# Relative Performance Evaluation and Long-Term Incentives

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# Relative Performance Evaluation and Long-Term Incentives

**ABSTRACT**: Many prior studies test the theoretical prediction that relative performance evaluation (RPE) improves contracting by filtering out uncontrollable shocks to performance. However, the theory also holds that such noise filtering can have adverse long-term effects because it undermines incentives to invest and to optimize firm risk exposure. We argue that this trade-off between long-term incentives and noise filtering affects earnings relatively more than stock returns because earnings reflect managerial actions with a greater delay. In our empirical analysis, we find that incentive contracts use peer earnings differently than peer stock returns and that CEO compensation is positively associated with peer earnings, particularly when the CEO has greater control over the firm's strategic direction and when peer performance reflects persistent favorable shocks. Our findings imply that earnings-based RPE protects executives from bad luck but rewards them for good luck and that this asymmetry may be driven by optimal contracting as well as rent seeking.

**Keywords**: *Relative performance evaluation, CEO compensation, incentives, peer group choice*.
**Data Availability**: Data used in this study is publicly available.

# I. INTRODUCTION

A large stream of RPE literature is motivated by single-period agency models where it is always optimal to protect a risk-averse manager from uncontrollable shocks to performance (Holmström 1982; Feltham and Xie 1994). However, it is also well known that in multi-period settings the anticipation of future noise filtering undermines ex ante incentives to take long-term actions (Meyer and Vickers 1997; Casas-Arce and Martinez-Jerez 2009). This trade-off between ex ante incentives to make long-term investments and ex post demand for noise-filtering has motivated prior work on performance target ratcheting (Indjejikian, Matějka, and Schloetzer 2014b), stock option repricing (Saly 1994; Acharya, John, and Sundaram 2000), and the choice of performance measures (Hemmer 1996; Dikolli 2001; Dutta and Reichelstein 2003), but there is hardly any empirical evidence on how it affects the use of RPE.

Relatedly, most prior RPE studies examine the use of peer *stock returns* in incentive contracting. It is now well established that CEO compensation is associated positively with the firm's own stock returns but negatively with peer stock returns (Albuquerque 2009), which is consistent with the role of RPE in filtering out common shocks reflected in own as well as peer performance. In contrast, there is little evidence on accounting-based RPE and it remains unclear when and how peer *earnings* are used in CEO incentive contracts (Lobo, Neel, and Rhodes 2018; Nam 2020).

We predict that peer earnings improve incentive contracting not only by filtering out noise but also by incentivizing long-term investments.[1] The association between CEO compensation and peer earnings then depends on whether the contractual demand for noise filtering exceeds the demand for long-term investments. The tension between the two RPE roles is more pronounced for earnings than for stock returns because earnings reflect information about CEO actions with a greater delay. Specifically, if a performance measure immediately reflects all benefits of long-term investments, there is no ex ante incentive conflict and the primary role of RPE is to ex post filter out noise. In contrast, if a performance

[1] We use the term long-term investments or actions in a broad sense to refer not only to investments in new products, technologies, facilities, or distribution channels but also to other costly choices with long-term benefits such as maintaining a cash cushion or attracting new capital. Long-term actions also encompass strategic planning and increasing firm exposure to high-growth industries or firm resilience to economic downturns (Gopalan, Milbourn, and Song 2010).

measure reflects investments with a delay, there is a contractual demand for long-term incentives in the form of expected compensation contingent on future performance (Dutta and Reichelstein 2003). Yet, the anticipation of future noise-filtering weakens the link between expected compensation and future performance and thus undermines long-term incentives to invest (Meyer 1995; Meyer and Vickers 1997). We therefore expect that peer earnings are used for noise filtering relatively less than peer stock returns.

The trade-off between long-term incentives and noise filtering should be even more pronounced for firms that can benefit from strategic repositioning closer to a new and more profitable set of peers. This makes the anticipation of future noise filtering even more damaging to long-term incentives because investments in strategic repositioning can reduce current earnings and at the same time increase future performance expectations (Indjejikian, Matějka, Merchant, and Van der Stede 2014a). In such settings, firms may use RPE not so much to filter out noise but to reward the CEO for moving the firm in a direction followed by successful peers. Empirically, this would manifest as a *positive* association between CEO compensation and peer earnings.

Our empirical analysis relies on a comprehensive peer choice model that allows for changes in peer group composition over time. This contrasts with the most common approach in prior literature which identifies peers based on largely time-invariant characteristics such as industry and size (Albuquerque 2009). Although several recent studies allow for changing peer groups, it typically comes at the cost of using only limited information about relevant peer characteristics. For example, some studies take advantage of enhanced proxy statement disclosures, which now include a list of peers used by boards to determine CEO compensation (Gong, Li, and Shin 2011; Hung and Shi 2023). The downside of this approach is that data on self-disclosed peers are available only since 2006 and the choice of publicly disclosed peers can also reflect various biases (Bizjak, Lemmon, and Nguyen 2011; Vaan, Elbers, and DiPrete 2019). Other recent studies use time-varying characteristics such as stock-return correlations (Bloomfield, Guay, and Timmermans 2022) or product similarity (Jayaraman, Milbourn, Peters, and Seo 2021) to identify peers outside of traditional industry categories. The downside is that relying on a small number of such firm-peer characteristics disregards other relevant determinants of exposure to common shocks.

We construct peer groups as follows. First, we estimate a model of the choice of self-disclosed peers using Incentive Lab data. We include firm-peer economic characteristics such as relative sales, different types of industry classification (Fama-French 48 and two- and three- digit SIC codes), diversification strategy (single- or multi-segment firms), proximity of corporate headquarters, product and life-cycle stage similarity, talent flows, stock-return correlations (daily and weekly), and quarterly earnings correlations. Second, we use the coefficient estimates to calculate predicted values for all sample firm-years, i.e., even when data on actual peer choice is unavailable. These values aggregate all relevant economic determinants from the peer choice model. Using these predicted values rather than the disclosed choices to identify peers also alleviates biases due to strategic disclosure. Third, for each firm-year, we select peers with the highest 20 predicted values and use them to calculate peer stock returns and peer earnings. In our validation tests, we show that our measures of peer performance are strongly associated with firm own performance, even after controlling for measures of peer performance commonly used in prior work.

We use our new peer performance measures to test several predictions motivated by the trade-off between long-term incentives and noise filtering. First, we replicate findings from prior literature that CEO compensation is positively associated with own stock returns and earnings but negatively associated with peer stock returns. Second, we show that the association between CEO compensation and peer earnings is significantly more positive than the association with peer stock returns, which is consistent with our argument that peer earnings are used to provide long-term incentives because firm own earnings reflect information about CEO effort with a delay.

Third, we compare the use of RPE in single-segment firms versus conglomerates. We expect that long-term incentives are particularly important in conglomerates where the CEO can more easily reallocate capital and thus has a greater control over firm strategy and peer group composition (Gopalan et al. 2010). We find that CEO compensation in conglomerates is decreasing in peer stock returns but increasing in peer earnings.[2] In contrast, the significantly positive association between CEO compensation and peer earnings is not apparent in single-segment firms. This provides further evidence consistent with our theory that peer earnings are informative about CEO long-term actions not yet reflected in current firm earnings.

Next, as in Gopalan et al. (2010), we predict that the use of RPE is asymmetric because noise filtering is relatively more important than long-term incentives during economic downturns, whereas the opposite holds during upturns. We further predict that this RPE asymmetry is more pronounced for peer earnings than for peer stock returns because conservative financial reporting makes earnings relatively slower in incorporating good news than bad news (LaFond and Roychowdhury 2008). We find strong support for both predictions in that CEO compensation is decreasing in both peer stock returns and peer earnings during economic downturns but increasing in peer earnings during upturns.

To provide further evidence that our main findings are driven by the information content of peer performance, we identify a cross-section of firms where peer earnings are highly informative about current and future firm own earnings. Specifically, we measure peer information content as the average predicted value from our peer choice model for the top 20 peers selected in each firm-year. A high peer information content implies the focal firm has many peers that are economically similar, at least in terms of the main determinants of peer group choice such as daily and weekly stock return correlations, relative size, and talent flows. We show that our main findings are significantly stronger in the subsample of firms with an above-median peer information content.

Finally, we note the strong RPE asymmetry documented in our study implies that CEOs are protected from bad luck but rewarded for good luck (Bertrand and Mullainathan 2001; Garvey and Milbourn 2006). Although we argue that this asymmetry arises as a result of optimal contracting, we also test whether it is

[2] We do not assume that compensation contracts include explicit provisions that would make incentive awards contingent on favorable performance of an ex ante defined peer group. Rather, we assume that performance of peers selected by our peer choice model is correlated with private information corporate boards use to evaluate CEO long-term strategic actions such as expanding new markets, acquisitions, and divestitures. Whereas firm stock returns often quickly incorporate such value-enhancing strategic actions, firm earnings do so with a delay and may initially decrease even for strategic actions that boost long-term profitability. In that sense, we view peer performance as an empirical proxy for unobservable leading indicators of future firm performance (Hayes and Schaefer 2000; Said, HassabElnaby, and Wier 2003; Dikolli and Sedatole 2007).

related to governance strength and CEO rent seeking (Bebchuk, Fried, and Walker 2002). We measure weak governance with an indicator variable for a large number of board members serving on many other boards (Bloomfield et al. 2022). We find some evidence that the RPE asymmetry and its compensation-increasing effects are more pronounced when governance is weak.

Combined, our findings make two major contributions to prior literature. First, most prior studies examine the standard prediction of single-period agency models that CEO compensation is negatively associated with peer performance. We argue that a simple extension of the theoretical arguments to multi-period settings motivates a different prediction. If earnings reflect managerial effort with a substantial delay, the resulting dynamic incentive conflicts can give rise to a *positive* association between CEO compensation and peer earnings. Using a large sample of 41,958 firm-year observations from 1992–2021, we show that this association is indeed significantly positive on average. We further show that the association between CEO compensation and peer earnings is even more positive when the CEO has greater control over the firm's strategic direction and when peer earnings likely reflect persistent favorable shocks, i.e., in settings where contractual demand for long-term incentives likely dominates the demand for noise filtering.

Second, we validate a new approach to measuring peer performance and constructing peer groups, which allows us to incorporate more information about relevant firm-peer characteristics than has been feasible so far. A unique feature of our approach is that it leverages the proxy statement disclosures since 2006 to learn about peer groups with the greatest potential to facilitate RPE even in the pre-2006 period. We show that this approach considerably increases the power of RPE tests. Moreover, it greatly reduces the cost of RPE data collection because the coefficient estimates from our peer choice model allow researchers to incorporate information about self-disclosed peers without purchasing or hand-collecting such data.

## II. THEORY AND HYPOTHESES

### RPE and Noise Filtering

The theoretical underpinning of the RPE literature is the single-period moral hazard model where a risk-neutral firm contracts with a risk-averse manager to take a costly unobservable action using a noisy signal about firm performance and managerial effort (Holmström 1982; Feltham and Xie 1994). The firm can incentivize effort only by making the manager's compensation contingent on the noisy signal. This creates contractual demand for noise filtering to make compensation less volatile, which reduces the costs of incentive provision (Holmström 1979). As long as the firm and its peers are exposed to common random shocks, peer performance should be used for noise-filtering purposes and make incentive contracts more efficient.

Early empirical studies on RPE examine whether incentive contracts filter out noise by putting a negative weight on peer stock returns but find only limited support for the theoretical prediction (Jensen and Murphy 1990; Janakiraman, Lambert, and Larcker 1992; Aggarwal and Samwick 1999b; Garvey and Milbourn 2003). One explanation for the mixed results is that researchers cannot accurately identify peer groups used in incentive contracts and consequently peer performance is measured with error (Dikolli, Hofmann, and Pfeiffer 2013). Albuquerque (2009) argues that peer performance measures derived from market or industry indices reduce the power of RPE tests because they disregard other important determinants of common shock exposure such as relative size. She finds strong evidence that incentive contracts put a negative weight on stock returns of industry-size matched peers (further referred to as SIC2-size peers). Several recent studies provide similar evidence that firms use peer stock returns to filter out noise from CEO compensation. To measure peer stock returns, Gong et al. (2011) use self-disclosed peers from firms' proxy statements and Jayaraman et al. (2021) define peers based on size, book-to-market ratio, and product similarity scores (Hoberg and Phillips 2016).

Another explanation for the inconclusive early findings is that the benefits of noise filtering may be offset by its cost (Gibbons and Murphy 1990). In particular, RPE is costly or less effective when the number of suitable peers is small (Jayaraman et al. 2021; Tice 2023). By putting a negative weight on peer performance, RPE contracts incentivize aggressive competitive behavior (Bloomfield et al. 2022; Feichter, Moers, and Timmermans 2022), peer-harming disclosures (Bloomfield, Heinle, and Timmermans 2023), or a lack of cooperation (Holzhacker, Kramer, Matějka, and Hoffmeister 2019). Noise filtering can also conflict with the retention objectives of compensation contracts if CEO labor market opportunities are positively associated with peer performance (Oyer 2004; Rajgopal, Shevlin, and Zamora 2006).

In addition, RPE can facilitate rent extraction if powerful CEOs influence the choice of peers, performance measures, or other features of RPE contracts (Dikolli, Diser, Hofmann, and Pfeiffer 2018). There is some evidence that RPE is asymmetric in the sense that CEOs are protected from bad luck but rewarded for good luck, particularly when corporate governance is weak (Bertrand and Mullainathan 2001; Garvey and Milbourn 2006). There is also evidence that CEOs select peers strategically to justify higher compensation (Bizjak et al. 2011; Faulkender and Yang 2013; Vaan et al. 2019; Bakke, Mahmudi, and Newton 2020). However, both the RPE asymmetry and the selection of peers to justify higher pay can also be explained as an optimal response to a greater demand for CEO talent or changes in labor market opportunities (Bizjak, Lemmon, and Naveen 2008; Albuquerque, De Franco, and Verdi 2012).

Although there is now ample evidence on the costs and benefits of using peer stock returns in incentive contracts, our understanding of the use of peer earnings is still limited. Several studies detect a negative weight on peer stock returns but at the same time no weight or even a positive weight on peer earnings in CEO incentive contracts (Gibbons and Murphy 1990; Janakiraman et al. 1992; Albuquerque 2009; Lobo et al. 2018; Nam 2020). These results cannot be explained by the costs of RPE discussed above because those would affect both stock returns and earnings equally. Lobo et al. (2018) and Nam (2020) show that selecting peers on accounting comparability, in addition to size and industry, yields a negative association between peer earnings and CEO cash compensation but no association with equity compensation.

**RPE and Long-Term Incentives**

Most prior RPE studies are motivated by the insights from the standard single-period moral hazard model, even though there is also a large stream of analytical work on muti-period contracting examining a closely related incentive design issue that can be characterized as follows (Acharya et al. 2000). Suppose the firm and the manager agree on a compensation contract for two or more periods. What are the welfare consequences of incorporating new information that becomes available after the first period? The simple single-period intuition that more information is always better does not carry over to multi-period settings. If the firm cannot commit to ignoring future information about its own or peer performance, it can be considerably more costly to incentivize effort in the first period (Laffont and Tirole 1993).

From the perspective of the multi-period framework, RPE can be viewed as a special case of using future information. The use of information about future peer performance has noise-filtering benefits but the anticipation of it undermines first-period incentives, which means that better information about peer performance can actually reduce rather than increase efficiency of incentive contracts (Meyer and Vickers 1997). Conversely, commitment not to use future information exposes the manager to more risk but also strengthens long-term incentives to invest in profitable opportunities or to increase resilience to economic downturns. This trade-off affects RPE as well as various other incentive design choices (Demski and Frimor 1999; Indjejikian and Nanda 1999). For example, Acharya et al. (2000) discuss why resetting strike prices on underwater stock options (using future information about noise realizations) is often beneficial but too much resetting can be harmful. Indjejikian et al. (2014b) argue that it is efficient to underuse information about past performance when revising annual performance targets.

Dutta and Reichelstein (2003) analyze a multi-period model where the manager exerts effort increasing current profits but also makes investments increasing future profits. They examine whether incentive contracts use leading indicators of performance (defined as noisy forecasts of future investment returns) or delay rewards by making them contingent on realized future profits. The incentive problem is that the firm rationally adjusts performance expectations for increased profits due to past investments and, anticipating such adjustments, the manager has no incentives to invest. Commitment to long-term contracts (by both the manager and the firm) makes rewards contingent on future profits more effective but does not fully eliminate the demand for leading indicators. Similar to the use of peer performance for noise filtering, the leading indicator is negatively associated with future compensation because future performance benefited from first-period investment. However, the association between the leading indicator and first-period compensation may be positive if uncertainty about the future would otherwise lead to underinvestment (Dutta and Reichelstein 2003: 847). In other words, exactly because future RPE filters out the effect of past investments on profitability, it may be important to put a *positive* weight on peer performance early on when it acts as a leading indicator of future performance.

Several other RPE studies emphasize that the manager can take actions affecting the firm's strategic direction and long-term profitability. It is now well understood that the strong demand for noise filtering and the resulting negative weight on peer performance in the single-period RPE model are driven by the assumption that noise exposure is independent of effort (Ball, Bonham, and Hemmer 2020). If this assumption does not hold and managerial effort affects firm exposure to random shocks, then noise filtering can become very costly. Schäfer (2023) illustrates this point in a model where the manager supplies costly effort but also decides on strategic differentiation that can increase firm profits by reducing resemblance to peers. The cost of noise filtering in this setting is the manager's reluctance to engage in strategic differentiation. Similarly, some studies argue that noise filtering encourages costly long-term competition and that a *positive* weight on peer performance motivates strategic actions that soften competitive behavior (Aggarwal and Samwick 1999a; Vrettos 2013).

Ball et al. (2020) and Hemmer (2023) relax the assumption that exposure to common shocks is independent of managers' actions. RPE then provides incentives to increase effort as well as resemblance to more profitable (aspirational) peers. Putting a negative weight on peer performance filters out noise but undermines incentives to mimic aspirational peers. The optimal incentive contract puts a positive weight on the correlation between firm and aspirational peer performance and the weight on peer performance need not be negative. Several other studies provide a similar insight. If the correlation between own and peer performance is increasing in own and peer actions (rather than independent of those actions, as assumed in most single-period models), then RPE can manifest as a *positive* weight on peer performance (Celentani and Loveira 2006; Magill and Quinzii 2006; Fleckinger 2012).

Gopalan et al. (2010) go a step further by abstracting away from managerial effort increasing firm performance, which eliminates the well-understood demand for noise filtering. The key incentive design issue is then how to increase exposure to a favorable common shock, or reduce exposure to an unfavorable one, rather than how to supply more effort. The optimal incentive contract motivates the CEO to direct resources to a business sector with high expected profitability, which necessitates a *positive* weight on peer performance, particularly if the CEO has greater control over the firm's strategic direction.

**Hypotheses**

The theory predicts that the sign of the association between CEO compensation and peer performance depends on the relative importance of noise filtering versus long-term incentives. Strong contractual demand for noise filtering should manifest as CEO compensation increasing in firm's own performance but decreasing in peer performance. In practice, this can be implemented with incentive grants that have explicitly defined performance measures, peer groups, and payouts contingent on outperforming peers (Carter, Ittner, and Zechman 2009; Bettis, Bizjak, Coles, and Kalpathy 2018; Pawliczek 2021).[3] Alternatively, firms can wait until peer performance is observed and then filter out noise from CEO compensation by adjusting incentive awards upward for unfavorable shocks reflected in poor peer performance and downward for good peer performance (Albuquerque 2009).

As the demand for long-term incentives increases, the association between CEO compensation and peer performance should at first become less negative and then turn positive as peer performance increasingly acts a leading indicator of firm's future performance (Dikolli 2001). In practice, this does not necessarily mean that firms explicitly contract on peer performance. Rather, peer performance is likely to

[3] Incentive awards with explicitly defined peer groups and vesting conditions based on relative performance are not very common in our sample. As discussed later, our main findings remain unchanged if we exclude or separately examine firm-year observations with such incentive awards (see Table 10).

be correlated with boards' private information about progress on strategic objectives and long-term goals that is not yet reflected in current performance (Hayes and Schaefer 2000).

We make several predictions about the relative importance of noise filtering versus long-term incentives and the implications for the association between CEO compensation and peer performance. First, we expect that incentive contracts use peer earnings differently than peer stock returns. Given that stock returns incorporate both the costs and long-term benefits of strategic investments relatively quickly (Gopalan et al. 2010), the need to use peer stock returns as a leading indicator of firm's own stock returns is low and incentive contracts may use peer stock returns primarily for noise filtering. In contrast, earnings incorporate investment benefits much slower than its costs (Penman and Zhang 2002; Albuquerque 2009), which increases the demand for forward-looking information contained in peer earnings (Dutta and Reichelstein 2003). Firms where strategic repositioning and other long-term investments are critical may use peer earnings primarily as a leading indicator of their own future earnings and, consequently, CEO compensation may even be increasing in peer earnings.

**H1**: The association between CEO compensation and peer performance is higher for peer earnings than for peer stock returns.

Second, we test the prediction of Gopalan et al. (2010) that the weight on peer performance is higher in conglomerates where the CEO can more easily reallocate capital and thus has greater control over the firm's strategic direction. As discussed in the theory section, incentive contracts that put a highly negative weight on peer performance preserve the status quo because, besides noise, they also filter out the benefits of strategic repositioning closer to more profitable peers. This may be less of a concern in single-segment firms but a key role of conglomerate CEOs is to identify and invest in high-growth business segments, which makes long-term incentives relatively more important than noise filtering. By H1, this effect should manifest primarily in the weight on peer earnings because peer stock returns are used relatively more for noise filtering than for long-term incentives.

**H2a**: The association between CEO compensation and peer performance is higher in conglomerates than in single-segment firms.

**H2b**: The effect described in H2a is more pronounced for peer earnings than for peer stock returns.

Third, Gopalan et al. (2010) also predict that the weight on peer performance is higher for favorable than for unfavorable shocks. The intuition is that risk-averse CEOs have relatively strong incentives to avoid bad states of the world and, consequently, the need for noise filtering likely dominates the need for long-term incentives to reduce exposure to unfavorable shocks. In contrast, when experiencing favorable shocks and anticipating high compensation, CEOs may be complacent with good firm performance and may underinvest in increasing the firm's upside risk exposure. This strengthens contractual demand for long-term incentives, which manifests empirically as a positive weight on peer performance.

Asymmetric RPE could arise as a result of optimal contracting even where there is no demand for long-term incentives. For example, Celentani and Loveira (2006) assume that marginal product of effort is greater in good states of the world, which makes it likely that managerial effort and peer performance are high at the same time. In such environments, managerial compensation is decreasing in peer performance in bad times but increasing in good times. A similar asymmetry also arises in the model of Ball et al. (2020). If high peer performance is very informative about high managerial effort, then the use of peer performance information boosts managerial compensation both for favorable and unfavorable shocks.

Thus, we expect asymmetric RPE for all measures of peer performance. Nevertheless, given that it can at least partly be explained by contractual demand for long-term incentives, which affects the use of earnings more than the use of stock returns, we also predict that the RPE asymmetry is more pronounced for peer earnings.

**H3a**: The association between CEO compensation and peer performance is higher during economic upturns than during downturns.

**H3b**: The RPE asymmetry described in H3a is more pronounced for peer earnings than for peer stock returns.

## III. DATA AND RESEARCH DESIGN

### Data Sources and Sample

Our main source of data is the intersection of Execucomp and Compustat for the years 1992–2021. We obtain stock price and inflation data from the Center for Research in Security Prices (CRSP), self-disclosed peers from Incentive Lab, and data on similarity in firms' 10-K product descriptions from the library of Hoberg and Phillips.[4] As in Albuquerque (2009), we drop all non-CEO observations, those with multiple CEOs in a firm-year, and those with a new CEO on the job for less than a year. The resulting dataset has 46,524 firm-CEO-year observations. We further drop 2,675 observations with missing data on CEO compensation, stock returns, or return on assets (ROA) and obtain the main sample of up to 43,849 firm-year observations from 3,817 unique firms. The samples available for our tests are smaller due to missing data on peer performance or one of the moderating variables, as shown in Table 1. All variables denominated in dollars are adjusted for inflation and presented in 1992 dollars. All continuous variables are winsorized at the 1st and 99th percentiles.

### Variable Measurement

We use two sets of variables in our empirical analysis. The first set below largely follows the variable definitions from Albuquerque (2009). The second set is derived from the peer selection model discussed in the next subsection.

*CEO compensation* is the natural logarithm of one plus total annual flow compensation, including salary, bonus, other incentive payouts, restricted stock, and stock options (tdc1 in Execucomp).

*Firm stock return* is the natural logarithm of [(1 + ret/100) / (1 + cpi)], where ret is the annual (compounded) stock return obtained from monthly data and cpi is the annual rate of inflation.

*Firm ROA* is the natural logarithm of one plus annual income before extraordinary items (ib in Compustat) divided by beginning-of-year total assets (at), both adjusted for inflation.

[4] https://hobergphillips.tuck.dartmouth.edu/industryconcen.htm.

*Peer stock return* (*SIC2-size*) is calculated in the same way as *Firm stock return* and averaged for all peers in the same two-digit SIC code and size quartile, excluding the own-firm stock return. Size quartiles are based on beginning-of-year market value. When the number of peers in an industry-size group is two or less, we use the average of all peer returns in the industry regardless of size. *Favorable shock* (*peer stock*) is an indicator variable equal to one if *Peer stock return* > 0.

*Peer ROA* (*SIC2-size*) is calculated in the same way as *Firm ROA* and averaged for all peers in the same two-digit SIC code and size quartile, using the same procedure as *Peer stock return* (*SIC2-size*). *Favorable shock* (*peer ROA*) equals to one if *Peer ROA* > 0.

*Assets* are a proxy for firm size, measured as the natural logarithm of total assets (at in Compustat). We use total assets rather than sales or market value because the latter two are more closely correlated with firm stock returns and ROA.

*CEO chair* is an indicator for CEO being also the board chair.

*Tenure* is the natural logarithm of the number of years since the CEO took office. The number of years is calculated as one twelfth of the number of months between the current fiscal year and month and the month the CEO took office (becameceo in Execucomp).

*Ownership* is an indicator for an above-median CEO ownership, calculated as the percentage of shares (excluding options) owned by the CEO divided by the number of common shares outstanding at the end of the fiscal year.

*Conglomerate* is an indicator for firms reporting positive sales and assets in more than one three-digit SIC code as in Gopalan et al. (2010). We drop observations for which the sum of reported sales in the Compustat segment files does not fall within 25 percent of total firm sales in the annual files as in Ozbas and Scharfstein (2010). Table 1 shows that these data requirements considerably reduce the number of non-missing observations. Conglomerates comprise 50 percent of the sample and the remaining 50 percent are single-segment firms.

**New Measures of Peer Performance**

Peer stock returns and ROA, as defined in the previous section, are the most commonly used measures of peer performance. Their main downside is that they are defined in terms of only two largely time-invariant characteristics (industry and size). Our theoretical arguments call for measures of peer performance that allow for changes in firm strategy and thus also peer group composition over time. To construct such measures, we proceed as follows.

First, we use Incentive Lab data on self-disclosed peers. This includes peer groups used to benchmark general compensation for the CEO (referred to as Peer Data for Benchmark Compensation Comparisons) as well as peer groups for relative performance awards (Peer Data for Relative Performance Goals). Ninety nine percent of the observations are from the 2006–2021 sample period following enhanced proxy statement disclosure requirements. The remaining one percent are observations from voluntary disclosures during 1998–2005.

Second, we measure several firm-peer characteristics expected to be major determinants of firms' choices of peers for RPE purposes. As discussed below, this includes multiple measures based on correlations between firm and peer performance, similarity in diversification strategy, geographical proximity, lifecycle stage, product similarity, talent flows, industry classification, and relative size.

*CorrD*, *CorrDP* are indicator variables based on firm-peer correlations in daily stock returns over a calendar year. Specifically, we calculate firm and peer returns as the natural logarithm of 1 + ret − spret, where ret is the daily (firm or peer) stock return and spret is the daily return of the S&P500 index. For each firm-year in our sample, we calculate correlations for all potential peers from the population of CRSP firms with non-missing daily returns in a year (4,000–5,000 correlations depending on the year).[5] *CorrD* equals one if a peer is among the top 20 peers with the highest correlations in a given firm-year.

[5] We exclude non-firm entities with daily returns on CRSP such as funds and trusts.

*CorrDP* equals one if a peer is among the top 20 peers in at least one other year during the 1992–2021 sample period.[6]

*CorrW*, *CorrWP* are based on firm-peer correlations in weekly stock returns over a period of five calendar years. We use the same daily returns adjusted for S&P500 as above. We aggregate them into weekly returns with (typically) five trading day periods ending on Wednesday. For each firm-year in our sample, we calculate correlations for all potential peers from the population of CRSP firms with non-missing weekly returns over the current and four prior years (3,000–4,000 correlations depending on the year). *CorrW* equals one if a peer is among the top 20 peers in a given firm-year. *CorrWP* equals one if a peer is among the top 20 peers in at least one other year during the sample period.

*CorrQ*, *CorrQP* are indicator variables based on firm-peer correlations in quarterly sales changes, calculated as ($saleq_q$ - $saleq_{q-1}$)/ $saleq_{q-1}$, over a period of ten calendar years. Given that 1986 is the first year with quarterly data available, we calculate the quarterly correlations starting in 1995, which is the first fiscal year with 40 observations available, including quarterly sales from 1986–1995. For each firm-year in our sample, we calculate correlations for all potential peers from the population of Compustat firms with non-missing quarterly sales over the ten-year period ending with the current year. *CorrQ* equals one if a peer is among the top 20 peers for a given firm-year. *CorrQP* equals one if a peer is among the top 20 peers in at least one other year during the sample period.

*FF48*, *SIC2*, *SIC3* are indicators for a firm-year-peer match in terms of industry classification. *FF48* equals one if both the firm and the peer have the same Fama French 48 industry code in a given fiscal year. *SIC3* is defined similarly for the three-digit SIC classification. *SIC2* equals one if both the firm and the peer have the same SIC2 code but a different SIC3 code.

*Segments* is an indicator variable for a firm-year-peer match in terms of diversification strategy. It equals one if both the firm and the peer are single-segment firms in a given year or if they are both conglomerates, as defined earlier.

[6] For example, if a peer appeared among the top 20 for a given firm in years 1995 and 2000, then *CorrD* = 1 in those two years and *CorrD* = 0 in all other years, whereas *CorrDP* = 1 for all years during the sample period.

*Proximity* is an indicator variable for proximity in terms of geographical location. It equals one if firm and peer headquarters are less 100 miles apart in a given year (it changes over time only in the rare cases where the firm or the peer move their corporate headquarters).

*TNIC* is the product similarity score of Hoberg and Phillips (2016) calculated for each firm-year-peer combination. In particular, we use the TNIC3TSIMM variable from the TNIC3HHI data file.

*TalentFlows* is an indicator variable equal to one if at least one of the named executive officers in Execucomp moved between the firm and the peer in the last five years (Albuquerque et al. 2012).

*LifeCycle* is an indicator variable equal to one if the firm and the peer are in the same life cycle stage, calculated as in Drake and Martin (2020).

*RelSize* is an indicator for firm-year-peer similarity in terms of annual sales. For this calculation, we consider all Compustat firms with sales, total assets, and market value of at least ten million. For each firm-year, we calculate peer relative size ratios as the absolute value of (psale – sale)/sale, where psale stands for annual peer sales and sale stands for firm sales. We use the ratio to split the Compustat population into quartiles. *RelSize* equals one for all peers in the lowest quartile, i.e., for all peers with sales that are relatively close to the sales of the focal firm in a fiscal year.

Third, we use the sample of 21,953,349 firm-year-peer observations with non-missing data on all the variables defined above. This subsample includes 11,793 firm-years and 4,353 unique (potential) peers. We use it to estimate the following peer choice model, where the dependent variable, *Rpeer*, is an indicator that equals one for a peer disclosed by a firm as a compensation or performance benchmarking peer in a given year:[7]

$$\begin{aligned} Rpeer = {} & \beta_1 + \beta_2\, CorrD + \beta_3\, CorrDP + \beta_4\, CorrW + \beta_5\, CorrWP + \beta_6\, CorrQ + \beta_7\, CorrQP + \beta_8\, FF48 + \\ & + \beta_9\, SIC2 + \beta_{10}\, SIC3 + \beta_{11}\, Segments + \beta_{12}\, Proximity + \beta_{13}\, TNIC + \beta_{14}\, TalentFlows + \\ & + \beta_{15}\, LifeCycle + \beta_{16}\, RelSize + \varepsilon . \end{aligned} \tag{1}$$

[7] We have considered other potential determinants of peer choice, including firm-peer similarity in terms of leverage, market-to-book ratio, R&D expenses and advertising expenses as a percentage of total assets, fiscal year end, and financial reporting comparability (De Franco, Kothari, and Verdi 2011). We do not include them in model (1) either because their coefficient estimates are not significantly positive or because increasing similarity does not have a monotonic effect.

Table 2 presents descriptive statistics for all variables in the peer choice model. Table 3 presents Logit estimates of (1).[8] We find that the most important determinants of peer choice are stock return correlations, relative size, and talent flows. Quarterly sales correlations are statistically significant in our model but add less incremental explanatory power. As for industry, the Fama French classification has the most explanatory power, followed by the SIC2 classification. The combined explanatory power of *FF48*, *SIC2*, and *SIC3* is comparable to *TNIC*, which suggests that product similarity scores are important in explaining firms' peer choices. *Segments*, *Proximity,* and *LifeCycle* are also highly statistically significant in the peer choice model. The predicted values from model (1), *Ppeer*, represent the ex ante likelihood of being selected as a peer for a given firm-year. The correlation between *Ppeer* and *Rpeer*, the actual peer choice, is 0.408 ($p < 0.001$).

Fourth, we calculate *Ppeer* for all firm-year-peer observations during 1992–2021 that have nonmissing data on at least one of the firm-peer correlations (*CorrD*, *CorrW*, or *CorrQ*). This is a much larger sample of 237,425,299 firm-year-peer observations, including 43,078 firm-years and 18,665 unique peers. For each firm-year, we then select *Predicted peers* as those with the highest 20 *Ppeer* values.[9] Importantly, this (as well as the next) step no longer uses Incentive Lab data on self-disclosed peers. The coefficient estimates from Table 3, combined with Compustat, CRSP, Execucomp, and TNIC data on the right-hand-side variables in model (1), are sufficient to obtain the set of *Predicted peers* for any firm-year.

Finally, we use the analysis above to construct the following variables with descriptive statistics at the bottom of Table 1. *Predicted* is the firm-year average of *Ppeer* for all 20 *Predicted peers*. *Predicted peer stock return* is calculated the same way as *Firm stock return* (based on annual inflation-adjusted stock returns) and averaged for all *Predicted peers*. *Predicted peer ROA* is calculated as *Firm ROA* and averaged for all *Predicted peers*. As a simplification, we use the same labels as in the case of SIC2-size

[8] Our main findings remain qualitatively unchanged results when we estimate the peer choice model in (1) using OLS or Logit adjusted for rare events (King and Zeng 2001).

[9] Missing values for the right-hand side variables are set to zero, which reduces *Ppeer* and the likelihood of being selected as a predicted peer but does not prevent potential peers with some missing values from being among the top 20.

peers to refer to favorable shocks: *Favorable shock* (*Predicted peer stock*) equals one if *Predicted peer stock return* > 0 and *Favorable shock* (*Predicted peer ROA*) equals one if *Predicted peer ROA* > 0.

**Validation Analysis**

Panel A of Table 4 compares the predictive power of *Ppeer* to several benchmarks. As in Table 1, the unconditional mean of *Rpeer* is only 0.8 percent. However, conditional on being in the same SIC2 industry as the focal firm, the likelihood of being chosen as a peer increases to 8.7 percent. Being in the same SIC2 industry and having the same relative size further increases the likelihood to 20.8 percent. The likelihood is even higher, at 31.3 percent, in the subsample with the highest *Ppeer* values, holding the number of observations constant. Thus, the overlap between self-disclosed peers and *Predicted peers* (based on *Ppeer*) is higher than for SIC2-size peers because the former uses more information about firm-peer characteristics, not just relative size and SIC industry classification.

Panel B of Table 4 examines the extent to which firm own performance can be explained by peer performance measures defined in terms of SIC2-size peers and *Predicted peers*, respectively. To facilitate the comparison, we present standardized coefficients in all regressions and include firm and year fixed effects. Column (1) shows that *Firm stock return* is positively associated with *SIC2-size peer stock return* (0.230, $p < 0.001$) but even more strongly associated with *Predicted peer stock return* (0.409, $p < 0.001$). The within-$R^2$ of 0.217 is also larger than the within-$R^2$ from a regression including only *SIC2-size peer stock return* as a predictor (0.144, untabulated).[10] Column (2) estimates the same regression as column (1) but uses a subsample of observations with high peer information content (*Predicted low* = 0), defined as above-median values of *Predicted*. As expected, the standardized coefficient estimate of *Predicted peer stock return* (0.441, $p < 0.001$) is higher than in column (1) and the within-$R^2$ increases to 0.333.

The increase in explanatory power that comes from using *Predicted peers* is even more pronounced for peer earnings. In an untabulated test, we find that *Firm ROA* is positively associated with *SIC2-size peer ROA* but the within-$R^2$ is only 0.014. Adding *Predicted peer ROA* in column (3) yields a coefficient

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[10] We rely on the within-$R^2$ to measure explanatory power because our main analysis includes firm and year fixed effects and thus removes all between-variation.

estimate that is more than ten times larger and the within-$R^2$ increases from 0.014 to 0.130. This suggests that SIC2-size peers are largely ineffective in capturing within-firm common shocks to ROA. Using *Predicted peers* is a considerable improvement but it is still the case that common shocks to ROA are more difficult to capture than shocks to stock returns. Column (4) uses the subsample of observations with a high peer information content. The within-$R^2$ further increases from 0.130 to 0.215 and the coefficient on *Predicted peer ROA* increases from 0.464 to 0.569 (both $p < 0.001$), whereas the coefficient on *SIC2-size peer ROA* increases only slightly from 0.033 to 0.057 (both $p = 0.001$).

Panel C of Table 4 examines the extent to which *Predicted peer* performance is a leading indicator of future firm performance. As in Panel B, columns (1) and (3) use the full sample of firm-year observations and columns (2) and (4) use subsamples where *Predicted peer* performance has a high information content. Columns (1) and (2) show that peer stock returns do not predict next year's *Firm stock return*$_{t+1}$ because the within-$R^2$ is not meaningfully larger than zero. In contrast, *Predicted peer ROA* does seem to be a leading indicator of next year's *Firm ROA*$_{t+1}$. Specifically, in column (3), the standardized coefficient on *Predicted peer ROA* (0.230, $p < 0.001$) is much larger than the coefficient on *SIC2-size peer ROA* (0.029, $p = 0.010$) and the within-$R^2$ is 0.035. Both coefficients as well as the within-$R^2$ are higher in column (4), which suggests that *Predicted peer* earnings with a high information content can better explain contemporaneous firm earnings as well as better predict future firm earnings.

In summary, Table 4 compares *Predicted peer* performance to the commonly used measure of peer performance from Albuquerque (2009). In all our tests, we find that our new measures of *Predicted peer* performance have considerably more explanatory power. Appendix B presents a comparison with two other measures of peer performance proposed in recent work. We find that our measures of *Predicted peer* performance have more explanatory power than performance of peers based on financial reporting comparability (Lobo et al. 2018; Nam 2020). Peers based on product similarity (Jayaraman et al. 2021) perform slightly better than *Predicted peers* when explaining contemporaneous *Firm stock return* but much worse than *Predicted peers* when explaining *Firm ROA*.

## IV. MAIN FINDINGS

### Peer ROA versus Peer Stock Returns in RPE

To test H1, we estimate a model of *CEO compensation* as a function of firm performance, peer performance, a limited amount of control variables, firm and year fixed effects:[11]

$$\begin{aligned} \textit{CEO Compensation} = {} & \beta_1 + \beta_2 \textit{Firm stock return} + \beta_3 \textit{Firm ROA} + \beta_4 \textit{Peer stock return} + \\ & + \beta_5 \textit{Peer ROA} + \beta_6 \textit{Assets} + \beta_7 \textit{CEO chair} + \beta_8 \textit{Tenure} + \beta_9 \textit{Ownership} + \\ & + \textit{Firm FE} + \textit{Year FE} + \varepsilon. \end{aligned} \tag{2}$$

The well-established finding from the RPE literature is that *CEO compensation* is negatively associated with *Peer stock return*, $\beta_4 < 0$, as a way of filtering out noise and reducing compensation fluctuations due to common shocks to firm and peer performance. H1 predicts that $\beta_5 > \beta_4$ because firm earnings reflect CEO actions with a delay and consequently *Peer ROA* is used not only to filter out noise but also to provide long-term incentives.

Column (1) of Table 5 estimates the RPE model in (2) using SIC2-size peers as in Albuquerque (2009). We use a larger sample with 16 additional years but find similar results. Holding firm own performance constant, CEO compensation is decreasing in peer stock returns but increasing in peer earnings. Column (2) estimates the same regression but presents standardized coefficient estimates for all performance variables to allow for a comparison of the relative magnitudes of their effects. Column (3) uses *Predicted peers* to measure performance and shows largely similar coefficient estimates and $R^2$. Consistent with H1, we find that the difference between the weight on *Predicted peer ROA* and the weight on *Predicted peer stock return* is significantly positive ($\beta_5 - \beta_4 = 0.042$, $p < 0.001$). The difference is even more pronounced in column (2), which means that H1 is supported regardless of whether we use SIC2-size peers or *Predicted peers* for our tests.

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[11] Some prior studies use additional control variables such as firm sales, market value or market-to-book ratio, dividends, and volatility in stock returns. We do not include them in (2) because they are closely related either to firm earnings or to stock returns, which could introduce a bias when estimating the relative importance of stock returns versus ROA.

Table 5 further shows several significant effects of our control variables. Not surprisingly, compensation is higher in larger firms (as measured by total assets) and for CEOs who are also board chairs or have longer tenures. We include these control variables in all our regressions, discussed next, but we do not tabulate them because their effects remain qualitatively unchanged.

**RPE in Conglomerates and Single-Segment Firms**

The theoretical argument motivating H1 is that peer earnings can be used not only for noise filtering but also to strengthen long-term incentives, which calls for a positive or at least a less negative association with CEO compensation than in the case of peer stock returns. H2a predicts that the association between CEO compensation and peer performance is less negative in conglomerates, where long-term incentives are more important than in single-segment firms, because conglomerate CEOs are responsible for the choice of industries they operate in and should therefore be more exposed to random fluctuations or trends in industry performance. H2b predicts that this conglomerate effect will be more pronounced for peer earnings because, as predicted by H1 and corroborated in Table 5, peer stock returns are used relatively more for noise filtering than for long-term incentives.

In the first column of Table 6, we estimate model (2) after adding the main effect of *Conglomerate* and its interactions with *Predicted peer* stock returns and ROA. We find that $\beta_5 - \beta_4 > 0$ both in single-segment firms (0.026, $p = 0.032$) and in conglomerates (0.072, $p < 0.001$), which provides further support for H1 and our theory that peer earnings are used relatively less for noise filtering and more for long-term incentives than peer stock returns. Consistent with H2a and H2b, the first column of Table 6 also shows that the weakly positive weight on *Predicted peer ROA* documented in Table 5 is largely driven by conglomerates (0.040, $p = 0.007$). In single-segment firms, the weight on *Predicted peer ROA* is not significantly different from zero (0.005, $p = 0.554$). As predicted by H2b, the conglomerate effect is more pronounced for *Predicted peer ROA* than for *Predicted peer stock return* (0.045, $p = 0.009$).

Importantly, the second column of Table 6 shows that using only SIC2-size peers would yield no support for H2a or H2b because none of the interactions between *Conglomerate* and peer performance is significantly different from zero (0.005, $p = 0.413$, and 0.009, $p = 0.436$, respectively). This suggests that using more information than just size and industry classification to select peers allows for more refined tests of the theory.

An alternative way to estimate the RPE models in Table 6 is to use *CEO cash compensation* rather than total compensation as the dependent variable. Table C1 in Appendix C shows that the results remain largely unchanged. The only notable difference is that the interaction term of *Conglomerate* with *SIC2-size peer ROA* is significantly positive (0.015, $p = 0.044$), although still much smaller in magnitude than the interaction effect with *Predicted peer ROA* (0.062, $p < 0.001$).

**The RPE Asymmetry**

H3a predicts that long-term incentives are relatively more important in favorable economic environments, whereas the demand for noise-filtering dominates when firms experience unfavorable shocks. H3b predicts that this RPE asymmetry is more pronounced for peer earnings than for peer stock returns because peer earnings can be used as a leading indicator of future firm performance and should have more predictive power during economic expansions. To provide additional evidence consistent with this theoretical motivation, we first extend our validation tests in Panel C of Table 4 by adding an interaction term between *Favorable shock (ROA)* and *Predicted peer ROA*. In untabulated tests, we find that peer earnings strongly predict future firm earnings in favorable environments but have significantly weaker predictive power in unfavorable environments.

The first column of Table 7 presents our tests of H3a and H3b based on estimations that extend model (2) by adding interactions between peer performance and *Favorable shock*. Consistent with H3a, both interactions are highly significant. Specifically, during unfavorable times, the CEO compensation is associated negatively both with *Predicted peer stock return* (–0.053, $p < 0.001$) and *Predicted peer ROA* (–0.023, $p = 0.038$). These associations are significantly higher during favorable times, by 0.049 ($p < 0.001$) for peer stock returns and by 0.154 ($p < 0.001$) for peer ROA. Consistent with H3b, the difference in this asymmetry is also significant (0.154 – 0.049 = 0.105, $p < 0.001$).

The estimates in the first column of Table 7 imply that RPE substantially increases expected CEO compensation. In unfavorable states of the world, *Predicted peer stock return* filters out noise by increasing CEO compensation—if a negative *Predicted peer stock return* decreases by one standard deviation, CEO compensation increases by 5.2 percent. However, the noise-filtering effect is negligible in favorable states of the world—if a positive *Predicted peer stock return* increases by one standard deviation, CEO compensation decreases by only 0.4 percent. This RPE asymmetry is even more pronounced for *Predicted peer ROA*. If a negative *Predicted peer ROA* decreases by one standard deviation, CEO compensation increases by 2.2 percent. If a positive *Predicted peer ROA* increases by one standard deviation, CEO compensation increases by 14.0 percent.

The second column of Table 7 estimates the same model using SIC2-size peers. The results for peer stock returns are similar to those in the first column—CEO compensation is negatively associated with *SIC2-size peer stock return* (–0.050, $p < 0.001$) during unfavorable times and this association is significantly higher during favorable times (by 0.035, $p = 0.010$). However, there is no significant asymmetry in the use of *SIC2-size peer ROA* and the association with CEO compensation is positive both for favorable and unfavorable shocks.

Table C2 in Appendix C shows that the results are slightly different if we use *CEO cash compensation* as the dependent variable. The main finding of a strong RPE asymmetry in the use of *Predicted peer ROA* is qualitatively unchanged. However, we also find a significant asymmetry in in the use of *SIC2-size peer ROA* and no asymmetry in the use of peer stock returns (regardless of the peer group definition).

## V. ADDITIONAL EVIDENCE

We extend our main tests in three ways. First, we provide evidence that the finding of a strong RPE asymmetry in Table 7 is driven by the information content of peer performance rather than by some unobserved confounders. Second, we examine whether the RPE asymmetry, which increases CEO expected compensation, could at least be partly driven by weak corporate governance. Finally, to reduce heterogeneity in how RPE is implemented, we re-estimate our results separately for the subsamples of firms that use explicit RPE incentive grants with pre-specified peer groups and those that do not.

**RPE and Peer Information Content**

Theory predicts that the reliance on peer performance in incentive contracts should be greater when peer performance is more informative about managerial effort and shocks to firm own performance (Holmström 1979). Some firms have many similar peers exposed to the same economic shocks, whereas other firms have few peers and are therefore less likely to rely on RPE (Bloomfield et al. 2022). Our approach to constructing peer groups allows us to measure the availability of peers exposed to similar shocks, which we refer to as peer information content. Specifically, the firm-year average of the predicted values from model (1), *Predicted*, measures the extent to which a firm has many peers in a given fiscal year that are similar in terms of stock return correlations, relative size, talent flows, and other important determinants of peer choice. *Predicted low* is an indicator variable for below-median values of *Predicted* and represents a low peer information content.

Table 8 provides evidence that our main findings are stronger in the subsample of observations with a high information content (*Predicted low* = 0). The first column re-estimates the model from Table 7 in this subsample only. The second column presents similar results in the full sample after including the main and interaction effects of *Predicted low*. The coefficient estimates on *Predicted peer stock return* remain largely unchanged and its interaction effects are insignificant. In contrast, we find that the effect of *Predicted peer ROA* depends on peer information content. When peer performance is highly informative, we find a negative association with CEO compensation in unfavorable times (–0.051, $p < 0.001$) and a positive association in favorable times (–0.051 + 0.195 ≐ 0.143, $p < 0.001$). When peer information content is low, the effect of *Predicted peer ROA* in unfavorable times is less negative (higher by 0.045, $p = 0.006$). Similarly, the increase in the association during favorable times (0.195, $p < 0.001$) is less pronounced when peer information content is low (–0.073, $p = 0.013$). These findings provide at least some reassurance that our main results are driven by differences in the information content of peer performance rather than by some confounders.

**RPE and Corporate Governance**

We further examine whether the RPE asymmetry in Table 7 can at least partly be attributed to weak governance or rent seeking by entrenched CEOs (Bebchuk et al. 2002). RPE could be used as "camouflage" or "stealth compensation" that makes total expected compensation less transparent. The RPE asymmetry and its "failure to filter out windfalls" could be a scheme "designed to benefit executives without being perceived as clearly unreasonable" (Bebchuk and Fried 2003). The role of the board and its compensation committee is to prevent such abuses, so CEO rent seeking is unlikely to fully explain the RPE asymmetry (Albuquerque et al. 2012). However, RPE involves numerous incentive design choices, including the choices of peer group (Bizjak et al. 2008), performance-vesting provisions (Core and Packard 2022), or adjustments to performance measures (Bloomfield, Gipper, Kepler, and Tsui 2021; Curtis, Li, and Patrick 2021), and entrenched CEOs may be able to influence at least some of the choices to their advantage.

To operationalize weak governance, we assume that board monitoring is less effective when boards are larger and board members busier, as in Bloomfield et al. (2022). We measure board busyness as the percentage of board members who serve on at least three other boards. We create indicator variables for observations with (i) the number of board members at or above the sample median and (ii) board busyness at or above the sample median. The data is available for 28,297 firm-year observations and 37.4 percent of them have *Weak governance* with both (i) and (ii) equal to one. The remaining 62.6 percent observations have *Strong governance*, i.e., either a below-median number of board members or below-median board busyness.

Table 9 provides evidence that our main findings are stronger when governance is weak. The first column re-estimates the model from Table 7 in the subsample with weak governance only (*Strong governance* = 0). The second column presents similar results in the full sample after including the main and interaction effects of *Strong governance*. The coefficient estimates on *Predicted peer stock return* remain largely unchanged and its interaction effects are insignificant. In contrast, the effect of *Predicted peer ROA* depends on corporate governance. When governance is weak, the association between CEO compensation and *Predicted peer ROA* is negative in unfavorable times (–0.066, $p = 0.012$) and positive in favorable times (–0.066 + 0.220 = 0.154, $p < 0.001$). When governance is strong, the effect of *Predicted peer ROA* in unfavorable times is less negative (higher by 0.050, $p = 0.049$). Similarly, the increase in the association during favorable times (0.220, $p < 0.001$) is less pronounced when governance is strong (–0.099, $p = 0.008$). These findings suggest that the RPE asymmetry exists even in firms with strong governance, although it is more pronounced when governance is weak and thus may at least partly be related to rent seeking by entrenched CEOs.

**Explicit RPE Incentive Grants**

In our last set of analyses, we examine the extent to which firms use RPE ex post after both firm and peer performance is realized versus rely on explicit RPE incentive grants with ex ante specified peer groups and performance measures. Incentive Lab data on the latter is available for 37.6 percent for our sample. We identify explicit RPE incentive grants as follows. First, we start with all incentive grants in the file "Grants of Plan-Based Awards" that have at least some vesting conditions based on performance relative to peers (labelled as "Rel" or "Abs/Rel") or non-zero relative performance goals (numRelative > 0). Second, we retain only incentive grants with an ex ante specified peer group in the file "Relative Performance Goals" and exclude grants where an index (most commonly S&P500) is used instead of disclosing specific peers. Third, we calculate *RPE grant %* as the sum of the value of all explicit RPE grants to the CEO in a given firm-year divided by the total value of all CEO grants in that year. We find that explicit RPE incentive grants are relatively small on average but increasing over time. Specifically, the average *RPE grant %* is 4.4 percent in the pre-2006 period, 11.3 percent in the post-2006 period, and around 13.3 percent since 2012.

Table 10 examines whether the results in Table 7 depend on how firms implement RPE. The first column excludes all observations with *RPE grant %* > 0. The second column uses these excluded observations to separately estimate a similar model, except that peer performance is calculated based on the peers disclosed in the explicit RPE incentive grants. The third column estimates the results in the subsample of observations from 1992 to 2005, a time period with little or no explicit RPE incentive grants. The results are very similar to those in Table 7, particularly in the first and third columns of Table 10. The second column also shows a significant RPE asymmetry, even though it uses only a small subsample of 2,411 observations with *RPE grant %* > 0 and non-missing data on self-disclosed peer groups. These findings suggest that our main results are unaffected by the heterogeneity in how firms implement RPE.

## VI. DISCUSSION AND SUMMARY

We introduce a new method of identifying peers and measuring peer performance for RPE purposes. In contrast to prior work, we select peers based on multiple firm-peer characteristics including self-disclosed peers, stock-return correlations, quarterly earnings correlations, several types of industry classifications, relative sales, geographical proximity, diversification strategy, talent flows, product and life cycle stage similarity. We find that relative firm size, daily and weekly stock return correlations, and talent flows are the most important determinants of peer choice. Our new measures of peer performance substantially increase the explained within-firm variance in performance relative to measures of SIC2-size peer performance most commonly used in prior work. This is particularly important for measures of peer earnings because the within-firm variance in firm ROA explained by SIC2-size peer earnings is close to zero.

The theoretical motivation of our empirical analysis also contrasts with much of prior work on RPE which derives its predictions from the single-period moral hazard model. We draw on analytical studies of dynamic incentive contracts to argue that multi-period contracts use peer performance not only to filter out noise but also to provide long-term incentives. While prior work shows that noise filtering calls for a negative incentive weight on peer performance, we argue that the incentive weight need not be negative and could even be positive in settings where peer performance is used primarily to incentivize long-term investments. Our empirical analysis tests several hypotheses about the relative importance of noise filtering and long-term incentives.

Specifically, the theory predicts that peer performance measures can facilitate intertemporal matching between investments and their returns and consequently incentivize long-term managerial actions. Contractual demand for long-term incentives or intertemporal matching is greater for performance measures such as earnings that reflect managerial actions with a greater delay (Dutta and Reichelstein 2003). Consistent with the theory, we find that the association between CEO compensation and peer earnings is more positive than the association with peer stock returns. We also show that peer earnings are a leading indicator of future firm performance but peer stock returns are not.

The theory also predicts that the association between CEO compensation and peer performance should be more positive in conglomerates where CEOs have greater control over long-term strategic choices, particularly for peer earnings that are informative about future firm performance. Consistent with the theory, we find that CEO compensation is negatively associated with peer stock returns both in conglomerates and single-segment firms. In contrast, we find a significantly *positive* association between CEO compensation and peer earnings in conglomerates and no association in single-segment firms, which provides further evidence consistent with the theory that the incentive weight on peer performance reflects a trade-off between noise filtering and long-term incentives.

Finally, the theory predicts that noise filtering is the primary purpose of RPE when firms experience unfavorable shocks to their performance. In contrast, in favorable economic environments, the primary purpose of RPE may be to provide long-term incentives and reward strategic repositioning closer to successful peers (Gopalan et al. 2010; Schäfer 2023). This implies that optimal long-term contracts may often feature asymmetric RPE. Using new measures of peer performance, our study provides evidence of an RPE asymmetry much stronger in magnitude than documented in prior work. Our study is also the first to show that the RPE asymmetry is stronger for peer earnings than for peer stock returns, particularly when peer earnings have a high information content.

Our finding of a strong RPE asymmetry relates to the debate on optimal contracting versus rent seeking motives behind CEO incentive design choices (Bebchuk and Fried 2003; Albuquerque et al. 2012). Adjusting CEO compensation for bad luck and at the same time rewarding good luck, as implied by the RPE asymmetry, could be viewed as a difficult-to-detect scheme to enrich entrenched executives. Although we cannot rule out that the asymmetry is at least partly driven by rent seeking, we provide evidence that optimal contracting motives such as the demand for long-term incentives is an equally or more important driver of the RPE asymmetry.

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**TABLE 1. Descriptive Statistics for the Sample Used in the Main Analysis**

| Variable | Obs. | Mean | SD | Q1 | Median | Q3 |
|---|---|---|---|---|---|---|
| *CEO compensation* | 43,849 | 3,230 | 3,564 | 973 | 2,039 | 4,076 |
| *Firm stock return* | 43,849 | 0.056 | 0.407 | -0.137 | 0.089 | 0.283 |
| *Firm ROA* | 43,849 | 0.042 | 0.095 | 0.012 | 0.043 | 0.085 |
| *SIC2-size peer stock return* | 43,797 | 0.074 | 0.259 | -0.052 | 0.094 | 0.224 |
| *Favorable shock* (*SIC2-size peer stock*) | 43,797 | 0.676 | 0.468 | 0.000 | 1.000 | 1.000 |
| *SIC2-size peer ROA* | 41,757 | 0.011 | 0.106 | 0.007 | 0.033 | 0.062 |
| *Favorable shock* (*SIC2-size peer ROA*) | 41,757 | 0.780 | 0.414 | 1.000 | 1.000 | 1.000 |
| *Assets* | 43,848 | 7,271 | 20,290 | 416 | 1,295 | 4,546 |
| *CEO chair* | 43,849 | 0.542 | 0.498 | 0.000 | 1.000 | 1.000 |
| *Tenure* | 43,849 | 8.440 | 7.127 | 3.333 | 6.167 | 11.167 |
| *Ownership* | 42,874 | 0.500 | 0.500 | 0.000 | 0.500 | 1.000 |
| *Conglomerate* | 35,397 | 0.501 | 0.500 | 0.000 | 1.000 | 1.000 |
| *Predicted* | 43,077 | 0.230 | 0.204 | 0.071 | 0.154 | 0.341 |
| *Predicted peer stock return* | 43,077 | 0.037 | 0.261 | -0.088 | 0.070 | 0.201 |
| *Favorable shock* (*Predicted peer stock*) | 43,077 | 0.625 | 0.484 | 0.000 | 1.000 | 1.000 |
| *Predicted peer ROA* | 43,077 | 0.026 | 0.071 | 0.013 | 0.037 | 0.063 |
| *Favorable shock* (*Predicted peer ROA*) | 43,077 | 0.843 | 0.364 | 1.000 | 1.000 | 1.000 |

See Appendix A for variable definitions. Statistics for *CEO Compensation*, *Assets*, and *Tenure* are presented prior to taking the log transformation. The main sample includes up to 43,849 firm-year observations with 1992–2021 data available in Execucomp and Compustat. Lower sample size for some of the variables reflects missing values in additional data sources used.

**TABLE 2. Descriptive Statistics for the Sample used for the Peer Choice Model**

| Variable | Obs. | Mean | SD | Q1 | Median | Q3 |
|---|---|---|---|---|---|---|
| *Rpeer* | 21,953,349 | 0.008 | 0.087 | 0.000 | 0.000 | 0.000 |
| *Ppeer* | 21,953,349 | 0.008 | 0.042 | 0.001 | 0.002 | 0.005 |
| *CorrD* | 21,953,349 | 0.007 | 0.084 | 0.000 | 0.000 | 0.000 |
| *CorrDP* | 21,953,349 | 0.039 | 0.193 | 0.000 | 0.000 | 0.000 |
| *CorrW* | 21,953,349 | 0.008 | 0.089 | 0.000 | 0.000 | 0.000 |
| *CorrWP* | 21,953,349 | 0.031 | 0.173 | 0.000 | 0.000 | 0.000 |
| *CorrQ* | 21,953,349 | 0.007 | 0.086 | 0.000 | 0.000 | 0.000 |
| *CorrQP* | 21,953,349 | 0.025 | 0.155 | 0.000 | 0.000 | 0.000 |
| *FF48* | 21,953,349 | 0.040 | 0.197 | 0.000 | 0.000 | 0.000 |
| *SIC2* | 21,953,349 | 0.023 | 0.149 | 0.000 | 0.000 | 0.000 |
| *SIC3* | 21,953,349 | 0.017 | 0.129 | 0.000 | 0.000 | 0.000 |
| *Segments* | 21,953,349 | 0.195 | 0.396 | 0.000 | 0.000 | 0.000 |
| *Proximity* | 21,953,349 | 0.032 | 0.177 | 0.000 | 0.000 | 0.000 |
| *TNIC* | 21,953,349 | 0.017 | 0.033 | 0.000 | 0.000 | 0.022 |
| *TalentFlow* | 21,953,349 | 0.000 | 0.011 | 0.000 | 0.000 | 0.000 |
| *LifeCycle* | 21,953,349 | 0.403 | 0.490 | 0.000 | 0.000 | 1.000 |
| *RelSize* | 21,953,349 | 0.250 | 0.433 | 0.000 | 0.000 | 1.000 |

Table 2 presents descriptive statistics for the sample of all firm-year-peer observations with non-missing 1998–2021 data on the variables used in the estimation of the peer choice model. It includes 11,793 firm-years and 4,353 unique (potential) peers. See Appendix A for variable definitions.

**TABLE 3. Peer Choice Model**

| | *Rpeer* | |
|---|---|---|
| | Coefficient | *t* -statistic |
| *Intercept* | -6.857 | 140.900 |
| *CorrD* | 0.750 | 32.570 |
| *CorrDP* | 1.542 | 33.660 |
| *CorrW* | 0.480 | 17.460 |
| *CorrWP* | 0.758 | 19.970 |
| *CorrQ* | 0.295 | 7.720 |
| *CorrQP* | 0.392 | 8.720 |
| *FF48* | 1.014 | 9.570 |
| *SIC2* | 0.631 | 6.000 |
| *SIC3* | 0.275 | 2.400 |
| *Segments* | 0.699 | 15.320 |
| *Proximity* | 0.702 | 14.320 |
| *TNIC* | 8.802 | 16.830 |
| *TalentFlow* | 1.519 | 8.700 |
| *LifeCycle* | 0.301 | 14.740 |
| *RelSize* | 1.626 | 40.090 |
| Pseudo - $R^2$ | | 0.333 |
| Observations | | 21,953,349 |

Table 3 presents Logit model estimates from the sample described in Table 2. The dependent variable, *Rpeer*, equals one if a potential peer is listed by a firm as a compensation or performance benchmarking peer in a given year (firm-years without Incentive Lab data on peers are dropped from the sample). See Appendix A for variable definitions.

**TABLE 4. Validation Analysis**

**Panel A. The Likelihood of Selecting Peers with Different Characteristics**

| Variable - statistic reported | Obs. | Mean |
|---|---|---|
| *Rpeer* - mean for all potential peers | 21,953,349 | 0.008 |
| *Rpeer* - mean for peers with the same SIC2 code | 868,927 | 0.087 |
| *Rpeer* - mean for peers with the same SIC2 code and *RelSize* quartile | 229,088 | 0.208 |
| *Rpeer* - mean for *Predicted peers* with the highest *Ppeer* values | 229,089 | 0.313 |

Panel A reports the unconditional mean of *Rpeer* (which equals one when a potential peer is listed by a firm as a compensation or performance benchmarking peer in a given year) in the sample used in Tables 2 and 3 as well as conditional means for various subsamples from the full sample of 21,953,349 firm-year-peer observations.

**Panel B. Contemporaneous Associations between Firm and Peer Performance**

| | *Firm stock return $_t$* | | *Firm ROA $_t$* | |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| *SIC2-size peer stock return $_t$* | 0.230 *** | 0.244 *** | | |
| | (0.000) | (0.000) | | |
| *Predicted peer stock return $_t$* | 0.409 *** | 0.441 *** | | |
| | (0.000) | (0.000) | | |
| *SIC2-size peer ROA $_t$* | | | 0.033 ** | 0.057 *** |
| | | | (0.001) | (0.001) |
| *Predicted peer ROA $_t$* | | | 0.464 *** | 0.569 *** |
| | | | (0.000) | (0.000) |
| Standardized coefficients | Yes | Yes | Yes | Yes |
| Year fixed effects | Yes | Yes | Yes | Yes |
| Firm fixed effects | Yes | Yes | Yes | Yes |
| Within - $R^2$ | 0.217 | 0.333 | 0.130 | 0.215 |
| $R^2$ | 0.411 | 0.516 | 0.514 | 0.562 |
| Observations | 42,883 | 21,403 | 40,838 | 20,651 |

***, ** represent significance at the 0.001 and 0.010 levels using standard errors clustered at the firm level. Panel B examines the extent to which firm performance is contemporaneously correlated with alternative measures of peer performance. Columns (1) and (3) use the sample of firm-year observations described in Table 1. Columns (2) and (4) use a subsample with a high peer information content (above-median values of *Predicted*). Within-$R^2$ is the percentage of variance explained that is not due to firm or year fixed effects. All variables are standardized to have zero mean and variance of one to facilitate comparisons. See Appendix A for variable definitions.

**TABLE 4. Validation Analysis (Cont'd)**

**Panel C. Associations between Peer Performance and Future Firm Performance**

| | *Firm stock return* $_{t+1}$ | | *Firm ROA* $_{t+1}$ | |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| *SIC2-size peer stock return* $_t$ | -0.073 *** | -0.085 *** | | |
| | (0.000) | (0.000) | | |
| *Predicted peer stock return* $_t$ | 0.003 | 0.003 | | |
| | (0.819) | (0.841) | | |
| *SIC2-size peer ROA* $_t$ | | | 0.029 * | 0.081 *** |
| | | | (0.010) | (0.000) |
| *Predicted peer ROA* $_t$ | | | 0.230 *** | 0.274 *** |
| | | | (0.000) | (0.000) |
| Standardized coefficients | Yes | Yes | Yes | Yes |
| Year fixed effects | Yes | Yes | Yes | Yes |
| Firm fixed effects | Yes | Yes | Yes | Yes |
| Within - $R^2$ | 0.004 | 0.005 | 0.035 | 0.061 |
| $R^2$ | 0.268 | 0.293 | 0.484 | 0.493 |
| Observations | 34,768 | 17,820 | 33,144 | 17,184 |

***, * represent significance at the 0.001 and 0.050 levels using standard errors clustered at the firm level. Panel C examines the extent to which alternative measures of peer performance predict next year's firm performance. Columns (1) and (3) use the sample of firm-year observations described in Table 1. Columns (2) and (4) use a subsample with a high peer information content (above-median values of *Predicted*). Within-$R^2$ is the percentage of variance explained that is not due to firm or year fixed effects. All variables are standardized to have zero mean and variance of one to facilitate comparisons. See Appendix A for variable definitions.

**TABLE 5. Peer ROA versus Peer Stock Returns in RPE**

| | *CEO compensation* | | |
|---|---|---|---|
| | (1) | (2) | (3) |
| | SIC2-size peers | SIC2-size peers | Predicted peers |
| *Firm stock return* | 0.156 *** | 0.064 *** | 0.063 *** |
| | (0.000) | (0.000) | (0.000) |
| *Firm ROA* | 0.745 *** | 0.071 *** | 0.072 *** |
| | (0.000) | (0.000) | (0.000) |
| *Peer stock return* | -0.082 *** | -0.021 *** | -0.019 *** |
| | (0.000) | (0.000) | (0.000) |
| *Peer ROA* | 0.288 *** | 0.030 *** | 0.023 ** |
| | (0.000) | (0.000) | (0.002) |
| *Assets* | 0.364 *** | 0.364 *** | 0.365 *** |
| | (0.000) | (0.000) | (0.000) |
| *CEO chair* | 0.044 *** | 0.044 *** | 0.040 ** |
| | (0.001) | (0.001) | (0.002) |
| *Tenure* | 0.033 *** | 0.033 *** | 0.036 *** |
| | (0.000) | (0.000) | (0.000) |
| *Ownership* | 0.020 | 0.020 | 0.023 |
| | (0.136) | (0.136) | (0.091) |
| Standardized coefficients | No | Yes | Yes |
| Year fixed effects | Yes | Yes | Yes |
| Firm fixed effects | Yes | Yes | Yes |
| Within - $R^2$ | 0.119 | 0.119 | 0.118 |
| $R^2$ | 0.741 | 0.741 | 0.738 |
| Observations | 40,654 | 40,654 | 41,958 |

***,** represent significance at the 0.001 and 0.010 levels, respectively, using standard errors clustered at the firm level. Table 5 estimates a model of *CEO compensation* as a function of firm performance, peer performance, and control variables. Column (1) presents coefficient estimates using *SIC2-size peer stock return* and *SIC2-size peer ROA*. Column (2) estimates the same model as column (1) but presents standardized coefficient estimates for all performance variables to allow for a comparison of the relative magnitudes of their effects. Column (3) uses *Predicted peer stock return* and *Predicted peer ROA* and presents their standardized coefficients. Within-$R^2$ is the percentage of variance explained that is not due to firm or year fixed effects. See Appendix A for variable definitions.

**TABLE 6. RPE in Conglomerates and Single-Segment Firms**

| | *CEO compensation* | |
|---|---|---|
| | Predicted peers | SIC2-size peers |
| *Firm stock return* | 0.064 *** | 0.064 *** |
| | (0.000) | (0.000) |
| *Firm ROA* | 0.075 *** | 0.072 *** |
| | (0.000) | (0.000) |
| *Conglomerate* | 0.007 | 0.017 |
| | (0.706) | (0.355) |
| *Peer stock return* | -0.021 ** | -0.028 *** |
| | (0.001) | (0.000) |
| *Peer stock return · Conglomerate* | -0.006 | 0.005 |
| | (0.422) | (0.413) |
| *Peer ROA* | 0.005 | 0.027 ** |
| | (0.554) | (0.002) |
| *Peer ROA · Conglomerate* | 0.040 ** | 0.009 |
| | (0.007) | (0.436) |
| Control variables | Yes | Yes |
| Year fixed effects | Yes | Yes |
| Firm fixed effects | Yes | Yes |
| Within - $R^2$ | 0.123 | 0.124 |
| $R^2$ | 0.740 | 0.744 |
| Observations | 33,729 | 32,609 |

***,** represent significance at the 0.001 and 0.010 levels, respectively, using standard errors clustered at the firm level. We estimate an extended model of *CEO compensation* using the same control variables as in Table 5. *Peer stock return* (*ROA*) represent *Predicted peer stock return* (*ROA*) in the first column and *SIC2-size peer stock return* (*ROA*) in the second column. Within-$R^2$ is the percentage of variance explained that is not due to firm or year fixed effects. See Appendix A for variable definitions.

**TABLE 7. The RPE Asymmetry**

| | *CEO compensation* | |
|---|---|---|
| | Predicted peers | SIC2-size peers |
| *Firm stock return* | 0.063 *** | 0.064 *** |
| | (0.000) | (0.000) |
| *Firm ROA* | 0.071 *** | 0.070 *** |
| | (0.000) | (0.000) |
| *Peer stock return* | -0.053 *** | -0.050 *** |
| | (0.000) | (0.000) |
| *Favorable shock (stock)* | 0.025 * | 0.029 * |
| | (0.010) | (0.010) |
| *Peer stock return · Favorable shock (stock)* | 0.049 *** | 0.035 ** |
| | (0.000) | (0.010) |
| *Peer ROA* | -0.023 * | 0.020 * |
| | (0.038) | (0.013) |
| *Favorable shock (ROA)* | 0.035 * | 0.027 * |
| | (0.042) | (0.030) |
| *Peer ROA · Favorable shock (ROA)* | 0.154 *** | 0.029 |
| | (0.000) | (0.117) |
| Control variables | Yes | Yes |
| Year fixed effects | Yes | Yes |
| Firm fixed effects | Yes | Yes |
| Within - $R^2$ | 0.123 | 0.119 |
| $R^2$ | 0.740 | 0.741 |
| Observations | 41,958 | 40,654 |

***, **, * represent significance at the 0.001, 0.010, and 0.050 levels, respectively, using standard errors clustered at the firm level. We estimate an extended model of *CEO compensation* using the same control variables as in Table 5. *Peer stock return* (*ROA*) represent *Predicted peer stock return* (*ROA*) in the first column and *SIC2-size peer stock return* (*ROA*) in the second column. Within-$R^2$ is the percentage of variance explained that is not due to firm or year fixed effects. See Appendix A for variable definitions.

**TABLE 8. The RPE Asymmetry and Peer Information Content**

| | *CEO compensation* | |
|---|---|---|
| | Predicted peers | Predicted peers |
| *Firm stock return* | 0.070 *** | 0.063 *** |
| | (0.000) | (0.000) |
| *Firm ROA* | 0.088 *** | 0.071 *** |
| | (0.000) | (0.000) |
| *Peer stock return* | -0.066 *** | -0.058 *** |
| | (0.000) | (0.000) |
| *Favorable shock (stock)* | 0.035 ** | 0.023 |
| | (0.009) | (0.067) |
| *Peer stock return · Favorable shock* | 0.050 ** | 0.050 ** |
| | (0.006) | (0.003) |
| *Peer ROA* | -0.058 ** | -0.051 *** |
| | (0.001) | (0.001) |
| *Favorable shock (ROA)* | 0.082 ** | 0.073 ** |
| | (0.002) | (0.005) |
| *Peer ROA · Favorable shock (ROA)* | 0.179 *** | 0.195 *** |
| | (0.000) | (0.000) |
| *Predicted low* | | 0.021 |
| | | (0.594) |
| *Peer stock return · Predicted low* | | 0.013 |
| | | (0.376) |
| *Favorable shock (stock) · Predicted low* | | 0.002 |
| | | (0.901) |
| *Peer stock return · Favorable shock (stock) · Predicted Low* | | -0.007 |
| | | (0.754) |
| *Peer ROA · Predicted low* | | 0.045 ** |
| | | (0.006) |
| *Favorable shock (ROA) · Predicted low* | | -0.059 |
| | | (0.070) |
| *Peer ROA · Favorable shock (ROA) · Predicted low* | | -0.073 * |
| | | (0.013) |
| Control variables | Yes | Yes |
| Year fixed effects | Yes | Yes |
| Firm fixed effects | Yes | Yes |
| Within - $R^2$ | 0.106 | 0.124 |
| $R^2$ | 0.741 | 0.740 |
| Observations | 21,022 | 41,958 |

***, **, * represent significance at the 0.001, 0.010, and 0.050 levels, respectively, using standard errors clustered at the firm level. The first column estimates the same model as Table 7 in the subsample of observations with a high peer information content (*Predicted low* = 0). The second column presents similar results in the full sample after including the main and interaction effects of *Predicted low*.
*Predicted low* is an indicator for below-median predicted values from model (1), which capture the ex ante likelihood of being listed as a peer in the proxy statement. See Appendix A for other variable definitions.

**TABLE 9. The RPE Asymmetry and Corporate Governance**

| | *CEO compensation* | |
|---|---|---|
| | Predicted peers | Predicted peers |
| *Firm stock return* | 0.054 *** | 0.057 *** |
| | (0.000) | (0.000) |
| *Firm ROA* | 0.082 *** | 0.056 *** |
| | (0.000) | (0.000) |
| *Peer stock return* | -0.048 * | -0.050 ** |
| | (0.041) | (0.002) |
| *Favorable shock (stock)* | 0.016 | 0.011 |
| | (0.403) | (0.510) |
| *Peer stock return · Favorable shock* | 0.051 | 0.056 * |
| | (0.078) | (0.013) |
| *Peer ROA* | -0.082 * | -0.066 * |
| | (0.017) | (0.012) |
| *Favorable shock (ROA)* | 0.105 * | 0.086 * |
| | (0.012) | (0.020) |
| *Peer ROA · Favorable shock (ROA)* | 0.191 *** | 0.220 *** |
| | (0.000) | (0.000) |
| *Strong governance* | | 0.036 |
| | | (0.417) |
| *Peer stock return · Strong governance* | | -0.007 |
| | | (0.670) |
| *Favorable shock (stock) · Strong governance* | | 0.021 |
| | | (0.328) |
| *Peer stock return · Favorable shock (stock) · Strong governance* | | 0.007 |
| | | (0.783) |
| *Peer ROA · Strong governance* | | 0.050 * |
| | | (0.049) |
| *Favorable shock (ROA) · Strong governance* | | -0.044 |
| | | (0.279) |
| *Peer ROA · Favorable shock (ROA) · Strong governance* | | -0.099 ** |
| | | (0.008) |
| Control variables | Yes | Yes |
| Year fixed effects | Yes | Yes |
| Firm fixed effects | Yes | Yes |
| Within - $R^2$ | 0.075 | 0.104 |
| $R^2$ | 0.734 | 0.760 |
| Observations | 10,354 | 28,297 |

***, **, * represent significance at the 0.001, 0.010, and 0.050 levels, respectively, using standard errors clustered at the firm level. The first column estimates the same model as Table 7 in the subsample of observations with weak governance (*Strong governance* = 0), as reflected in compensation committees having a large (above-median) number of members and many (above-median percentage) busy members. The second column presents similar results in the full sample after including the main and interaction effects of *Strong governance*.

**TABLE 10. The RPE Asymmetry and Explicit RPE Incentive Grants**

| | *CEO compensation* | | |
|---|---|---|---|
| | Predicted peers | Disclosed peers | Predicted peers |
| *Firm stock return* | 0.063 *** | 0.049 ** | 0.069 *** |
| | (0.000) | (0.002) | (0.000) |
| *Firm ROA* | 0.070 *** | 0.063 ** | 0.091 *** |
| | (0.000) | (0.002) | (0.000) |
| *Peer stock return* | -0.051 *** | -0.020 | -0.058 *** |
| | (0.000) | (0.391) | (0.000) |
| *Favorable shock (stock)* | 0.024 * | -0.009 | 0.020 |
| | (0.021) | (0.746) | (0.196) |
| *Peer stock return · Favorable shock (stock)* | 0.048 *** | -0.011 | 0.034 |
| | (0.001) | (0.773) | (0.087) |
| *Peer ROA* | -0.019 | -0.050 * | -0.017 |
| | (0.098) | (0.031) | (0.351) |
| *Favorable shock (ROA)* | 0.035 | 0.114 * | -0.008 |
| | (0.053) | (0.041) | (0.792) |
| *Peer ROA · Favorable shock (ROA)* | 0.154 *** | 0.113 ** | 0.192 *** |
| | (0.000) | (0.004) | (0.000) |
| Control variables | Yes | Yes | Yes |
| Year fixed effects | Yes | Yes | Yes |
| Firm fixed effects | Yes | Yes | Yes |
| Within - $R^2$ | 0.121 | 0.082 | 0.098 |
| $R^2$ | 0.731 | 0.772 | 0.745 |
| Observations | 38,481 | 2,411 | 17,796 |

***, **, * represent significance at the 0.001, 0.010, and 0.050 levels, respectively, using standard errors clustered at the firm level. The first column estimates the same model as Table 7 after excluding observations with explicit RPE incentive grants listed in Incentive Lab. The second presents the estimation results for the observations excluded from the first column. Peer performance is calculated using the peers disclosed in the explicit RPE incentive grants. The third column uses the subsample of observations from 1992 to 2005, a time period with little or no explicit RPE incentive grants.

## APPENDIX A

| Variable | Definition |
|---|---|
| *CEO compensation* | natural logarithm of 1 + tdc1, where tdc1 is total CEO compensation (in $ thousands). |
| *Firm stock return* | natural logarithm of [(1 + ret / 100) / (1 + cpi)], where ret is the compounded annual stock return obtained from monthly data and cpi is the rate of inflation. |
| *Firm ROA* | natural logarithm of (1 + ib / at), where ib is income before extraordinary items and at are beginning-of-year total assets, both adjusted for inflation. |
| *Peer stock return* (*SIC2-size*) | peer returns are calculated as in *Firm stock return* and averaged for all peers with the same SIC2 code and size quartile. |
| *Favorable shock* (*peer stock*) | an indicator for *Peer stock return* > 0. |
| *Peer ROA* (*SIC2-size*) | peer ROA is calculated as in *Firm ROA* and averaged for all peers with the same SIC2 code and size quartile. |
| *Favorable shock* (*peer ROA*) | an indicator for *Peer ROA* > 0. |
| *Assets* | natural logarithm of total assets (in $ millions). |
| *CEO chair* | an indicator for CEO being also the board chair. |
| *Tenure* | natural logarithm of the number of years since the CEO took office. |
| *Ownership* | an indicator for an above-median percentage of shares owned by the CEO. |
| *Conglomerate* | an indicator for firms with positive sales and assets in more than one SIC3 code. |
| *Predicted low* | an indicator for below-median value of *Predicted* (defined below). |
| *Strong governance* | an indicator for compensation committees with below-median number of members or below-median percentage of busy members. |
| Variables used in the peer choice model in Table 3 | |
| *Rpeer* | an indicator for a peer disclosed by a firm as a compensation or performance benchmarking peer in a given year. |
| *Ppeer* | predicted value from the peer choice model in (1), i.e., the ex ante likelihood of being listed as a peer in the proxy statement of a firm-year. |
| *CorrD* | an indicator for a peer with one of the 20 highest correlations between firm and peer daily stock returns in a given firm-year. |
| *CorrDP* | an indicator for a peer with *CorrD* = 1 in at least one other year during the 1992–2021 sample period. |
| *CorrW* | an indicator for a peer with one of the 20 highest correlations between firm and peer weekly stock returns over a period of five calendar years ending with the current year. |
| *CorrWP* | an indicator for a peer with *CorrW* = 1 in at least one other year during the 1992–2021 sample period. |

| | |
|---|---|
| *CorrQ* | an indicator for a peer with one of the 20 highest correlations between firm and peer correlations in quarterly sales changes over a period of ten calendar years ending with the current year. |
| *CorrQP* | an indicator for a peer with *CorrQ* = 1 in at least one other year during the 1992–2021 sample period. |
| *FF48* | an indicator for a firm-year-peer match in the Fama French 48 code. |
| *SIC2* | an indicator for a firm-year-peer match in SIC2 and a different SIC3. |
| *SIC3* | an indicator for a firm-year-peer match in SIC3. |
| *Segments* | an indicator for a firm-year-peer match in diversification strategy, i.e., in both being single-segment firms or both being conglomerates in a given year. |
| *Proximity* | an indicator for firm-year-peer headquarters distance less 100 miles. |
| *TNIC* | firm-year-peer product similarity score from Hoberg and Phillips (2016). |
| *TalentFlows* | an indicator equal to one if at least one of the named executive officers in Execucomp moved between the firm and the peer in the last five years. |
| *LifeCycle* | an indicator equal to one if the firm and the peer are in the same life cycle stage. |
| *RelSize* | an indicator for firm-year-peer similarity in terms of annual sales, i.e., the lowest quartile of the absolute value of (psale – sale)/sale, where psale stands for annual peer sales and sale stands for firm sales. |
| Variables defined based on the peer choice model | |
| *Predicted* | firm-year average of *Ppeer* for the 20 highest predicted values from model (1). |
| *Peer stock return* (*Predicted*) | peer performance calculated as in *Firm stock return* and averaged for the 20 peers with the highest *Ppeer* for a given firm-year. |
| *Peer ROA* (*Predicted*) | peer performance calculated as in *Firm ROA* and averaged for the 20 peers with the highest *Ppeer* for a given firm-year. |

# APPENDIX B

**Alternative Measures of Peer Performance**

The main analysis compares our measures of *Predicted peer* performance to the most commonly used measures of peer performance defined in terms of SIC2-size. Several recent studies show that using other information to define peers can increase the power of empirical tests, even though the additional data requirements reduce the sample size available for estimation. In what follows, we discuss two such alternative measures of peer performance and present validation results similar to those in Table 4.

We define *ALT1 peer stock return* and *ALT1 peer ROA* as in Nam (2020) using the measure of financial reporting comparability (FRC) from De Franco et al. (2011). Specifically, from each SIC2-size peer group, we select those that have the highest quartile of FRC and from this subset further select the top ten peers (minimum of five) that are closest to the focal firm in terms of market value.

We define *ALT2 peer stock return* and as in Jayaraman et al. (2021) using the measure of product similarity from Hoberg and Phillips (2016). Specifically, we start from the peer groups defined by the text-based network industry classifications of Hoberg and Phillips (2016). We then select one quarter of the peer group (minimum of two peers) that is closest to the focal firm in terms of Mahalanobis distance calculated from market value and book-to-market ratio. *ALT2 peer ROA* is calculated as all other peer ROA measures using the same peer groups as *ALT2 peer stock return*.

**Validation Results**

Table B1 shows that *Predicted peer stock return* performs much better than *ALT1 peer stock return* when explaining *Firm stock return*, particularly in column (2), which uses the subsample of *Predicted peers* with a high information content. *Predicted peer ROA* also has slightly higher standardized coefficients than *ALT1 peer ROA* when explaining *Firm ROA* in columns (3) and (4). Both measures of peer earnings are significant predictors of next year's firm earnings but *Predicted peer ROA* performs better, particularly in the high information content subsample in column (6).

Table B2 shows that *ALT2 peer stock return* performs slightly better than *Predicted peer stock return* in columns (1) and (2) but much worse in all other tests. Specifically, in column (1), the standardized coefficient estimates for the contemporaneous association between *Firm stock return* and *ALT2 peer stock return* is 0.390 ($p < 0.001$) as compared to 0.312 ($p < 0.001$) for *Predicted peer stock return*. The difference is less pronounced in column (2). However, the standardized coefficient estimates for *Predicted peer ROA* are several times larger than those for *ALT2 peer ROA* in columns (3)–(6), which suggests that *ALT2 peer ROA* has much less information content about current and future firm earnings.

**TABLE B1. Validation Analysis with Peers Based on Financial Reporting Comparability**

| | *Firm stock return $_t$* | | *Firm ROA $_t$* | | *Firm ROA $_{t+1}$* | |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| *ALT1 peer stock return $_t$* | 0.079 *** | 0.055 *** | | | | |
| | (0.000) | (0.000) | | | | |
| *Predicted peer stock return $_t$* | 0.498 *** | 0.556 *** | | | | |
| | (0.000) | (0.000) | | | | |
| *ALT1 peer ROA $_t$* | | | 0.275 *** | 0.248 *** | 0.114 *** | 0.115 *** |
| | | | (0.000) | (0.000) | (0.000) | (0.000) |
| *Predicted peer ROA $_t$* | | | 0.313 *** | 0.394 *** | 0.146 *** | 0.207 *** |
| | | | (0.000) | (0.000) | (0.000) | (0.000) |
| Standardized coefficients | Yes | Yes | Yes | Yes | Yes | Yes |
| Year fixed effects | Yes | Yes | Yes | Yes | Yes | Yes |
| Firm fixed effects | Yes | Yes | Yes | Yes | Yes | Yes |
| Within - $R^2$ | 0.222 | 0.328 | 0.201 | 0.278 | 0.038 | 0.069 |
| $R^2$ | 0.441 | 0.535 | 0.555 | 0.607 | 0.486 | 0.513 |
| Observations | 21,611 | 12,814 | 21,611 | 12,814 | 17,492 | 10,579 |

*** represent significance at the 0.001 level using standard errors clustered at the firm level. The validation tests presented are similar to those in Table 4. *ALT1 peer stock return* is defined as in Nam (2020) based on financial reporting comparability. See Appendix A for other variable definitions. Columns (1), (3), and (5) use all available observations from 1992–2021. Columns (2), (4), and (6) use subsamples with a high peer information content (above-median values of *Predicted*).

**TABLE B2. Validation Analysis with Peers Based on Product Similarity**

| | *Firm stock return* $_t$ | | *Firm ROA* $_t$ | | *Firm ROA* $_{t+1}$ | |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| *ALT2 peer stock return* $_t$ | 0.390 *** | 0.384 *** | | | | |
| | (0.000) | (0.000) | | | | |
| *Predicted peer stock return* $_t$ | 0.312 *** | 0.349 *** | | | | |
| | (0.000) | (0.000) | | | | |
| *ALT2 size peer ROA* $_t$ | | | 0.119 *** | 0.159 *** | 0.063 *** | 0.109 *** |
| | | | (0.000) | (0.000) | (0.000) | (0.000) |
| *Predicted peer ROA* $_t$ | | | 0.459 *** | 0.555 *** | 0.219 *** | 0.266 *** |
| | | | (0.000) | (0.000) | (0.000) | (0.000) |
| Standardized coefficients | Yes | Yes | Yes | Yes | Yes | Yes |
| Year fixed effects | Yes | Yes | Yes | Yes | Yes | Yes |
| Firm fixed effects | Yes | Yes | Yes | Yes | Yes | Yes |
| Within - $R^2$ | 0.290 | 0.371 | 0.150 | 0.230 | 0.037 | 0.060 |
| $R^2$ | 0.472 | 0.546 | 0.536 | 0.570 | 0.502 | 0.491 |
| Observations | 28,696 | 16,401 | 28,688 | 16,400 | 23,350 | 13,672 |

*** represent significance at the 0.001 level using standard errors clustered at the firm level. The validation tests presented are similar to those in Table 4. *ALT2 peer stock return* is defined as in Jayaraman et al. (2021) based on product similarity. See Appendix A for other variable definitions. Columns (1), (3), and (5) use all available observations from 1992–2021. Columns (2), (4), and (6) use subsamples with a high peer information content (above-median values of *Predicted*).

## APPENDIX C

**TABLE C1. CEO Cash Compensation and RPE in Conglomerates**

| | *CEO cash compensation* | |
|---|---|---|
| | Predicted peers | SIC2-size peers |
| *Firm stock return* | 0.098 *** | 0.097 *** |
| | (0.000) | (0.000) |
| *Firm ROA* | 0.076 *** | 0.082 *** |
| | (0.000) | (0.000) |
| *Conglomerate* | 0.015 | 0.022 |
| | (0.336) | (0.175) |
| *Peer stock return* | -0.019 *** | -0.018 *** |
| | (0.000) | (0.000) |
| *Peer stock return · Conglomerate* | 0.003 | 0.006 |
| | (0.607) | (0.161) |
| *Peer ROA* | 0.020 ** | 0.011 |
| | (0.002) | (0.060) |
| *Peer ROA · Conglomerate* | 0.067 *** | 0.017 * |
| | (0.000) | (0.029) |
| Control variables | Yes | Yes |
| Year fixed effects | Yes | Yes |
| Firm fixed effects | Yes | Yes |
| Within - $R^2$ | 0.171 | 0.167 |
| $R^2$ | 0.777 | 0.779 |
| Observations | 33,607 | 32,450 |

***, **, * represent significance at the 0.001, 0.010, and 0.050 levels, respectively, using standard errors clustered at the firm level. We estimate the same model as in Table 6 except that the dependent variable is *CEO cash compensation*, defined as salary, bonus, long-term incentive payouts (before 2007), and non-equity incentive plan payouts (after 2006). See Appendix A for other variable definitions.

**TABLE C2. CEO Cash Compensation and the RPE Asymmetry**

| | *CEO cash compensation* | |
|---|---|---|
| | Predicted peers | SIC2-size peers |
| *Firm stock return* | 0.099 *** | 0.099 *** |
| | (0.000) | (0.000) |
| *Firm ROA* | 0.072 *** | 0.078 *** |
| | (0.000) | (0.000) |
| *Peer stock return* | -0.026 *** | -0.028 *** |
| | (0.000) | (0.000) |
| *Favorable shock (stock)* | 0.015 * | 0.021 ** |
| | (0.026) | (0.008) |
| *Peer stock return · Favorable shock (stock)* | -0.001 | 0.007 |
| | (0.897) | (0.496) |
| *Peer ROA* | -0.021 ** | 0.003 |
| | (0.002) | (0.544) |
| *Favorable shock (ROA)* | 0.084 *** | 0.022 * |
| | (0.000) | (0.018) |
| *Peer ROA · Favorable shock (ROA)* | 0.158 *** | 0.061 *** |
| | (0.000) | (0.000) |
| Control variables | Yes | Yes |
| Year fixed effects | Yes | Yes |
| Firm fixed effects | Yes | Yes |
| Within - $R^2$ | 0.169 | 0.161 |
| $R^2$ | 0.769 | 0.767 |
| Observations | 41,809 | 40,472 |

***, **, * represent significance at the 0.001, 0.010, and 0.050 levels, respectively, using standard errors clustered at the firm level. We estimate the same model as in Table 7 except that the dependent variable is *CEO cash compensation*, defined as salary, bonus, long-term incentive payouts (before 2007), and non-equity incentive plan payouts (after 2006). See Appendix A for other variable definitions.