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## Abstract

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Keywords: CEO Compensation, Relative Performance Evaluation

JEL Classifications: G30, G34, J33, M12, M52



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**Abstract**

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## I. Introduction

Few aspects of CEO compensation have attracted more attention than the use of relative performance evaluation (RPE).[1] Indeed, an influential line of research posits RPE is used to achieve a more informative signal of CEOs' efforts and to reduce CEO exposure to common risk (Holmstrom (1979, 1982), Holmstrom and Milgrom (1987)).[2] By removing the common risk from firm performance, firms can provide the same level of incentives to a risk-averse manager but at a lower cost (Holmstrom (1982)).

In this study, we investigate another economic rationale for the use of RPE. Our premise is based on Gibbons and Murphy (1990), who show RPE in CEO compensation can be used as an efficient way to compensate CEOs for their talent. In their setting, firms learn CEO talent from CEO performance relative to peer CEOs and compensate their CEOs according to their relative performance in order to retain their talent. We study the talent-retention hypothesis in two ways. First, we examine the contractual terms of RPE in CEO compensation and analyze the extent to which they are consistent with talent-retention motives. Second, using an improved empirical specification to detect RPE on a long panel of compensation data of CEOs of US firms, we test whether the transferability of CEO talent relates to a stronger use of RPE in CEO compensation.

The 2006 SEC executive-compensation disclosure rules require US firms to detail the contractual terms that govern CEO compensation. In particular, companies must disclose the type of performance measures they use to evaluate CEO performance and the relation between the level of these measures and CEO compensation. In our sample, about 34% of the firms that grant performance-based awards disclose that they compensate their CEOs based on their performance relative to peers. RPE terms are often part of a long-term incentive plan, which provides rewards to CEOs who stay with the firm for a stated period of time. The performance period itself is usually three years and the CEO cannot receive the award until the end of the performance period. If the CEO leaves the firm beforehand, he or she usually forgoes the award.

[1] RPE is the practice of compensating the CEO based on firm performance relative to peer firms.
[2] The theory was tested in the data. See, e.g., Antle and Smith (1986) and Janakiraman, Lambert, and Larcker (1992).

This feature is considered an important mechanism to retain CEO talent (Oyer (2004)): The firm commits to paying large sums of money provided that the CEO performs well and does not leave the firm.

The evidence regarding the contractual terms indicates RPE could play a role also for talent-retention purposes. We find the peers chosen to benchmark CEO performance tend to be the same peer CEOs who are also used to benchmark CEO compensation. The latter are considered the relevant talent pool of candidates for a CEO position (Bizjak, Lemmon, and Naveen (2008), Faulkender and Yang (2010, 2013), Albuquerque, De Franco, and Verdi (2013)). The high overlap between performance peers and compensation peers suggests firms in general view talent peers—CEOs whom the firm competes for talent—as close substitutes for CEO performance peers. Clearly, talent peers and performance peers should highly overlap also if performance peers are used to eliminate a common shock, because talent peers are usually CEOs who work in firms similar to the firm in question. Interestingly, we find performance peers are not necessarily involved in the same activities as the firm. About a third of all performance peers in our sample do not even belong to the same 2-digit SIC code as the firm.

An implication of the talent-retention hypothesis is that CEOs should be paid based on their talent relative to peers only when CEO talent is easily transferrable. In such cases, CEOs would require a commitment to be paid for their outside opportunities in order to stay with the firm. To the extent that relative performance reveals CEO relative talent and therefore impacts CEO outside opportunities, RPE provides such a commitment mechanism. To test this prediction, we study cross-sectional variations in the presence of RPE in CEO compensation across a large panel of firms between 1992 and 2017.

We find that as CEO talent becomes less transferrable, firms rely less on RPE in CEO compensation. We use five different proxies to capture the transferability of CEO talent: (i) whether CEO talent is general enough for CEOs to easily transfer their talent across firms (Custódio, Ferreira, and Matos (2013)); (ii) whether the CEO is also the founder of the firm, because the founder is likely to have strong firm-specific talent that cannot be easily transferred to other firms; (iii) whether the CEO is around retirement age, because CEOs around retirement age are likely to retire due to social norms (Jenter and Lewellen (2015)) and thus are less likely to move to other firms; (iv) whether firms in the industry tend to

promote insiders as their new CEOs (Cremers and Grinstein (2014)); and (v) whether the state in which the firm is headquartered enforces non-compete clauses that restrict managers from leaving their firms for competitors (Garmaise (2011)). Overall, our evidence shows that when CEO talent is less transferrable, firms tend to rely less on RPE, consistent with the talent-retention hypothesis.

To improve the accuracy of our tests, we embed several of the features observed in the contract in the empirical model. First, we construct peer groups using the ExecuComp sample rather than the full Compustat sample, and thus use only the set of the largest firms in the US. As Albuquerque (2009) shows, studying peers that are similar in size to the firm increases the accuracy of RPE tests.[3] Second, we measure the performance of each firm over three years, because this period is the performance term observed in the contracts. We also aim to capture the features of the observed pay-performance relation. Specifically, we embed the rank-based features of RPE found in the contracts. We find our refined specification improves the fit of the regression. Such specification differs from those used in past studies, which assume a log-linear relation between CEO compensation and the distance between CEO performance and that of peers.[4] Clearly, misspecification of the empirical model is bound to exist even if we embed non-linearities of the common contractual terms, because we cannot observe the terms for each firm. To ensure our results are not driven by one particular econometric model, we run the regressions in both their rank-based and distance-based forms and find similar patterns.

This study contributes to the literature in several ways. Our primary contribution is to shed new light on an under-explored role of RPE in CEO compensation. In that sense, our paper answers the recent call made in Edmans, Gabaix, and Jenter (2017) for more work that analyzes the importance of other explanations beyond moral hazard for observed CEO compensation contracts. We further argue that analyzing the talent-retention motive is important because the prevalent approach in the literature is to focus

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

[4] See, e.g., Gibbons and Murphy (1990), Aggarwal and Samwick (1999b), Bertrand and Mullainathan (2001), Garvey and Milbourn (2003), Rajgopal, Shevlin, and Zamora (2006), Gopalan, Milbourn, and Song (2010), and Vrettos (2013).

on the predictions from the standard agency models to study RPE practices and infer their relative optimality.

Second, our evidence suggests labor-market motives play a role in the design of CEO compensation contracts. The talent-retention hypothesis has cross-sectional implications for when RPE is useful and when it is not: These implications can help future research connect RPE either to good governance or to optimal contracting. It thus extends the literature that studies the possibility that performance-based compensation is used to retain talent. For example, Murphy (1986) studies the properties and implications of multiperiod managerial contracts under two alternative hypotheses: incentives and talent-learning. His findings yield mixed results that generally support the talent-learning hypothesis over the incentive hypothesis. However, Murphy (1986) does not study RPE. Oyer (2004) argues that when outside opportunities for rank-and-file employees are correlated with firm value, compensating employees with options commits firms to meeting employees' future outside opportunities. An important assumption in Oyer's model is that firms cannot condition payment directly on outside opportunities, only on firm's stock price. Oyer's restrictive assumption is arguably more relevant to cases of lower-ranked employees, but is less relevant to CEOs. The reason is that, empirically, firms do use peer firms' compensation to determine CEOs' outside opportunities (e.g., Bizjak, Lemon, and Naveen (2008)). We argue that once we allow firms to condition CEO compensation on outside opportunities, and once firm performance relative to peers is positively correlated with outside opportunities, the optimal compensation contract does include RPE. RPE allows the firm to tie compensation to fluctuations in CEO reservation wage because the latter depends on CEO talent *relative* to peers.

Our hypothesis and our results stand in contrast to those of Rajgopal, Shevlin, and Zamora (2006), who test Oyer's predictions. Rajgopal et al. (2006) find a negative correlation between firm performance and future use of RPE. They interpret good past performance as a measure of transferability of CEO talent, and they conclude firms do not use RPE to retain talent. We reach the opposite conclusion. Unlike their study, we interpret past performance as a measure of the talent of the CEO compared to others, which, in

turn, determines the level of CEO compensation. We use other, more established measures of transferability of CEO talent when testing our hypothesis.

Finally, this study complements previous studies examining the contractual terms in executive compensation. Using disclosed contractual terms, Gong, Li, and Shin (2011), De Angelis and Grinstein (2011) and Bettis, Bizjak, Coles, and Young (2014) document the use of RPE in US firms. Using survey data, Murphy (1999) examines the contractual terms of US annual bonus plans. He documents that RPE tends to be rank based. This result is also found in UK equity grants (Carter, Ittner, and Zechman (2009)). Our main innovation relative to these studies is to relate the contractual features associated with RPE with the talent-retention motive, in order to shed new light on the motivation for RPE.

## II. How Is RPE Incorporated in CEO Compensation Contracts?

We start our analysis by documenting how RPE is incorporated in CEO compensation contracts. Our goal is threefold. First, we wish to document the exact terms of the contract. Second, we wish to use the information found in the contract to better design the empirical model in our regression analysis in section III. Studies assume, in general, a log-linear relation between performance and compensation and a one-year performance horizon. We show the accuracy of the regression model can be improved by incorporating some of the features in the contract. Third, we wish to examine whether the contractual terms can be explained by the talent-retention hypothesis.

In the past, public US firms were not required to fully disclose the contractual terms that govern CEO compensation. However, in December 2006, the SEC issued new disclosure requirements concerning CEO compensation. With this new information, we can identify how firms employ RPE. We read the proxy statements of all S&P 500 firms as of December 2007 and summarize the way RPE is implemented in the compensation contracts.[5] We collect information such as how relative performance is measured, the form of the pay-performance relation, the duration over which performance is evaluated, the form of

[5] See De Angelis and Grinstein (2011, 2015) for more detailed explanations about the 2006 disclosure rules and the data-collection methodology, and for examples of implementation of these rules among firms.

compensation for meeting the performance goals, and so on. Our sample consists of 494 firms.[6] We use the Compustat definition of fiscal year 2007, which means firms are included in our sample if their fiscal year ends between 06/01/2007 and 05/31/2008. In a separate sample, we also collect data on the choice of RPE peers from the Incentive Lab database covering 2006 to 2012 and provide information on the characteristics of RPE peers. The Incentive Lab database sample includes the largest 750 public US firms in terms of market capitalization for each year.

Firms in the sample can grant both performance-based and non-performance-based awards. Performance-based awards are paid conditional on achieving a specified performance goal, whereas non-performance-based awards are granted to the CEO at the discretion of the board. For the performance-based awards, firms disclose the amount likely to be paid in the future (referred to as "target payment"). This value is the amount expensed by the company in its financial statements. If the payment is in the form of equity, the amount expensed is evaluated using the grant-date fair value of the equity awards. In our sample, 90% of the firms grant some type of performance-based award in 2007. The average value of the award is $4.8 million.

We summarize the findings regarding the implementation of RPE in Table 1. Panel A shows 34% of the firms in the sample that grant performance-based awards state that they tie CEO compensation to firm performance relative to peers (i.e., RPE).[7] On average, RPE users tie 49% of the value of performance-based award to RPE. Among RPE users, substantial variation exists in the use of RPE across firms: The standard deviation of RPE weight is 24% and the range of RPE weight is 90% (i.e., minimum is 10% and maximum is 100%). The use of RPE is widely spread across all sectors (not shown), with 68% of the firms in the Utilities and Energy industries relying on RPE, 47% in the Chemical industry, and 38% in the Telecom and Banking industries.

[Insert Table 1 here]

[6] Six firms belonged to the S&P 500 index as of December 2007 for which we are not able to retrieve proxy statements.
[7] As a comparison, in the UK, Carter et al. (2009) find in their sample that 51% of the firms rely on RPE. On the other hand, in the US, Gong et al. (2011) find 25% of their sample firms rely on RPE.

Similar to Gong et al. (2011) and Bettis et al. (2014), we find the use of RPE tends to be concentrated in equity awards: 56% of RPE firms tend to use RPE solely in equity awards, 32% solely in non-equity awards, and 12% in both equity and non-equity awards (not reported).

We are particularly concerned with whether the contractual terms are 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 the CEO receives compensation according to the RPE terms. In general, we find complete compliance with the terms of the contract, though we note that departures from full compliance could occur since firms might have discretion on how exactly they define performance, especially accounting-based performance.

We note that although all firms declaring use of RPE indeed provide compensation based on RPE, other firms may rely on RPE without disclosing the use of RPE in the contract, because the firm in question ties RPE to a discretionary part of the compensation. 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 Section III, we test the relation between CEOs' entire realized compensation, using a panel regression analysis.

Firms in our sample measure CEO performance relative to peers in two different ways. One way is measuring the distance between CEO performance and the average performance of peers. The larger the distance between CEO performance and that of peers, the higher the compensation (see the example of Murphy Oil 2008 proxy statement). 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 ranking CEO performance relative to peers; the contract maps the rank of CEO performance into a level of compensation, and the closer the CEO is to the top of the performance distribution among a set of peers, the higher the compensation. When compensation is given in the form of shares, the value to the CEO is not only determined by the relative ranking, but also by the actual value of his shares. Panel B shows the vast majority of the RPE contracts (88% of the sample) are based on the rank of the performance. Only a few firms use both distance-based and rank-based RPE (2% of the sample).

In general, firms choose to tie different measures of firm performance to peer performance. Panel C shows the most common performance measure used in RPE is market based (i.e., stock price performance compared to index returns, or stock price performance compared to that of a peer group). We observe that 75% of RPE users associate RPE with market-based measures, whereas only 36% associate it with accounting-based measures.[8] These numbers do not add up to 1, because some firms employ both market-based and accounting-based performance measures. This finding is consistent with Carter et al. (2009) and Gong et al. (2011), who find most RPE users employ total shareholder returns (TSR) as their measure of performance.

Panel C of Table 1 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 2008 proxy statement). RPE users tie on average 12% of the value of the award to that measure. A total of 17% of RPE users use income-growth measures compared to peers and they tie on average 11% of the award to these measures. Sales growth measures compared to peers are the third most popular among accounting measures. A total of 9% of RPE users employ these measures, and they tie about 5% of the value of the award to that measure.

Panel D of Table 1 describes the performance horizon associated with RPE. In their proxy statements, firms provide the performance horizon by which they examine CEO performance against that of peers. We find that, on average, the performance horizon associated with RPE is 2.6 years. The most common performance horizon associated with RPE is three years (63% of RPE users). The CEO cannot receive the award until the end of the performance period, and if the CEO leaves the company beforehand, he or she usually forgoes the award.[9] We note that such a long vesting requirement is considered an important mechanism to retain CEO talent (Oyer 2004): To retain the CEO, the firm commits to paying large sums of money provided the CEO performs well and does not leave the firm.

[8] We also find that, on average, 70% of the value of the award tied to RPE is associated with market-based measures (see De Angelis and Grinstein (2011) for more details).
[9] For example, Rockwell Automation states that the CEO will not be able to collect the award if he or she quits before the third year of performance.

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 not achieving 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 threshold, a cap exists, above which CEO compensation is not going to increase if the maximum performance is met. Firms also report target performance, which falls between the minimum-performance threshold and the maximum-performance cap. The target performance is the expected performance of the CEO.

Because 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. For example, a CEO can start receiving awards if performance is higher than the $10^{th}$ percentile of the peer performance distribution, and awards will increase if performance ranking is higher, until reaching the performance that is in the $90^{th}$ percentile of peer performance. A higher performance ranking will not provide the CEO with more compensation.

Firms that use RPE define peer groups against which to benchmark CEO performance. We investigate the identity of the peers used in RPE. We analyze the peers on several dimensions. First, we examine the extent to which firms use peer groups or indexes such as industry indexes or market indexes against which to benchmark CEO performance. Second, we examine the overlap between the characteristics of the firm and the characteristics of the peers. We compare size, industry distribution, and stock return correlation. We also compare the characteristics of the RPE peers against the characteristics of the compensation peers (i.e., peers against which the firm benchmarks CEO compensation). Our goal is to examine the extent to which the choice of peers can be explained also by the talent-retention hypothesis.

Table 2 Panel A shows the comparison. Panel A shows the majority of the firms in the sample (64%) benchmark RPE against a performance peer group, rather than an industry index or a market index. This result suggests most firms are consciously choosing RPE peer firms rather than relying on existing industry indexes.

[Insert Table 2 here]

Panel B shows the overlap between compensation peers and RPE peers in our sample. Compensation peers are peers against which the company benchmarks the compensation of the CEO, and they are considered peers against which the firm benchmark CEO talent (e.g., Bizjak, Lemmon, and Naveen (2008)). The table shows 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 table also shows performance peers tend to be a subset of the compensation peers. The fraction of overlapping peers among performance peers (*# Same Peers /# Performance Peers*) has a median of 95.65%. Panel C shows these statistics are relatively stable across the years.

Table 3 shows a comparison of the characteristics of RPE peers and compensation peers. Panel A shows the size distribution of peers is very similar across the two groups. On average, 48.46% of the compensation peers are within 50%-200% of the market cap of the firm, versus 48.11% of the RPE peers. The fraction of compensation peers who are at least double in size compared to the firm is 30.90%, versus 29.94% for the RPE peers. The fraction of compensation peers less than 50% in market cap is 20.63%, versus 21.95% in RPE peers.

The industry distribution is somewhat different between compensation peers and RPE peers (see Panel B). The fraction of compensation peers within the same 4-digit SIC code as the sample firm is 29.58% versus 38.46% for 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. Using the TNIC classification proposed by Hoberg and Phillips (2010, 2016), we find only about half of the performance peers (53%) are within the same TNIC as the firm.

Panel C reports the percentage of peers that have high stock return correlation with the firm. The correlations are computed using the 36 monthly stock returns preceding the fiscal-year-end date. We require at least 24 months of stock return data. We compute these pairwise correlations between each firm in the sample and each potential peer (i.e., all sample firms). We then rank the potential peers according to these

correlations for each firm and identify whether the potential peers are indeed selected as performance or compensation peers. To compute the fraction of peer firms that have the highest stock return correlation with the firm, we divide the number of peers that are ranked among X# firms by X. However, in cases where X is larger than the total number of peers, we use the total number of peers as the denominator.

On average, only about 21% of the compensation peers are ranked among the top 10 in terms of stock return correlation. This number increases to only 26% for the performance peer group. Only slightly more than half of the performance peers are in the top 100 firms (54%).

[Insert Table 3 here]

**A. Discussion**

Overall, several features of the RPE contract are common across firms. First, firms benchmark CEO performance to peers by compensating the CEO based on the ranking of CEO performance relative to the performance of the peer group rather than based on the difference between CEO performance and average index performance. Second, a strong overlap exists between performance peers and compensation peers. The latter are considered the relevant talent pool against which to evaluate the CEO. Third, RPE is done, in general, over a three-year period, payments are usually vested, and the CEO forgoes the compensation if the CEO leaves the company before the awards vest.

The above features tend to support the talent-retention hypothesis. Under this hypothesis, the performance of the CEO should be benchmarked against peer CEOs who belong to the same talent group, and CEO compensation should be based on their ranked-performance relative to peers. Moreover, CEO compensation should depend on the CEO not leaving the firm.

We note that some of the above contractual terms can also be consistent with the agency theory. To the extent that talent pools overlap with industry pools, we should perhaps observe a correlation between the two even under the agency explanation. Three-year performance terms could also provide a more accurate signal for CEO effort than one-year performance terms. In fact, the two theories are not mutually

exclusive, and RPE might play both roles. To test more carefully whether RPE is used to retain talent, we resort to the panel regression analysis in the next section.

## III. Panel Regression Analysis

In this section, we test the talent-retention hypothesis on a large panel of CEO compensation data. Our purpose is twofold. First, we revisit the empirical specification to detect RPE, given the evidence regarding the functional form of RPE in the compensation contract. Second, we test the predictions under the talent-retention hypothesis.

Regression-based analysis may seem unnecessary when contracts are available to us. Nevertheless, several reasons motivate the use of a regression analysis using realized compensation. First, CEO performance compensation has two components: predetermined awards and discretionary awards. Although we observe the terms of the predetermined awards, we do not observe the terms under the discretionary awards. De Angelis and Grinstein (2015) show discretionary awards are, on average, about half of total CEO compensation. Ignoring the discretionary component would lead to an incomplete view of the role of RPE in compensation policies. Second, we do not observe the contractual terms of CEO compensation before 2006.[10] A regression model allows us to examine compensation patterns even when the contractual terms are not observable. Third, the vast majority of empirical work on executive compensation relies on regression models. To compare our findings with previous studies, analyzing RPE with a methodology similar to that used in prior studies is useful.

### A. Database Construction

[10] We do not know how often and how exactly RPE was used before the 2006 disclosure rules. Because firms were not required before 2006 to fully disclose how they tie compensation to performance, information on the relation between the two is relatively scarce. Murphy (1999) examines data extracted from Towers Perrin's Annual Incentive Plan Design Survey from 1997 and finds about 29% of the firms in his sample use RPE—the majority of which use rank-based performance to determine the award. Bettis, Bizjak, Coles, and Kalpathy (2010) examine performance-contingent equity grant awards between 1995 and 2001 and find only 23% of the firms in their sample disclose performance-vested provisions in equity grants. The majority of these firms disclose such provisions only once between 1995 and 2001.

We retrieve the entire ExecuComp database from fiscal year 1992 to 2017. 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 also includes firms that previously belonged to these indexes but have been removed.

We use CEO total direct compensation (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 compensation as our dependent variable to account for the skewness in the compensation distribution.

We note that ExecuComp changed the definition of TDC1 from 2006 onward, as a result of the 2006 disclosure rules. As discussed in Walker (2011) (appendix B), under the pre-disclosure-rules regime, ExecuComp uses the ex-post values of performance share grants. However, under the post-disclosure-rules regime, ExecuComp uses the grant-date value of these performance share grants. Thus, after 2006, TDC1 captures the ex-ante target compensation of the grants rather than realized compensation based on relative performance. Because we are interested in capturing the extent to which realized compensation relates to relative performance (to gauge the reliance on RPE), we adjust the TDC1 variable in the post-disclosure period to better match with the data prior to 2006. Specifically, we subtract the grant-date fair value of stock awarded under plan-based awards (STOCK_AWARDS_FV) and add the value of restricted shares that vested during the fiscal year (SHRS_VEST_VAL). Effectively, we substitute the ex-ante value of the restricted stock awards with the ex-post realized value of the restricted stock awards. We note this adjustment is not perfect, because shares given to CEOs under performance-based stock plans could be non-vested too. Unfortunately, given the data limitation in the ExecuComp database and the way firms report compensation after 2006, we were not able to find a way to calculate the amount of non-vested and vested shares the CEO has received each year in the post-disclosure-rules period. To ensure our results are not driven by misevaluations of the awards in the post-disclosure period, we perform the tests also on the

subset of the panel under the previous disclosure regime (i.e., ExecuComp data item OLD_DATAFMT_FLAG equals 1).

For performance measures, we use the one-year total shareholder return (TSR), the annualized three-year TSR, and the return on assets (ROA), which is the annual net income of the firm divided by the total assets.[11] We include the natural log of total assets to control for size and the natural log of CEO tenure to measure CEO tenure. Except indicator and CDF measure variables, all variables are winsorized at 1% in both tails in order to mitigate the potential effects of outliers. Assets and compensation variables are adjusted for inflation and are expressed in 1992 dollars. We restrict our sample to firms in which CEO tenure is greater than or equal to one year, to ensure we do not capture compensation to CEOs who entered the firm after the beginning of the fiscal year. We also only keep firms for which we have the one-year TSR, ROA, and total assets information. Because we are interested in studying how firm relative performance affects compensation, we also require that at least another firm exists in the same 2-digit SIC code for that year in the ExecuComp database with non-missing TSR and TSR (3 years) variables. Our full sample consists of 38,177 firm-year CEO compensation observations.

Table 4 shows summary statistics for our sample firms. Panel A reports the statistics for the pre-disclosure-rules period, and Panel B reports them for our full sample period. In the full sample period, the median log compensation is 7.571, which corresponds to total compensation of $1.94 million in 1992 dollars. The 25$^{th}$ percentile of the distribution of the log compensation corresponds to $0.96 million and the 75$^{th}$ percentile corresponds to $4.01 million. The median annual TSR for a firm is 10.5% and the median annualized three-year TSR is 9.6%. The log size of the median firm is 7.207, which corresponds to $1.35 billion in 1992 dollars.

[Insert Table 4 here]

**B. Empirical Specification**

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

Studies that test the use of RPE in CEO compensation tend to adopt a standard log-linear empirical regression specification similar to the following (e.g., Gibbon and Murphy (1990)):

$$(1)\quad LOG\_TDC_{ijkt} = \alpha_0 + \alpha_1 TSR\_1\_YEAR\_IND._{jt} + \alpha_2 TSR\_1\_YEAR_{it} + \alpha_3 ROA_{it} + \alpha_4 LOG\_AT_{it} + \alpha_5 LOG\_CEO\_TENURE_{it} + \eta_{ik} + \theta_t + \varepsilon_{it,}$$

where firm is indexed by *i*, industry is indexed by *j*, CEO is indexed by k, and time is indexed by *t*. Performance variables are measured on an annual basis, and industry is defined at the 2-digit SIC code level. $TSR\_1\_YEAR\_IND._{jt}$ is the equal-weighted average TSR of firms that belong to the same industry, excluding firm *i*. Also included are CEO-firm fixed effects, $\eta_{ik}$, and year fixed effects, $\vartheta_{t,}$, to control for unobserved heterogeneity across CEO-firm pair match and over the years.

Using this specification, the literature tests whether, on average, CEO compensation is paid based on RPE. Holding firm performance constant, a negative coefficient of the industry return, $\alpha_1$, would suggest CEO compensation increases as industry performance decreases and would be consistent with the presence of RPE in a distance-based fashion.

Because RPE terms are observable, we offer several adjustments to the standard log-linear specification that fit better with the observed RPE terms. First, we rely on the literature that has refined the definition of industry peers when the information on peers is unavailable. Albuquerque (2009) shows peer firms tend to come from the same industry and same size cohort. Therefore, she relies in her empirical specification on industry peers that belong to the same size cohort as the firm and shows that this choice improves the accuracy of the test. Indeed, consistent with Albuquerque, Table 3 shows peers in our sample are chosen from the same size cohort as the firm. To incorporate this relative-peer-size argument, we use the ExecuComp sample to construct peers rather than the full Compustat sample. We expect the ExecuComp universe to be more representative of the actual peer groups than the Compustat universe because it includes the largest firms in the US. We further confine ourselves to peers that belong to the same 2-digit SIC code as the firm.

Second, we measure performance return over a three-year period rather than a one-year period because contractual terms show the majority of the RPE terms rely on a three-year performance period and on stock returns.

Third, we offer a refinement on how to measure RPE. Relative performance is measured in the contracts as the rank-based performance of the CEO relative to peers. So, a CEO who is in the 90$^{th}$ percentile of peer performance will receive a larger compensation than a CEO who is in the 80$^{th}$ percentile of peer performance. Rank-based performance is in contrast to the standard specification, which measures relative performance as the difference between firm performance and average industry performance. To capture the performance rank of the CEO, we measure the rank percentile of CEO performance relative to industry peers. Specifically, we create a CDF (or cumulative distribution function) measure of CEO performance, which we define as follows: CDF= *(# firms in the industry j – performance rank of firm i within industry j + 1)/(# firms in the industry j)*, where the top performance rank equals 1 (and thus the CDF of firm *i* equals 1 too). Hence, a higher CDF indicates a higher rank performance of firm *i* in industry *j*. We summarize our refined specification as follows:

$$(2)\quad LOG\_TDC_{ijkt} = b_0 + b_1\, CDF(TSR_{ijt}\, 3\_YEARS) + b_2\, TSR\_3\_YEARS_{it} + b_3\, ROA_{it} + b_4\, LOG\_AT_{it} + b_5\, LOG\_CEO\_TENURE_{it} + \eta_{ik} + \theta_t + \varepsilon_{it}.$$

Under equation (2), RPE is captured by performance relative to peers (CDF(TSR_3_YEARS$_{ijt}$)). If CEO compensation exhibits RPE then, holding TSR_3_YEARS$_{ijt}$ constant, a CEO should receive more compensation if his ranked performance (CDF(TSR_3_YEARS$_{ijt}$)) is larger. Thus, a positive coefficient on CDF(TSR_3_YEARS$_{ijt}$), $b_1$, will be consistent with the use of RPE in CEO compensation.

Note that although we expect these refinements to improve the accuracy of our tests, the resulting regressions are likely to still exhibit misspecification. For example, we might have misspecification in the choice of peers because we cannot observe the actual peers that the firm chooses. We also relate (log) CEO compensation to rank performance, yet for some firms, compensation for ranked performance is given in the form of shares, and the value of these shares is determined also by the stock price. Unfortunately, we

cannot account for such misspecifications, because we cannot observe the actual contracts. To ensure our results are not an artifact of a unique empirical specification, we also study alternative empirical specifications. We first propose to capture the functional form observed in the contract, using a more refined non-linear model. For instance, we cap the distribution at the 75$^{th}$ percentile and at the 25$^{th}$ percentile. (i.e., if the CDF is lower than 0.25, we replace the CDF with 0, and if the CDF is higher than 0.75, we replace the CDF with 0.75). Second, we run median regressions to further account for potential nonlinearities. Finally, we modify industry classification to 3-digit and 4-digit SIC code classification rather than the 2-digit SIC code. In all these specifications, we find consistent evidence of the presence of RPE in CEO compensation.[12]

### C. Testing the Presence of RPE in CEO Compensation

We start with the linear specification (1), in which our horizon for CEO performance is one year, as is the case in the literature. Table 5 Column 1 shows log compensation is positively related to the firm's stock return and accounting return. The coefficient of the industry return is negative and significant, consistent with Albuquerque (2009), and supports the presence of RPE in the pre-disclosure rules period. The results are statistically weaker when we consider the full sample period (column 3).

[Insert Table 5 here]

Columns 2 and 4 show the regression result of the specification where we replace the industry performance with the cumulative return distribution relative to peers (CDF). As before, the coefficients of the TSR and the ROA are positive and significant. The CDF coefficient (percentile rank of the CEO performance relative to the industry) is significant and in a direction consistent with the use of RPE.

We also note the three-year performance regression along with the use of a CDF-based model fits the data better than the traditional empirical model. The within R-squared of the CDF-based model is 18.6% when we study the pre-disclosure-rules period and 21.7% when we study the full sample period, whereas it

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

is 16.1% and 19.0%, respectively, for the traditional empirical specification. The absolute increase is 2.5% and 2.7%, respectively, which translates into a relative increase of about 15.5% and 14.2%, respectively.[13]

Overall, we find a three-year performance horizon and a CDF-based model fits the data better than the standard regression (1) that uses a one-year performance horizon and a distance-based RPE specification. This result is consistent with the patterns that we find in the actual compensation contracts. We therefore use our refined regression (2) (specification 6 in the table) in subsequent analysis. However, for robustness purposes, we also study the distance-based RPE version of this specification.

### D. RPE in CEO Compensation and Transferability of CEO Talent

With the improved specification discussed in the previous section, we test in this section the cross-sectional implications of the talent-retention hypothesis. According to the hypothesis, firms will use RPE in compensation contracts to pay CEOs for their outside opportunities. A natural implication is that these outside opportunities will be relevant when CEO talent is more easily transferable and/or where leaving the firm is less costly for the CEO. In such cases, the threat of the CEO leaving the firm is higher and the firm will try to prevent such situation by conditioning payment on relative performance. Similarly, if the CEO underperforms, the firm will find it optimal to reduce CEO compensation because of the outside opportunity to bring a new CEO. However, when CEO talent is not transferrable, the firm and the CEO will have less need to tie the compensation to that of peer CEOs.

To test this prediction, we study cross-sectional variations in the presence of RPE in CEO compensation, and, in particular, whether firms rely less on RPE when CEO talent is less easily transferable. To capture the transferability of CEO talent, we use several different measures. We divide them into measures that are based on CEO characteristics (Table 6) and on measures that are based on industry and state characteristics (Table 7).

[13] To ensure these differences are not driven by different sample size, we also ran the above specifications, but imposing similar sample sizes in columns 1 and 3 and columns 6 and 8, respectively. The coefficient of interests is similar to the ones reported above, and the within R-squared changes to 15.8% and 18.4%, respectively. In this case, using specification (2) rather than specification (1) leads to a relative increase in within R-squared of 17.7% when we study the pre-disclosure-rules period, and of 17.9% when we study the full sample period.

### 1. Evidence from CEO Characteristics

Our first cross-sectional test relies on a measure proposed by Custódio et al. (2013) and aims to identify whether a CEO tends to be a specialist or a generalist. Because specialist CEOs are likely to be less responsive to outside opportunities due to less transferable talents, we expect these CEOs to not be compensated based on RPE. Custódio et al. (2013) build a generalist index based on the past occupation of the CEO. We classify CEOs as specialists in two ways: First, we define them as specialists if their annual generalist index is below the median of the distribution of this measure in our sample (columns 1 and 2 in Table 6) and second, if their index is in the first quartile of the distribution (columns 3 and 4).

Our second test relies on a dummy variable indicating whether the CEO is a founder (columns 5 and 6). We retrieve the founding year of the company from the MSCI GMI ratings database, formerly known as Corporate Library.[14] In addition to capturing firm-specific skills, this measure also captures agent-specific costs to leaving the company, as a result of the loss of utility derived by running the firm one has founded. We therefore expect outside opportunities to be less relevant to founder-CEO firms, and thus these firms should rely less on RPE.

Our third test relies on whether the CEO is around retirement age (columns 7 and 8). As documented in Jenter and Lewellen (2015), the propensity of CEOs to leave the firm spikes significantly at around age 65. This phenomenon is likely to capture CEO retirement preferences and is often attributed to social norms in the labor literature. CEOs who plan to retire are likely to be less responsive to outside opportunities and, hence, under the talent-retention hypothesis, we expect the reliance on RPE to be lower for these CEOs. Following Jenter and Lewellen (2015), we define CEOs around retirement age as those of ages 64 to 66 inclusive.

[14] The founding year used by the MSCI GMI ratings database takes into account also the years in which the firm was private. Some studies approximate the founding year with the year the firm went public (this represents the IPO year for most firms). See, e.g., 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.

[Insert Table 6 here]

Supporting the talent-retention hypothesis, we find the coefficient of CDF(TSR_3_YEARS)* LOWER_TRANSFERABILITY is negative in all eight specifications and significant at the 5% level in six out of the eight specifications.[15] The economic magnitude of our findings is important. Whereas we observe a positive and significant sensitivity of CEO compensation to rank performance (i.e., the coefficient of CDF(TSR_3_YEARS) is positive and significant across all specifications), this sensitivity is close to 0 or even negative when CEO talent transferability is lower (i.e., the sum of the coefficient of CDF(TSR_3_YEARS) and the coefficient CDF(TSR_3_YEARS)* LOWER_TRANSFERABILITY is close to 0 or even negative). In other words, our findings indicate that, in general, firms tend to rely on RPE in CEO compensation but that RPE is not present when CEO talent transferability is lower, consistent with the talent-retention hypothesis.

**2. Evidence from Industry and State Characteristics**

In a similar vein to our first test above but using an industry-level measure, we study the extent to which CEO talent in the industry tends to be firm specific (columns 1 and 2 in Table 7). Specifically, we use the measure proposed by Cremers and Grinstein (2014), which is the percentage of new CEOs, in a given industry, who have been promoted within the firm rather than hired from outside. These data are obtained from Cremers and Grinstein (2014) for the Fama and French 48-industry classification. We classify industries in the top quartile of the distribution of this measure as industries with more firm-specific talent, and under the talent-retention hypothesis, we expect less use of RPE in these industries.

Our last measure is based on the enforceability of non-compete clauses that restrict managers from joining a competing firm. According to the talent-retention hypothesis, RPE should be less prevalent when these clauses are more enforceable, because they restrict the transferability of CEO talent to other firms. To measure the enforceability of non-compete clauses, we borrow the state-level index proposed in Garmaise

[15] We use the age 64-66 as the retirement age to be consistent with Jenter and Lewellen (2015). However, we note that age 66 is already past retirement age threshold. If we change the definition of retirement age to 64-65 inclusive, the coefficient of the interaction term in column 7 becomes significant at the 10% level.

(2011). Garmaise builds an enforceability index across states and finds enforceability is associated with lower executive compensation. We classify firms as having stronger enforceability of non-compete clauses when their state-level index is above the median (columns 3 and 4).

[Insert Table 7 here]

Columns 1 and 2 show firms in industries with a high ratio of insider CEOs have considerably less RPE. We do not find firms in states with higher enforceability of non-compete clauses tend to exhibit less sensitivity of compensation to rank performance (columns 3 and 4). We suspect the non-significance is due to industry composition: California notably has an index of 1; that is, non-compete clauses are not enforced, so in California, we would expect more reliance on RPE. However, firms in California tend to be high-tech firms with high firm-specific talent. In this case, we expect less reliance on RPE. To capture both effects, we create a dummy variable that captures firms that are both in insider industries and in high-enforcement states. Under the talent-retention hypothesis, we expect little RPE in these firms, because firm-specific talent is high and firms can use the non-compete clause to retain their CEO. We find evidence consistent with this prediction (see results in columns 5 and 6).

Overall, the results in this section show firms tend to rely less on RPE in cases in which CEO talent is more firm specific, and when leaving the firm for another company is costlier. Hence, our findings are consistent with the notion that the transferability of CEO talent is an important driver in the decision to use RPE in CEO compensation, supporting the talent-retention hypothesis.

### E. Additional Analysis

As mentioned earlier, the TDC1 variable in the post-disclosure-rules period had to be adjusted because it does not capture well CEO compensation based on relative performance. To ensure the results are not driven by errors in the valuation of the awards in the post-disclosure-rules period, we study separately firms under the previous disclosure regime. Specifically, we repeat all the tests over the pre-disclosure-rules period (1992-2006). Our results tend to be consistent with the results over the entire period (1992-2017). Hence, our findings indicate our cross-sectional analysis is unlikely to be driven by

compensation practices in recent years and in particular by the emergence of performance-based awards, and potential misevaluations of these awards (e.g., Li and Wang (2016), Bettis, Bizjak, Coles, and Kalpathy (2018)). They also support the argument that the use of RPE is not a recent-period phenomenon but exists in the sample across all periods. These findings support Murphy (1999), who documents the use of rank-based RPE in bonus plans already in 1997.

We also rerun our regressions, but this time using a distance-based RPE specification as used in the existing literature. Although we expect a weaker fit of this regression with the data, we test whether the results using this specification show patterns similar to the results with our specification using the CDF measure. Specifically, we replicate the tests from Tables 6 and 7 respectively, but we substitute TSR_3_YEARS_IND. for CDF(TSR_3_YEARS). We show the results in Tables 8 and 9. We expect a negative coefficient on the industry return, consistent with the presence of RPE, and a positive coefficient on the industry return interaction term with measures used for lower transferability of CEO talent, indicating less reliance on RPE. We find the coefficient for TSR_3_YEARS_IND is indeed negative in general (mostly in the pre-disclosure-rules period), but it is not statistically significant. Consistent with the talent-retention hypothesis, the interaction term of the transferability of CEO talent with industry return is positive in general, although it is marginally statistically significant in only four of all the specifications. We conclude the distance-based RPE specification shows patterns similar to the rank-based RPE specification (i.e., a lower use of RPE in CEO compensation when the CEO talent is less transferable), except that it is less statistically significant.

[Insert Table 8 and Table 9 here]

## IV. Conclusion

We study the rationale that RPE in the CEO compensation contract is used to retain CEO talent and find several observed features of the contract are consistent with the talent-retention hypothesis. Overall, our findings support the notion that talent-retention and labor-market considerations influence the use of

RPE. Our results call for more theoretical work that embeds labor-market considerations in an incomplete contract framework to help understand economic rationale for the use of RPE.

The notion that performance-based compensation could have a role in retaining talent is not new. For example, Oyer (2004) argues option compensation to rank-and-file employees is used to retain them rather than motivate them to increase productivity. An important assumption in his model is that firms cannot condition payment on employees' outside opportunities, only on firms' stock price. Therefore, his setting does not allow RPE. We argue Oyer's assumption is more relevant to cases of lower-ranked employees, but is less relevant to CEOs, since firms do condition CEO compensation on performance of peers and can therefore use peer performance to measure CEO outside opportunities. Once we allow firms to condition CEO compensation on outside opportunities, and once firm performance relative to peers is positively correlated with outside opportunities, the optimal compensation contract includes RPE.

Our findings shed new light on the puzzle of why firms do not use RPE. The talent-retention hypothesis implies RPE is useful when the market for CEO talent exists and is viable and when relative performance captures well the relative talent of the CEO. These requirements are quite restrictive and are not likely to hold across all firms. Indeed, we find that when the market for CEO talent is less efficient, firms refrain from using RPE.

Our results can also provide a new perspective on existing results regarding the use of RPE. For example, Bertrand and Mullainathan (2001) show firms with more inside and grey directors rely less on RPE. They interpret this finding as indicating the lack of RPE is associated with worse boards. However, such board structure is also consistent with the case where insiders on the board compete for a CEO position (Fama (1980)), a practice more likely to take place when CEO talent is more firm specific.

Our finding that talent-retention considerations influence the use of RPE does not necessarily indicate RPE contracts do not have an incentive role. In fact, CEOs who know better performance implies larger compensation will have incentives to work harder, especially if talent is only partly observed through past performance (Holmstrom (1999)).

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**Table 1**
**Examination of the Functional Form of RPE in CEO Compensation Contracts**

Table 1 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* |

**Table 2**
**Examination of the Choice of Performance Benchmarks and Comparison with the Compensation Benchmark**

Panel A reports the proportions of firms relying on different types of performance benchmarks for a sample of 494 S&P500 members in 2007. Panel B reports the number of self-selected peers in performance peer groups and compares it with the set of peers in the compensation peer group. Panel C reports the mean statistics across years. Results in Panels 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 (1,251 firm-year observations). *# Distinct Peers* is the total number of peers across both compensation peers and performance peers, without double counting peers that appear in both groups. *# Same Peers* is the total number of peers that appear in both groups.

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% |

**Table 3**
**Comparison of Performance Peers and Compensation Peers**

Panel A reports firm size characteristics across peers that are in the 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 C reports the percentage of peers that have high stock return correlation with the firm.

Panel A : Percentage of Peers Similar in Size to 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% |
| TNIC | 53.24% | 41.99% |

Panel C : Percentage of Peers with High Stock Return Correlation with the Firm
*[# of selected peers with high correlation / Min (Max # of potential peers with high correlation, Max number of matched peers for the firm)]*

| | Performance Peers {1} | Compensation Peers {2} |
|---|---|---|
| *Stock Return Correlation is in the:* | | |
| Top 10 (# Firms) | 25.98% | 21.37% |
| Top 50 (# Firms) | 43.60% | 35.75% |
| Top 100 (# Firms) | 54.36% | 46.06% |
| Top 1 percentile | 29.61% | 22.81% |
| Top 5 percentile | 53.04% | 44.78% |
| Top 10 percentile | 63.45% | 55.78% |

**Table 4**
**Descriptive Statistics**

Table 4 provides descriptive statistics of the main variables used in this study. The sample is composed of firms in the ExecuComp database. The full sample period is from fiscal year 1992 to fiscal year 2017. Panel A reports the statistics for the pre-disclosure-rules period and Panel B reports them for the full sample period. 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 1 plus CEO total direct compensation. For the post-disclosure-rules period, total direct compensation (TDC1) is adjusted by subtracting the grant-date fair value of stock awarded under plan-based awards (STOCK_AWARDS_FV) and adding the value of restricted shares that vested during the fiscal year (SHRS_VEST_VAL). TSR is the firm's stock return, assuming the dividend payments are reinvested. TSR_IND. is the equal-weighted average TSR of firms that belong to the same industry (using the 2-digit SIC classification), excluding the firm. CDF(TSR) is the rank percentile of CEO performance relative to industry peers (using the 2-digit SIC classification). A higher CDF (TSR) indicates better performance relative to peers. ROA is the ratio of net income to total assets. LOG_AT is the natural logarithm of 1 plus total assets. LOG_CEO_TENURE is the natural logarithm of 1 plus the number of years the CEO has been in position. GA is an index capturing the extent to which the CEO is generalist based on the CEO's past occupations (Custódio et al. (2013)). CEO_FOUNDER is a dummy variable equal to 1 if the CEO was in place when the company was founded. The proportion of insiders among all new CEOs within an industry is collected from Cremers and Grinstein (2014) for Fama-French 48-industry classification. The NON-COMPETE_ENFORCEABILITY_INDEX is a state-level measure capturing the extent to which non-compete agreements can be enforced (Garmaise (2011)). Except indicator and CDF measure variables, all variables are winsorized at 1% in both tails. Compensation and asset variables are expressed in 1992 dollars.

| Panel A: Pre-Disclosure Rules Period [1992-2006] | | | | | | |
|---|---|---|---|---|---|---|
| | Mean | SD | p25 | p50 | p75 | N |
| LOG_TDC | 7.513 | 1.059 | 6.769 | 7.455 | 8.224 | 18,176 |
| TSR_1_YEAR | 0.176 | 0.514 | -0.123 | 0.112 | 0.369 | 18,176 |
| TSR_1_YEAR_IND. | 0.176 | 0.237 | 0.007 | 0.146 | 0.316 | 18,176 |
| CDF(TSR_1_YEAR) | 0.521 | 0.289 | 0.273 | 0.519 | 0.771 | 18,176 |
| TSR_3_YEARS | 0.127 | 0.265 | -0.019 | 0.112 | 0.257 | 17,389 |
| TSR_3_YEARS_IND. | 0.126 | 0.122 | 0.053 | 0.127 | 0.204 | 17,389 |
| CDF(TSR_3_YEARS) | 0.523 | 0.289 | 0.273 | 0.520 | 0.773 | 17,389 |
| ROA | 0.034 | 0.103 | 0.012 | 0.041 | 0.080 | 18,176 |
| LOG_AT | 7.245 | 1.736 | 5.965 | 7.069 | 8.375 | 18,176 |
| LOG_CEO_TENURE | 1.978 | 0.705 | 1.407 | 1.946 | 2.485 | 18,176 |
| CEO_GENERALIST_INDEX(GA) | 0.006 | 0.974 | -0.729 | -0.163 | 0.560 | 15,600 |
| CEO_FOUNDER | 0.135 | 0.341 | 0 | 0 | 0 | 11,380 |
| CEO_AGE | 55.72 | 7.245 | 51 | 56 | 61 | 16,995 |
| PROP_OF_INSIDERS_AMONG_NEW_CEOS | 0.700 | 0.112 | 0.610 | 0.710 | 0.800 | 18,122 |
| NON-COMPETE_ENFORCEABILITY_INDEX | 3.917 | 2.154 | 3 | 4 | 5 | 17,709 |

| Panel B: Full Sample Period [1992-2017] | | | | | | |
|---|---|---|---|---|---|---|
| | Mean | SD | p25 | p50 | p75 | N |
| LOG_TDC | 7.593 | 1.039 | 6.870 | 7.571 | 8.298 | 38,177 |
| TSR_1_YEAR | 0.156 | 0.487 | -0.122 | 0.105 | 0.345 | 38,177 |
| TSR_1_YEAR_IND. | 0.155 | 0.242 | 0.009 | 0.143 | 0.298 | 38,177 |
| CDF(TSR_1_YEAR) | 0.520 | 0.289 | 0.270 | 0.517 | 0.769 | 38,177 |
| TSR_3_YEARS | 0.101 | 0.249 | -0.036 | 0.096 | 0.224 | 36,683 |
| TSR_3_YEARS_IND. | 0.101 | 0.124 | 0.023 | 0.109 | 0.183 | 36,683 |
| CDF(TSR_3_YEARS) | 0.521 | 0.289 | 0.273 | 0.519 | 0.770 | 36,683 |
| ROA | 0.033 | 0.103 | 0.010 | 0.040 | 0.079 | 38,177 |
| LOG_AT | 7.333 | 1.743 | 6.060 | 7.207 | 8.474 | 38,177 |
| LOG_CEO_TENURE | 1.996 | 0.697 | 1.447 | 1.961 | 2.492 | 38,177 |
| CEO_GENERALIST_INDEX(GA) | 0.011 | 0.974 | -0.729 | -0.147 | 0.586 | 18,318 |
| CEO_FOUNDER | 0.106 | 0.308 | 0 | 0 | 0 | 30,026 |
| CEO_AGE | 56.01 | 7.134 | 51 | 56 | 61 | 36,898 |
| PROP_OF_INSIDERS_AMONG_NEW_CEOS | 0.690 | 0.120 | 0.610 | 0.710 | 0.800 | 38,040 |
| NON-COMPETE_ENFORCEABILITY_INDEX | 3.892 | 2.192 | 3 | 4 | 5 | 37,080 |

**Table 5**
**Testing the Presence of RPE in CEO Compensation**

Table 5 shows results of CEO-firm fixed effect regressions. The dependent and explanatory variables are defined in Table 4. Industry performance is based on 2-digit SIC classification. In the 3-year-performance-horizon specification (i.e., columns (5) to (8)), we restrict the sample to CEOs who are at least in the third 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. ***, **, and * indicate p-values less than 0.01, 0.05, and 0.10, respectively.

| *Dependent Variable = LOG_TDC* | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| *Performance Horizon:* | *1 year* | | | | *3 years* | | | |
| *Sample Period* | *Pre-Disclosure Rules* | | *Full Sample* | | *Pre-Disclosure Rules* | | *Full Sample* | |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| CDF(TSR_1_YEAR) | | 0.117*** | | 0.097*** | | | | |
| | | (0.027) | | (0.017) | | | | |
| TSR_1_YEAR_IND. | -0.070** | | -0.024 | | | | | |
| | (0.029) | | (0.020) | | | | | |
| TSR_1_YEAR | 0.128*** | 0.067*** | 0.117*** | 0.067*** | | | | |
| | (0.014) | (0.019) | (0.009) | (0.012) | | | | |
| CDF(TSR_3_YEARS) | | | | | | 0.111*** | | 0.123*** |
| | | | | | | (0.038) | | (0.024) |
| TSR_3_YEARS_IND. | | | | | -0.028 | | 0.084* | |
| | | | | | (0.072) | | (0.051) | |
| TSR_3_YEARS | | | | | 0.556*** | 0.451*** | 0.583*** | 0.471*** |
| | | | | | (0.036) | (0.053) | (0.024) | (0.036) |
| ROA | 0.970*** | 0.958*** | 0.907*** | 0.897*** | 0.560*** | 0.559*** | 0.529*** | 0.532*** |
| | (0.101) | (0.101) | (0.060) | (0.060) | (0.110) | (0.110) | (0.061) | (0.062) |
| LOG_AT | 0.361*** | 0.362*** | 0.335*** | 0.335*** | 0.354*** | 0.356*** | 0.334*** | 0.337*** |
| | (0.023) | (0.023) | (0.017) | (0.017) | (0.024) | (0.024) | (0.017) | (0.017) |
| LOG_CEO_TENURE | 0.232*** | 0.231*** | 0.270*** | 0.271*** | 0.256*** | 0.258*** | 0.280*** | 0.282*** |
| | (0.035) | (0.035) | (0.026) | (0.026) | (0.049) | (0.049) | (0.035) | (0.035) |
| CEO-Firm F.E. and Year F.E. | Y | Y | Y | Y | Y | Y | Y | Y |
| Observations | 18,176 | 18,176 | 38,177 | 38,177 | 15,334 | 15,334 | 32,572 | 32,572 |
| Within R-squared | 0.161 | 0.162 | 0.190 | 0.191 | 0.185 | 0.186 | 0.216 | 0.217 |

**Table 6**
**RPE in CEO Compensation and Transferability of CEO Talent: Evidence from CEO Characteristics**

Table 6 shows results of CEO-firm fixed-effect regressions. The dependent and explanatory variables are defined in Table 4. Specifications in odd-numbered columns are estimated using the pre-disclosure-rules period (i.e., 1992-2006), whereas those in even-numbered columns are estimated using the full sample period (i.e., 1992-2017). Industry performance is based on 2-digit SIC classification. We restrict the sample to CEOs who are at least in the third year of their contract (i.e., CEO Tenure is greater or equal to 2). LOWER_TRANSFERABILITY is a dummy variable equal to 1 in situations when we expect the CEO talent to be less transferable or less likely to be transferred to another company. We classify CEOs as *Specialist* if their annual generalist index (Custódio et al. (2013)) is below the median (columns (1) and (2)) or in the first quartile (columns (3) and (4)). We follow Jenter and Lewellen (2015) and classify firms with a CEO of retirement age as firms in which CEO age is between 64 and 66 inclusive. The constant term is not reported, and in columns 1, 2, 3, 4, 7, and 8, the coefficient for LOWER_TRANSFERABILITY is not reported. We also include ROA, LOG_AT and LOG_CEO_TENURE as control variables and interact these variables with LOWER_TRANSFERABILITY (coefficients are not reported). Robust standard errors clustered at the firm level are reported in parentheses. ***, **, and * indicate p- values less than 0.01, 0.05, and 0.10, respectively.

| | *Dependent Variable = LOG_TDC* | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| *Measure Used for Lower Transferability of CEO Talent:* | *Specialist CEOs (GA<Median)* | | *Specialist CEOs (GA<Q1)* | | *Firms with a founder CEO* | | *Firms with a CEO of retirement age* | |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| CDF(TSR_3_YEARS) | 0.166*** | 0.182*** | 0.133*** | 0.130*** | 0.139*** | 0.129*** | 0.091** | 0.123*** |
| | (0.060) | (0.056) | (0.049) | (0.045) | (0.051) | (0.027) | (0.040) | (0.024) |
| CDF(TSR_3_YEARS) * LOWER_TRANSFERABILITY | -0.147** | -0.169** | -0.168** | -0.143** | -0.318*** | -0.095 | -0.121 | -0.185*** |
| | (0.073) | (0.067) | (0.075) | (0.070) | (0.123) | (0.076) | (0.111) | (0.071) |
| TSR_3_YEARS | 0.423*** | 0.445*** | 0.460*** | 0.495*** | 0.411*** | 0.458*** | 0.468*** | 0.468*** |
| | (0.087) | (0.083) | (0.070) | (0.066) | (0.072) | (0.042) | (0.055) | (0.037) |
| TSR_3_YEARS * LOWER_TRANSFERABILITY | 0.066 | 0.066 | -0.005 | -0.050 | 0.292* | 0.130 | -0.021 | 0.172 |
| | (0.101) | (0.097) | (0.097) | (0.092) | (0.154) | (0.096) | (0.213) | (0.117) |
| Controls | Y | Y | Y | Y | Y | Y | Y | Y |
| Controls * LOWER_TRANSFERABILITY | Y | Y | Y | Y | Y | Y | Y | Y |
| CEO-Firm F.E. and Year F.E. | Y | Y | Y | Y | Y | Y | Y | Y |
| Observations | 13,183 | 15,502 | 13,183 | 15,502 | 9,729 | 25,854 | 14,354 | 31,510 |
| Within R-squared | 0.192 | 0.185 | 0.193 | 0.185 | 0.201 | 0.230 | 0.197 | 0.224 |

**Table 7**
**RPE in CEO Compensation and Transferability of CEO Talent: Evidence from Industry and State Characteristics**

Table 7 shows results of CEO-firm fixed-effect regressions. The dependent and explanatory variables are defined in Table 4. Specifications in odd-numbered columns are estimated using the pre-disclosure-rules period (i.e., 1992-2006), whereas those in even-numbered columns are estimated using the full sample period (i.e., 1992-2017). Industry performance is based on 2-digit SIC classification. We restrict the sample to CEOs who are at least in the third year of their contract (i.e., CEO Tenure is greater or equal to 2). LOWER_TRANSFERABILITY is a dummy variable equal to 1 in situations when we expect the CEO talent to be less transferable or less likely to be transferred to another company. Specifically, LOWER_TRANSFERABILITY equals 1 in industries where the market for CEO talent is likely to be more firm specific, such as where the proportion of insiders among all new CEOs (Cremers and Grinstein (2014)) is in the top quartile (columns (1) and (2)) and when firms are located in states where the non-compete enforceability index (Garmaise (2011)) is greater than or equal to the median (columns (3) and (4)). The constant term is not reported, and in columns 3, 4, 5, and 6, the coefficient for LOWER_TRANSFERABILITY is not reported. We also include ROA, LOG_AT and LOG_CEO_TENURE as control variables and interact these variables with LOWER_TRANSFERABILITY (coefficients are not reported). Robust standard errors clustered at the firm level are reported in parentheses. ***, **, and * indicate p-values less than 0.01, 0.05, and 0.10, respectively.

| | *Dependent Variable = LOG_TDC* | | | | | |
|---|---|---|---|---|---|---|
| *Measure Used for Lower Transferability of CEO Talent:* | *Industries with high ratio of insider CEOs* | | *States with high non-compete enforcement* | | *States with high non- compete enf. & Ind. with insiders CEOS* | |
| | (1) | (2) | (3) | (4) | (5) | (6) |
| CDF(TSR_3_YEARS) | 0.170*** | 0.176*** | 0.133** | 0.107*** | 0.145*** | 0.148*** |
| | (0.045) | (0.027) | (0.065) | (0.036) | (0.044) | (0.026) |
| CDF(TSR_3_YEARS) * LOWER_TRANSFERABILITY | -0.154** | -0.136*** | -0.030 | 0.028 | -0.139* | -0.122** |
| | (0.068) | (0.041) | (0.073) | (0.041) | (0.074) | (0.050) |
| TSR_3_YEARS | 0.392*** | 0.401*** | 0.432*** | 0.475*** | 0.422*** | 0.435*** |
| | (0.061) | (0.041) | (0.083) | (0.051) | (0.059) | (0.039) |
| TSR_3_YEARS * LOWER_TRANSFERABILITY | 0.137 | 0.191*** | 0.019 | -0.007 | 0.105 | 0.198*** |
| | (0.091) | (0.058) | (0.095) | (0.057) | (0.097) | (0.071) |
| Controls | Y | Y | Y | Y | Y | Y |
| Controls * LOWER_TRANSFERABILITY | Y | Y | Y | Y | Y | Y |
| CEO-Firm F.E. and Year F.E. | Y | Y | Y | Y | Y | Y |
| Observations | 15,286 | 32,452 | 14,938 | 31,649 | 14,890 | 31,529 |
| Within R-squared | 0.189 | 0.219 | 0.185 | 0.217 | 0.184 | 0.217 |

**Table 8**

**RPE in CEO Compensation and Transferability of CEO Talent: Evidence from CEO Characteristics – Distance-based Specification**

Table 8 shows results of CEO-firm fixed effect regressions. The dependent and explanatory variables are defined in Table 4. Specifications in odd number columns are estimated using the pre-disclosure rules period (i.e., 1992-2006) while those in even number columns are estimated using the full sample period (i.e., 1992-2017). 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). LOWER_TRANSFERABILITY is a dummy variable equals to one in situations when we expect the CEO talent to be less transferable or less likely to be transferred to another company. We classify CEOs as *Specialist* if their annual generalist index (Custódio et al. (2013)) is below the median (columns (1) and (2)) or in the first quartile (columns (3) and (4)). We follow Jenter and Lewellen (2015) and classify firms with a CEO of retirement age as firms in which CEO age is between 64 and 66 inclusive. The constant term is not reported, and in column 1, 2, 3, 4, 7 and 8 the coefficient for LOWER_TRANSFERABILITY is not reported. We also include ROA, LOG_AT and LOG_CEO_TENURE as control variables and interact these variables with LOWER_TRANSFERABILITY (coefficients are 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 Lower Transferability of CEO Talent:* | *Specialist CEOs (GA<Median)* | | *Specialist CEOs (GA<Q1)* | | *Firms with a founder CEO* | | *Firms with a CEO of retirement age* | |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| TSR_3_YEARS_IND. | -0.134 | -0.133 | -0.059 | -0.028 | -0.065 | 0.091 | -0.001 | 0.082 |
| | (0.111) | (0.103) | (0.090) | (0.083) | (0.092) | (0.057) | (0.074) | (0.052) |
| TSR_3_YEARS_IND. * LOWER_TRANSFERABILITY | 0.198 | 0.257** | 0.121 | 0.138 | 0.425* | 0.120 | 0.499** | 0.462*** |
| | (0.129) | (0.120) | (0.137) | (0.127) | (0.228) | (0.145) | (0.196) | (0.124) |
| TSR_3_YEARS | 0.593*** | 0.633*** | 0.588*** | 0.618*** | 0.550*** | 0.583*** | 0.552*** | 0.583*** |
| | (0.062) | (0.060) | (0.048) | (0.046) | (0.050) | (0.028) | (0.037) | (0.025) |
| TSR_3_YEARS * LOWER_TRANSFERABILITY | -0.098 | -0.131* | -0.168** | -0.199*** | -0.048 | 0.010 | -0.242 | -0.111 |
| | (0.078) | (0.074) | (0.074) | (0.068) | (0.107) | (0.074) | (0.172) | (0.097) |
| Controls | Y | Y | Y | Y | Y | Y | Y | Y |
| Controls * LOWER_TRANSFERABILITY | Y | Y | Y | Y | Y | Y | Y | Y |
| CEO-Firm F.E. and Year F.E. | Y | Y | Y | Y | Y | Y | Y | Y |
| Observations | 13,183 | 15,502 | 13,183 | 15,502 | 9,729 | 25,854 | 14,354 | 31,510 |
| Within R-squared | 0.192 | 0.184 | 0.192 | 0.184 | 0.201 | 0.230 | 0.197 | 0.223 |

**Table 9**

**RPE in CEO Comp. and Transferability of CEO Talent: Evidence from Ind. and State Characteristics – Distance-based Specification**

Table 9 shows results of CEO-firm fixed effect regressions. The dependent and explanatory variables are defined in Table 4. Specifications in odd number columns are estimated using the pre-disclosure rules period (i.e., 1992-2006) while those in even number columns are estimated using the full sample period (i.e., 1992-2017). 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). LOWER_TRANSFERABILITY is a dummy variable equals to one in situations when we expect the CEO talent to be less transferable or less likely to be transferred to another company. Specifically, LOWER_TRANSFERABILITY equals one in industries when the market for CEO talent is likely to be more firm-specific such as where the proportion of insiders among all new CEOs (Cremers and Grinstein (2014)) is in the top quartile (columns (1) and (2)) and when firms are located in states where the non-compete enforceability index (Garmaise (2011)) is greater or equal to the median (columns (3) and (4)). The constant term is not reported, and in column 3, 4, 5 and 6 the coefficient for LOWER_TRANSFERABILITY is not reported. We also include ROA, LOG_AT and LOG_CEO_TENURE as control variables and interact these variables with LOWER_TRANSFERABILITY (coefficients are 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 Lower Transferability of CEO Talent:* | *Industries with high ratio of insider CEOs* | | *States with high non-compete enforcement* | | *States with high non- compete enf. & Ind. with insiders CEOS* | |
| | (1) | (2) | (3) | (4) | (5) | (6) |
| TSR_3_YEARS_IND. | -0.070 | 0.027 | -0.132 | 0.064 | -0.038 | 0.057 |
| | (0.080) | (0.057) | (0.113) | (0.072) | (0.079) | (0.055) |
| TSR_3_YEARS_IND. * LOWER_TRANSFERABILITY | 0.092 | 0.100 | 0.170 | 0.018 | -0.044 | 0.050 |
| | (0.130) | (0.081) | (0.125) | (0.076) | (0.157) | (0.099) |
| TSR_3_YEARS | 0.549*** | 0.571*** | 0.570*** | 0.576*** | 0.554*** | 0.574*** |
| | (0.042) | (0.028) | (0.055) | (0.038) | (0.039) | (0.026) |
| TSR_3_YEARS * LOWER_TRANSFERABILITY | -0.004 | 0.044 | -0.034 | 0.015 | 0.008 | 0.078 |
| | (0.071) | (0.049) | (0.070) | (0.047) | (0.083) | (0.058) |
| Controls | Y | Y | Y | Y | Y | Y |
| Controls * LOWER_TRANSFERABILITY | Y | Y | Y | Y | Y | Y |
| CEO-Firm F.E. and Year F.E. | Y | Y | Y | Y | Y | Y |
| Observations | 15,286 | 32,452 | 14,938 | 31,649 | 14,890 | 31,529 |
| Within R-squared | 0.187 | 0.217 | 0.184 | 0.216 | 0.183 | 0.216 |

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