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Accounting comparability and relative performance evaluation in CEO compensation

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Abstract We investigate whether accounting comparability is associated with the likelihood that CEO compensation is tied to relative accounting performance (e.g., return on assets). We predict that higher accounting comparability increases the risk-sharing benefit of accounting-based RPE because peer firm performance better controls for common risk in RPE firm performance. Thus, firms that have higher accounting comparability with potential performance peers will be more likely to include accounting-based RPE as a component of the total CEO compensation contract. We find support for this prediction using (1) an explicit test design that relies on the ex ante terms of CEO compensation contracts obtained from proxy disclosures, and (2) an implicit design that relies on the actual realizations of CEO compensation. To provide further evidence, we examine the association between accounting comparability and the selection of performance peers when the CEO compensation contract includes an accounting-based RPE component. We find that higher comparability between the RPE firm and a potential peer firm increases (decreases) the potential peer firm's likelihood of being selected into (dropped from) the peer group. Cross-sectional analyses show that this association is less pronounced, or not present, when the relative performance measure is price-based (as opposed to accounting-based), indicating that these results do not merely reflect a more general role of comparability in all RPE contracts.

Keywords Accounting comparability · Relative performance evaluation · RPE · Peer selection

JEL Classification M12 · M41

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1 Introduction

This study examines the role of accounting comparability in the CEO's relative performance evaluation (RPE) contract. We argue that the implementation of accounting-based RPE in CEO compensation relies on identifying peers with both similar economics *and* similar accounting. Our results indicate that firms with more comparable accounting to their peers are more likely to implement an accounting-based RPE contract. Additionally, when the CEO's contract includes accounting-based RPE, the RPE peer group comprises firms whose accounting is more comparable to that of the contracting firm. These findings are important for several reasons. First, we provide initial evidence on how accounting comparability relates to internal decision-making and the contractibility of accounting performance. Second, our findings illustrate factors that influence the decision to implement accounting-based RPE in the CEO's contract. Third, we demonstrate that implicit tests of accounting-based RPE are better specified when the peer group is identified based on similar economics *and* more comparable accounting.

In constructing the manager's contract, boards choose between multiple measures to capture manager effort. Boards tie CEO compensation to price-based measures of performance when price provides a contractible signal of effort (Sloan 1993; Lambert and Larcker 1987). When price-based performance measures are susceptible to shocks outside the manager's control, RPE improves the risk-sharing benefits between managers and shareholders (Lazear and Rosen 1981; Holmstrom 1982; Nalebuff and Stiglitz 1983). Empirical studies find implicit evidence of price-based RPE, where performance is evaluated relative to a peer group exposed to similar risk (i.e., same industry and similar size) (Albuquerque 2009; Gong et al. 2011). This is consistent with proxy statement disclosures that commonly cite the use of RPE for executive compensation.

Prior literature also touts the benefits and the contractibility of *earnings*-based performance measures when earnings provide an incrementally informative signal of manager effort (Holmstrom 1979; Watts and Zimmerman 1978; Lambert and Larcker 1987; Banker and Datar 1989; Bushman and Indjejikian 1993). While stock returns signal how the manager's effort translates into expected future cash flows, accounting performance signals how the manager's effort translates into realized performance in the current period. Accounting performance is susceptible to both the underlying economic performance and the accounting system that translates economic performance into earnings. Therefore, we conjecture that when the board evaluates accounting-based performance relative to the firm's peers, it identifies peers that share similar economics *and* similar accounting, to effectively mitigate the manager's exposure to common risk. This leads to our prediction that firms whose accounting is more comparable to that of potential performance peers will be more likely to include accounting-based RPE in the CEO's compensation contract.[1]

Examining the relation between firms' accounting comparability and compensation contract design is important for at least three reasons. First, RPE is an increasingly

[1] We use the term "accounting-based RPE" to describe a compensation contract that awards any component of pay based on accounting performance relative to a peer group. This is likely to be in conjunction with pay components based on other performance measures (i.e., stock price), or evaluated on a non-relative basis.

common feature of executive compensation contracts, representing 32% of total compensation for top executives in 2012 (Bettis et al. 2014). In our sample, RPE use increased from 14% of S&P 1500 firms in 1998 to 57% in 2015. Second, accounting-based performance metrics are more common in compensation contracts than price-based metrics. Using a 2007 sample of S&P 500 firms that granted performance-based awards, De Angelis and Grinstein (2015) report that 98% of firms awarded CEO pay using accounting-based metrics, while only 30% use rice-based metrics. Despite this near universal use of accounting metrics in general, the results of prior literature identifying accounting-based RPE implicitly (i.e., the association between CEO compensation and peer firm earnings) are mixed. However, Gong et al. (2011) report that in a 2006 sample of proxy statements filed by S&P 500 firms, 35% of equity-based RPE plans and 60% of cash-based RPE plans used accounting metrics. To date, the literature lacks a clear understanding of the sources of this variation in firms' decision to use accounting metrics in RPE contracts. Third, prior studies indicate substantial benefits of accounting comparability to external users of financial statements (e.g., De Franco et al. 2011; DeFond et al. 2011; Young and Zeng 2015; Neel 2017; Ahmed et al. 2017). We extend the literature by investigating whether accounting comparability relates to contracting within the firm when CEO pay can depend not only on the firm's own performance but also on the performance of the RPE peer group.

We predict that firms with greater accounting comparability with peers that share common risk are more likely to include accounting-based RPE in the CEO's compensation contract. We perform two complementary tests of this prediction. First, we perform an explicit test using proxy disclosures from S&P 1500 firms over the period 1998–2015. We measure accounting comparability following the approach of Barth et al. (2012) and identify peers with common risk based on two-digit SIC. The results are consistent with our prediction. To mitigate the confounding effect of similar economics between the RPE firm and its peer firms, we control for the historic correlations in earnings, cash flow, and stock return performance between the RPE firm and its peers and find consistent results. Additionally, our results hold when we use instrumental variable estimation to address the possibility that an omitted firm or industry characteristic simultaneously determines accounting-based RPE and accounting comparability.

Second, we perform an implicit test based on the associations between realized CEO compensation and both the firm's own performance and a peer group's performance. A negative relation between compensation and the ROA of the firm's peer group, controlling for the firm's own ROA, will indicate the use of accounting-based RPE. We find evidence of accounting-based RPE when the peer group comprises firms matched to the compensation firm on industry, size, *and* high comparability. However, we find no evidence of accounting-based RPE when the peer group is matched on industry and size alone. This result not only supports our prediction but also indicates that implicit tests of accounting-based RPE may be better specified when the peer group is identified based on comparable accounting to the contracting firm.

Next, we triangulate our results by performing additional cross-sectional tests of RPE peer selection. First, our hypothesis suggests that firms that use accounting-based RPE are more likely to select performance peers with more comparable accounting. Using RPE peer group data from firms' proxy disclosures, we find results consistent with this prediction. Second, our hypothesis suggests that intertemporal changes in peer group composition are also associated with accounting comparability.

Consistent with this prediction, we show that firms with relatively lower comparability with the RPE firm are dropped from the peer group, while firms with relatively higher comparability are added to the peer group. In contrast to these findings, our hypothesis also suggests that the documented association between accounting comparability and peer selection should be weaker, or nonexistent, when the RPE contract does not include an accounting metric. Accordingly, we repeat the peer selection tests on a sample of RPE firms that use *only* price-based RPE. As expected, the results reveal a less pronounced association between comparability and the likelihood of being selected as a performance peer. Further, we no longer find an association between comparability and intertemporal changes in peer group composition. This analysis suggests that our main results reflect a role for accounting comparability in RPE that is specific to the use of accounting metrics.

Our study makes several contributions. First, we contribute to the literature investigating the use of RPE and the use of accounting measures for executive compensation. We show that firms with greater accounting comparability with potential performance peers are significantly more likely to use accounting-based RPE. Second, our results provide insight into the role of accounting comparability in internal decision making and contracting (e.g., Chen et al. 2015). Prior studies typically examine the role of accounting comparability with respect to external users of financial statements. In contrast, our findings are consistent with a role for accounting comparability in decision making within the firm. Finally, our study contributes to the literature investigating the importance of peer group identification in implicit tests of RPE. Prior studies show that tests of price-based RPE require identification of performance peers subject to similar external shocks. Our evidence suggests that implicit tests of accounting-based RPE are better specified when performance peers are selected based on comparable accounting.

In a related study, Ozkan et al. (2012) find that IFRS adoption is associated with accounting-based RPE with foreign peers in cash compensation contracts. This finding indicates that CEO cash compensation is more sensitive to foreign peers' earnings when the foreign peers follow IFRS. Our study differs from, and complements, Ozkan et al. (2012) in two important ways. First, the result in Ozkan et al. (2012) could be due to perceptions of the reliability of foreign peers' earnings instead of accounting comparability (e.g., IOSCO 2000; Armstrong et al. 2010; Barth et al. 2008), since the adoption of IFRS can significantly shift a firm's reporting regime and its access to capital and foreign markets. Additionally, the paper's sample period coincides with increased cross-border economic integration in the E.U. and improvements in country-specific regulatory enforcement (Christensen et al. 2013). It is difficult to disentangle the effect of IFRS on comparability from these confounding effects. We examine accounting comparability within US GAAP and therefore remove this possibility. Second, our study relies on firms' SEC disclosures to identify RPE, whereas Ozkan et al. (2012) employ an implicit approach based on the relation between executive pay and peer firm earnings. This approach can lead to spurious results when the test assigns a peer group that is not made up of the true RPE peers (Gong et al. 2011).

A second unpublished study, Nam (2016), also investigates the impact of accounting comparability on accounting-based RPE and peer selection. Nam (2016) relies on implicit tests of accounting-based RPE and investigates the role of comparability in peer selection without regard to the underlying type of performance metric used in the compensation grant. Our study differs from his in several respects. First, we use firms' proxy statement disclosures to identify the use of accounting-based RPE in order to

examine the role of comparability in firms' ex-ante contracting. We use implicit tests in order to reconcile the results of our explicit tests with the existing literature. Second, our investigation of RPE peer selection focuses on the underlying type of performance metric. In particular, we show that the effect of comparability is muted or absent when the RPE grants do not include an accounting metric. Third, we examine intertemporal changes in peer group composition and thus provide more compelling evidence of an association between comparability and peer selection. Finally, our analysis rules out several alternative explanations for the documented results.

We review the related literature and develop our hypotheses in Section 2, and describe the research design in Section 3. In Section 4, we describe our samples and report empirical results for hypothesis tests, additional analysis, and robustness tests. We present our conclusion in Section 5.

2 Related literature and hypothesis development

2.1 Literature on accounting comparability

Standard setters, securities regulators, and financial intermediaries all tout the desirability of accounting comparability. The conventional wisdom is that greater information comparability will permit investors to make better-informed decisions when allocating capital among potential firms. Much of the literature on accounting comparability focuses on cross-country differences in accounting treatments arising from either differing standards or institutional environments. Increased liquidity around mandatory IFRS adoption is more pronounced among firms that exhibit an increase in cross-country comparability with industry peers (Neel 2017). The ability of value estimates to explain cross-sectional variation in observed price (i.e., pricing accuracy) and the ability of the pricing multiple to predict future market-to-book multiples each improve with higher cross-border accounting comparability (Young and Zeng 2015). Additionally, increased foreign mutual fund investment subsequent to mandatory IFRS adoption is greatest among firms with a large number of peers that begin to use the same accounting standards (DeFond et al. 2011).

However, we also expect accounting treatments to vary across firms in the same country. US GAAP provides managers with discretion in reporting earnings that represent the economic performance of the business. Examples include estimates for deferred tax assets (Schrand and Wong 2003); pension rates of return and salary growth assumptions (Bergstresser et al. 2006); estimates of bad debt expense (McNichols and Wilson 1988); and capital versus operating lease accounting (Imhoff and Thomas 1988). Moreover, recent survey evidence indicates that public company CFOs believe about 10 cents of every dollar of earnings per share (among other publicly traded companies) is attributable to within-GAAP reporting discretion (Dichev et al. 2016).

Although manager discretion can lead to less comparable earnings across firms, empirical evidence to date suggests benefits of reporting earnings that are more comparable. Sell-side financial analysts exhibit greater accuracy and agreement when forecasting earnings for US firms whose financial statements are more comparable to those of industry peers (De Franco et al. 2011). Stock prices are more efficient with respect to accruals and unexpected earnings for firms with greater accounting

comparability with industry peers (Ahmed et al. 2017). Acquisition synergies are larger and post-acquisition operating performance is better when there is greater comparability between the acquisition target and its industry peers (Chen et al. 2015). Our study adds to this literature documenting the consequences of earnings comparability within the US by investigating the stewardship value of accounting information.

2.2 Literature on accounting-based performance measures in compensation

CEO effort is generally unobservable. Therefore, firm owners rely on imperfect and noisy measures of effort to evaluate CEO performance. Under the umbrella of principal-agent theory, several studies investigate the conditions under which performance measures enter compensation contracts. Early studies show that a performance measure will enter the contract when it is incrementally informative about effort, relative to other available performance measures (Holmstrom 1979), and will receive a larger weight in the contract when it is a more precise signal of effort (Lambert and Larcker 1987). Assuming that firm owners are primarily interested in rewarding the CEO for effort that maximizes firm value, stock price may be considered the optimal performance measure.

In practice, however, firms use both price-based and accounting-based performance to identify the CEO's contribution to firm value.[2] In one view, accounting metrics enter the contract when, compared to stock prices, they are less susceptible to shocks outside of the CEO's control (Kim and Suh 1993; Sloan 1993). The accounting metric effectively serves a noise-filtering role and will carry a larger weight in the contract when price is a noisier signal of effort. Bushman and Indjejikian (1993) offer an alternative explanation, arguing that the addition of an accounting metric to the contract enables shareholders to motivate CEO effort along multiple dimensions. In this case, the accounting metric does not simply filter the noise in stock price. Rather, accounting performance and price each provide a signal of CEO effort along different dimensions. For example, price can signal effort toward initiating positive net present value projects with cash flows realized in future periods, while earnings can signal effort to generate current period cash flows that satisfy near-term requirements.[3]

Resolving these competing explanations for the presence of accounting metrics in compensation contracts is beyond the scope of our paper. Nevertheless, we find the latter explanation more compelling. Prior literature investigates the properties of earnings related to the contracting value of earnings. These studies find that compensation is more sensitive to accounting earnings that are more precise in the sense that they are more persistent and value relevant (Baber et al. 1998; Bushman et al. 2006). Moreover, mature firms and firms with fewer operating segments are more likely to use accounting metrics (De Angelis and Grinstein 2015). These findings are consistent with accounting performance serving as an informative signal of CEO effort when optimal

[2] Possible performance targets extend beyond price-based and accounting-based metrics. For example, the balanced scorecard incorporates non-financial performance metrics such as customer satisfaction, production quality, efficiency, etc. (Kaplan and Norton 1996). However, we follow prior literature by focusing on accounting- and price-based performance as the two primary performance benchmarks.

[3] While Sloan (1993) focuses on the noise-filtering role of earnings, his result that CEO compensation is associated with the component of earnings that is orthogonal to firm-specific returns suggests that earnings is incrementally informative about managers' actions (Lambert 1993). This result is also consistent with earnings signaling an aspect of CEO effort that is not also reflected in price.

operating activities are easier for boards to identify. For example, mature firms are likely to focus on achieving production efficiencies as a source of dividend payouts to shareholders, while less complex firms integrate the performance of fewer (potentially diverse) operating units into consolidated earnings (De Angelis and Grinstein 2015).

In addition to the type of performance measure, shareholders also choose between relative and absolute benchmarks. Theory predicts that RPE improves risk sharing between the principal and the agent by controlling for common exogenous shocks. Thus, RPE rewards the agent for performance under the agent's control while shielding the agent from systematic risk common to multiple agents (Lazear and Rosen 1981; Holmstrom 1982; Nalebuff and Stiglitz 1983). Empirical studies that use an implicit approach to identify price-based RPE in executive compensation contracts provide mixed evidence, but do find support for RPE when the research design accounts for competition (DeFond and Park 1999), CEOs' age and wealth constraints (Garvey and Milbourn 2003), CEOs' outside employment opportunities (Rajgopal et al. 2006), peer groups matched on industry and size (Albuquerque 2009), firm growth options (Albuquerque 2014), and systematic risk (Tice 2018). Moreover, firm proxy disclosures provide evidence of price-based RPE in practice (Bannister and Newman 2003; Gong et al. 2011).

In contrast, several studies that investigate accounting-based RPE fail to find empirical support for its use. These studies implicitly model RPE with accounting measures such as return on assets (Gibbons and Murphy 1990; Albuquerque 2009) and return on equity (Janakiraman et al. 1992). This lack of support is puzzling, given that proxy statement disclosures explicitly state the use of accounting-based RPE for CEO compensation (De Angelis and Grinstein 2015; Gong et al. 2011).

2.3 Hypothesis development

As noted above, firms will use an accounting metric in CEO compensation when it is incrementally informative about CEO effort. Accounting performance is a function of economic performance and the accounting system's translation of that performance into earnings. Therefore, the accounting-based performance measure is susceptible to economic risk and the translation of that risk into earnings by the accounting system. RPE can improve risk sharing between the CEO and shareholders when a performance metric is exposed to risk and a suitable peer group is identified that is exposed to similar risk. For accounting-based performance measures, we expect this to be the case when the contracting firm's accounting is more comparable to that of other firms in its common risk pool. Two firms' accounting is comparable if, when they experience similar economic outcomes, they report similar accounting amounts. This implies that the connection between economic fundamentals and accounting will be correlated across the two firms. In turn, we expect this correlation to affect how common risk manifests in their accounting performance. In particular, when two firms have more comparable accounting, common risk that is reflected in both firms' economic performance will similarly manifest in their accounting performance. Thus, we expect greater risk-sharing benefits of accounting-based RPE when the contracting firm's accounting is more comparable with that of firms in its common risk pool. We state our hypothesis in the alternative form:

Hypothesis: Accounting comparability is positively associated with the use of accounting-based RPE in CEO compensation.

3 Research design

3.1 Accounting comparability

We use three measures of accounting comparability, based on the underlying logic that the accounting of two firms is more comparable if they report similar accounting amounts when they experience similar economic outcomes (De Franco et al. 2011; Barth et al. 2012). Following Barth et al. (2012), we use stock price, stock return, and cash flow as economic outcomes, and combinations of net income and book value of equity as accounting amounts. The first measure estimates a firm's mapping from quarterly net income to subsequent quarterly cash flow using the following firm-level regression estimated over rolling 16-quarter windows:

$$CFO_{t+1} = \beta_0 + \beta_1 NI_t + \varepsilon_t. \tag{1a}$$

CFO is quarterly cash flow from operations scaled by beginning total assets, and *NI* is quarterly net income before extraordinary items scaled by beginning total assets. Equation (1a) provides a unique mapping between firm *i*'s accounting and economics over 16 quarters. The similarity of the mappings for firms *i* and *j* represents the comparability in their accounting.

For each of the 16 quarters we calculate firm *i*'s predicted subsequent cash flow using firm *i*'s own coefficient estimates from Eq. (1a) and firm *i*'s own net income. Similarly, for each of the 16 quarters we calculate firm *j*'s predicted subsequent cash flow using firm *j*'s own coefficient estimates from Eq. (1a) but firm *i*'s net income. By using firm *i*'s net income when computing fitted cash flow for both firms, the design explicitly holds economic outcomes constant.

We calculate $COMPCFO_{ijt}$, the average comparability between firm *i* and firm *j* during the 16-quarter period ending in year *t*, as the negative of the average absolute difference in the predicted subsequent cash flows. Larger (i.e., less negative) values of $COMPCFO_{ijt}$ indicate greater accounting comparability. We use this annual firm-pair measure of comparability in tests of peer selection. We calculate $COMPCFO\_I_{it}$, an annual measure of firm *i*'s accounting comparability with its industry peers, as the median value of $COMCFO_{ijt}$ for all available firm *i*-firm *j* pairs in which firm *j* is in firm *i*'s twodigit SIC industry. We use this annual firm measure of comparability in tests of accounting comparability and the decision to use accounting metrics in RPE.

The second comparability measure estimates a firm's mapping from the level and change in quarterly net income per share to stock return using the following firm-level regression estimated over rolling 16-quarter windows:

$$\begin{aligned} RETURN_t = {} & \beta_0 + \beta_1 NI/P_t + \beta_2 \Delta NI/P_t + \beta_3 LOSS_t + \beta_4 LOSS_t \times NI/P_t \\ & + \beta_5 LOSS_t \times \Delta NI/P_t + \varepsilon_t. \end{aligned} \tag{1b}$$

RETURN is stock return beginning 2 months before the quarter end and ending 1 month after the quarter end, *NI/P* is net income before extraordinary items per share scaled by beginning price, and $\Delta NI/P$ is change in net income before extraordinary items per share scaled by beginning price. We permit the coefficients on *NI/P* and $\Delta NI/P$ to differ for loss

firms using the indicator *LOSS*, which equals one when *NI/P* is negative and zero otherwise. Using the procedure discussed above we generate $COMPRET_{ijt}$ and $COMPRET\_I_{it}$.

The third comparability measure uses the mapping from quarterly net income per share and book value of equity per share to stock price using the following firm-level regression estimated over rolling 16-quarter windows:

$$PRICE_t = \beta_0 + \beta_1 NIPS_t + \beta_2 BVPS_t + \varepsilon_t. \quad (1c)$$

PRICE is stock price per share 1 month after the quarter end, *NIPS* is quarterly net income before extraordinary items per share, and *BVPS* is quarter end book value of equity per share. Using the procedure discussed above we generate $COMPPRC_{ijt}$ and $COMPPRC\_I_{it}$.

The above procedures generate three annual firm-pair and firm accounting comparability measures. We expect these individual comparability measures to contain uncorrelated noise. Thus, principal component analysis should provide a more precise estimate of true accounting comparability. Accordingly, we extract an annual firm-pair accounting comparability factor (*COMPFAC*) and an annual firm accounting comparability factor (*COMPFAC_I*) from these two sets of individual comparability measures. We use these factors in later tests, in addition to the primary measures.

We also perform validation tests of these comparability measures and examine whether similarity in two firms' accounting inputs is associated with higher values of our empirical proxy for accounting comparability. The results indicate that the comparability factor for a firm-pair is larger when the firms both use LIFO, have more similar rates of depreciation, and have more similar rates of asset write-downs. These results are consistent with the comparability measures reflecting similarities in firms' observable accounting choices. See Appendix 1 for details.

3.2 Explicit use of accounting metrics in RPE

We examine the role of accounting comparability in the decision to explicitly specify an RPE contract that includes an accounting metric, while also controlling for several other factors that may affect the RPE decision, with the following logistic regression:

$$\begin{aligned} Prob(RPEACCT_t = 1) = \Phi(&\alpha + \beta_1 COMP\_I_{t-1} + \beta_2 CORR\_ROA\_I_{t-1} + \beta_3 CORR\_CF\_I_{t-1} \\ &+\beta_4 CORR\_RET\_I_{t-1} + \beta_5 INDHERF_{t-1} + \beta_6 SIZE_{t-1} + \beta_7 BM_{t-1} \\ &+\beta_8 ROA_{t-1} + \beta_9 ADJROA_{t-1} + \beta_{10} RET_{t-1} + \beta_{11} ADJRET_{t-1} \\ &+\beta_{12} GROWTH_{t-1} + \beta_{13} INV_{t-1} + \beta_{14} DIVYIELD_{t-1} + \beta_{15} RETVOL_{t-1} \\ &+\beta_{16} CFVOL10_{t-1} + \beta_{17} EARNVOL_{t-1} + \beta_{18} WEALTH_{t-1} \\ &+\beta_{19} BOARDIND_{t-1} + \beta_{20} BOARDSIZE_{t-1} + \varepsilon_t) \end{aligned} \quad (2)$$

The dependent variable, $RPEACCT_t$, is an indicator that equals one for firms that use accounting-based RPE for cash and/or equity compensation, and zero otherwise.[4]

[4] Accounting-based RPE contracts contain at least one grant with an accounting-based target specified relative to the performance of a peer group. The performance-based grants can be either cash or equity-based.

COMP_I is the annual decile rank of *COMPCFO_I*, *COMPRET_I*, *COMPPRC_I*, or *COMPFAC_I* and ranges from 0.0 to 1.0.[5] We control for other firm, CEO, and governance characteristics previously shown to influence the use of RPE (Gong et al. 2011; Bettis et al. 2014). We are particularly concerned with controlling for the similarity in performance between the compensation firm and its industry peers. Accordingly, we control for the median correlation between the firm and its industry peers with respect to earnings (*CORR_ROA_I*), cash flows (*CORR_CF_I*), and market returns (*CORR_RET_I*). We compute these correlations over the prior 5 years and use annual deciles rank transformations to maintain consistency with the accounting comparability measures. We present detailed definitions in Appendix 2 of all variables used here and in the rest of the paper. We include year and industry fixed effects in Eq. (2) and determine significance using *z*-statistics based on standard errors clustered by year and firm to correct for cross-sectional and time-series dependence.

We also examine the explicit use of accounting-based RPE using a two-stage instrumental variable model. It is possible that RPE use and accounting comparability are simultaneously determined by an omitted firm or industry characteristic such as low performance relative to peers or growth options. Our first instrument for accounting comparability is analyst forecast accuracy (*ACCURACY*), computed as the absolute value of the last median IBES consensus annual earnings estimate available prior to the earnings announcement date less the actual IBES earnings, scaled by price and multiplied by −1. De Franco et al. (2011) find that analysts generate more accurate earnings forecasts for high comparability firms due to lower costs of information acquisition. Our second instrument is the proportion of two-digit SIC industry peers that use the same audit firm as the contracting firm (*SAMEAUD%*). Francis et al. (2014) find evidence consistent with each audit firm developing a unique "audit style" which leads to greater accounting comparability among its clients. In the first-stage regression, we use OLS to regress the accounting comparability factor (*COMPFAC_I*) on both instruments, all other independent variables from Eq. (2), and industry and year fixed effects. In the second-stage regression, we estimate Eq. (2) using the predicted value of *COMPFAC_I* from the first-stage (*COMPFAC_IHAT*). We estimate the second-stage using both a probit model (IVP) (Newey 1987) and OLS model (2SLS) (Theil 1953; Basmann 1957).

3.3 Implicit use of accounting metrics in RPE

We also use an implicit approach to test for the presence of RPE based on the associations between realized compensation and both the firm's own performance and a peer group's performance. A negative relation between compensation and the performance of the firm's peer group, holding constant the firm's own performance, provides evidence of RPE. Prior studies generally fail to find implicit evidence of accounting-based RPE when peer groups are matched to the contracting firm on industry and size (Janakiraman et al. 1992; Gibbons and Murphy 1990; Albuquerque 2009). However, our hypothesis suggests that implicit tests of accounting-based RPE are better specified when accounting comparability between peer firms and the

[5] We transform the comparability measures into annual deciles that range from 0 to 9 and divide by 9. Our inferences are unchanged if we use the raw variables in place of the decile ranks.

contracting firm is higher. Therefore, we use an implicit specification and condition the peer groups on comparability, in addition to industry and size.

We estimate the following equation:

$$\begin{aligned} COMPENSATION = {} & \alpha + \beta_1 ROA + \beta_2 PEER\,ROA + \beta_3 RET + \beta_4 PEER\,RET \\ & + \beta_5 SIZE + \beta_6 GROWTH \quad OPTIONS + \beta_7 TENTURE \\ & + \beta_8 REGULATED + \beta_9 CHAIR + \beta_{10} OWNERSHIP + \varepsilon_t \end{aligned} \tag{3}$$

The dependent variable is the log of CEO compensation, where compensation is measured as cash compensation, restricted stock compensation, or the sum of both cash and restricted stock compensation.[6] We capture the CEO's compensation with cash and/or restricted stock because these two components of compensation comprise the largest percentage of awards with accounting-based RPE.[7] *ROA* is annual net income before extraordinary items scaled by beginning assets, and *RET* is the 12-month buy and hold return over the fiscal year. *PEER ROA* is the median *ROA* of the matched peer group. We use two peer groups when computing *PEER ROA*. First, we select the ten (minimum five) two-digit SIC industry peers closest in beginning of year market value to the compensation firm to generate an industry-size matched group consistent with prior studies. Second, we retain only those industry peer firms in the top annual decile of comparability with the compensation firm, based on *COMPFAC*, and then select the ten (minimum five) potential peers closest in market value to generate the peer group. *PEER RET* is the median *RET* of the ten (minimum five) two-digit SIC industry peers closest in beginning of year market value to the compensation firm. *SIZE* is the natural log of beginning market value of equity, *GROWTH OPTIONS* is beginning total assets plus market value of equity minus common equity scaled by total assets, *TENURE* is the log of CEO tenure, *REGULATED* equals one for firms with SIC codes between 4900 and 4939, *CHAIR* equals one if the CEO is also the board Chair, *OWNERSHIP* equals one if CEO percentage ownership is above the annual sample median. We include industry and year fixed effects, and compute t-statistics using standard errors clustered by year and firm. Finally, we transform all firm and peer performance measures by adding one and taking the natural log.

4 Sample description and empirical results

4.1 Explicit use of accounting metrics in RPE

4.1.1 Sample and descriptive statistics

We obtain compensation disclosure data from the ISS Incentive Lab database for 22,742 firm-years spanning 1998 to 2015. We retain 17,144 observations on S&P 1500 firms matched to Execucomp. We delete 7019 observations lacking sufficient data for our accounting comparability measures, 273 observations

[6] Cash compensation is measured as the sum of salary, bonus, and long-term incentive payouts prior to 2006 and the sum of salary, bonus, and non-equity incentives post 2006.

[7] Prior research shows that restricted stock is the primary component of equity pay using RPE (Gong et al. 2011; Bettis et al. 2014). Additionally, less than 1% of option grants in the ISS Incentive Lab database are tied to accounting-based RPE. Therefore, we exclude option compensation.

lacking the Compustat or CRSP data required to compute other independent variables, and 1432 observations lacking the required data on board composition. Finally, we delete 39 observations the SEC classifies as conglomerates (SIC code 9997).[8] This leaves a final sample of 8381 observations.

Table 1, panel A reports descriptive statistics for the three comparability measures and additional independent variables used in our tests.[9] Panel B reports the use of accounting-based performance metrics, RPE, and accounting-based RPE by year for all S&P 1500 firms available on ISS Incentive Lab and for our final sample of S&P 1500 firms. For the full Incentive Lab sample, the proportion of firms that use accounting-based performance metrics in performance awards increases steadily over the sample period, from 42.9% in 1998 to 97.3% in 2015. Additionally, the use of all RPE and RPE using accounting metrics increases from 14% to about 57% and from 5.6 to 14%, respectively. We also note that the increase in RPE use appears smooth over the sample period despite mandated RPE disclosure beginning in 2006. The year-over-year increase in the proportion of firms disclosing RPE use for 2006 (2.3%) is very close to the average annual change (2.5%). Thus, the introduction of the mandatory disclosure regime does not appear to affect the proportion of firms reporting the use of RPE. Our final sample exhibits a similar increase in RPE use over time and is generally similar to the full Incentive Lab sample, which suggests that our inferences should generalize reasonably well to the population of S&P 1500 firms.

Panel C reports RPE use and average accounting comparability by industry. We order the 46 industries from largest to smallest percentage of firm-years that use accounting-based RPE (column 3), and include annual decile ranks of the comparability measures (columns 4 through 6) to aid interpretation. The average comparability rank of the ten industries with the largest percentage of accounting-based RPE use in column (3) (Banking to Building Materials) is 0.583.[10] In contrast, the average comparability rank of the 13 industries with no accounting-based RPE (Apparel to Textiles) is 0.502. We also find a correlation between the percentage of firms that use accounting-based RPE and average rank comparability of 0.31 (untabulated). Consistent with our hypothesis, panel C suggests that firms in industries with greater accounting comparability are more likely to compensate their CEOs based on relative accounting performance.[11]

Column (2) of panel C reports the percentage of firm-years that use RPE in any form (i.e., accounting-based and/or price-based). Interestingly, the

[8] These observations are for six firms: Berkshire Hathaway, Carlisle Companies, General Electric, Leucadia National Corp., Teleflex, and Textron. We delete these firms because we are unable to make reasonable industry matches for them.

[9] We report correlations in Table 2.

[10] We first compute the average comparability rank for each industry. For example, the average comparability rank for Banking is (0.597 + 0.634 + 0.764) / 3 = 0.665. Second, we compute the group average using each industry's average rank.

[11] On the other hand, it raises the possibility that some other industry characteristic results in both higher comparability and greater use of accounting-based RPE. We address this possibility by including both industry fixed effects and controls for within-industry economic similarity in our model. Additionally, we complement our main analyses with an instrumental variable specification.

Table 1 Descriptive Statistics and RPE Use

Panel A: Descriptive Statistics

	N	Mean	Std Dev	25th Pctl	Median	75th Pctl
RPEACCT	8381	0.094	0.292	0	0	0
COMPCFO_I	8381	−0.021	0.014	−0.027	−0.018	−0.012
COMPRET_I	8381	−0.159	0.135	−0.187	−0.119	−0.080
COMPPRC_I	8381	−23.525	13.021	−29.508	−20.511	−14.124
CORR_ROA	8381	0.119	0.243	−0.044	0.093	0.273
CORR_CF	8381	0.054	0.167	−0.050	0.035	0.133
CORR_RET	8381	0.340	0.298	0.130	0.380	0.581
INDHERF	8381	0.053	0.047	0.029	0.038	0.060
SIZE	8381	8.556	1.486	7.508	8.396	9.561
BM	8381	0.463	0.307	0.247	0.397	0.604
ROA	8381	0.053	0.067	0.021	0.050	0.089
ADJROA	8381	0.065	0.102	0.003	0.039	0.098
RET	8381	0.157	0.403	−0.082	0.124	0.340
ADJRET	8381	0.104	0.349	−0.100	0.053	0.250
GROWTH	8381	0.094	0.198	−0.005	0.071	0.162
INV	8381	0.087	0.075	0.033	0.070	0.120
DIVYIELD	8381	0.016	0.018	0.000	0.012	0.025
RETVOL	8381	0.024	0.012	0.015	0.021	0.029
CFVOL	8381	0.052	0.046	0.022	0.039	0.066
EARNVOL	8381	0.051	0.059	0.017	0.032	0.063
WEALTH	8381	14.981	4.040	14.724	15.924	16.942
BOARDIND	8381	0.756	0.147	0.670	0.800	0.880
BOARDSIZE	8381	9.917	2.296	8	10	11
CONSULT	4596	0.932	0.252	1	1	1

Table 1 (continued)

Panel B: Accounting Metric and RPE Use in CEO Compensation Plans by Year

	S&P 1500 Firms on ISS Incentive Lab				Sample			
	Firms	Accounting Metrics %	RPE %	RPE with Accounting Metrics %	Firms	Accounting Metrics %	RPE %	RPE with Accounting Metrics %
1998	485	42.9%	14.0%	5.6%	312	34.0%	11.2%	3.5%
1999	531	38.1%	13.4%	5.3%	347	35.7%	12.1%	3.7%
2000	560	40.4%	14.3%	5.5%	370	35.9%	11.6%	3.8%
2001	593	41.4%	14.7%	6.1%	394	34.8%	12.9%	4.8%
2002	616	43.7%	14.9%	5.7%	400	38.3%	13.5%	5.0%
2003	639	45.4%	16.0%	6.4%	410	41.0%	14.6%	6.3%
2004	639	48.4%	19.7%	7.2%	446	40.8%	17.3%	6.7%
2005	650	52.8%	21.7%	7.8%	482	45.9%	22.8%	7.3%
2006	703	77.5%	24.0%	9.4%	488	80.1%	26.2%	9.4%
2007	757	82.0%	24.8%	8.7%	429	82.1%	28.7%	10.7%
2008	767	84.7%	26.2%	8.6%	524	85.9%	30.7%	10.1%
2009	776	82.1%	28.4%	10.2%	547	83.5%	31.8%	11.2%
2010	784	85.1%	31.6%	11.2%	561	84.8%	35.5%	11.6%
2011	788	86.4%	36.7%	11.9%	567	87.3%	38.1%	11.6%
2012	795	89.8%	43.8%	13.0%	577	92.2%	46.6%	12.0%
2013	797	91.8%	48.7%	13.2%	566	94.0%	51.8%	12.7%
2014	791	95.7%	54.0%	14.3%	549	96.7%	58.7%	14.9%
2015	595	97.3%	56.6%	14.0%	412	98.3%	60.0%	15.3%

Table 1 (continued)

Panel C: RPE Use in CEO Compensation Plans and Accounting Comparability by Industry

	Firm-years	RPE %	RPE with Accounting Metrics %	Annual Decile Rank of *COMPCFO_I*	Annual Decile Rank of *COMPRET_I*	Annual Decile Rank of *COMPPRC_I*
	(1)	(2)	(3)	(4)	(5)	(6)
Banking	333	48.0%	33.6%	0.597	0.634	0.764
Construction	55	29.1%	20.0%	0.525	0.644	0.519
Energy	544	53.3%	18.9%	0.496	0.515	0.527
Auto & Trucks	123	43.1%	18.7%	0.509	0.453	0.546
Insurance	423	29.8%	18.4%	0.706	0.598	0.794
Business Supplies	166	39.2%	17.5%	0.653	0.456	0.679
Steel Works	169	35.5%	17.2%	0.450	0.581	0.647
Shipping Containers	59	49.2%	15.3%	0.646	0.627	0.706
Machinery	406	28.1%	13.3%	0.437	0.427	0.502
Building Materials	188	35.6%	12.2%	0.639	0.525	0.693
Beer & Liquor	47	31.9%	10.6%	0.827	0.099	0.520
Chemicals	283	38.2%	9.5%	0.282	0.307	0.168
Utilities	547	71.3%	8.8%	0.824	0.667	0.861
Financial Trading	454	35.9%	8.4%	0.560	0.448	0.633
Electronic Equip.	587	24.2%	8.2%	0.314	0.607	0.294
Wholesale	232	11.6%	7.8%	0.578	0.455	0.552
Measuring Equip.	207	11.1%	7.7%	0.421	0.415	0.389

Table 1 (continued)

Communication	208	39.4%	7.7%	0.518	0.460	0.545
Computers	304	19.1%	6.3%	0.319	0.579	0.346
Food Products	162	34.0%	6.2%	0.769	0.438	0.591
Restaurant & Hotel	143	27.3%	5.6%	0.594	0.487	0.492
Ind. Metal Mining	36	77.8%	5.6%	0.219	0.170	0.139
Coal	37	70.3%	5.4%	0.270	0.568	0.505
Retail	137	11.7%	5.1%	0.446	0.464	0.440
Electrical Equip.	91	35.2%	4.4%	0.453	0.294	0.493
Consumer Goods	183	14.8%	4.4%	0.469	0.324	0.282
Pharmaceutical	366	24.9%	4.4%	0.275	0.351	0.080
Aircraft	76	57.9%	3.9%	0.654	0.279	0.712
Transportation	267	16.5%	3.0%	0.628	0.582	0.672
Healthcare	102	6.9%	2.9%	0.497	0.466	0.574
Personal Services	42	26.2%	2.4%	0.519	0.542	0.410
Medical Equip.	221	15.8%	2.3%	0.452	0.370	0.346
Entertainment	45	8.9%	2.2%	0.272	0.528	0.323
Business Services	765	12.3%	0.9%	0.335	0.521	0.307
Apparel	46	15.2%	0.0%	0.517	0.461	0.275
Candy & Soda	13	7.7%	0.0%	0.803	0.650	0.769
Fabricated Prod.	2	0.0%	0.0%	0.000	0.778	0.333
Defense	12	100.0%	0.0%	0.750	0.083	0.639
Misc.	11	9.1%	0.0%	0.636	0.515	0.586
Precious Metals	18	50.0%	0.0%	0.302	0.512	0.228

Table 1 (continued)

Printing & Pub	103	17.5%	0.0%	0.648	0.504	0.546
Real Estate	12	0.0%	0.0%	0.287	0.315	0.185
Recreation	58	12.1%	0.0%	0.364	0.678	0.224
Rubber & Plastic	34	14.7%	0.0%	0.663	0.703	0.618
Ship & Rail Equip	29	3.4%	0.0%	0.552	0.414	0.651
Textiles	35	5.7%	0.0%	0.533	0.587	0.765

Panel A reports descriptive statistics for variables used in tests of accounting comparability and the decision to use RPE with accounting metrics RPE use by year. Panel B reports the percentage of firms that use accounting-based performance metrics, RPE, and accountingbased RPE. Panel C reports RPE use and accounting comparability by industry. See Appendix 2 for variable definitions

Table 2 Correlations with Pearson (Spearman) Below (Above) the Diagonal

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
(1)	*RPEACCT*		**0.14**	**0.12**	**0.08**	**0.09**	**−0.02**	**0.22**	**0.11**	**−0.06**	**−0.09**	0.01
(2)	*COMPFAC_I*	**0.12**		**0.10**	**0.17**	**0.16**	**0.04**	**0.36**	**0.36**	**−0.20**	**−0.43**	−0.01
(3)	*CORR_ROA*	0.13	**0.11**		0.25	**0.20**	**0.14**	**0.10**	**0.20**	**−0.17**	**−0.22**	−0.01
(4)	*CORR_CF*	0.09	**0.16**	**0.30**		**0.14**	**0.05**	**0.11**	**0.14**	**−0.07**	**−0.15**	0.01
(5)	*CORR_RET*	0.08	**0.13**	**0.19**	**0.14**		−0.01	**0.23**	**0.26**	**−0.17**	**−0.22**	**−0.07**
(6)	*INDHERF*	**−0.04**	**0.03**	**0.10**	**0.04**	**−0.02**		**−0.13**	**−0.03**	**0.07**	**−0.15**	0.02
(7)	*SIZE*	**0.22**	**0.33**	**0.12**	**0.11**	**0.22**	**−0.07**		**0.28**	**−0.25**	**−0.28**	**−0.03**
(8)	*BM*	**0.10**	**0.24**	**0.22**	**0.14**	**0.24**	**−0.03**	**0.29**		**−0.53**	**−0.51**	**−0.30**
(9)	*ROA*	**−0.03**	**−0.05**	**−0.15**	**−0.05**	**−0.14**	**0.05**	**−0.15**	**−0.40**		**0.78**	**0.14**
(10)	*ADJROA*	**−0.06**	**−0.40**	**−0.22**	**−0.15**	**−0.21**	**−0.15**	**−0.15**	**−0.39**	**0.65**		**0.08**
(11)	*RET*	0.00	**−0.06**	**−0.02**	0.00	**−0.07**	0.00	**−0.08**	**−0.32**	**0.14**	**0.07**	
(12)	*ADJRET*	**−0.02**	**−0.13**	**−0.06**	**−0.04**	**−0.10**	**−0.03**	**−0.13**	**−0.28**	**0.13**	**0.15**	**0.79**
(13)	*GROWTH*	**−0.03**	**−0.09**	**−0.07**	−0.01	**−0.06**	−0.02	**−0.11**	**−0.17**	**0.20**	**0.12**	**0.15**
(14)	*INV*	**−0.07**	**−0.41**	**−0.05**	**−0.05**	**−0.10**	**−0.09**	**−0.33**	**−0.27**	**0.08**	**0.21**	−0.02
(15)	*DIVYIELD*	**0.11**	**0.31**	**0.06**	**0.07**	**0.17**	**−0.05**	**0.34**	**0.23**	**−0.10**	**−0.13**	**−0.20**
(16)	*RETVOL*	**−0.05**	**−0.34**	**0.13**	**−0.05**	**0.03**	0.02	**−0.27**	**0.17**	**−0.23**	**−0.08**	**−0.12**
(17)	*CFVOL*	**−0.08**	**−0.49**	0.00	**−0.04**	**−0.09**	0.00	**−0.40**	**−0.16**	**0.04**	**0.13**	**0.06**
(18)	*EARNVOL*	**−0.06**	**−0.52**	0.00	**−0.05**	**−0.02**	**−0.06**	**−0.36**	**−0.14**	**−0.08**	**0.09**	**0.05**
(19)	*WEALTH*	**0.05**	**0.02**	**−0.06**	**−0.02**	−0.01	**−0.04**	**0.18**	**−0.19**	**0.11**	**0.11**	**0.22**
(20)	*BOARDIND*	**0.13**	**0.11**	**0.01**	0.00	**0.15**	**−0.03**	**0.30**	**0.07**	**−0.02**	0.00	**−0.03**
(21)	*BOARDSIZE*	**0.10**	**0.22**	**0.04**	**0.08**	**0.06**	−0.01	**0.57**	**0.13**	**−0.07**	**−0.08**	**−0.07**
(22)	*CONSULT*	**0.04**	0.00	**−0.04**	−0.01	**0.05**	−0.03	**0.10**	**0.06**	**−0.06**	**0.00**	−0.02

Table 2 (continued)

	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)
(1)	−0.01	**−0.04**	**−0.10**	**0.13**	**−0.06**	**−0.09**	**−0.07**	**0.03**	**0.14**	**0.11**	**0.04**
(2)	**−0.08**	**−0.08**	**−0.44**	**0.40**	**−0.36**	**−0.54**	**−0.60**	**−0.06**	**0.11**	**0.25**	0.01
(3)	**−0.05**	**−0.08**	**−0.07**	**0.05**	**0.13**	**0.01**	**0.04**	**−0.09**	0.00	**0.03**	**−0.04**
(4)	**−0.02**	**0.06**	**−0.06**	**0.11**	**−0.03**	**−0.03**	**−0.06**	**−0.06**	−0.01	**0.08**	0.00
(5)	**−0.07**	**−0.07**	**−0.13**	**0.15**	**0.03**	**−0.12**	**−0.06**	**−0.05**	**0.15**	**0.06**	**0.04**
(6)	**−0.02**	**0.02**	**−0.13**	**−0.09**	**0.13**	**0.10**	**0.05**	−0.02	**−0.08**	**−0.06**	**−0.04**
(7)	**−0.09**	**−0.13**	**−0.33**	**0.43**	**−0.34**	**−0.46**	**−0.44**	**0.27**	**0.32**	**0.57**	**0.11**
(8)	**−0.28**	**−0.21**	**−0.33**	**0.20**	**0.08**	**−0.22**	**−0.21**	**−0.35**	**0.08**	**0.14**	**0.06**
(9)	**0.16**	**0.26**	**0.30**	**−0.13**	**−0.14**	**0.19**	**0.14**	**0.23**	**−0.05**	**−0.13**	**−0.07**
(10)	**0.19**	**0.19**	**0.34**	**−0.19**	−0.01	**0.24**	**0.24**	**0.21**	**−0.05**	**−0.15**	**−0.05**
(11)	**0.69**	**0.13**	**−0.04**	**−0.13**	**−0.20**	0.00	−0.01	**0.34**	**0.01**	**−0.03**	0.00
(12)		**0.15**	**0.04**	**−0.13**	**0.03**	**0.05**	**0.04**	**0.25**	**−0.03**	**−0.06**	0.00
(13)	**0.17**		**0.12**	**−0.26**	**0.02**	**0.19**	**0.10**	**0.21**	**−0.15**	**−0.13**	−0.02
(14)	**0.06**	**0.12**		**−0.30**	**0.20**	**0.43**	**0.49**	**0.03**	**−0.08**	**−0.20**	0.00
(15)	**−0.19**	**−0.20**	**−0.28**		**−0.36**	**−0.47**	**−0.46**	**−0.15**	**0.24**	**0.39**	**0.04**
(16)	**0.09**	**0.03**	**0.22**	**−0.17**		**0.38**	**0.42**	**−0.20**	**−0.23**	**−0.27**	**−0.05**
(17)	**0.11**	**0.20**	**0.37**	**−0.33**	**0.35**		**0.72**	**−0.03**	**−0.19**	**−0.36**	**−0.07**
(18)	**0.10**	**0.13**	**0.39**	**−0.30**	**0.36**	**0.72**		**−0.03**	**−0.14**	**−0.36**	−0.03
(19)	**0.15**	**0.11**	**−0.02**	**−0.11**	**−0.15**	**−0.06**	**−0.03**		**0.12**	**0.10**	**0.04**
(20)	**−0.08**	**−0.15**	**−0.11**	**0.20**	**−0.22**	**−0.16**	**−0.11**	**0.17**		**0.18**	**0.17**
(21)	**−0.10**	**−0.10**	**−0.22**	**0.29**	**−0.25**	**−0.33**	**−0.30**	**0.10**	**0.12**		**0.15**
(22)	−0.01	−0.02	−0.02	**0.03**	**−0.04**	**−0.06**	−0.03	**0.07**	**0.18**	**0.16**	

Table 2 reports Pearson and Spearman correlations for variables used in tests of accounting comparability and the decision to use RPE with accounting metrics. Bold indicates a significant correlation at the 5% level. See Appendix 2 for variable definitions

correlation between the percentage of firms that use RPE in any form and average rank comparability is only 0.07 (untabulated), considerably smaller than the correlation between accounting-based RPE use and comparability (0.31). This suggests that accounting comparability is more important in the decision to use an accounting metric in RPE than the decision to use RPE generally.

4.1.2 Results

Table 3, panel A reports the results of estimating Eq. (2). We first note that the concordant rate is in excess of 76% in all cases and that the signs of the control variables are generally consistent with those in Gong et al. (2011) and Bettis et al. (2014).[12] Additionally, the coefficient estimates for the controls for similarity in earnings performance (*CORR_ROA_I*) and cash flow performance (*CORR_CF_I*) are positive and generally significant. Consistent with our hypothesis, the coefficient on each of the accounting comparability measures is positive and significant.[13] Consistent with PCA removing uncorrelated noise from the individual measures, the coefficient on the accounting comparability factor (*COMPFAC_I*) is highly significant (p-value < 0.01). This coefficient indicates that an increase from the bottom to the top decile of accounting comparability increases the odds of using accounting-based RPE by about four times.[14]

Table 3, panel B reports the instrumental variable estimation result. As expected, the coefficients on the instruments are positive and significant (p-value < 0.01). The partial R^2 from the first-stage regression (due to the two instruments) is 0.014 and the partial F-statistic (56.62) is significant, indicating that the inclusion of the two instruments improves the first-stage model. The results of the second-stage regressions confirm the positive association between comparability and the explicit use of accountingbased RPE. The coefficient on *COMPFAC_IHAT* is positive and significant in both the IVP model (p-value < 0.01) and the 2SLS model (p-value < 0.05).[15]

[12] Although the coefficient signs on the control variables are consistent with Gong et al. (2011) and Bettis et al. (2014), these coefficients are generally not significant. Untabulated analysis indicates that this is due to the inclusion of industry fixed effects in our model. Omitting the fixed effects increases the significance of the control variables substantially, but does not affect our inferences.

[13] Throughout the paper, we use the term significant (marginally significant) to denote a five (ten) percent significance level under a one-sided alternative when we have a directional hypothesis, and under a two-sided alternative otherwise.

[14] The "odds" of using accounting-based RPE equals the probability of using accounting-based RPE divided by the probability of not using accounting-based RPE. To compute the increase in odds, we exponentiate the coefficient on the ranked accounting comparability measure (range 0 to 1). For example, the coefficient on *COMPFAC_I* is 1.336, resulting in $e^{1.336} = 3.80$.

[15] We adjust standard errors for firm clusters in the second-stage regressions. We are unable to adjust the second-stage standard errors for both firm and year clusters because the estimated covariance matrix of moment conditions is not full rank. As an alternative, we partial out the model constant and all exogenous regressors and estimate the coefficient for *COMPFAC_IHAT*. This permits us to adjust the resulting standard error for firm and year clusters. Our inferences are unchanged. We also use an over-identifying restrictions test in the 2SLS specification to formally confirm that the two instruments satisfy the exclusion restriction. The test-statistic ($\chi^2(1) = 1.34$; p-value = 0.247) indicates that the instruments and error term from the second-stage model are uncorrelated (Sargan 1958; Basmann 1960).

Table 3 Accounting-Based RPE and Accounting Comparability

Panel A: Logistic Regressions

Decile Rank Values of Accounting Comparability

COMP_I =	***COMPCFO_I***	***COMPRET_I***	***COMPPRC_I***	***COMPFAC_I***
COMP_I	1.222***	0.629**	0.479**	1.336***
	(0.003)	(0.018)	(0.048)	(0.000)
CORR_ROA_I	0.715***	0.765***	0.765***	0.713***
	(0.005)	(0.003)	(0.003)	(0.005)
CORR_CF_I	0.293	0.327*	0.332*	0.290
	(0.142)	(0.099)	(0.098)	(0.156)
CORR_RET_I	−0.003	−0.020	−0.043	−0.005
	(0.989)	(0.935)	(0.863)	(0.983)
INDHERF	−4.860	−4.704	−4.928	−4.482
	(0.122)	(0.128)	(0.106)	(0.144)
SIZE	0.332***	0.358***	0.386***	0.365***
	(0.000)	(0.000)	(0.000)	(0.000)
BM	−0.174	0.152	−0.067	0.016
	(0.529)	(0.566)	(0.812)	(0.953)
ROA	3.471	3.262	3.927*	2.952
	(0.131)	(0.146)	(0.080)	(0.195)
ADJROA	−2.483	−3.838**	−3.681*	−2.440
	(0.215)	(0.041)	(0.059)	(0.196)
RET	0.263	0.323	0.180	0.315
	(0.285)	(0.219)	(0.482)	(0.238)
ADJRET	−0.162	−0.079	−0.050	−0.110
	(0.524)	(0.776)	(0.846)	(0.691)
GROWTH	0.100	0.053	0.111	0.012
	(0.683)	(0.815)	(0.644)	(0.962)

Table 3 (continued)

INV	1.759	0.929	0.677	1.864
	(0.373)	(0.653)	(0.744)	(0.349)
DIVYIELD	8.504	8.844	8.516	8.169
	(0.122)	(0.102)	(0.120)	(0.133)
RETVOL	−4.073	2.139	−4.781	4.722
	(0.593)	(0.789)	(0.528)	(0.561)
CFVOL	1.733	0.001	0.031	1.443
	(0.511)	(1.000)	(0.991)	(0.596)
EARNVOL	2.321	2.870	1.788	2.958
	(0.329)	(0.220)	(0.446)	(0.212)
CEOWEALTH	0.026	0.027	0.030*	0.024
	(0.132)	(0.110)	(0.093)	(0.144)
BOARDIND	2.292**	2.354***	2.307***	2.349***
	(0.012)	(0.009)	(0.010)	(0.009)
BOARDSIZE	−0.018	−0.013	−0.012	−0.016
	(0.644)	(0.732)	(0.756)	(0.694)
Observations	8381	8381	8381	8381
Concordant	77.3%	77.0%	76.9%	77.6%
Pseudo R2	14.1%	13.8%	13.8%	14.4%

Table 3 (continued)

Panel B: Instrumental Variable Regressions

	First-stage		Second-Stage Probit (IVP)		OLS (2SLS)	
	Coef	***p*-value**	**Coef**	***p*-value**	**Coef**	***p*-value**
COMPFAC_I HAT			2.887***	(0.000)	0.391***	(0.017)
SAMEAUD%	0.127***	(0.002)				
ACCURACY	4.619***	(0.000)				
CORR_ROA_I	0.036***	(0.000)	0.318**	(0.019)	0.062***	(0.001)
CORR_CF_I	0.037***	(0.000)	0.046	(0.660)	0.009	(0.599)
CORR_RET_I	−0.010	(0.220)	−0.028	(0.793)	−0.009	(0.602)
INDHERF	−0.145**	(0.042)	−1.295	(0.307)	−0.231	(0.120)
SIZE	−0.000	(0.901)	0.179***	(0.000)	0.032***	(0.000)
BM	0.075***	(0.000)	−0.110	(0.458)	−0.014	(0.546)
ROA	0.680***	(0.000)	−0.482	(0.705)	−0.056	(0.751)
ADJROA	−1.126***	(0.000)	1.647	(0.244)	0.270	(0.207)
RET	−0.058***	(0.001)	0.352***	(0.005)	0.047**	(0.042)
ADJRET	0.044**	(0.017)	−0.210	(0.123)	−0.025	(0.274)
GROWTH	0.055***	(0.000)	−0.159	(0.233)	−0.016	(0.455)
INV	−0.620***	(0.000)	2.593**	(0.010)	0.323**	(0.053)
DIVYIELD	1.123***	(0.000)	1.415	(0.619)	0.372	(0.467)
RETVOL	−5.260***	(0.000)	16.906***	(0.009)	2.695**	(0.019)
CFVOL	−0.905***	(0.000)	2.605**	(0.042)	0.334	(0.102)
EARNVOL	−0.790***	(0.000)	2.963**	(0.015)	0.421**	(0.024)
CEOWEALTH	0.002***	(0.001)	0.006	(0.451)	0.000	(0.751)

Table 3 (continued)

BOARDIND	−0.033*	(0.094)	1.101***	(0.004)	0.143***	(0.003)
BOARDSIZE	−0.000	(0.876)	−0.012	(0.545)	−0.002	(0.505)
Adj R^2	$R^2 = 0.571$					
Partial R^2	$R^2 = 0.014$					
Partial F-stat	$F_p = 56.62$ ($p < 0.01$)					
Over-identifying restrictions test					$X^2(1) = 1.34$ ($p = 0.247$)	
Durbin-Wu-Hausman test			$X^2(1) = 4.82$ ($p = 0.028$)		$X^2(1) = 5.35$ ($p = 0.021$)	

Panel A reports coefficient estimates and *p*-values (in parentheses) from pooled estimations of Eq. (2). The sample includes 8381 observations for S&P 1500 firms listed in the Compustat file for 1998–2015. The dependent variable is *RPEACCT*, which equals one if the firm explicitly reports using accounting metrics in RPE, and zero otherwise. *COMP_I* is the annual decile rank of each accounting comparability measure. See the Appendix 2 for other variable definitions. Independent variables (except *INDHERF*) are winsorized at the top and bottom percentiles. Year and industry fixed effects are included but not tabulated. We report one-sided *p*-values for signed hypotheses (two-sided otherwise) based on z-statistics computed using standard errors clustered by year and firm to correct for cross-sectional and time-series dependence (Gow et al. 2010). *, **, and *** indicate significance at the 10%, 5%, and 1% levels

Panel B reports the results of estimating a two-stage instrumental variable probit model (IVP) and two-stage instrumental variable OLS model (2SLS) of Eq. (2). The dependent variable in the first-stage regression is *COMPFAC_I*. The dependent variable in the second stage regressions is *RPEACCT*. *COMPFAC_IHAT* is the predicted value from the first-stage regression. See the Appendix 2 for other variable definitions. Year and industry fixed effects are included but not tabulated. We report, in parentheses, one-sided *p*-values for signed hypotheses (two-sided otherwise). *, **, and *** indicate significance (two-sided) at the 10%, 5%, and 1% levels

4.2 Implicit use of accounting metrics in RPE

4.2.1 Sample

We use a sample of 13,240 firm-years during the 1993–2015 period with compensation data available from Execucomp, positive common equity, total assets of at least $10 million, only one CEO during the year, CEO tenure of at least 1 year, non-missing PERMNO match, non-missing data for all control variables, and at least 50 two-digit SIC industry peers.

4.2.2 Results

Table 4 reports the results of estimating Eq. (3). We first compute PEER ROA using industry-size matched firms in columns (1) to (3). We find no evidence of RPE in ROA for any compensation definition. In contrast, the coefficient on *PEER ROA* is positive and significant in each case. We do find evidence of RPE in stock returns for cash compensation and cash plus restricted stock, with a positive coefficient on *RET* (p-value < 0.01) and a negative coefficient on *PEER RET* (p-value < 0.05). These results, based on industry-size matched peer groups, are consistent with those reported in previous studies (Janakiraman et al. 1992; Gibbons and Murphy 1990; Albuquerque 2009).[16]

We next compute *PEER ROA* using comparability-industry-size matched firms in columns (4) to (6), consistent with our hypothesis. For cash compensation in column (4), we now find evidence of RPE in ROA, with a positive coefficient on *ROA* (p-value < 0.01) and a negative coefficient on *PEER ROA* (p-value < 0.01). We do not find evidence of RPE in ROA with respect to restricted stock awards in column (5). In particular, the coefficients on *ROA* and *PEER ROA* are both insignificant. For the sum of cash and restricted stock in column (6), the coefficient on *PEER ROA* is again negative and significant (p-value < 0.01). However, we hesitate to conclude that firms use RPE in ROA for cash and restricted stock combined because the coefficient on firms' own ROA is not significantly positive, as we would expect under RPE.[17] Interestingly, once we use a peer group for ROA conditioned on comparability in columns (4) to (6), we no longer find evidence of RPE in stock returns for any compensation definition. We suspect that this result is related to our definitions of compensation and our exclusion of option grants, which are more likely to be tied to stock returns. Thus, we caution against interpreting our rejection of RPE in stock returns based on cash and restricted stock as a rejection of RPE in stock returns more generally.

[16] We do not investigate the source of this positive association between industry-size matched ROA and compensation, instead leaving that to future research.

[17] In untabulated tests our results hold when we also estimate Eq. (3) using a comparability-industry-size matched measure of *PEER RET*. Additionally, we also estimate Eq. (3) including both industry-size and comparability-industry-size matched measures of *PEER ROA* and *PEER RET* together. We continue to find evidence of RPE in ROA for cash compensation based on the comparability-industry-size matched measure of peer ROA but not the industry-size matched measure of peer ROA.

Table 4 Accounting Comparability and Implicit Tests of RPE using ROA and Stock Returns

Dependent Variable:	PEER ROA using industry-size matched group			PEER ROA using comparability-industry-size matched group		
	Cash (1)	Stock (2)	Cash & Stock (3)	Cash (4)	Stock (5)	Cash & Stock (6)
INTERCEPT	10.960***	−1.897	10.668***	10.905***	−2.389**	10.584***
	(0.000)	(0.123)	(0.000)	(0.000)	(0.049)	(0.000)
ROA	0.156*	−1.382	−0.145	0.350***	−0.924	0.060
	(0.057)	(0.963)	(0.865)	(0.000)	(0.880)	(0.311)
PEER ROA	0.412**	5.332***	0.752***	−0.655***	−0.436	−0.612***
	(0.035)	(0.001)	(0.001)	(0.000)	(0.379)	(0.000)
RET	0.306***	0.457***	0.307***	0.292***	0.394***	0.290***
	(0.000)	(0.001)	(0.000)	(0.000)	(0.003)	(0.000)
PEER RET	−0.088**	0.169	−0.080**	−0.042	0.547**	−0.012
	(0.022)	(0.451)	(0.024)	(0.299)	(0.024)	(0.756)
SIZE	0.326***	0.943***	0.403***	0.339***	1.031***	0.421***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
GROWTH_OPTIONS	0.024**	−0.257***	0.032**	0.026***	−0.215**	0.037***
	(0.019)	(0.005)	(0.014)	(0.010)	(0.016)	(0.004)
TENURE	0.081***	−0.516***	0.044***	0.083***	−0.509***	0.045***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
REGULATED	0.041	2.270	0.304**	0.032	2.222	0.292**
	(0.692)	(0.101)	(0.020)	(0.755)	(0.109)	(0.024)
CHAIR	0.071***	0.104	0.040	0.073***	0.111	0.042
	(0.004)	(0.684)	(0.289)	(0.003)	(0.667)	(0.265)
OWNERSHIP	0.050**	−0.325	0.016	0.051**	−0.300	0.018
	(0.036)	(0.116)	(0.578)	(0.037)	(0.149)	(0.529)
Observations	13,240	13,240	13,240	13,240	13,240	13,240
Adj. R^2	58.1%	44.3%	62.9%	58.2%	44.2%	62.9%

This Table reports regression results from estimations of Eq. (3). The sample includes 13,240 firm-years with cash and restricted stock compensation available from Execucomp, positive common equity, total assets of at least $10 million, only one CEO during the year, CEO tenure of at least 1 year, non-missing PERMNO match, non-missing data for all control variables, and at least 50 two-digit SIC industry peers. The dependent variables are the natural log of CEO cash compensation, natural log of restricted stock compensation, and the natural log of cash plus restricted stock. *ROA* is annual income before extraordinary items divided by beginning total assets. *PEER ROA* is the median ROA of the RPE firm's matched peer group. We use two peer groups for *PEER ROA*. The industry-size matched peer group includes two-digit SIC industry peers matched on size. The comparability-industry-size mat6ched peer group includes two-digit SIC industry peers matched on both high comparability and size. RET is the annual stock return. *PEER RET* is the median annual stock return of the RPE firm's industry-size matched peer group. See section 3.3 for additional details on computing peer ROA and stock returns. See Appendix 2 for variable definitions

We report two-sided *p*-values in parentheses based on t-statistics computed using standard errors clustered by year and firm to correct for cross-sectional and time-series dependence (Gow et al. 2010). *, **, and *** indicate significance at the 10%, 5%, and 1% levels

Table 5 Peers Selection Under RPE With and Without Accounting Metrics

	Peers Selected versus Not Selected			Peers Added versus Dropped		
	RPE with accounting metrics	RPE without accounting metrics	*p-value* for	RPE with accounting metrics	RPE without accounting metrics	*p-value* for
	(a)	(b)	(a) = (b)	(i)	(ii)	(i) = (ii)
COMPFAC	0.684***	0.480***	(0.041)	0.766**	−0.317	(0.007)
	(0.000)	(0.000)		(0.017)	(0.146)	
SAME_SIC3	1.677***	1.090***	(0.000)	−0.236	−0.176	(0.807)
	(0.000)	(0.000)		(0.379)	(0.236)	
SP1500	0.778***	0.789***	(0.899)	0.530**	0.474***	(0.839)
	(0.000)	(0.000)		(0.011)	(0.001)	
SAME_SP	0.434***	0.201*	(0.000)	−0.059	0.141	(0.454)
	(0.002)	(0.054)		(0.746)	(0.423)	
CORR_ROA	0.406**	0.399***	(0.898)	0.283	0.078	(0.574)
	(0.035)	(0.000)		(0.424)	(0.675)	
CORR_CF	0.298***	0.391***	(0.309)	0.023	0.086	(0.860)
	(0.009)	(0.000)		(0.916)	(0.346)	
CORR_RET	0.628***	0.341***	(0.002)	−0.322	−0.146	(0.621)
	(0.000)	(0.001)		(0.371)	(0.360)	
ROA_DIFF	−0.387**	−0.077	(0.002)	−0.416	0.136	(0.172)
	(0.035)	(0.451)		(0.312)	(0.579)	
RET_DIFF	−0.321*	−0.203***	(0.217)	−0.814*	0.082	(0.001)
	(0.067)	(0.000)		(0.087)	(0.695)	
SIZE_DIFF	−0.002*	0.001*	(0.000)	0.006**	−0.001	(0.024)
	(0.061)	(0.066)		(0.036)	(0.730)	
BM_DIFF	−2.767***	−0.748**	(0.000)	−1.272*	−0.505	(0.321)
	(0.000)	(0.012)		(0.078)	(0.183)	
$ROA_{PEER}\_ROA_{IND}$	0.015	−0.015	(0.326)	−0.125	−0.005	(0.376)
	(0.783)	(0.677)		(0.270)	(0.961)	
$RET_{PEER}\_RET_{IND}$	−1.050**	−1.634***	(0.004)	0.046	0.164	(0.889)
	(0.026)	(0.000)		(0.965)	(0.692)	
$SALE_{PEER}\_SALE_{IND}$	−0.030***	−0.009*	(0.000)	−0.061***	−0.025**	(0.031)
	(0.000)	(0.058)		(0.004)	(0.050)	
$SIZE_{PEER}\_SIZE_{IND}$	0.026***	0.006**	(0.000)	0.033***	0.009	(0.030)
	(0.000)	(0.033)		(0.006)	(0.262)	
Intercept	−1.599***	−1.590***		0.995*	0.157	
	(0.000)	(0.000)		(0.087)	(0.597)	
Observations	10,052	23,820		538	1842	

Table 5 (continued)

	Peers Selected versus Not Selected			Peers Added versus Dropped		
	RPE with accounting metrics (a)	RPE without accounting metrics (b)	*p-value* for (a) = (b)	RPE with accounting metrics (i)	RPE without accounting metrics (ii)	*p-value* for (i) = (ii)
Concordant	83.3%	71.0%		73.9%	58.9%	
Pseudo R-square	27.9%	10.4%		13.9%	1.9%	

This table compares the coefficient estimates obtained from Eq. (4) for samples in which the RPE contract includes an accounting metric and samples in which the RPE contract does not include an accounting metric

In columns (a) and (b) the dependent variable is *SELECTED* which equals one if the peer firm is chosen as an RPE peer, and zero otherwise. See Appendix 2 for variable definitions. The sample in column (a) includes 5026 firms selected as performance peers and 5026 firms not selected as performance peers for RPE firms that use accounting metrics in the RPE contract. The sample in column (b) includes 11,910 firms selected as performance peers and 11,910 firms not selected as performance peers for RPE firms that do not use accounting metrics in the RPE contract. Unselected peers are matched to selected peers based on two-digit SIC industry and size

In columns (i) and (ii) the dependent variable is *ADDED* which equals one if the peer firm is added to the peer group during the current year, and zero otherwise. See Appendix 2 for variable definitions. The sample in column (a) includes 538 firms that were either added or dropped from performance peer groups for RPE firms that use accounting metrics in the RPE contract. The sample in column (b) includes 1842 firms that were either added or dropped from performance peer groups for RPE firms that do not use accounting metrics in the RPE contract

We report one-sided *p*-values for signed hypotheses (two-sided otherwise) based on *z*-statistics computed using standard errors clustered by year and RPE firm to correct for cross-sectional and time-series dependence (Gow et al. 2010). *, **, and *** indicate significance (two-sided) at the 10%, 5%, and 1% levels. We also report *p*-values (two-sided) for the difference in coefficient estimates between the two samples

Taken together, the results based on implicit RPE in ROA provide support for our hypothesis with respect to cash compensation, where we would expect annual incentive pay to be closely aligned with accounting-based measures of firm performance.

4.3 Additional analysis of RPE performance peer selection

Although our study's main focus is on RPE contracts that include an accounting metric, in this section we provide additional evidence by also examining RPE contracts that do not include an accounting metric. Specifically, we investigate the association between accounting comparability and RPE performance peer selection, conditional on whether the RPE contract includes an accounting performance metric or only price-based metrics (e.g., total shareholder return). We expect accounting comparability to be associated with the likelihood that an RPE firm selects a potential performance peer when the contract includes an accounting metric. In contrast, when the RPE contract does not include an accounting metric, we expect a weaker (or no) association between accounting comparability and peer selection.

4.3.1 Peer selection likelihood

We draw our test design from Gong et al. (2011), who examine the determinants of performance peer selection among RPE firms that use price-based metrics. In particular, we estimate the following logistic regression in which the unit of observation is an annual pair of RPE firm and potential peer firm (both selected and unselected):

$$\begin{aligned} Prob(SELECTED_{ijt}=1) = \Phi(&\alpha + \beta_1 COMPFAC_{ijt-1} + \beta_2 SAME\_SIC3_{ijt-1} + \beta_3 SP1500_{ijt-1} \\ &+\beta_4 SAME\_SP_{ijt-1} + \beta_5 CORR\_ROA_{ijt-1} + \beta_6 CORR\_CF_{ijt-1} \\ &+\beta_7 CORR\_RET_{ijt-1} + \beta_8 ROA\_DIFF_{ijt-1} + \beta_9 RET\_DIFF_{ijt-1} \\ &+\beta_{10} SIZE\_DIFF_{ijt-1} + \beta_{11} BM\_DIFF_{ijt-1} + \beta_{12} ROA_{PEER}\_ROA_{IND\ ijt-1} \\ &+\beta_{13} RET_{PEER\_RETIND\ ijt-1} + \beta_{14} SALE_{PEER}\_SALE_{IND\ ijt-1} \\ &+\beta_{15} SIZE_{PEER}\_SIZE_{IND\ ijt-1} + \varepsilon_{ijt}) \end{aligned} \quad (4)$$

The dependent variable, $SELECTED_{ijt}$, is an indicator variable that equals one if a potential peer firm j is selected as a performance peer for firm i in year t, and zero otherwise. *COMPFAC* is the firm-pair comparability factor transformed into annual deciles; it ranges from 0.0 to 1.0. We include controls for similar performance between the RPE firm and the potential peer firm over the prior 5 years and for the most recent year (*CORR_ROA*, *CORR_CF*, *CORR_RET*, *ROA_DIFF*, *RET_DIFF*). To maintain consistency with the accounting comparability measures, we use annual decile ranks for each of the measures of similar performance. We also control for common risk and similar economic fundamentals between the RPE firm and the potential peer firm. All variable definitions are in Appendix 2.

We use Incentive Lab to identify a sample of RPE firms over the 2000–2015 period that use self-selected peer groups. We then match each RPE firm to all firms in its disclosed performance peer group with the required data. Next, to each selected RPE peer firm we match an unselected firm from the Compustat universe of domestic firms with all required data, in the same two-digit SIC industry as the selected peer, and closest in prior year market value of equity to the selected peer. We use this matched sample of unselected peers, as opposed to the universe of unselected peers, to reduce potential bias and inefficiency in the estimated coefficients (Owen 2007; Gong et al. 2011).[18] This procedure results in a final sample of 5026 selected and unselected peer observations for RPE contracts that include an accounting performance metric, and 11,910 selected and unselected peer observations for RPE contracts that include only price-based metrics.

The results of estimating Eq. (4) are reported in Table 5. For RPE firms that use an accounting metric in column (a), the coefficient on *COMPFAC* is positive and significant (p-value < 0.01), and indicates that moving from the bottom to the top decile of accounting comparability between the RPE firm and the potential peer firm approximately doubles the odds that the peer is chosen.[19] As expected, the coefficient on

[18] Our inferences are unchanged when we match selected and unselected peers based on three-digit SIC code industries or the 48 Fama-French industries. Additionally, our inferences are unchanged when we use unselected peers that are matched to the RPE firm (as opposed to the selected peer firm) based on size and two-digit SIC industry.

[19] The odds ratio is equal to 1.98 ($e^{0.684}$).

COMPFAC in column (b) when the RPE firm does not use an accounting metric is significantly smaller (0.480 versus 0.684) (p-value < 0.05).

4.3.2 Intertemporal changes in RPE peer groups

We also examine peer selection using intertemporal changes in RPE peer group composition. If accounting comparability leads to better peer matching, we should observe relatively lower (higher) comparability peers being dropped from (added to) the peer group over time when the contract includes an accounting metric. For each year, we retain those RPE firms with peer data available for the current and prior year. Next, we identify members of the performance peer group that were either added or dropped from the prior year to the current year. Finally, we retain annual RPE firm-peer pairs with all required data to compute the variables in Eq. (4). This procedure results in a sample of 338 and 200 performance peers that are added and dropped, respectively, from peer groups during our sample period. We replace the dependent variable in Eq. (4) with *ADDED*, which equals one for peers added to the peer group and zero for peers dropped from the peer group.

For RPE firms that use an accounting metric in Table 5 column (i), the coefficient on *COMPFAC* is positive and significant (p-value < 0.05), indicating that accounting comparability increases the likelihood that a peer firm is added to the peer group versus dropped from the peer group in any given year. We test RPE firms that do not use an accounting metric in column (ii). As expected, the coefficient on *COMPFAC* is again significantly smaller (−0.317 versus 0.766) (p-value < 0.01). Moreover, the coefficient is no longer positive or significant at conventional levels, suggesting that accounting comparability does not vary between added and dropped peers when the RPE contract does not include an accounting metric.

The above analysis demonstrates two important points. First, the association we observe between accounting comparability and firms' use of accounting-based RPE extends to the actual selection of performance peers, an important component of the contract. Second, the association that we observe between comparability and performance peer selection either weakens or disappears when the contract does not include an accounting metric. Together, these results demonstrate that the importance of comparability in accounting-based RPE does not merely reflect a more general role in all RPE contracts.

4.4 Robustness tests

In this section we describe several untabulated robustness tests.

4.4.1 Controlling for additional compensation contract terms

We estimate Eq. (2) with additional contract terms to mitigate the confounding effects of (1) the association between accounting comparability and the use of other performance targets and (2) different targets substituting for one other. Our results hold when we control for the use of accounting-based absolute performance evaluation, price-based absolute performance evaluation, and price-

based RPE. Interestingly, firms are about half as likely to use accounting-based RPE when they use price-based absolute performance evaluation, although we do not find an association between the use of accounting-based RPE and price-based RPE.

4.4.2 Restricting the sample to firms that use RPE in any form

We expect the dependent variable in our primary tests to capture boards' joint decision to use RPE and an accounting performance metric in the RPE contract. However, it is possible that the documented positive association between accounting comparability and accounting-based RPE is driven by an underlying association between comparability and the decision to use RPE in general (as opposed to accounting-based RPE specifically). To rule out this possibility, we estimate Eq. (2) using a restricted sample of firms that use RPE in any form (i.e., accounting-based and/or price-based). Our inferences are unchanged.

4.4.3 Restricting the sample period to the mandatory disclosure regime

The SEC did not require firms to disclose details of executive compensation contracts until 2006. Thus, our sample period includes both a voluntary disclosure regime (1998–2005) and a mandatory disclosure regime (2006–2015). We find that our inferences are unchanged when we restrict the analysis to the mandatory disclosure regime. In tests based on the mandatory disclosure period, we additionally control for the use of a compensation consultant (Gong et al. 2011). This consultant data is only available during the 2006–2015 period.

4.4.4 Alternative industry definitions

Throughout the study we define industry based on two-digit SIC code. As an alternative, we define industry based on either three-digit SIC code or the 48 Fama-French industries. Our inferences are unchanged.

4.4.5 Alternative accounting comparability measures

De Franco et al. (2011) propose a measure of accounting comparability based on the mapping from returns to earnings. Our inferences are unchanged when we use this measure. We also follow an alternative approach in Barth et al. (2012) that is based on the similarity in the coefficients obtained from Eqs. (1a) to (1c). This follows from the assumption that differences in predicted cash flow, returns, and price should be driven by differences in those estimated coefficients. Specifically, we compute the annual firm-pair absolute difference in the coefficients on *NI*, *NIPS/P*, *ΔNIPS/P*, *BVPS*, and *NIPS* and then extract an annual firm-pair factor using these five absolute differences. Our inferences are unchanged.

4.4.6 Peer selection and additional controls for peer earnings attributes

Other attributes of peer firms' earnings may represent omitted correlated variables in the peer selection tests if the attributes are positively correlated with

comparability *and* the likelihood that an RPE peer is chosen. To rule out this confounding effect, we control for additional peer earnings attributes that are plausibly correlated with comparability and that boards are likely to consider when selecting RPE peers. We consider three accounting-based peer earnings attributes (persistence, predictability, and smoothness) and three market-based peer earnings attributes (value relevance, timeliness, and conservatism) (Francis et al. 2004). Depending on the specification, we find that firms that use accounting-based RPE are more likely to select peers with earnings that are predictable, smooth, timely, and conservative. Nevertheless, we continue to find a significant positive association between comparability and accounting-based RPE peer selection under both specifications.

4.4.7 Changes in accounting comparability with peers following their addition to the peer group

In this study, we measure accounting comparability between the RPE firm and peer firms over the 4 years prior to the test year. This approach follows from our assumption that boards observe similarities and differences between firms and then adjust the compensation contract moving forward. A potential alternative explanation for our results is that the board first selects the performance peers and then the manager increases the accounting comparability with the selected peers. We find no empirical evidence to support this alternative explanation based on the following analysis. First, we identify 158 firms that began using accounting-based RPE during our sample period. Second, we identify all peers that are included in the performance peer group during the 4 years following the initial adoption of accounting-based RPE. Third, we compute the accounting comparability measures between the RPE firm and each peer firm over the 4 years preceding and following the adoption of accounting-based RPE. For example, if a firm adopts accounting-based RPE in 2005, the post period is 2005–2008 and the pre period is 2001–2004. This results in a sample of 935 firm-pairs with the required data. Fourth, we compare the average comparability for the pre and post periods. We do not find a significant change in comparability for any of the measures. We also use two restricted samples in which we require the peer firm to be included in the peer group in the initial adoption year or in all four post-adoption years. Again, we do not find a significant change in comparability. Finally, as an alternative we identify the year that each peer firm is added to a performance peer group and compare the average pre- to post-addition change in comparability for the RPE and peer firm. We again find no significant difference. Together, these results suggest that firms do not strategically increase comparability with peer firms ex post.

5 Conclusion

This study examines the role accounting plays in the use of relative performance evaluation (RPE) and the selection of RPE peers using data from S&P 1500 firms' proxy disclosures. When two firms have more comparable

accounting, common risk should have a similar effect on the firms' accounting performance. This implies that accounting comparability can increase the risk-sharing benefit of accounting-based RPE. Using data from firms' proxy disclosures, we document that firms are more likely to use accounting metrics in RPE when they have greater accounting comparability with other firms in their industry. We also show that implicit tests are better able to detect accounting-based RPE when peer groups are formed based on comparability, in addition to industry and size. Moreover, when two firms have comparable accounting, we also expect them to be a better match along accounting dimensions when they are also a better match along economic dimensions. Consistent with this reasoning, we find that higher comparability between the RPE firm and a potential peer firm increases (decreases) its likelihood of being selected into (dropped from) the peer group. Cross-sectional analyses show that this association is less pronounced, or not present, when the relative performance measure is price-based (as opposed to accounting-based), indicating that these results do not merely reflect a more general role of comparability in all RPE contracts. These results highlight the different considerations in RPE peer selection depending on the underlying performance metric.

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Appendix 1

This appendix describes the validation tests we perform for the accounting comparability measures used in the study.

Our approach to measuring accounting comparability closely follows De Franco et al. (2011), who develop their measure of accounting comparability using returns and net income to measure economic events and accounting outcomes, respectively. Like De Franco et al. (2011), we validate our three measures of accounting comparability by showing that they are larger for firms with similar book-to-market ratio and market value of equity. However, unlike De Franco et al. (2011), we focus on accounting inputs and investigate whether two firms in the same industry rank higher on our comparability measures when they make similar accounting choices. First, we expect firm pairs that both use LIFO to exhibit greater comparability because the LIFO inventory cost flow assumption generally results in a firm's most recent product costs passing through COGS. Second, we expect greater comparability between firm pairs with similar rates of annual depreciation/amortization expense because the proportion of long-term assets expensed during the year differs across firms. Third, we expect firm pairs with similar rates of asset write-downs to exhibit greater comparability because firms in the same industry are exposed to similar economic shocks but can differ in how they recognize those shocks.

We collect all manufacturing firm-years available on Incentive Lab through 2014. To each firm-year we match all firms from Compustat in the same two-digit SIC industry and retain annual firm-pairs with all required data. This procedure results in 820,667 annual firm-pairs. *BOTH_LIFO* equals one if both firms use LIFO, and is zero otherwise. We identify the use of LIFO based on a non-zero LIFO reserve as reported in Compustat. *DEP_RATE_DIFF* is the absolute difference in the annual depreciation rate for the firm pair, averaged over the prior 4 years. We compute the annual depreciation rate as the sum of depreciation and amortization expense divided by the sum of gross PP&E and intangible assets. *WD_RATE_DIFF* is the absolute difference in the annual asset write-down rate, averaged over the prior 4 years. We compute the annual asset write-down rate as asset write-downs divided by gross PP&E. In order to identify meaningful effects for our test variables we control for firm-pair differences in inventory scaled by total assets (*INV_DIFF*), gross PP&E scaled by total assets (*PPE_DIFF*), intangible assets scaled by total assets (*INT_DIFF*), market value of equity (*MV_DIFF*), and book-to-market ratios (*BM_DIFF*).

We regress the comparability factor (*COMPFAC*) on the measures of similar accounting choices (*BOTH_FIFO*, *DEP_RATE_DIFF* and *WD_RATE_DIFF*) and controls. We include year and two-digit SIC industry fixed effects, and compute standard errors clustered by firm and year. We report the results in Table 6 of this appendix. Consistent with our expectations, the results in column (1) show that the comparability factor for the pair is larger when both firms use LIFO and smaller when the differences in the rates of depreciation and asset write-downs are larger. To provide a sense of the economic magnitude of these effects, column (2) reports the results when both the dependent and independent continuous variables are ranked into annual deciles.[20] Comparability between firm-pairs that both use LIFO is about 1.6 deciles higher, while an increase from the bottom to the top decile of difference in depreciation rate and asset write-down rate reduces comparability by about 2.1 deciles and 0.5 deciles, respectively.

Table 6 also reports the predicted rank comparability for firm-pairs under varying assumptions of economic and accounting similarity. First, we assume average economic similarity (i.e., set all control variables = 0.5) and the most similar accounting (i.e., *BOTH_LIFO* = 1, *DEP_RATE_DIFF* = 0, and *WD_RATE_DIFF* = 0). Using these assumptions the predicted rank comparability is 0.786 for the estimation in column (2) of Table 6. In contrast, the predicted rank comparability between firms with average economic similarity and the most dissimilar accounting (i.e., *BOTH_LIFO* = 0, *DEP_RATE_DIFF* = 1, and *WD_RATE_DIFF* = 1) is only 0.362. Thus, changing the assumption from the most similar to the most dissimilar accounting methods, while holding economic differences constant, substantially reduces the predicted value of comparability. Importantly, we note that the effects of economic similarity on our comparability factor are also generally significant, but smaller in magnitude.

Thus, our comparability measures are more strongly associated with accounting choices than with economic similarity.[21]

[20] We omit the industry and year fixed effects when using the ranked variables to facilitate our subsequent calculations of predicted comparability. Our inferences are unchanged when we include these fixed effects.
[21] The results hold when we match firm-pairs on three-digit or four-digit SIC in the rank regressions.

Table 6 Validation of accounting comparability measures

		Raw variables	Annual decile ranks of all continuous variables		
	Pred	Two-digit SIC match (1)	Two-digit SIC match (2)	Three-digit SIC match (3)	Four-digit SIC match (4)
BOTH_LIFO	+	0.364***	0.162***	0.213***	0.201***
		(0.000)	(0.000)	(0.000)	(0.000)
DEP_RATE_DIFF	–	−0.469***	−0.214***	−0.195***	−0.233***
		(0.002)	(0.000)	(0.000)	(0.000)
WD_RATE_DIFF	–	−1.257***	−0.048***	−0.045***	−0.038***
		(0.000)	(0.001)	(0.002)	(0.007)
Control Variables					
INV_DIFF	–	−0.697***	−0.048***	−0.021	−0.044***
		(0.000)	(0.000)	(0.109)	(0.008)
PPE_DIFF	–	−0.040*	−0.033***	0.021**	0.032***
		(0.091)	(0.001)	(0.041)	(0.009)
INT_DIFF	–	−0.074	0.033***	0.001	−0.015
		(0.135)	(0.004)	(0.969)	(0.392)
MV_DIFF	–	−0.006***	−0.109***	−0.135***	−0.133***
		(0.001)	(0.000)	(0.000)	(0.000)
BM_DIFF	–	−0.067**	−0.046***	−0.008	−0.025*
		(0.029)	(0.001)	(0.302)	(0.055)
Constant		−0.064	0.726***	0.655***	0.691***
		(0.371)	(0.000)	(0.000)	(0.000)
Year FE		yes	no	no	no
Industry FE		yes	no	no	no

Table 6 (continued)

	Raw variables	Annual decile ranks of all continuous variables		
	Two-digit SIC match	Two-digit SIC match	Three-digit SIC match	Four-digit SIC match
Pred	(1)	(2)	(3)	(4)
Observations	820,667	820,667	302,770	125,534
Adj R2	11.1%	9.1%	7.9%	10.9%
Predicted Comparability Decile assuming average economic differences (i.e., all ranked control variables equal 0.5)				
Similar accounting (*BOTH_LIFO* = 1, *DEP_RATE_DIFF* = 0, and *WD_RATE_DIFF* = 0)		0.786	0.798	0.800
Different accounting (*BOTH_LIFO* = 0, *DEP_RATE_DIFF* = 1, and *WD_RATE_DIFF* = 1)		0.362	0.344	0.328
Similar - Different		0.424	0.454	0.472

This table reports coefficient estimates and *p*-values (in parentheses) from pooled regressions of the accounting comparability factor (*COMPFAC*) on predicted determinants of accounting comparability. The maximum sample includes 820,667 manufacturing firm-pair observations matched on two-digit SIC code industry. All variable definitions are provided in this Appendix. Independent variables are winsorized at the top and bottom percentiles. Year and industry fixed effects are included where noted but not tabulated. We report one-sided *p*-values for signed hypotheses (two-sided otherwise) based on t-statistics computed using standard errors clustered by year and firm to correct for cross-sectional and time-series dependence (Gow et al. 2010). *, **, and *** indicate significance at the 10%, 5%, and 1% levels.

Appendix 2

Variables used in explicit tests of accounting comparability and the use of accounting-based RPE	
RPEACCT	An indicator variable that equals 1 if the CEO's cash and/or equity compensation contract includes an accounting-based performance measure in relative performance evaluation and 0 otherwise.
ADJRET	Annual stock return minus the median industry (two-digit SIC) return.
ADJROA	Annual ROA minus the median industry (two-digit SIC) ROA.
BM	Book value of common equity divided by market value of common equity.
BOARDIND	Percent of outsiders on the board.
BOARDSIZE	Number of members on the board.
CFVOL	Standard deviation of annual operating cash flows, divided by beginning total assets, computed over rolling 8-year windows.
CORR_CF	Median correlation between the firm and its two-digit SIC industry peers with respect to annual cash flows divided by beginning total assets. Computed over prior 5 years.
CORR_RET	Median correlation between the firm and its two-digit SIC industry peers with respect to annual stock return. Computed over prior 5 years.
CORR_ROA	Median correlation between the firm and its two-digit SIC industry peers with respect to annual income before extraordinary items divided by beginning total assets. Computed over prior 5 years.
DIVYIELD	Total dividends divided by market value of common equity.
EARNVOL	Standard deviation of annual ROA, computed over rolling 8-year windows.
GROWTH	Annual percentage sales growth.
INDHERF	Herfindahl Index estimated by two-digit SIC industry.
INV	The sum of annual R&D, capital expenditures, and advertising expense, divided by total assets.
RET	Annual stock return.
RETVOL	Standard deviation of daily stock returns, estimated over 1 year.
ROA	Annual income before extraordinary items divided by beginning total assets.
SIZE	Natural log of market value of common equity.
WEALTH	The sum of the intrinsic value of stock holdings and the Black-Scholes value of option holdings.
Variables used in implicit tests of accounting comparability and the use of accounting-based RPE	
CHAIR	Indicator that equals one if the CEO is also the board chair, 0 otherwise.
GROWTH OPTIONS	Beginning total assets plus market value of equity minus common equity, divided by total assets.
OWNERSHIP	Indicator that equals one if CEO percentage ownership is above the annual sample median, 0 otherwise.
PEER RET	The median annual stock return of the RPE firm's matched peer group based on industry and size. See section 3.3 for additional details.
PEER ROA	The median ROA of the RPE firm's matched peer group. We use two peer groups. The first is matched on industry and size. The second is matched on comparability, industry, and size. See Section 3.3 for additional details.
REGULATED	Indicator that equals one for firms with SIC codes between 4900 and 4939, 0 otherwise.
RET	Annual stock return.
ROA	Annual income before extraordinary items divided by beginning total assets.

SIZE	Natural log of market value of common equity.
TENURE	Log of CEO tenure in years.
Variables used in tests of accounting comparability and RPE peer selection	
BM_DIFF	Absolute difference in book-to-market ratio between the RPE firm and a potential peer firm.
CORR_CF	Correlation in annual cash flows, divided by total assets, between the RPE firm and potential peer firm over prior 5 years.
CORR_RET	Correlation in annual return between the RPE firm and potential peer firm over prior 5 years.
CORR_ROA	Correlation in annual income before extraordinary items, divided by total assets, between the RPE firm and potential peer firm over prior 5 years.
RET_DIFF	Absolute difference in annual return between the RPE firm and a potential peer firm.
$RET_{PEER}\_RET_{IND}$	Potential peer's IBES annual stock return forecast minus median industry IBES annual stock return forecast.
ROA_DIFF	Absolute difference in annual ROA between the RPE firm and a potential peer firm.
$ROA_{PEER}\_ROA_{IND}$	Potential peer's IBES annual ROA forecast minus median industry IBES annual ROA forecast.
$SALE_{PEER}\_SALE_{IND}$	Potential peer annual sales minus median industry annual sales.
SAME_SIC3	Indicator variable that equals 1 if the RPE firm and potential peer firm are in the same three-digit SIC industry, and 0 otherwise.
SAME_SP	Indicator variable that equals 1 if the RPE firm and potential peer firm are in the same S&P sub-index, and 0 otherwise.
SELECTED	Indicator that equals one if the potential peer is selected as a RPE performance peer, and zero otherwise.
SIZE_DIFF	Absolute difference in assets between the RPE firm and a potential peer firm.
$SIZE_{PEER}\_SIZE_{IND}$	Potential peer assets minus median industry assets.
SP1500	Indicator variable that equals 1 if the potential peer firm is in the S&P 1500 index, and 0 otherwise.
SP1500	Indicator variable that equals 1 if the potential peer firm is in the S&P 1500 index, and 0 otherwise.

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