1. As a consequence the setting in the second period is similar to the equilibrium in Gabaix and Landier (2008), where more talented CEOs are matched to larger firms. We assume that the resulting size distribution follows a pareto distribution, in the same spirit of Gabaix and Landier (2008).

The competitive compensation in the second period will follow Gabaix and Landier (2008). Given their parametrization of the distribution of talent and relation between talent, size and performance, the compensation of the CEO in the second period will be given by the following formula:

[7] We base this assumption on several CEO compensation regularities. First, CEO compensation is benchmarked against compensation of other firms in the industry (e.g., Bizjak, Lemmon, and Naveen, 2008, Faulkender and Yang, 2010). Second, CEO performance compensation is benchmarked against industry performance (e.g., De Angelis and Grinstein, 2011).

[8] We focus on this equilibrium because empirically CEOs tend to remain in one firm for several years (see e.g., Murphy, 1986).

$$w(n) = \frac{A^{\gamma} BC}{\alpha\gamma - \beta} n^{-(\alpha\gamma - \beta)} \quad (1)$$

Where n is the rank of managerial talent relative to peers and the rest of the variables are parameters which describe the distribution of talent and the relation between talent, firm size, and performance.[9]

Suppose that due to costly renegotiation, at date 0 managers write a long-term contract with the firm regarding their compensation in period 2. The contract will map the observed performance in period 1 to CEO compensation in period 2. Since performance rank maps into talent rank, we can substitute talent rank with CEO performance rank and write the contract based on the performance rank of the CEO in period 1.

$$w(Perf.Rank) = \frac{A^{\gamma} BC}{\alpha\gamma - \beta} (Perf.Rank)^{-(\alpha\gamma - \beta)} \quad (2)$$

Gabaix and Landier estimate that $\alpha \simeq 1, \gamma \simeq 1,$ and $\beta \simeq 2/3$. Under these assumptions equation (2) becomes:

$$w(Perf.Rank) = 3ABC(Perf.Rank)^{-1/3} \quad (3)$$

A. Contract Implementation

The above compensation contract can be implemented in many different ways. Since there is a one-to-one mapping among talent, performance, and firm size, one can implement the contract using any of those parameters. Note, however, that contracts will differ substantially across firms and industries because of the unique parameters *A, B, C* associated with each industry. To the extent that writing contracts is costly, contracting directly based on firm size or performance will be costly.

[9] Note that firm' size rank at date 1 is a direct outcome of talent rank and thus *n* corresponds also to the rank of firm size relative to peers.

However, if managers and firms contract on ranked-based performance evaluation as in equation 3, then the contract can be standardized across different industries.

We illustrate the implementation using the following example. A CEO at the top 1% of the distribution should receive $3ABC(0.01)^{-1/3}$ and a CEO at the top 5% of the distribution should receive $3ABC(0.05)^{-1/3}$. Therefore, a CEO at the 1% of the distribution should receive $(0.01/0.05)^{-1/3}$ times the CEO at the 5% of the distribution. This means that regardless of the parameters A, B, and C we can implement the contract using the same scheme – giving the CEO who is ranked higher a multiple of the variable compensation to the CEO who is ranked lower. This implies a simple implementation of the contract: CEOs at the x% of the distribution should receive a certain amount which differs across sectors and industries (basically different *B*'s and *C*'s), but then they should receive the same multiple of this amount when they move from the x% of the distribution to the y% of the distribution. This will be a version of RPE where CEO compensation will be based on the rank of CEO performance relative to peer performance.

We note also that the relation between compensation and ranking should be convex and the convexity of the relation should depend on β. Put differently, an increase in talent from 5% to 1% of the distribution should involve a larger multiple (compensation increase) than an increase from the 9% to the 5% of the distribution. Using our previous example, this translates numerically into an increase of about 71% in performance-based compensation when talent increases from 5% to 1%, and an increase of about 22% in performance-based compensation when talent increases from 9% to 5%.

As in Oyer (2004), we can extend our intuition to the case of changing industry conditions. We illustrate industry shocks in the following way. Assume that an industry shock is a random variable G>0 with a finite support, that is realized at date 1 and affects the relation between talent and performance (the parameter C) such that the new C is G*C. Note that equation (3) will still preserve its functional form, except that the CEO will need to receive a multiple G of his compensation

for any given performance rank. One way to implement the contract is by giving the CEO shares instead of cash for any given ranked performance realization of performance.

II. Presence of RPE in CEO Compensation Contracts

The above illustration implies several empirical predictions on how relative performance evaluation can be implemented in practice. In this section, we examine the contractual terms of RPE of CEOs in public U.S. firms and compare them to the empirical predictions.

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. Thanks to 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.[10] We provide extensive information such as the form of the contract, how relative performance evaluation is measured, the length of time in which the performance is evaluated, the form of compensation for the contract 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 represents the top 750 firms in terms of market capitalization in each year.

A. RPE Contractual Terms

Our sample consists of 494 firms that belonged to the Standard and Poor's (S&P) 500 index as of December 2007.[11] We collect information about the RPE terms in CEO compensation from firms'

[10] In the appendix, we provide examples of how firms incorporate RPE in the CEO compensation contract. More detailed explanations about the 2006 disclosure rules and the data collection methodology can be found in De Angelis and Grinstein (2011, 2014).
[11] There are six firms that belonged to the S&P500 for which we are not able to retrieve proxy statements.

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 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 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 (i.e. the target value for non-equity awards and 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 awards 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).[12] On average, RPE users tie 49% of the value of performance-based award to RPE. Among RPE users, there are large variations 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). This result is consistent with our prediction that when there is uncertainty regarding talent and changing industry conditions: RPE payoff is in shares of the firm rather than cash.

[12] As a comparison, in the UK, Carter et al. (2009) find in their sample that 51% of the firms are RPE users. On the other hand, in the US, Gong et al. (2011) find that 25% of their sample firms are RPE users.

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 give RPE but do not disclose it in the contract because they tie the RPE to a discretionary part of the compensation to RPE.[13] We do not capture these firms in our current analysis 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 the 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 compared 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 closer the CEO to the top of the performance distribution among its peers the higher the compensation. Consistent with the prediction, panel B shows that the vast majority of the RPE (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).

[13] The board of directors could also consider peer performance in the CEO replacement decision. Jenter and Kanaan (2010) show that CEOs are fired after bad firm performance related to factors beyond their control. In other words, their findings suggest that, on average, firms do not filter out peer performance when considering CEO retention decisions.

A.2. Performance measure

In general, firms choose to tie different measures of firm performance to that of peers.[14] Panel C shows that the most common performance measure used in RPE is market-based (e.g. 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. (These numbers do not add up to one because some firms employ both market-based and accounting-based performance measures.) On average 70% of the value of the award tied to RPE is associated to stock price performance. 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). They 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 that measure. Sales growth measures compared to peers is the third most popular among accounting measures. A total of 9% of RPE users employ this measure and they tie about 5% of the value of the award to that measure.

A.3. Performance horizon

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

[14] Most firms disclose the weights assigned to each performance measure. When these weights are not disclosed, we assume that the payoff is divided equally among each performance measure. We use this assumption since most firms that disclose their weights use equal weights. Of the firms in our sample, 106 do not disclose their weights for performance-based cash compensation, and 30 do not disclose their weights for performance-based stock compensation (see De Angelis and Grinstein, 2011, for more details).

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).

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 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.[15] 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

[15] 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).

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%.

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 tend to represent 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. The convexity of the payoff between the performance thresholds is consistent with our argument.

[Insert Figure 2 here]

B. RPE Peer Group Analysis

Firms that use relative performance evaluation define a peer group to benchmark performance against. The peer group might have different roles depending on the driver behind the use of RPE. Holmstrom (1979, 1982) argues that the choice of peer group should be such that it provides sufficient statistic for the factors outside CEO control that also affect CEO performance. Green and Stokey (1983) show that tournaments would be better than simple contracts when common shocks affect all those who compete. Similar to Holmstrom, Green and Stokey (1983) show that peers should share common shocks to performance that are also shared by the CEO. Under the talent explanation for RPE, the group to benchmark against should be the relevant peers that the firm

competes against for CEO talent. At the same time the performance of the relevant peers should be comparable enough to that of the CEO.

B.1. RPE Peers vs. Compensation Peers

We investigate the identities of the peers used in RPE. We analyze the peers on several dimensions. First, we examine the overlap between RPE peers and compensation peers. Firms use compensation peers to benchmark salary and total compensation against that of peers, (e.g., Murphy 1999). These peers are the relevant talent pool for which CEO compensation should be benchmarked against (e.g., Bizjak, Lemmon and Naveen, 2008, Faulkender and Yang, 2010, 2013). To the extent that RPE peers are also chosen to ensure a relevant talent group, we should observe a strong overlap between the compensation peers and the RPE peers.

Table II panel A first shows the comparison. First, 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 stands in contrast to the findings in Gibbons and Murphy (1990), that CEO compensation is benchmarked against large industry-based or market-based indexes. It suggests that firms are consciously choosing RPE peer firms.

Panel B shows the overlap between compensation peers and RPE peers in our sample. 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 overlap in peers is about 63% on average, with more than 25% of the sample having full overlap between compensation peers and performance peers. Panel C shows that these statistics are relatively stable across the years.

Figure 4 shows the distribution of overlap between compensation peers and RPE peers. The figure shows that 34% of the firm 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 peers are very similar in size distribution. 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.

C. Discussion

There are several features of the RPE contract that are common across firms. First, consistent with the talent argument, 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 threshold performance and the maximum performance, and the payoff function tends to be 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. 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]

These contractual terms are interesting because they differ quite substantially from the specification used in past empirical studies for RPE. Over the years, studies that examined whether CEO compensation is based on RPE have assumed across the board a linear (or log-linear) relation between relative CEO performance and CEO compensation. Moreover, these studies often assumed one-year performance horizon as the explanatory variable, and they implicitly assumed that the compensation is based on the distance between CEO performance and industry performance rather than on the ranking of CEO performance.

We also find a strong overlap between compensation peers and RPE peers. About a third of the firms that provide relative performance evaluation 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.

Some of our findings regarding RPE are hard to reconcile using traditional arguments of RPE but are easier to reconcile with the talent arguments. First, firms use ranked-based performance evaluation rather than distance-based performance evaluation, as suggested by traditional agency models. Firms also tend to use RPE peers that overlap with compensation peers, a result which is consistent with the talent argument. The fact that RPE peers tend to be larger or similar in size to the firm is also hard to reconcile with agency theories. Agency argument for RPE implies that firms subject to a common shock should be included in the peer group, regardless if they are smaller or larger than the firm. In contrast, the talent argument implies that benchmarking should be done

relative to peers of similar managerial talent. Firm size is considered an important indicator of CEO talent (e.g., Rosen, 1981, Gabaix and Landier, 2008) and therefore confining the peers to firms with similar size is expected within the talent framework.

Lastly, the fact that the compensation is given in the form of stock is also hard to reconcile within the agency framework. Since the goal of RPE within the agency framework is to reduce noise associated with common shocks, it is not clear why the compensation itself should be subject to common shocks (firm shares). The talent argument provides a rationale for the use of firm shares – a way to benchmark the compensation to common shocks that affect productivity across all firms.

One of the drawbacks of examining the contractual terms in CEO compensation contracts, is that these terms apply only to part of the compensation. In fact, there is a significant part of the compensation that is not explicitly contracted upon (De Angelis and Grinstein, 2014). Many firms allow themselves the discretion to compensate the CEO beyond the amounts in the contract if they see fit. These discretionary parts can amount on average to around 50% of total compensation. One way to overcome this problem is to examine, within a panel regression framework, the realized CEO compensation, which includes both discretionary and non-discretionary compensation. This methodology assumes that the contractual terms are unobservable. Instead, inferences are based on the relation between firm-level attributes and variations in the compensation.

III. Panel Regression Analysis

A. Database Construction

We retrieve the entire Execucomp database between 1992-2005.[16] The Execucomp database contains compensation information for top executives in firms that belong to S&P 500, MidCap 400, and SmallCap 600 indexes. The database includes also firms that used to belong to these indexes but

[16] 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.

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.[17] 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 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 IV here]

Table IV 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

The purpose of our empirical analysis is two-fold. First, we wish to examine whether the specification coming out of our argument is supported by the data. Second, we wish to contrast the results to the results from traditional specifications that were used in the literature to detect RPE.

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

We therefore employ these main specifications in our analysis. The first specification follows the traditional specification to detect RPE, found in the literature (e.g., Gibbons and Murphy, 1990):

$$Log(TDC_{ijkt}) = a_0 + a_1\, TSR(ind.)_{jt} + a_2\, TSR_{it} + a_3\, ROA_{it} + a_4\, Log(AT_{it}) + a_5\, Log(CEO\ tenure_{it}) + \eta_{ik} + \vartheta_t + \varepsilon_{it} \quad (4)$$

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. $TSR(ind.)_{jt}$ is the equal-weighted average TSR of Execucomp firms that belong to the same industry, excluding the firm *i*.[18] 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 relative performance evaluation. 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.

The second specification follows the predictions from our argument:

$$Log(TDC_{ijkt}) = b_0 + b_1\, CDF(TSR_{ijt}) + b_2\, TSR_{it} + b_3\, ROA_{it} + b_4\, Log(AT_{it}) + b_5\, Log(CEO\ tenure_{it}) + \eta_{ik} + \vartheta_t + \varepsilon_{it} \quad (5)$$

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 argument predicts that firms will 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 our argument also predicts that an industry shock to all firms should also have an aggregate effect on CEO compensation. Firm TSR is used in this context as a proxy for the industry shock (similar to Oyer, 2004). We note that an alternative way to

[18] 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 the CDF. In addition, our main results are also similar if we use the peer-group measure proposed by Albuquerque (2009).

measure industry shocks is by including *TSR(ind.)* directly. We do so as part of a more comprehensive modeling in the third specification.

The third specification allows for both types of RPE, rank-based and distance-based:

$$Log(TDC_{ijkt}) = c_0 + c_1\, CDF(TSR_{ijt}) + c_2\, TSR(ind.)_{jt} + c_3\, TSR_{it} + c_4\, ROA_{it} + c_5\, Log(AT_{it}) + c_6\, Log(CEO\ tenure_{it}) + \eta_{ik} + \vartheta_t + \varepsilon_{it} \quad (6)$$

We also examine several variants of this specification. First, we use three year TSR performance instead of one year TSR performance horizon. Our argument does not speak directly to the choice of performance horizon; however, to the extent that long-term performance is a better indicator of CEO talent, one could expect the prediction from our argument to be stronger with a longer performance horizon. In addition, the three year performance horizon is more in line with what is observed in the contractual terms. 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.[19]

C. Main Results

Table V column 1 shows the results using the first specification, the basic regression analysis as being used in the prior literature. The results are consistent with the findings in the literature.

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

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 V here]

When we run specification 1 using three-year return instead of one-year return as the explanatory variable, the coefficients of the three-year stock return is both positive and significant, but the coefficient of the three-year industry return is not negative significant (see column 4). In fact, the coefficient is positive and significant, in contrast to the RPE hypothesis.

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.

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 IV) 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 as firm performance in the determination of the awards and the bonuses.

Column 3 in Table V 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.

In Columns 4 to 6 in Table V, we show the results of the three specifications but over a three-year horizon. 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 IV) 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.

Overall, the evidence on rank-based RPE is more pronounced when using three year performance. As mentioned earlier, even though our argument does not speak directly to the choice of performance horizon, we expect the prediction from our argument to be stronger with a longer performance horizon. In addition, given what we observed in the contractual terms, we also expect that the fit of our regressions should improve when using the three year performance horizon.

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 VI.

[Insert Table VI 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. Cross-Sectional Analysis

In this subsection, we test the cross-sectional implications of the talent argument. Our 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.[20] In addition to capture firm-specific skills, this measure also captures agent-

[20] 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

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 Custodio et al. (2013) and aims to identify whether the CEO tends to be a specialist or a generalist. Custodio 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 last cross-sectional test relies on industry-level measure of firm-specific talent based on the measure proposed by Cremers and Grinstein (2013). This measure captures the percentage of new CEOs in a given industry who have been replaced by insider CEOs (rather than by outsider CEOs). It is obtained from Cremers and Grinstein (2013) 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. 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 V). Three-year horizon for RPE is also observed in our analysis of compensation contracts.

Table VII shows the results. Columns 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

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.

talent is captured by whether the CEO is classified as a specialist. Columns 4 shows the results where the measure of more firm-specific skills is industries with low ratio of insider CEOs.

[Insert Table VII here]

Column 1 shows that the sensitivity of CEO compensation to RPE is 73% smaller among founder CEOs. Column 2 shows that CEOs who are specialist tend to have about 42% less sensitivity of compensation to rank-based RPE than CEOs who are generalist. When classifying the specialist using the first quartile, this difference increases: the sensitivity of CEO compensation to RPE 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 RPE that is about 45% weaker than the sensitivity of compensation to RPE in industries with less firm-specific skills.

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 our argument and indicate that the market for CEO talent is an important driver in the decision to use RPE.

IV. Additional Analysis

A. Simulation Analysis

It can be argued that the rank-based RPE specification is, in general, not that different from a distance-based specification and so the choice of empirical specification is not that important for inferences. We show in our analysis thus far that differences in the empirical specification could lead to differences in inferences. In this section we illustrate the importance of having the right functional form of RPE using 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.

B. Reverse matching

One possible explanation for ranked-based relative performance evaluation is that firms are doing it as part of a tournament across different CEOs. The tournament literature has identified tournaments across CEOs as a driver of performance, and it is possible that the rank-based performance evaluation is driven by tournament considerations.

One necessary requirement for tournament to be effective is that parties to the tournaments are all part of the tournament. If some parties do not participate in the tournament, then the

tournament itself does not hold. Table IX 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 relative performance evaluation. In fact, as the figure in Table IX shows, about 30% of the firms in our sample do not have any reverse peers. This finding does not support the tournament argument.

V. Conclusion

In this paper, we offer a novel explanation for the use of RPE. Our explanation is based on the fact that CEO participation constraint depends on both industry conditions and on CEO perceived talent relative to the industry. In order to avoid costly renegotiation, firms commit to compensation based on measures of industry conditions and perceived talent relative to industry. Our argument builds on the one proposed by Oyer (2004) and incorporate insights from competitive assignment models such as Sattinger (1979), Gabaix and Landier (2008), and Tervio (2008). We show that under mild assumptions regarding distribution of talent at the tail and the relation between talent and productivity, a common contract, invariant across industries, can be implemented. The contract is approximated with rank-based CEO performance. We also predict that RPE should have the flexibility to allow a change in the compensation if the firm was hit by a large common shock.

We investigate the empirical implications of this argument in two ways: first by directly examining the newly disclosed contractual terms that govern RPE in compensation contracts, and second, by incorporating predicted features of RPE in a panel regression framework. The results support our argument. Firms use RPE, and RPE is based on the ranking of the firm performance compared to the peer group. The functional form of the relation is quite similar across different industries and sectors. Our evidence also indicates that firms tend to rely more on rank-based RPE in firms and industries where CEO talent is more easily transferable. Finally, our analysis also shows why, in contrast to the prevailing practice, prior studies found weak evidence with respect to RPE.

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) Threshold (f) (#)	Target (g) (#)	Maximum (h) (#)	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) ($/Sh)	Grant Date Fair Value of Stock and Option Awards (l) ($)
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]	Grant Date Fair Value of Stock and Option Awards
				Threshold ($)	Target ($)	Maximum ($)	Threshold (#)	Target (#)	Maximum (#)	(#)	(#)	($ / Sh)	($)
(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.

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 Note (3)	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 Note (4)
		Threshold	Target	Maximum	Threshold	Target	Maximum				
[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.

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.

WEYERHAEUSER (WY) Proxy statement, March 12, 2008

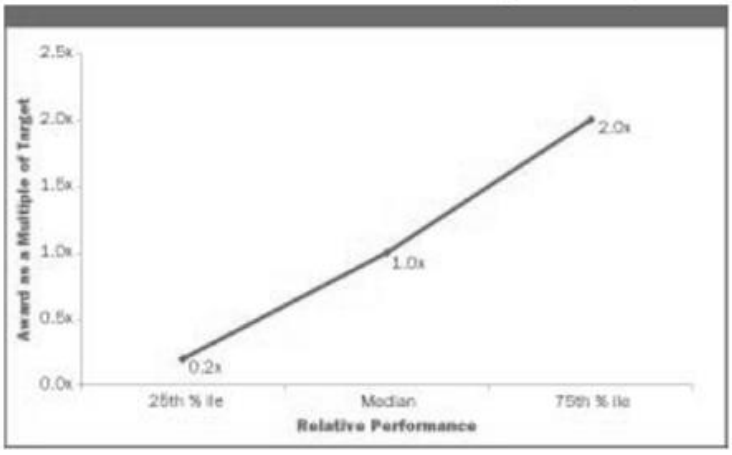
GRANTS OF PLAN-BASED AWARD

Name	Grant Date (1)	Estimated Future Payouts Under Equity Incentive Plan Awards (2) Threshold (#)	Target (#)	Max. (#)	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)
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*

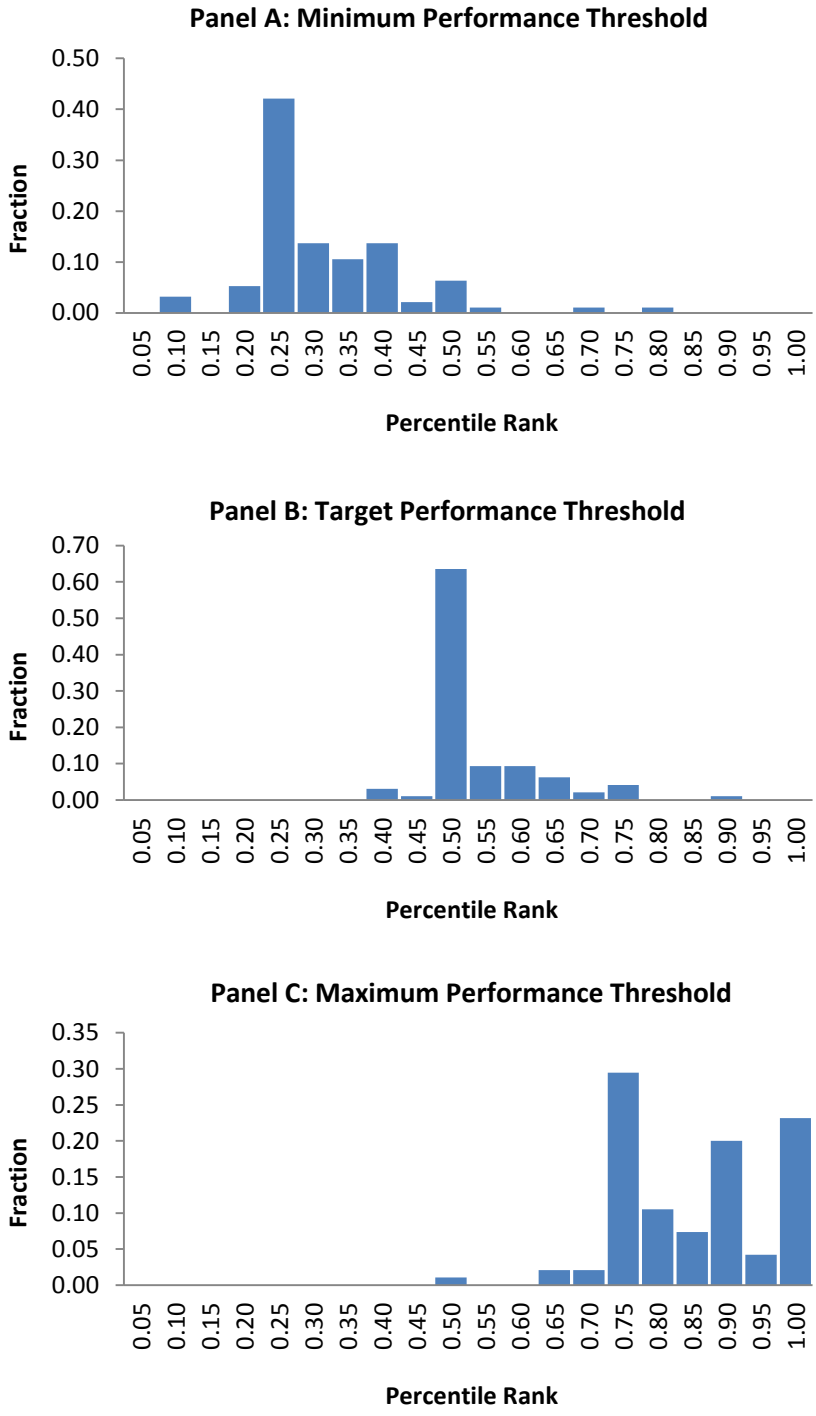


Figure 1. Histograms of the distribution of the performance thresholds when firms use rank-based RPE.

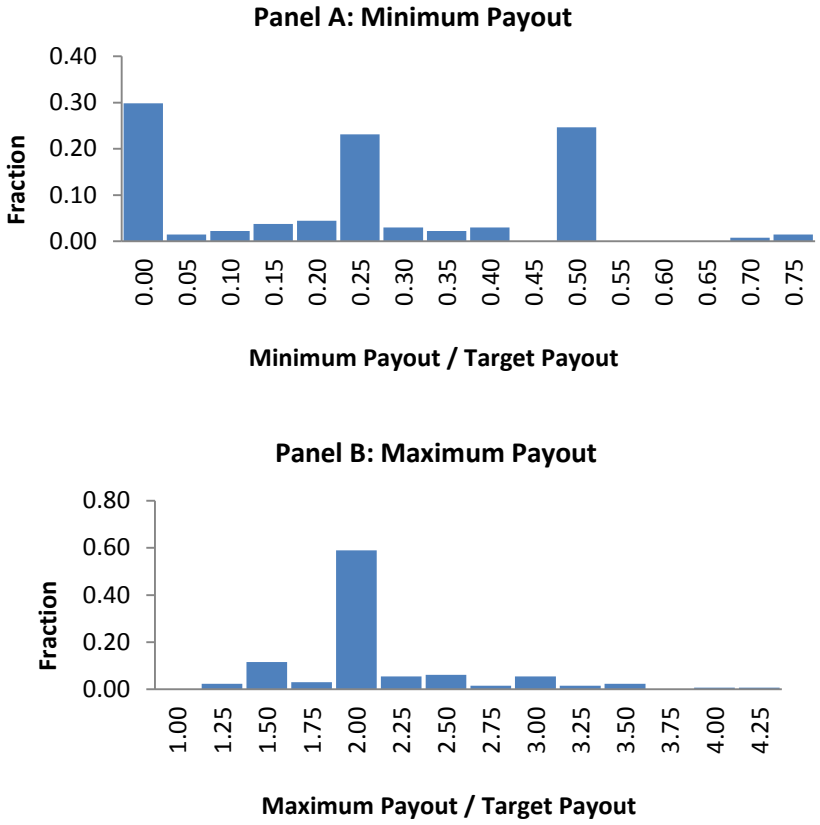


Figure 2. Histograms of the distribution of the minimum and maximum payouts relative to the target payouts for RPE users.

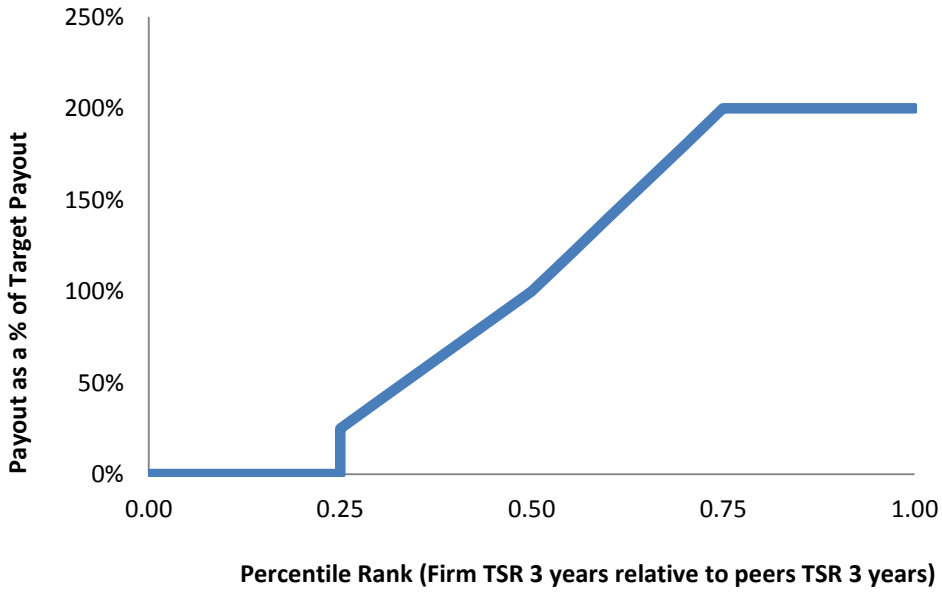


Figure 3. Illustration of the compensation payoff under common RPE terms.

Table II
Examination of the Choice of Performance Benchmarks and A 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 number 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

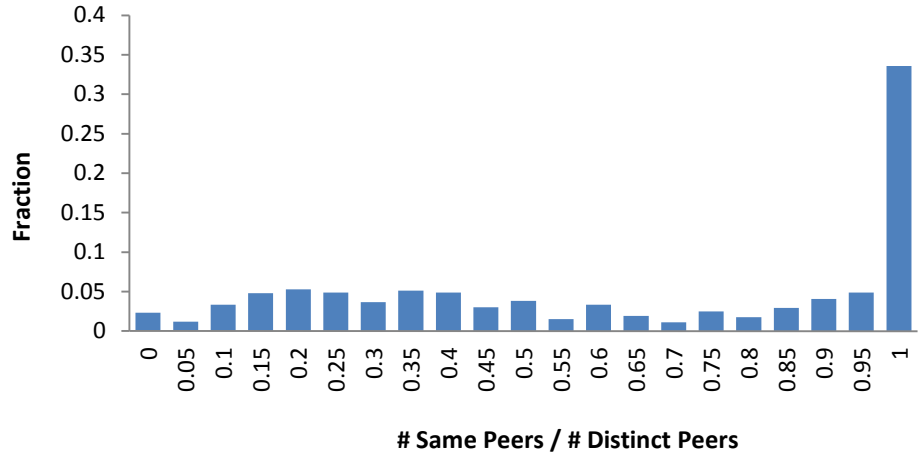
	Market Index	Industry Index	Performance Peer Group
Among RPE users, % of firms that benchmark performance to:	*23%*	*22%*	*64%*
Mean Weight	*19%*	*20%*	*61%*

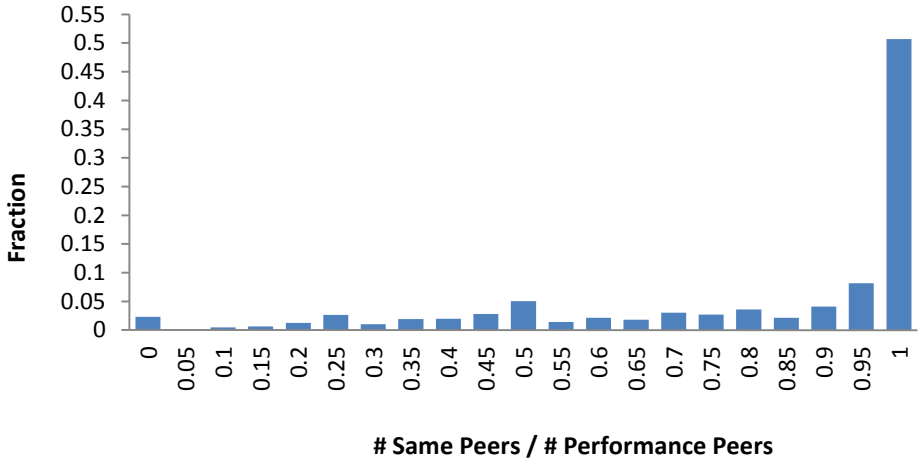
Panel B: Performance Peer Group and Compensation Peer Group

	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%





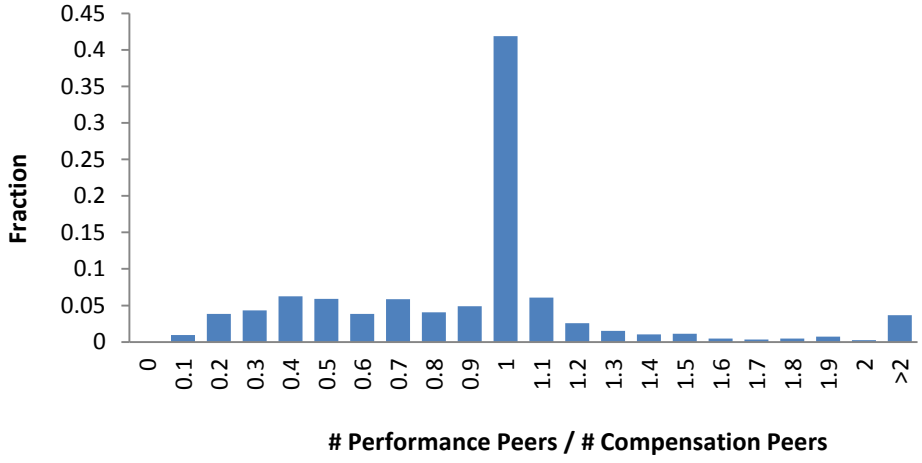


Figure 4. Histograms of the distribution of *# Same Peers / # Distinct Peers, # Same Peers / # Peers,* and *# Performance Peers / # Compensation Peers* in 2006-2012.

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
Descriptive Statistics

Table IV 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 V
Testing the Presence of RPE in CEO Compensation

Table V shows results of CEO-firm fixed effect regressions. The dependent and explanatory variables are defined in Table IV. 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 VI
RPE across Sample Periods

Table VI shows results of CEO-firm fixed effect regressions. The dependent and explanatory variables are defined in Table IV. 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 VII
Cross Sectional Analysis

Table VII shows results of CEO-firm fixed effect regressions. The dependent and explanatory variables are defined in Table IV. 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 (Custodio 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 is in the top quartile (Cremers and Grinstein, 2013). The constant term is not reported, and in column 2 and 3 the dummy for *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*
	(1)	(2)	(3)	(4)
CDF (TSR 3 years)	0.269***	0.313***	0.306***	0.297***
	(0.042)	(0.049)	(0.039)	(0.038)
CDF (TSR 3 years) * More Firm-Specific	-0.197**	-0.134**	-0.230***	-0.112*
	(0.085)	(0.064)	(0.068)	(0.061)
TSR 3 years	0.046***	0.050***	0.050***	0.046***
	(0.012)	(0.014)	(0.011)	(0.009)
TSR 3 years * More Firm-Specific	0.032	0.006	0.013	0.020
	(0.020)	(0.017)	(0.015)	(0.016)
ROA	0.837***	0.353*	0.508***	0.456***
	(0.186)	(0.193)	(0.141)	(0.118)
ROA * More Firm-Specific	-0.275	0.371	0.152	0.917***
	(0.321)	(0.234)	(0.268)	(0.310)
Log AT	0.379***	0.384***	0.379***	0.356***
	(0.033)	(0.028)	(0.027)	(0.030)
Log AT * More Firm-Specific	0.033	-0.027	-0.030	0.048
	(0.064)	(0.020)	(0.027)	(0.048)
Log CEO Tenure	0.240***	0.247***	0.224***	0.216***
	(0.051)	(0.053)	(0.050)	(0.047)
Log CEO Tenure * More Firm-Specific	-0.006	-0.040	0.009	0.072
	(0.086)	(0.038)	(0.042)	(0.049)
CEO-Firm F.E.	Y	Y	Y	Y
Year F.E.	Y	Y	Y	Y
Observations	9,829	12,993	12,993	15,072
Within R-squared	0.196	0.185	0.185	0.180

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	# Years = 14	Firm Perf. → N(0.18,0.53)
# Firms per industry = 30	F_FE → N(0,1)	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
Reverse Matching

Table IX 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%

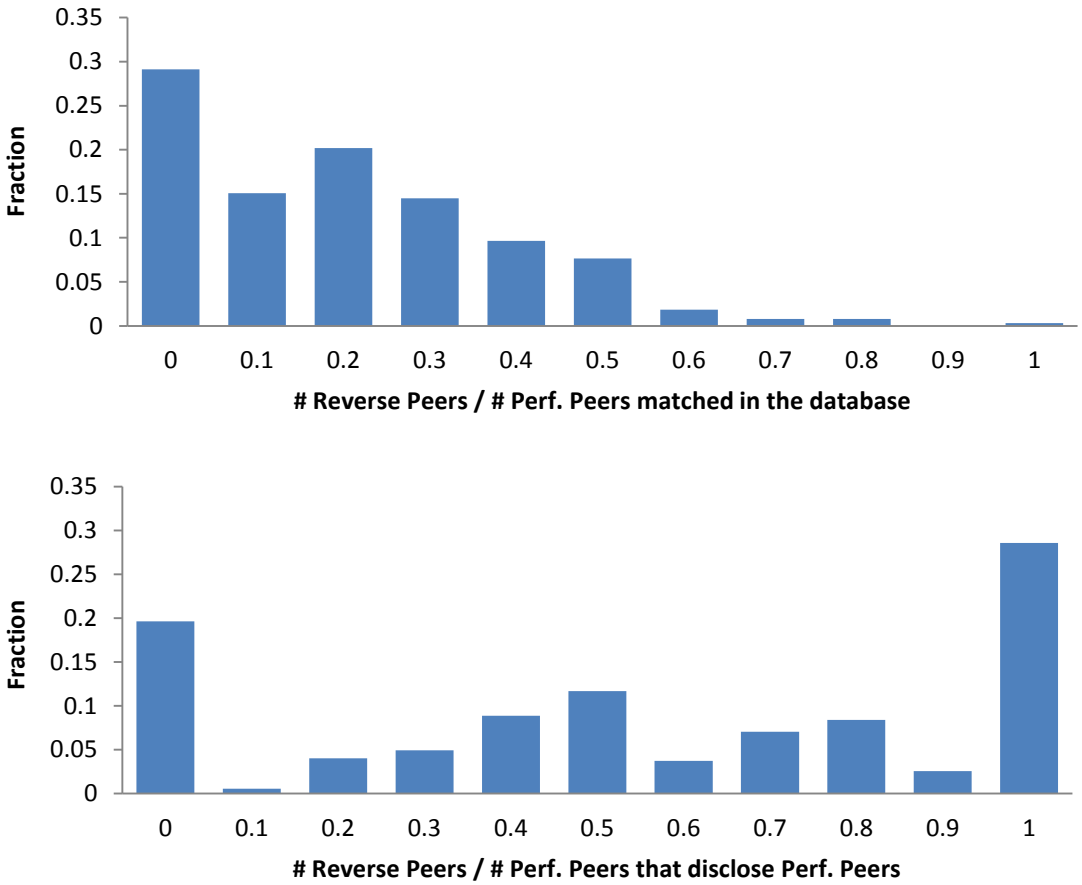


Figure 5: Histogram of *# Reverse Peers / # Performance Peers* in 2006-2012