Customer RPE: Using customer performance to filter noise out of CEO incentive contracts

Mary Ellen Carter
Carroll School of Management
Boston College
maryellen.carter@bc.edu

Jen Choi
Goizueta Business School
Emory University
jen.choi@emory.edu

Karen L. Sedatole*
Goizueta Business School
Emory University
ksedatole@emory.edu

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* Corresponding author

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ABSTRACT

Prior research documents negative incentive weights on industry peer performance in CEO contracting in what is known as "relative performance evaluation" (RPE). RPE improves the efficiency of incentive contracting by filtering noise from CEO performance measurement. We test whether the performance of a firm's customer base is also used to improve incentive contracting, what we term "customer relative performance evaluation" (customer RPE). Consistent with customer RPE, we document a negative incentive weight on customer performance in CEO incentive contracts incremental to the negative incentive weight on performance of industry peers documented in prior research. Further, the negative incentive weight on customer performance is larger in absolute value for firms whose performance is more highly correlated with their customers' performance, when the firm's products/services are more specialized, and when the firm has lower operating flexibility. But, we also find the the weight on customer performance decreases when potential adverse consequences triggered by customer RPE are more costly. Our findings suggest firms weigh the benefits of improved contracting through customer RPE against the negative actions it potentially motivated.

1. INTRODUCTION

Relative performance evaluation (RPE) refers to the use of peer performance, in addition to firm performance to evaluate a CEO. By using peer performance, a firm can identify shocks that are shared with its peers and not indicative of CEO effort, and remove these shocks for evaluation purposes. A key decision in implementing RPE is the selection of peer firms against which performance is compared. Indeed, a challenge of implementing RPE is identifying peers that share common noise with the firm (Gibbons and Murphy 1990). Prior studies find that firms use market indices to filter out economy-wide shocks or other firms in the same industry to remove industry-wide shocks (Rajgopal et al. 2006; Albuquerque et al. 2009). In this paper, we extend prior RPE research to examine the extent to which firms incorporate the performance of *their unique customer base* into RPE, what we term "customer RPE."

We contend that using customers as RPE peers enables the firm to filter out demand shocks that are transmitted to the firm from its downstream trading partners. Shocks to the firm's customer base, as opposed to shocks common to the customer industry as a whole, may not be captured by industry peer performance and thus cannot be filtered by using industry peers or market indices. Also, while idiosyncratic performance shocks of industry peers are, by definition, uninformative about the firm's performance and thus undermines the incentive risk reduction role of industry peer RPE (Wu 2013; Wu 2017), idiosyncratic shocks to a customer's performance are relevant to CEO incentive risk reduction because those shocks transfer up the supply chain to affect the firm's own performance. Adding customers as RPE peers enables the firm to filter out exogenous shocks in a more precise and comprehensive manner, making customer RPE incrementally valuable over industry peer RPE examined in prior research as a means of filtering noise from CEO performance and improving incentive contracting efficiency.

While research examining RPE peer disclosures documents that 40 percent of disclosed peers do not belong in the same two-digit industry group as the firm (Gong et al. 2011), it has not explicitly examined the nature of the firms comprising that 40 percent. Indeed, in our sample, we find that 21 percent of firms disclosing the explicit use of RPE in their proxy statements name at least one customer as an RPE peer.

We identify a firm's customers using the Supply Chain Relationship data from FactSet, which maps the supply chain partners of firms with data sourced from 8-Ks/10-Ks, press releases, corporate action releases, and company websites. Using these data, we examine the extent to which customer performance affects CEO compensation using the "implicit" (or indirect) RPE test in which RPE is inferred from a negative incentive weight on peer performance (either industry peer performance or, the focus of our study, customer performance) in CEO compensation. The indirect test of RPE is more comprehensive than analyzing RPE peers disclosed in proxy statements because firms selectively disclose RPE peers (Faulkender and Yang 2010; Gong et al. 2011) and actual relative performance evaluation use may be larger than what firms report in the proxy statements (Black, Dikolli, and Hofmann 2015).

We find a negative compensation incentive weight on mean customer performance, consistent with the use of customer RPE to insulate the effect of downstream demand shocks on firm performance. This negative incentive weight on customer performance is incremental to that on industry-size peers (firms in the same 2-digit SIC code and size quartile, as defined in Albuquerque 2009) and the market index (S&P 500 index), and is robust to the inclusion of CEO- or firm-fixed effects.

To address the concern that customer performance is correlated with some underlying characteristic (i.e., geography or technology) that influences focal firm compensation, we examine

the relation using "non-customer" performance. That is, we examine the incentive weight on the performance of the firm's customers in the year prior to becoming a customer and in the year after they cease being a customer. If our findings were due to some other factor related to the customer-firm match and not customer RPE, we would expect to see the negative incentive weight we document in these pre- and post-relationship periods. We find no incentive weight on customer performance for these inactive customer relationships.

To rule out the concern that some common factor affects both the customer's performance and the focal firm's compensation but is not related to the use of customer RPE, we examine major natural disasters at a customer's headquarters (Barrot and Sauvagnat 2016), which creates negative exogenous shocks to customer performance that would be unrelated to focal firm CEO efforts. We find that focal firm CEO compensation is shielded from natural disasters at a customer's customer headquarters. Also, we find that the focal firm CEO is not shielded from these shocks in the year prior to them becoming a customer and in the year after they cease being a customer. Together, these tests affirm our evidence of customer RPE.

Because the informativeness of peer group performance is critical to the ability of RPE to mitigate contracting risk and improve contracting efficiency (Holmstrom 1982), we examine whether the use of customer RPE varies with proxies for the extent to which shocks to customer performance transfer to the firm – that is, the degree of common risk. In cross-sectional tests, we document a larger negative incentive weight on customer performance with greater correlation between the focal firm and customer performance. We also find a larger negative incentive weight for firms whose product/service offerings are more specialized. These firms are more likely to be tied to their customers making them more vulnerable to customer shocks. Lastly, we posit that firms vary in their ability to adapt to performance shocks. Firms that are less affected by demand

3

shocks have less need/benefit from insulating CEO compensation from those shocks. Consistent with this, we find a less negative incentive weight for firms that have greater operating flexibility.

Because RPE means that improved performance of a customer peer firm negatively influences CEO compensation, customer RPE creates incentives for CEOs to engage in more aggressive strategic behaviors with its downstream partners (e.g., price gouging). These strategic behaviors may negatively affect long-term value creation for the firm. We consider these tradeoffs by examining whether the negative incentive weight on customer performance in CEO contracting is weaker when cooperation with the customer is more beneficial to the firm. We use customer base concentration (indicating a more profitable relationship, Patatoukas 2011) and future relationship duration as proxies for the value of cooperation and the need to dampen aggressive strategic actions with the customer. We find that higher customer base concentration and longer future relationship duration lead to a smaller negative incentive weight on customer performance.

Our research contributes to the literature by broadening the scope of relative performance evaluation, a line of inquiry that has gained considerable attention from accounting, finance, and economics researchers (Bertrand and Mullainathan 2001, Jenter and Kanaan 2015, Jayaraman et al. 2020). While previous studies have been limited to examining firm's industry competitors or market indices as RPE peers, we examine the role of a firm's customers as RPE peers. We show that customer relative performance evaluation provides an additional lever, not previously documented, by which firms filter noise from performance measures and reduce incentive contracting risk. Moreover, our results show that the incentive weight on customer peer performance has different determinants from that on industry peer performance. For example, tournament theory suggests that more specialized firms would put less weight on industry peer performance because the similarity of the firm to its competitor peers is low (e.g. Lazear and Rosen

1981, Albuquerque 2013). In contrast, we show that more specialized firms put more weight on customer peer performance. Finally, we provide evidence of trade-offs firms face when incorporating customer performance into RPE. Firms forego the benefits of noise-filtering when cooperation with the customer, or de-escalation of aggressive behavior against the customer, is of value to the focal firm. Thus, our study contributes to the growing body of research on the determinants of RPE peer group composition and the consequences of such choices.

2. PRIOR LITERATURE AND HYPOTHESIS DEVELOPMENT

The "informativeness criterion" (Holmstrom 1982) argues that any signal that is informative about CEO effort should be used in incentive contracting. Consistent with this criterion, relative performance evaluation (RPE) refers to the use of peer performance, in addition to own-firm performance, in evaluating a CEO's efforts. Under RPE, common exogenous shocks that are shared by both a firm and its peers can be filtered out from the firm's performance by incorporating peer performance in determining compensation. By implementing RPE, a firm can increase the precision of performance measurement, sheltering the CEO from performance effects beyond his control, and thus increase the efficiency of CEO compensation contracts (Lazear and Rosen 1981; Holmstrom 1982).

Given the theoretical benefit of RPE, prior research has empirically examined its use in compensation contracting. Bannister et al. (2011) document that 30% of the S&P 500 firms explicitly acknowledge the use of RPE in their proxy statements, while Gong et al. (2011) find that 25% of the S&P 1500 firms explicitly disclose their use of RPE in their proxy statements after the SEC 2006 disclosure rule. Furthermore, consistent with Antle and Smith (1986) who state that firms use RPE without explicitly disclosing so, Albuquerque (2009) documents a negative association between CEO compensation and industry-size peer performance across firms in the

CRSP/Compustat-Merged sample.

A key decision in the implementation of RPE is the selection of peer firms against which performance is compared. Indeed, a challenge of implementing RPE is identifying peers that share common noise with the firm (Gibbons and Murphy 1990). Assuming that firms use RPE to filter out economy-wide or industry-wide shocks, prior studies have focused on the use of market indices (e.g. Hall and Liebman 1998) or industry peers (e.g. Gibbons and Murphy 1990) as RPE peers.[1] However, a firm's specific and unique supply chain also imposes performance risk in the form of demand shocks transferred to the firm from its downstream trading partners (Olsen and Dietrich 1985; Cohen and Frazzini 2008; Cheng and Eshleman 2014). Ball Corporation, a major metal packaging company in the U.S., writes in their 2017 10-K (p. 8): "The primary customers for our aerospace segment are U.S. government agencies or their prime contractors. Our contracts with these customers are subject to several risks, including funding cuts and delays, technical uncertainties, budget changes, competitive activity and changes in scope." That is, Ball Corporation's performance is exposed to external shocks transferred from its customers that are not necessarily associated with the CEO's actions, and that do not necessarily affect Ball's competitors who do not share their customer base.

Shocks to customer demand may derive from exogenous events impacting the customers themselves (e.g. government funding cuts for Ball Corporation's customers), or deliberately induced by the customers (e.g. marketing promotions). Neither of these types of downstream demand shocks are informative of the focal firm CEO's efforts and, hence, their effects should be filtered from his incentive contract. Importantly, these demand shocks cannot be completely filtered out by RPE using only market or industry peers unless these peers share the same customer

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[1] "Industry peers" refers to other firms in the same industry defined as 1- to 4-digit SIC code (e.g. Gibbon and Murphy 1990, Garvey and Milbourn 2006, Albuquerque 2009) or 6-digit GICS codes (e.g. Albuquerque 2014).

base. Also, while filtering idiosyncratic performance shocks of industry peers from firm performance does not enhance the efficiency of CEO compensation contracts (Wu 2013; Wu 2017), filtering idiosyncratic shocks to a customer's performance is relevant to CEO incentive risk reduction because those shocks transfer up the supply chain to affect the firm's own performance.

As an example, a fire at a competitor peer firm (i.e., an idiosyncratic performance shock) would reduce that competitor firm's performance. Despite the fact that the competitor firm's idiosyncratic performance shock was uninformative about the focal firm CEO's effort, the CEO would benefit from this negative performance shock to his RPE peer with higher compensation. But, a fire at a customer peer firm, although also idiosyncratic in nature, would potentially negatively impact the focal firm's performance if, for example, the customer lost its ability to operate and reduced/ceased purchases from the focal firm. In this instance, customer performance would be informative in assessing the focal firm CEO's efforts as the CEO should not be penalized for a decline in performance due to the customer's fire.

Including customers as RPE peers, in addition to market or industry peers, provides the firm with an incrementally precise performance measure of CEO efforts. Thus, in addition to filtering out market and industry shocks by the inclusion of indices or similar peer firms, we predict that focal firms will incorporate customer RPE into CEO incentive contracting; that is, that there will be a negative association between CEO compensation and the performance of the firm's customer base. However, not all shocks transmitted from customers are exogenous to CEO efforts. For example, increased sales of a customer could be due to higher quality products supplied by the firm, and selecting well-performing customers may be related to CEO's negotiation efforts. In this case, filtering out customer shocks from firm performance comes at the expense of sacrificing the

sensitivity of pay-to-performance by filtering out shocks related to CEO efforts. Facing this tradeoff, firms might refrain from using customers as RPE peers.

H1: CEO compensation is negatively associated with the performance of the firm's customer base.

The theory underlying the value of RPE is that signals that are informative about CEO effort will be incorporated into an optimal incentive contract to improve incentive contracting efficiency (Holmstrom 1982). Peer performance, whether it be industry peer or customer peer, is informative about the focal firm CEO's efforts when the firm and its peers are both affected by "common shocks." Including peer performance into incentive contracting provides a means of filtering common shocks from the CEOs performance measure, thereby providing the firm with a more precise measure of CEO performance (e.g., Banker and Datar 1989). Empirical RPE research measures the degree of noise-filtering benefit – that is, the informativeness of peer performance – by the extent to which peer performance and focal firm performance covaries. Studies examining industry peer RPE document larger negative compensation incentive weights on industry peer performance when the correlation between focal firm and peer firm performance is larger (Gong et al. 2011; Albuquerque 2014). Further, firms are more likely to disclose the use of industry peer RPE when this correlation is higher (i.e., when there is more "common risk"), and are more likely to choose specific peers with "higher common-risk-reduction ability" (Gong et al. 2011). Accordingly, we expect greater use of customer RPE as the correlation of firm performance and the performance of its customer base increases. Stated formally:

H2a: The negative association between CEO compensation and the performance of the firm's customer base is larger in magnitude when customer and focal firm performance are more highly correlated.

Customer RPE provides valuable noise-filtering and compensation risk-reducing benefits. However, basing pay on performance relative to a customer means higher customer performance

leads to lower CEO pay (a negative pay-for-performance sensitivity for customer performance). This creates incentives for the CEO to take strategic actions to reduce the performance of RPE peers. Industry peer RPE research finds evidence of more aggressive strategic actions against competitors, especially when there is bilateral RPE induced by overlapping RPE peer groups (i.e., pairs of industry competitor firms that select each other as RPE peers) (Feichter, Moers and Timmermans 2019). Other research finds evidence of weaker competitor firm RPE in settings in which strategic interactions is not beneficial. Vrettos (2011) documents negative incentive weights on the performance of industry firm peers who are strategic rivals in the airline industry, but not for industry peers who are strategic partners. Aggarwal and Samwick (1999) find that RPE use is lower overall in industries that are already highly competitive. Both studies suggest that firms sometimes forego noise-filtering benefits of RPE when there is a desire to soften product market competition. While some efforts in this regard are desirable (e.g., aggressive pricing to capture a larger share of the supply chain profits), excessive strategic actions against customers could undermine customer relationships and signal to the customer base the firm's positioning of itself as an adversary instead of as a collaborative upstream partner. A degradation of the supplier-customer relationship can have long-term negative effects on the value of the firm and on the overall supply chain (e.g. Irvine et al. 2015). Thus, we predict that the use of customer RPE will be attenuated in settings in which expected value of supplier-customer relationship is higher. This leads to our second cross-sectional prediction:

> **H2b: The negative association between CEO compensation and the performance of the firm's customer base is lower in magnitude when customer value is larger to the firm.**

3. DATA AND RESEARCH DESIGN

We form our initial sample from our process of identifying data availability of customers

specific to a firm from Supply Chain Relationship data provided by FactSet. These data cover around 23,400 global firms and contains information of firms' supply chain partners. FactSet collects firm information from firm 8-Ks/10-Ks (including primary customer disclosures mandated by the SEC), company websites, press releases, and corporate action releases dating back to 2003. Note that the FactSet customer identifications include, but are broader than, the major customer data from Compustat Segment files which had been the primary data source in prior studies (e.g. Patatoukas 2011). We retrieve executive compensation data from Execucomp, stock price data from CRSP, and accounting data from Compustat. Our beginning sample size is 31,087 CEO-year observations for the period 2003 to 2018.

Our hypothesis H1 predicts that firms will use customer RPE. We test for the use of customer RPE using the implicit approach in which we infer customer RPE from a negative incentive weight on customer performance in a regression with CEO pay as the dependent variable. Importantly, we test for customer RPE incremental to industry peer firm RPE. To test hypothesis H1, we estimate the following model following previous studies (e.g. Albuquerque 2009, Albuquerque 2013, Jayaraman et al. 2020):

$$CEOPay_{it} = \beta_0 + \beta_1 CustPerf_{it} + \beta_2 PeerPerf_{it} + \beta_3 FirmPerf_{it} + < ControlVariables_{it} >$$
$$+\varepsilon_{it} \qquad\qquad (1)$$

The subscript t indicates the fiscal year while the subscript i represents the firm, and standard errors are clustered by firm. Firm fixed effects are included to control for firm-specific time-invariant factors that may influence CEO compensation (e.g., corporate governance attributes). Year fixed effects are also included.

3.1. Variable descriptions

3.1.1. *Dependent Variable*

Our dependent variable, CEO compensation ($CEOPay_{it}$), is defined as the log of total annual flow compensation, which is the sum of salary, bonus, the fair value of stock option awards and restricted stock awards the change in deferred compensation, non-equity incentive plan compensation, and all other compensation. Consistent with prior literature (Albuquerque 2009; Gong et al. 2011), we take the natural logarithm to mitigate skewness in CEO compensation. $CEOPay_{it}$ does not include the changes in value of existing firm options and stock holdings owned by the CEO that were granted in prior years, as these changes are mechanically related to firm performance (Albuquerque 2009) and customer performance (Cohen and Frazzini 2008; Eshleman and Guo 2014).

3.1.2. *Independent Variables*

We measure the incentive weights on four measures of performance: firm performance, mean industry peer performance, mean customer performance, and market performance (used in a robustness test). Firm performance ($FirmPerf_{it}$) is the natural logarithm of one plus annual stock return of the focal firm during the fiscal year. We predict that CEO compensation will be increasing in the firm's own performance (i.e., $\beta_3 > 0$ in equation (1)). Peer performance ($PeerPerf_{it}$) is the natural logarithm of one plus equal-weighted average of the annual stock return of the firm's industry-size peers (i.e., peer firms in the same 2-digit SIC code and size quartile) in year *t*, following Albuquerque (2009). Consistent with prior research documenting the use of industry peer RPE (Albuquerque 2009), we expect the coefficient on $PeerPerf_{it}$ to be negative (i.e., $\beta_2 < 0$ in equation (1)). In a robustness test, we include market performance,

11

$MktPerf_t$, computed as the S&P 500 market index return for year t.

Customer performance ($CustPerf_{it}$), our primary independent variable of interest, is the natural logarithm of one plus equal-weighted average of the annual stock returns of firm i's customers (as identified in the FactSet database) in year t.[2] To avoid overlapping firms in $CustPerf_{it}$ and $PeerPerf_{it}$, we omit from $CustPerf_{it}$ the annual returns of the firm's industry-size peers that are also identified as the firm's customers.[3] It is important to note that we are examining the effect of $CustPerf_{it}$ after controlling for $FirmPerf_{it}$. If customer performance related to CEO efforts (e.g. selecting well-performing customers) is already reflected in firm's stock returns, the coefficient on $CustPerf_{it}$ would represent the effect after controlling for that CEO-effort-related customer performance. Also, controlling for industry peer RPE ($PeerPerf_{it}$), the coefficient on $CustPerf_{it}$ represents noise-filtering that is incremental to industry peer RPE observed in prior studies (e.g. Albuquerque 2009). If firms use customer RPE as our hypothesis H1 predicts, CEO compensation will be negatively associated with average customer performance, $\beta_1 < 0$.

Hypothesis H2a predicts that the negative association between CEO total compensation and customer performance will be larger in magnitude when customer and focal firm performance are more highly correlated. To test this prediction, we calculate the correlation between firm performance ($FirmPerf_{it}$) and average customer performance from year t-4 to t ($Corr_{it}$), and interact this variable with customer performance ($CustPerf_{it}$). We use the correlation of annual returns because our $CEOPay_{it}$ measures the annual flow compensation. All interacted variables are mean-centered to facilitate interpretation and to alleviate multi-collinearity (Aiken and West

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[2] Results are robust when we require the customer to have a relationship with firm i that lasts more than 6 months during year t.

[3] Results are robust to the inclusion of overlapping customer and industry peers in $CustPerf_{it}$.

1991). Requiring 5-year returns for both the firm and the customer groups leads to a loss of 4,668

observations. To test Hypothesis H2a we estimate the following model:

$$CEOPay_{it} = \beta_0 + \beta_1 CustPerf_{it} + \beta_2 Corr_{it} + \beta_3 CustPerf_{it} * Corr_{it} + \beta_4 PeerPerf_{it} +$$

$$\beta_5 FirmPerf_{it} + < ControlVariables_{it} > + \varepsilon_{it} \tag{2}$$

Hypothesis H2a predicts that $\beta_3 < 0$ indicating a stronger customer RPE effect for firms

in which the correlation between firm performance and customer performance is larger. As before,

standard errors are clustered by firm. Firm and year fixed effects are included.

Hypothesis H2b predicts that the negative association between CEO total compensation

and customer performance will be smaller in magnitude when customer value is higher to the firm.

Although using customer RPE has the benefit of insulating demand shocks, this practice can also

motivate the CEO to take strategic actions (e.g., price gouging) harmful to the long-term

relationship with the customer and, ultimately, harmful to long-term firm value.

We use two proxies for customer value: customer-base concentration and average future

duration of the customer relationships. Patatoukas (2011) finds that more concentrated customer

relationships are more profitable for firms because of efficiency gains. In addition, all else equal,

customer relationships with longer future durations would bring higher total profit to the firm.[4]

Customer-base concentration, (CC_Rank_{it}), is defined as in Patatoukas (2011) as the decile rank

of the sum of customers' squared sales percentages. The average future duration of the firm's

customer relationships is $F\_duration_{it}$. Future customer relationship duration for each customer

is defined by the number of days between two dates: the first day of year t (or the start-date of the

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[4] A concentrated customer base also exposes the firm to greater risk due to lack of diversification. While we predict that the firm will decrease the negative incentive weight on customer performance to temper excessive strategic behaviors, a smaller negative incentive weight could also be interpreted to be the firm's efforts to motivate the CEO to take actions to mitigate risk imposed by a concentrated customer base. It is also possible the board will *increase* the negative incentive weight to reduce the risk exposure in the CEO incentive contract, which would bias us against finding our predicted result.

relationship, whichever comes later) and the second date is the end-date of the firm's final relationship with the customer.

To test Hypothesis H2a we estimate the following model:

$$CEOPay_{it} = \beta_0 + \beta_1 CustPerf_{it} + \beta_2 < customer\ value >_{it} + \beta_3 CustPerf_{it} *$$

$$< customer\ value >_{it} + \beta_4 PeerPerf_{it} + \beta_5 FirmPerf_{it} + < ControlVariables_{it} > +\varepsilon_{it}$$

(3)

Where our proxies for customer value are CC_Rank_{it} or $F\_duration_{it}$. All interacted variables are mean-centered to facilitate interpretation and to alleviate multi-collinearity. Hypothesis H2b predicts that $\beta_3 > 0$ indicating a weaker customer RPE effect for firms in which customer value is greater. As before, standard errors are clustered by firm and firm- and year-fixed effects are included.

3.1.3. Control Variables

Following prior literature, we control for focal firm stock return volatility (Vol_{it}), measured as the standard deviation of the monthly stock returns during year t, and leverage (Lev_{it}), defined as the book value of liability divided by the book value of assets. We also control for firm size ($Lnat_{it}$) measured as the logarithm of assets, growth opportunities (Mtb_{it}), measured as market value of equity divided by book value of equity, and an indicator variable for whether the CEO serves as the chairman of the board ($Duality_{it}$) during year t. We further control for CEO tenure ($LnCEOtenure_{it}$) measured as the logarithm of the full years the CEO has been in office until year t, and the sum of the value of stock and equity portfolio held by the CEO, also known as inside equity ($Firmspecificwealth_{it}$) (Coles et al. 2006). All continuous variables are winsorized at 1 percent (top and bottom). Variable definitions are in Appendix A.

Omitting observations with missing data for any of our variables results in a final sample

of 11,519 CEO-year observations from 1,720 firms from 2003 to 2018. The sample selection procedure is provided in detail in Table 1.

<div align="center">**<Insert Table 1 about here>**</div>

4. RESULTS

4.1. Descriptive Statistics

Table 2 provides the descriptive statistics for the sample. The mean (median) value of logged total annual flow compensation ($CEOPay_{it}$) is 8.22 (8.29). In raw values, the mean (median) value of total annual flow compensation is \$5.92 million (\$3.96 million). The mean (median) value of firms' logged annual stock return ($FirmPerf_{it}$) is 0.07 (0.10). The mean (median) value of customers' logged annual stock return ($CustPerf_{it}$) is 0.14 (0.12), while the mean (median) value of industry-size peers' logged annual return ($PeerPerf_{it}$) is 0.09 (0.11).

Following prior research, we form an industry peer group to compute $PeerPerf_{it}$ based on SIC 2-digit industry codes and size quartiles. For our customer performance variable, $CustPerf_{it}$, we use the FactSet database to identify explicit customers. Only around 4 percent of customers we identify would have been included in industry-size peer groups in previous studies (e.g., Albuquerque 2009, Albuquerque 2013), suggesting that the customer RPE that we examine is distinct from what these studies would observe. Recall that we create distinct sets of industry peers (firms in the same 2-digit SIC code industry and size quartile as the focal firm) and customer peers by removing any overlap between the two groups from the customer peer group. The average duration of customer relationships in our FactSet sample is 707 days.

<div align="center">**<Insert Table 2 about here>**</div>

Table 3 provides the Pearson correlation table for our sample. CEO pay ($CEOPay_{it}$) is negatively associated with customer performance ($CustPerf_{it}$), as well as peer performance

<div align="center">15</div>

($PeerPerf_{it}$). Firm performance ($FirmPerf_{it}$) is positively associated with customer performance ($CustPerf_{it}$), consistent with the prior literature (Cohen and Frazzini 2008) and in support of the potential value of customer performance in customer RPE. Firm performance ($FirmPerf_{it}$) is also positively correlated with peer performance ($PeerPerf_{it}$) and market performance ($MktPerf_{it}$), consistent with the value of each as the basis of industry peer RPE.

<div align="center">**<Insert Table 3 about here>**</div>

4.2. Test of hypothesis H1

4.2.1 Main tests

Table 4 presents the test of hypothesis H1 which predicts the use of customer RPE, indicated by a negative association between CEO total compensation and customer performance. Column 1 in Table 4 tests for this relation in the absence of industry peer RPE. Column 2, the estimation of equation (1), adds peer performance as a means of testing for customer RPE *incremental* to industry peer RPE documented in prior research. In Column 3, as a robustness test, we include a measure of market performance.

In all columns, the coefficients on $FirmPerf_{it}$ are positive and significant (0.114, 0.120, and 0.123, respectively, all p<0.01). This positive association between firm performance and CEO compensation is as expected and reflects CEO pay-for-performance. Consistent with our hypothesis H1, $CustPerf_{it}$ is negative and significant (-0.060, p<0.01) in Column 1, indicating that firms not only use own-performance when setting CEO compensation, but also use customer performance to filter out shocks transmitted from customers. Importantly, this result holds after controlling for $PeerPerf_{it}$ (Column 2) and for $MktPerf_{it}$ (Column 3), indicating that the risk-filtering effect of customer-relative performance evaluation (customer RPE) is incremental to that of RPE using industry-size peers or market index performance documented in prior studies

<div align="center">16</div>

(Albuquerque 2009, Albuquerque 2013).

In terms of economic significance, Column 3 indicates that a 10% increase in focal firm return leads to approximately a 1.17% increase in total CEO compensation (i.e., an increase in compensation of $46.43K at median levels of CEO compensation). Offsetting this increase in compensation, however, are adjustments to account for customer, peer, and market returns. A 10% increase in *customer* return (e.g., 14% to 15.4%) leads to approximately a 0.45% ($17.86K) decrease in total CEO compensation, and a 10% increase in *industry peer* firm return leads to approximately a 0.71% ($28.17K) decrease in total CEO compensation. Thus, customer RPE has an economically significant effect on total CEO compensation as compared to the effects on compensation of industry peer stock return performance and the firm's own stock return performance.

In untabulated analyses, we find that these results also hold at a 1% significance level after including CEO-fixed effects which control for CEO-specific time-invariant factors that may influence CEO compensation (e.g., CEO ability, CEO career opportunities). We also find that our conclusions are unchanged when we remove from the customer peer group any firms that are also identified as competitors by FactSet.

<Insert Table 4 about here>

4.2.2 Active and inactive relationships

A potential concern of our analysis is that customer selection is partly an endogenous decision of a firm. If the firm is more likely to trade with a customer who is in the same geographic area, shares the same technology, or uses the same materials, the firm and its customers are likely to share common shocks stemming from these similarities. If the firm insulates CEO compensation from these shocks by putting a negative weight on the common shocks themselves, CEO

compensation could be negatively correlated with customer performance even when the firm does not necessarily implement customer RPE. To mitigate this concern, we test if the negative association between CEO total compensation and customer performance holds for customer relationships that had just ended in year t-1 or that would just start in year t+1. If the results are driven by firms' placing a negative weight on common shocks rather than on customer performance, the associated relation should also be found in periods before the customer relation begins or after it ends.

<center>**<Insert Table 5 about here>**</center>

Results in Table 5 demonstrate that the significant association between CEO total compensation and customer performance is found only for active relationships (*CustPerf$_{it}$*), and not for recently ended or forthcoming inactive relationships (*CustPerf$_{it}$(inact)*). In the first column, *CustPerf$_{it}$(inact)* is performance of customers whose relationship with the firm ends in year t-1, and in the second column, *CustPerf$_{it}$(inact)* is performance of customers whose relationship with the firm starts in year t+1. In the third column, *CustPerf$_{it}$(inact)* is performance of all customers whose relationship with the firm ends any timebefore year t (e.g. ends in year t-1, year t-2…) or starts any time after year t (e.g. starts in year t+1, year t+2…). In this specification, we are able to conserve more observations since we do not require the firm-year observations to have customer relationships that had ended specifically in t-1 or that starts specifically in t+1. The results suggest the negative association between CEO total compensation and customer performance we document is likely due to customer RPE and not driven by correlated omitted variables.

4.2.3 Natural disasters at customer headquarters

It is possible that some omitted factor leads to both higher CEO pay and lower customer performance. To address this concern, we examine major natural disasters at a customer's

<center>18</center>

headquarters to identify exogenous demand shocks – a shock that affects customer performance but should not affect focal firm CEO compensation except through customer performance. Following Barrot and Saugasgnat (2016), we use natural disaster data from SHELDUS (Spatial Hazard and Loss Database for the United States). We restrict the sample of disasters to those lasting less than 30 days and causing estimated damages above $1 billion. We posit that major natural disasters at a customer's headquarters will generate negative demand shocks to the firm that are exogenous to CEO efforts.

As Barrot and Saugasgnat (2016) finds that natural disaster shocks through year t-3 to supply chain partners (suppliers in their study) has a significantly negative effect to firm performance in year t, we define $CustShock_{it}$ as 1 if any firm in the customer peer group has experienced a natural disaster from year t-3 to year t. About 3% of our observations has had a natural disaster happen to one of their customers in year t, and about 11% has had a natural disaster happen to one of their customers between in year t-3 and year t. Our expectation is that natural disasters to a focal firm's customer creates a negative exogenous shock that should be filtered out from CEO compensation. In untabulated analyses, we confirm that customer stock returns are negatively related to a natural disaster at a customer's headquarters.

<center>**<Insert Table 6 about here>**</center>

As reported in Table 6, we find evidence consistent with our expectation that firms filter out exogenous customer shocks as the coefficient on $CustShock_{it}$ is positive and significant. Furthermore, similar to our inactive/active relationships analyses, we find that the focal firm CEO is not shielded from natural disasters to customers whose relationship with the firm ends in year t-1, customers whose relationship with the firm starts in year t+1, and all customers whose relationship with the firm ends before year t (e.g. year t-1, year t-2…) or starts after year t (e.g.

year t+1, year t+2…). In untabulated analyses, we conduct an instrumental variables estimation where we use *CustShock$_{it}$* as an instrument that creates exogenous variation in customer stock returns. In the first stage, we instrument for customer stock returns using natural disasters at a customer's headquarters. In the second stage, we find that the instrumented customer stock returns are negatively associated CEO compensation. These tests help mitigate concerns that an omitted variable is leading to our results. They also help rule out the possibility that the relation we document between customer performance and CEO pay results from a potential mechanical relation between customer and firm performance (i.e. that they may be negatively related).

4.2 Test of hypothesis H2a

If the documented negative association between CEO pay and customer performance (H1) is driven by the firm's motive to filter out exogenous noise, theory (e.g. Holmstrom 1982) predicts that this association will be stronger when the firm shares more noise with its customers. Thus, H2a predicts that the negative association between focal firm and customer performance will be larger in magnitude when the focal firm and customer performance tend to comove.

<center>**<Insert Table 7 about here>**</center>

Table 7, Column 1 provides the estimation of equation (2) and the test of H2a. Consistent with results reported in Table 4, the incentive weight on focal firm performance is positive (0.097, p<0.01). As predicted in H2a, the coefficient on *CustPerf$_{it}$*Corr$_{it}$,* the interaction between customer performance and the firm-customer return correlation, is negative and significant (-0.081, p<0.10). This suggests that firms put a larger negative weight on customer performance when common variation is higher. Note that the coefficient on *CustPerf$_{it}$* is insignificant at conventional levels.

4.2.1 Sales volatility

<center>20</center>

As a robustness test, we substitute for the firm-customer return correlation variable a measure of focal firm sales volatility, *Salevol$_{it}$,* measured as the standard deviation of focal firm sales from year t-4 to t. To the extent that the focal firm's sales volatility is transferred from its customers, we would expect to see increased use of customer RPE (i.e., we would expect a negative association between CEO total and compensation and customer performance to be larger in magnitude). Table 7, Column 2 presents the results of our test of this expectation. As expected, we find a negative coefficient on *CustPerf$_{it}$*Salevol$_{it}$* (-0.213, p<0.10). This provides additional support for our conclusion that firms are using customer performance as a means of filtering noise from CEO performance measures.

4.2.2 Product specialization

To further corroborate our evidence in support of H2a, we examine whether firms that offer more specialized products or services use customer RPE to a greater extent. These firms are more likely to be tied to their customers at least in the short-run, and thus are less able to evade the shocks due to changes in customer demands. As our proxy for product specialization, we use the product similarity measure developed by Hoberg and Phillips (2016) ($Simm_{it}$).[5] Hoberg and Phillips (2016) calculate pairwise product similarity scores between firms in the CRSP/Compustat universe through textual analysis of product descriptions from firms' annual 10-K filings. Using these scores, they construct the Text-based Network Industry Classification (TNIC) for each firm, which classifies firms into product similarity "industries." The product similarity measure we use is the total similarity score for the focal firm's TNIC industry from the Hoberg and Phillips' Data Library.[6] This measure captures the degree of product similarity of the firms in the focal firm's

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[5] This measure is based on the similarity score generated by parsing the product descriptions from firm 10-Ks. More description is available at http://hobergphillips.tuck.dartmouth.edu/idata/Readme_tnic3HHIData.txt.
[6] http://hobergphillips.tuck.dartmouth.edu/

TNIC industry and is, thus, an inverse proxy for product specialization that is expected to result in a weaker (less negative) incentive weight on customer performance.

<Insert Table 8 about here>

Table 8 Column 1 presents the results of an OLS model in which we include interactions between customer performance ($CustPerf_{it}$) and product similarity ($Simm_{it}$). We find evidence that firms with higher levels of product similarity with other firms in their TNIC industry put a smaller negative weight (i.e., positive coefficient on the interaction term, $CustPerf_{it}*Simm_{it}$) on customer performance (0.009, p<0.10). We provide support for the expectation that firms use customer RPE to a greater extent when their products and services are more specialized and thus more likely tailored to their customers in the short-run.

4.2.3 Operating flexibility

Lastly, we examine whether focal firms with more operating flexibility that allows them to more readily adapt to demand shocks have less need for the use of customer RPE (i.e., they have a weaker negative relation between customer performance and CEO total compensation). Low operating leverage indicates a cost structure with low fixed costs relative to variable costs (i.e., high operating flexibility), while high operating leverage indicates a cost structure with high fixed costs relative to variable costs (i.e., low operating flexibility). Low operating leverage firms are exposed to lower performance risk from demand fluctuations. Following Novy-Marx (2011), we use the sum of selling, general, and administrative expenses and costs of goods sold divided by total book value of assets in year t as a measure of operating leverage.

Table 8 Column 2 presents the results of an OLS model in which we include interactions between customer performance ($CustPerf_{it}$) and operating leverage ($Opleverage_{it}$). Results suggest that firms with higher operating leverage, and thus lower operating flexibility, place a larger

negative weight on customer performance (coefficient on the $CustPerf_{it}*Opleverage_{it}$ interaction of -0.101, p<0.01). We thus provide support for the expectation that firms with greater operating flexibility make less use of customer RPE.

4.3 Test of hypothesis H2b

Although using customer RPE has the benefit of insulating demand shocks, this practice can also motivate the CEO to take strategic actions (e.g., price gouging) harmful to the long-term relationship with the customer and, ultimately, harmful to long-term firm value. Assuming that customer RPE is implemented with these potential adverse effects in mind, Hypothesis H2b predicts that customer performance is less likely to be used in incentive contracting if customer relationships have higher economic value to the firm.

<Insert Table 9 about here>

Table 9 presents the results of an OLS model of equation (3) in which we include interactions between customer performance ($CustPerf_{it}$) and each of our proxies of customer relationship value: CC_Rank_{it} (our measure of increased customer relationship value from customer base concentration, consistent with Patatoukas 2011) (Column 1) and $F\_duration_{it}$ (the measure of future customer relationship duration) (Column 2). As predicted by H2b, we find a positive coefficient on CC_Rank_{it} (0.013, p<0.10) indicating firms make less use of customer RE when the firm has higher customer-base concentration.

This result is in contrast to our previous result that firms with more specialized products make greater use of customer RPE. When stronger ties are due to high customer concentration, customers are likely to have higher market power over the firm. The focal firm has a higher need to avoid the adverse CEO incentives to engage in aggressive strategic interactions with the customer that may harm the relationship. This leads to a reduction in the use of customer RPE

(consistent with the documented positive coefficient on $CustPerf_{it}*CC\_Rank_{it}$ in Table 9, Column 1). By contrast, when stronger ties are due to the focal firm's product specialization, the focal firm is likely to have higher market power. Where the focal firm has market power from specialized products, the risk of the loss of the customer is lower and concern for excessive strategic interactions is reduced. The focal firm is thus more likely to use customer RPE and reap the benefits of a more efficient CEO compensation contract (consistent with the documented positive coefficient on $CustPerf_{it}*Simm_{it}$ in Table 8, Column 1).

Table 9, Column 2 tests if firms are less likely to use customer performance in incentive contracting when the relationship with customers has a higher average future duration ($F\_duration_{it}$). We find no significant (at conventional levels) relation. Specifically, the coefficient on the $CustPerf_{it}*F\_duration_{it}$ interaction variable is positive as predicted, but significant only in a one-tail prediction (0.025, p<0.20). In untabulated analyses, we find that firms are less likely to use customer performance in incentive contracting when the relationship history with customers has a higher average duration (0.041, p<0.10).

5. CONCLUSION

We examine whether firms use customer performance in evaluating CEO performance, a practice we call "customer relative performance evaluation" (customer RPE). We propose that firms use customer performance, in addition to industry peer performance and market indices, to filter out common performance shocks specific to the customer-supplier relation. Theory (Homstrom 1982) predicts that doing so improves the efficiency of CEO contracting.

Using Supply Chain Relationship data provided by FactSet, we compute customer performance for the specific customers comprising a firm's customer base. Consistent with our prediction, we find a significant negative association between CEO total compensation and

customer performance indicative of the use of customer RPE. Exploiting the timing of when customers are active and inactive, we document that this relation exists only when customers are currently purchasing from the focal firms. That we do not find a negative relation when customers are inactive (prior to becoming an active customer or after they cease being a customer) helps affirm that our findings are not caused by an omitted factor. We also test using a natural disaster to a customer's headquarters as an exogenous shock to customer performance, unrelated to focal firm CEO efforts, to help attribute our relation to customer RPE and not a mechanical relation between customer and firm performance.

In additional tests, we find that the negative incentive weight on customer performance is larger in magnitude when the focal firm is more vulnerable to shocks in demand transferred from the downstream customer. Specifically, the negative incentive weight is larger when focal firm performance is more highly correlated with customer performance, when focal firm sales are more volatile, and when the focal firm's products/services are less standardized. On the other hand, the negative weight is smaller when the firm has high operating flexibility that buffer its performance from demand shocks. Lastly, we present evidence that customer RPE is designed with the possible adverse effects of incentives for the CEO to engage in excessive strategic behavior with the customer. Finally, we find that the negative incentive weight on customer performance is smaller in magnitude when customer profitability (as proxied by customer concentration) is higher and when the future duration of customer relationships are longer, our proxies for the value of customer relationships. This finding is consistent with firms trading off the benefits of customer RPE when the costs of incentivizing negative strategic interactions with customers are higher.

While there is extensive prior research examining the use of industry peer RPE, we are the first study to document the use of customer performance in relative performance evaluation.

Demand shocks emanating from a firms specific customer base can expose a firm to significant performance risk – risk that is often times not imposed on the firms industry peers who do not have a relationship with that customer and, hence, not able to be filtered from firm performance measures using industry peer RPE. Absent customer RPE, firm performance risk translates to greater compensation risk and, in turn, larger compensation risk premium that must be paid to the CEO. Our study provides the first empirical evidence that contracting efficiency is restored through the use of customer RPE to filter demand shocks emanating up the supply chain.

APPENDIX A. Variable Definitions

$CEOPay_{it}$	Year t log of the sum of the focal firm CEO's: salary, bonus, the fair value of stock option awards and restricted stock awards (per SFAS 123R), the change in deferred compensation, non-equity incentive plan compensation, and all other compensation.
$CustPerf_{it}$	Log of 1 plus equal-weighted average of the annual stock returns of the focal firm's customers (as identified in the FactSet database) in year t
$PeerPerf_{it}$	Log of 1 plus equal-weighted average of annual stock return for year t across all firms in the Compustat-CRSP merged database that belong in the focal firm's same SIC 2-digit industry code and size quartile, but not identified as the focal firm's customer from FactSet database, for year t.
$MktPerf_{it}$	Log of 1 plus S&P 500 market index return for year t ending in fiscal month of firm i.
$FirmPerf_{it}$	Log of 1 plus annual stock return of the focal firm for fiscal year t.
$Corr_{it}$	Correlation between focal firm annual stock return and average customer annual stock return from year t to t-4.
$Salevol_{it}$	Standard deviation of focal firm sales from year t to t-4.
CC_Rank_{it}	Decile rank of the sum of customers' squared sales percentages for year t. $CC_{it} = \sum_{j=1}^{J} \left(\frac{Sales_{ijt}}{Sales_{it}}\right)^2$.
$F\_duration_{it}$	Log of the focal firm's average number of days of future customer relationship durations. Future customer relationship duration is computed for each customer relationship as the number of days between the first day of year t (or the start-date of the relationship, whichever comes later), and the end-date of the firm's final relationship with the customer.
$Simm_{it}$	The total similarity score for the focal firm's TNIC industry gathered from the Hoberg and Phillips' Data Library. This measure captures the degree of product similarity of the firms in the focal firm's TNIC industry. TNIC industry classification is based on textual analysis of 10-Ks for year t (Hoberg and Phillips 2016).
$Opleverage_{it}$	Focal firm sum of selling, general, and administrative expenses and costs of goods sold divided by total book value of assets for year t
Vol_{it}	Focal firm standard deviation of monthly stock returns during year t
Lev_{it}	Focal firm book value of liability divided by the book value of assets.
Mtb_{it}	Focal firm market value of equity, divided by total assets minus total liabilities for year t.
$Lnsale_{it}$	Value of log (total sales) for year t.
$Duality_{it}$	A dummy variable that indicates whether the focal firm CEO serves as the chairman of the board for year t.
$LnCEOtenure_{it}$	Log of the full years the focal firm CEO has been in office until year t.
$Firmspecificwealth_{it}$	Sum of the value of stock and equity portfolio held by the focal firm CEO, also known as inside equity, in year t.
$CustShock_{it}$	1 if one of the customers has experienced a major natural disaster from year t-3 to year t, 0 otherwise.

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TABLE 1
Sample Selection

All CEO-year observations from 2003 to 2018 from Execucomp	31,314
Less:	
Observations without CEO compensation data from Execucomp	204
Observations without customer relationship data from FactSet	17,716
Observations with insufficient data for control variables	1,875
Total CEO-year observations used in the main analysis	11,519

TABLE 2
Descriptive Statistics

Variables	N	Mean	SD	1st Qrt.	Median	3rd Qrt.
$CEOPay_{it}$ (Raw)	11,519	5927.51	7115.39	1906.70	3969.67	7448.62
$CEOPay_{it}$	11,519	8.22	0.98	7.55	8.29	8.92
$CustPerf_{it}$ (Raw)	11,519	0.14	0.35	-0.03	0.12	0.27
$CustPerf_{it}$	11,519	0.09	0.28	-0.03	0.11	0.24
$PeerPerf_{it}$ (Raw)	11,519	0.13	0.28	-0.01	0.12	0.27
$PeerPerf_{it}$	11,519	0.09	0.25	-0.01	0.11	0.24
$MktPerf_{it}$ (Raw)	11,519	0.09	0.15	0.03	0.11	0.16
$MktPerf_{it}$	11,519	0.07	0.16	0.03	0.11	0.15
$FirmPerf_{it}$ (Raw)	11,519	0.17	0.59	-0.12	0.11	0.35
$FirmPerf_{it}$	11,519	0.07	0.42	-0.13	0.10	0.30
$Corr_{it}$	6,851	0.42	0.47	0.12	0.54	0.80
$Salevol_{it}$	6,851	0.15	0.15	0.06	0.11	0.19
CC_{it}	6,584	0.09	0.13	0.02	0.04	0.09
$F\_duration_{it}$	11,515	6.82	0.98	6.18	6.95	7.54
$Simm_{it}$	8,401	3.43	4.20	1.24	1.83	3.72
$Opleverage_{it}$	8,401	0.84	0.62	0.43	0.69	1.06
Vol_{it}	11,519	0.10	0.06	0.06	0.09	0.13
Lev_{it}	11,519	0.52	0.24	0.35	0.52	0.67
Mtb_{it}	11,519	3.18	5.64	1.44	2.25	3.64
$Lnsale_{it}$	11,519	7.22	1.66	6.07	7.13	8.31
$Duality_{it}$	11,519	0.49	0.50	0.00	0.00	1.00
$LnCEOtenure_{it}$	11,519	1.65	0.92	1.10	1.79	2.30
$Firmspecificwealth_{it}$	11,519	52821.23	142802.50	6257.94	15822.43	41992.18
$CustShock_{it}$	11,795	0.11	0.31	0.00	0.00	0.00

All variables are defined in Appendix A.

TABLE 3
Correlations

		1	2	3	4	5	6	7	8	9	10	11	12
1	$CEOPay_{it}$	1											
2	$CustPerf_{it}$	**-0.033**	1										
3	$PeerPerf_{it}$	**-0.04**	**0.568**	1									
4	$MktPerf_{it}$	-0.003	**0.673**	**0.697**	1								
5	$FirmPerf_{it}$	**0.051**	**0.482**	**0.533**	**0.52**	1							
6	Vol_{it}	**-0.298**	**-0.062**	**-0.028**	**-0.174**	**-0.097**	1						
7	Lev_{it}	**0.285**	**-0.045**	**-0.041**	**-0.031**	**-0.074**	-0.002	1					
8	Mtb_{it}	**0.126**	**0.043**	**0.052**	**0.057**	**0.13**	**-0.074**	**0.078**	1				
9	$Lnsale_{it}$	**0.688**	**-0.028**	**-0.021**	-0.01	0.013	**-0.337**	**0.413**	**0.077**	1			
10	$Duality_{it}$	**0.144**	**0.038**	**0.045**	**0.03**	**0.039**	**-0.092**	**0.081**	0.007	**0.194**	1		
11	$LnCEOtenure_{it}$	**-0.02**	0.009	0.002	0.005	0.005	**-0.019**	**-0.104**	0.007	**-0.088**	**0.326**	1	
12	$Firmspecificwealth_{it}$	**0.151**	**0.031**	**0.044**	**0.033**	**0.088**	**-0.116**	-0.02	**0.087**	**0.209**	**0.132**	**0.226**	1

Bold indicates significance at $p < 0.05$. All variables are defined in Appendix A.

TABLE 4
Customer Relative Performance Evaluation (Test of hypothesis H1)

Variables	Prediction	Dependent variable: $CEOPay_{it}$		
		(1)	*(2)*	*(3)*
$CustPerf_{it}$	- (H1)	-0.060***	-0.056***	-0.048**
		(0.004)	(-2.680)	(-2.174)
$PeerPerf_{it}$	-		-0.073*	-0.075**
			(-1.910)	(-1.969)
$MktPerf_{it}$	-			-0.083
				(-0.987)
$FirmPerf_{it}$	+	0.114***	0.120***	0.123***
		(0.000)	(7.091)	(7.092)
Vol_{it}		-0.269*	-0.261*	-0.280*
		(0.071)	(-1.754)	(-1.851)
Lev_{it}		-0.251***	-0.250***	-0.249***
		(0.000)	(-3.684)	(-3.664)
Mtb_{it}		0.004***	0.004***	0.004***
		(0.001)	(3.370)	(3.376)
$Lnsale_{it}$		0.386***	0.386***	0.386***
		(0.000)	(16.381)	(16.377)
$Duality_{it}$		-0.003	-0.004	-0.003
		(0.887)	(-0.156)	(-0.137)
$LnCEOtenure_{it}$		0.042***	0.042***	0.042***
		(0.000)	(3.914)	(3.899)
$Firmspecificwealth_{it}$		-0.000	-0.000	-0.000
		(0.875)	(-0.155)	(-0.163)
Constant		5.516***	5.520***	5.527***
		(0.000)	(32.579)	(32.487)
Observations		11,519	11,519	11,519
R-squared		0.795	0.795	0.795
Year FE		Yes	Yes	Yes
Firm FE		Yes	Yes	Yes
Cluster		Firm	Firm	Firm
Number of Clusters		1,720	1,720	1,720

*** p<0.01, ** p<0.05, * p<0.10. All variables are defined in Appendix A.

TABLE 5
Active and Inactive Customer Relationships

Variables	Prediction	Dependent variable: $CEOPay_{it}$		
		$CustPerf_{it}(inact) =$ performance of customers whose relationship ends in year t-1	$CustPerf_{it}(inact) =$ performance of customers whose relationship starts in year t+1	$CustPerf_{it}(inact) =$ performance of customers whose relationship ends before year t or starts after year t
$CustPerf_{it}$	-	-0.139**	-0.172***	-0.066***
		(0.014)	(0.003)	(0.008)
$CustPerf_{it}(inact)$		0.021	0.032	0.004
		(0.634)	(0.373)	(0.897)
$PeerPerf_{it}$	-	-0.157*	-0.029	-0.076*
		(0.063)	(0.690)	(0.065)
$FirmPerf_{it}$	+	0.123***	0.139***	0.103***
		(0.001)	(0.000)	(0.000)
Vol_{it}		-0.124	0.017	-0.155
		(0.681)	(0.953)	(0.337)
Lev_{it}		-0.310*	-0.279*	-0.259***
		(0.098)	(0.063)	(0.000)
Mtb_{it}		0.006**	0.004**	0.004***
		(0.048)	(0.032)	(0.001)
$Lnsale_{it}$		0.429***	0.451***	0.381***
		(0.000)	(0.000)	(0.000)
$Duality_{it}$		-0.039	0.005	-0.006
		(0.404)	(0.895)	(0.813)
$LnCEOtenure_{it}$		0.010	0.033**	0.043***
		(0.618)	(0.041)	(0.000)
$Firmspecificwealth_{it}$		-0.000	-0.000	-0.000
		(0.255)	(0.284)	(0.717)
$Constant$		5.390***	5.110***	5.563***
		(0.000)	(0.000)	(0.000)
Observations		2,997	3,997	9,952
R-squared		0.837	0.825	0.788
Year FE		Yes	Yes	Yes
Firm FE		Yes	Yes	Yes
Cluster		Firm	Firm	Firm
Number of Clusters		1,030	1,191	1,413

*** p<0.01, ** p<0.05, * p<0.10. All variables are defined in Appendix A.

Variables	Prediction	Baseline regression	$Custshock_{it}(inact)=$ Natural disaster indicator variable for customers whose relationship ends in year t-1	$Custshock_{it}(inact)=$ Natural disaster indicator variable for customers whose relationship starts in year t+1	$Custshock_{it}(inact)=$ Natural disaster indicator variable for customers whose relationship ends before year t or starts after year t
			Dependent variable: $CEOPay_{it}$		
$Custshock_{it}$	+	0.068***	0.106***	0.054*	0.074***
		(0.001)	(0.005)	(0.076)	(0.000)
$Custshock_{it}(inact)$			-0.040	0.040	0.017
			(0.394)	(0.293)	(0.345)
$PeerPerf_{it}$	-	-0.080**	-0.175**	-0.062	-0.078*
		(0.033)	(0.035)	(0.394)	(0.057)
$FirmPerf_{it}$	+	0.114***	0.122***	0.136***	0.103***
		(0.000)	(0.001)	(0.000)	(0.000)
Vol_{it}		-0.240	-0.162	-0.013	-0.183
		(0.102)	(0.622)	(0.965)	(0.256)
Lev_{it}		-0.239***	-0.297	-0.305**	-0.256***
		(0.000)	(0.105)	(0.038)	(0.000)
Mtb_{it}		0.003***	0.006*	0.004**	0.005***
		(0.001)	(0.073)	(0.039)	(0.000)
$Lnsale_{it}$		0.374***	0.427***	0.466***	0.365***
		(0.000)	(0.000)	(0.000)	(0.000)
$Duality_{it}$		-0.003	-0.028	0.000	0.003
		(0.881)	(0.542)	(1.000)	(0.914)
$LnCEOtenure_{it}$		0.041***	0.008	0.035**	0.040***
		(0.000)	(0.663)	(0.027)	(0.000)
$Firmspecificwealth_{it}$		-0.000	-0.000	-0.000	-0.000
		(0.777)	(0.325)	(0.231)	(0.689)
Constant		5.592***	5.375***	4.994***	5.667***
		(0.000)	(0.000)	(0.000)	(0.000)
Observations		11,795	3,030	4,052	10,309
R-squared		0.795	0.837	0.826	0.790
Year FE		Yes	Yes	Yes	Yes
Firm FE		Yes	Yes	Yes	Yes
Cluster		Firm	Firm	Firm	Firm
Number of Clusters		1,742	1,034	1,203	1,437

*** p<0.01, ** p<0.05, * p<0.10. All variables are defined in Appendix A.

TABLE 7
The Effect of Common Noise on Customer RPE (Test of hypothesis H2a)

Variables	Prediction	Dependent variable: $CEOPay_{it}$	
		(1)	*(2)*
$CustPerf_{it}$	-	-0.033	-0.033
		(0.207)	(0.203)
$Corr_{it}$		0.028	
		(0.110)	
$CustPerf_{it}*Corr_{it}$	- (H2a)	-0.081*	
		(0.097)	
$Salevol_{it}$			0.050
			(0.575)
$CustPerf_{it}*Salevol_{it}$	-		-0.213*
			(0.088)
$PeerPerf_{it}$		-0.067	-0.066
		(0.125)	(0.131)
$FirmPerf_{it}$		0.097***	0.090***
		(0.000)	(0.000)
Vol_{it}		-0.287*	-0.298*
		(0.075)	(0.063)
Lev_{it}		-0.169**	-0.168*
		(0.049)	(0.051)
Mtb_{it}		0.001	0.001
		(0.252)	(0.287)
$Lnsale_{it}$		0.345***	0.347***
		(0.000)	(0.000)
$Duality_{it}$		-0.003	-0.003
		(0.921)	(0.907)
$LnCEOtenure_{it}$		0.046***	0.046***
		(0.000)	(0.000)
$Firmspecificwealth_{it}$		0.000***	0.000***
		(0.000)	(0.000)
Constant		5.848***	5.838***
		(0.000)	(0.000)
Observations		6,851	6,851
R-squared		0.833	0.833
Year FE		Yes	Yes
Firm FE		Yes	Yes
Cluster		Firm	Firm
Number of Clusters		1,163	1,163

*** p<0.01, ** p<0.05, * p<0.10. All variables are defined in Appendix A.

TABLE 8
The Effect of Shock Transferability on Customer RPE

Variables	Prediction	Dependent variable: $CEOPay_{it}$	
		(1)	*(2)*
$CustPerf_{it}$	-	-0.047	-0.028
		(0.147)	(0.386)
$Simm_{it}$		0.030***	
		(0.000)	
$CustPerf_{it}*Simm_{it}$	+	0.009*	
		(0.095)	
$Opleverage_{it}$			-0.384***
			(0.000)
$CustPerf_{it}*Opleverage_{it}$	-		-0.101***
			(0.003)
$PeerPerf_{it}$		-0.101**	-0.128***
		(0.044)	(0.009)
$FirmPerf_{it}$		0.160***	0.139***
		(0.000)	(0.000)
Vol_{it}		-0.792***	-0.020
		(0.000)	(0.925)
Lev_{it}		-0.074	-0.020
		(0.227)	(0.749)
Mtb_{it}		0.016***	0.017***
		(0.000)	(0.000)
$Lnsale_{it}$		0.455***	0.463***
		(0.000)	(0.000)
$Duality_{it}$		0.065**	0.060**
		(0.014)	(0.018)
$LnCEOtenure_{it}$		0.019	0.022*
		(0.143)	(0.084)
$Firmspecificwealth_{it}$		-0.000	-0.000*
		(0.175)	(0.085)
$Constant$		4.910***	4.738***
		(0.000)	(0.000)
Observations		8,401	8,401
R-squared		0.579	0.601
Year FE		Yes	Yes
Firm FE		Yes	Yes
Cluster		Firm	Firm
Number of Clusters		1,466	1,466

*** p<0.01, ** p<0.05, * p<0.10. All variables are defined in Appendix A.

TABLE 9

The Effect of Customer Relationship Value on Customer RPE (Test of Hypothesis H2b)

Variables	Prediction	Dependent variable: $CEOPay_{it}$	
		(1)	*(2)*
$CustPerf_{it}$	-	-0.080*	-0.058***
		(0.060)	(0.006)
CC_Rank_{it}		0.004	
		(0.427)	
$CustPerf_{it}*CC\_Rank_{it}$	+ (H2b)	0.013*	
		(0.089)	
$F\_duration_{it}$			-0.004
			(0.687)
$CustPerf_{it}*F\_duration_{it}$	+ (H2b)		0.025#
			(0.138)
$PeerPerf_{it}$		-0.109**	-0.072*
		(0.019)	(0.060)
$FirmPerf_{it}$		0.110***	0.120***
		(0.000)	(0.000)
Vol_{it}		-0.168	-0.259*
		(0.393)	(0.081)
Lev_{it}		-0.304***	-0.251***
		(0.000)	(0.000)
Mtb_{it}		0.001	0.004***
		(0.448)	(0.001)
$Lnsale_{it}$		0.377***	0.388***
		(0.000)	(0.000)
$Duality_{it}$		-0.034	-0.003
		(0.261)	(0.901)
$LnCEOtenure_{it}$		0.035***	0.042***
		(0.010)	(0.000)
$Firmspecificwealth_{it}$		0.000***	-0.000
		(0.003)	(0.790)
$Constant$		5.585***	5.502***
		(0.000)	(0.000)
Observations		6,584	11,515
R-squared		0.807	0.795
Year FE		Yes	Yes
Firm FE		Yes	Yes
Cluster		Firm	Firm
Number of Clusters		1,077	1,720

*** p<0.01, ** p<0.05, * p<0.10. All variables are defined in Appendix A.