Does It Pay to "Be Like Mike"? Aspirational Peer Firms and Relative Performance Evaluation*

Ryan T. Ball†
University of Michigan

Jonathan Bonham
University of Chicago

Thomas Hemmer
Rice University

August 2017

Abstract

We examine the manner and extent to which firms evaluate performance relative to aspirational peer firms. Guided by the predictions of an agency model, we find that CEO compensation increases in the correlation between own and aspirational peer firm performances. In addition, we define and test conditions where aggregate peer performance, which has been the primary focus of prior relative performance evaluation studies of competitive peers, is expected to have an association with CEO compensation. These conditions are supported by our empirical results. Finally, we document that our results are more pronounced when the firm-peer relationship is one-way and the peer firm is in a different industry and therefore is more aspirational.

JEL classification: G30, M12, M52.

Keywords: aspirational peer groups; relative performance evaluation; performance correlation.

*We appreciate helpful comments from Robert Bushman, Mirko Heinle, Raffi Indjejikian, Eva Labro, Abbie Smith and seminar participants at the Chinese University of Hong Kong, Hong Kong University of Science and Technology, the University of Chicago and the University of California at Berkeley.

†Corresponding author: Stephen M. Ross School of Business, University of Michigan, 701 Tappan Street, Ann Arbor, MI 48109, email: rtball@umich.edu, phone: (734) 764–3175

1. Introduction

Relative performance evaluation (RPE) stresses the importance of benchmarking firm performance to that of a group of peer firms. Beginning with Antle and Smith (1986), a vast number of empirical RPE studies have focused on the role of peer firms operating within the same competitive arena, which subjects them to common economic shocks. Comparing a firm's performance to that of its competitive peer provides a more precise signal of the manager's actions by filtering out the exogenous common shock, which is outside of his or her influence. While outperforming the competition generally increases firm value, it does not capture all value-increasing actions under the manager's control.

Beyond executing current strategies, firms also increase value by pursing new strategies that lead to opportunities not offered within the current competitive arena. Benchmarking firm performance against a competitive peer group will not sufficiently capture these type of actions. We posit that firms instead benchmark firm performance relative to an "aspirational" group of peer firms–those with value-maximizing strategies that a manager takes actions to emulate. This provides an incentive for managers to take actions that inevitably increase the correlation between the firm's performance and the performance of its aspirational peer in an effort to mimic their strategy. As a result, performance correlation captures the relative performance component of the manager's actions.

In this study, we examine the manner and extent to which the correlation between the performances of a firm and its aspirational peer (hereafter, performance correlation) affects CEO compensation. This extends previous RPE investigations that focus on the role of competitive peer firms in filtering out exogenous shocks by using aggregate peer performance in the evaluation of

CEO performance.[1] Our focus on the role of performance correlation with respect to aspirational peer firms complements these studies by identifying a new dimension of RPE that contributes to a more robust understanding of how firms evaluate and compensate executives.

Our empirical analysis is guided by a simplified version of an agency model recently proposed in Hemmer (2016). The model extends the fundamental one-firm, one-agent dynamic model of Holmström and Milgrom (1987) by including two firms: a focal firm and an aspirational peer firm. The aspirational firm is characterized by a more efficient production technology that the focal firm seeks to emulate. Both firms have a manager able to control the performance of his or her own firm in real time. As a result, the actions of the focal firm's manager implicitly influences the covariance between the performances of the two firms.

This general endogeneity of the performance covariance when RPE is optimal provides empirical predictions related to aspirational peers in stark contrast to those of prior RPE studies that focus on competitive peers. In particular, while the standard aggregation result for own performance remains valid (Holmström 1982; Holmström and Milgrom 1987), aggregate peer performance is no longer sufficient to capture the relative component, which requires information about the entire path of performances over the contracting horizon. Instead, if the performance of both firms is observed more frequently than the contract horizon, then the realized correlation between own and aspirational peer firm performance histories becomes a sufficient statistic for the information about relative performance contained in these paths. In equilibrium, the focal firm's manager is optimally provided incentives to increase the performance correlation in an effort to emulate the strategy of the peer firm. As a result, the optimal compensation given to the focal firm's manager becomes

[1] Key empirical papers on the relation between CEO compensation and aggregate performance of a competitive peer group are Antle and Smith (1986), Jensen and Murphy (1990), Barro and Barro (1990), Aggarwal and Samwick (1999b), Garvey and Milbourn (2003), and Albuquerque (2009), among others.

a linear function of aggregate own firm performance *and* the realized performance correlation, which is the primary factor that captures the relative evaluation component.

Testing this empirical prediction is predicated on our ability to identify peer firms that are considered aspirational in nature. While aspirational peers are readily defined by the parameters of our model, identifying them empirically is not so straightforward because the relevant parameter(s) are out-of-equilibrium constructs, as is often the case in principal-agent theory. Therefore, we begin our analysis with data provided by Equilar, an executive compensation consulting firm, which identifies a portfolio of peer firms for each focal firm. However, the type of peer firm (e.g., aspirational, competitive) is not provided. Therefore, our tests may lack sufficient power to detect an association between CEO compensation and peer performance correlation to the extent that identified set of firms represent a mixture of aspirational and competitive peers.

Our proxy for performance correlation is the correlation between three-day stock returns of the focal firm and its peer group measured within the fiscal year. We exclusively focus on stock returns, rather than an accounting-based metric (e.g., return on assets), because they provide frequent, real-time performance feedback. This feature permits the CEO's compensation to depend on performance correlation and is consistent with a key feature of our model. In addition, returns are the most prevalent performance measure used in prior RPE studies, which increases the comparability of our results with those in the existing literature.

Using 7,039 firm-year observations between 2007 and 2014 with identified peers, we test whether performance correlation affects annual CEO compensation. Our results are surprisingly sharp in that we find a strong and statistically significant positive association after controlling for a number of other compensation determinants, including aggregate own firm returns as well as aggregate peer returns. This is consistent with our central prediction that firms do evaluate CEOs relative to an aspirational peer group.

In light of our primary empirical finding, we further explore the role of aggregate peer performance, which has been the primary focus of prior RPE studies. We extend the structure of the model to allow for an asymmetry in the covariance sensitivity to positive and negative performances. In equilibrium, the sensitivity of CEO compensation to changes in aggregate peer performance is predicted to be increasing in the sign and magnitude of the asymmetry. We find empirical evidence consistent with this prediction, which has no counterpart in standard RPE models with competitive peers. This provides further evidence that, to some extent, firms benchmark performance relative to an aspirational group of peer firms.

We conclude our empirical analysis with a preliminary exploration of several characteristics of the relation between the firm and its peer in order to better identify aspirational peers and distinguish them from competitive peers. Our identification strategy utilizes a key result from our model: the positive association between compensation and performance correlation is increasing in the degree to which the peer firm is considered aspirational. Based on this guidance, we test whether the predicted implications of having a more or less aspirational peer are consistent with independently obtained characteristics that might reasonably be associated with aspirational peers.

We focus on the effect of three observable characteristics on the sensitivity of CEO compensation to performance correlation: (1) the peer firm does not list the focal firm as its peer (i.e., a one-way relationship), (2) the peer firm is larger in size than the focal firm, and (3) the peer firm is a different industry than the focal firm. The presence of these type of relationships between the firm and its peer is reasonably diagnostic of an aspirational peer, but not a competitive peer. For example, if a firm uses a competitive peer to filter exogenous common shocks, then the peer firm is expected to reciprocate and list the firm as its peer, which results in a relationship that is not one-way.

In our sample, each firm-year observation contains multiple peer firms with available data, which often have observable differences in the three relationship characteristics we examine. We utilize a novel research design that exploits important variation in these characteristics *within* each firm-year observation in order to measure and test the effect on sensitivity of CEO compensation to performance correlation. We find that this sensitivity becomes more positive, at statistically significant levels, when the relationship with the peer firm is one-way and when the peer firm is not in the same industry as the focal firm. The size of the peer firm relative to the focal firm does not significantly affect the association.

Our results indicate that a non-mutual firm-peer relationship and a peer that is in a different line of business are diagnostic of an aspirational peer relation with the focal firm. While obviously not conclusive, this result is informative in its own right and, again, cannot be explained by the standard RPE theory in which the optimal peer group formation is driven by exogenous covariance considerations.

Overall, the results of this study provide evidence consistent with firms benchmarking performance relative a set of aspirational peers that is distinct from the performance evaluation relative to a set of competitive peers. In addition, firms do not appear to exclusively select peer groups based on the exogenous covariance between them as per the standard RPE prediction. Instead, our results indicate that peers also choose peers based on aspirational properties.[2] This highlights the importance of distinguishing aspirational and competitive peers in order to better understand how firms evaluate their executives.

[2]Ma et al. (2017) provide empirical evidence inconsistent with firms optimally selecting peers solely on the exogenous covariance, which is predicted by standard RPE theory. They suggest that firms' seemingly suboptimal choices result from boards not "getting it right." However, the results of our study suggest that boards may still "get it right," while the standard RPE model with competitive peers is not sufficient to capture the multi-dimensional nature of RPE.

More broadly, the importance of this distinction is underscored by numerous examples from other endeavors. Sociology studies find that aspirational peers and associative peers (similar to competitive peers) have different influences on consumer behaviors (e.g., Merton and Rossi 1968; Bearden and Etzel 1982). The world's largest business education alliance, the Association to Advance Collegiate Schools of Business (AACSB), distinguishes peer schools that are aspirational from those that are competitive/comparable as part of their accreditation process. A professional basketball scout seeking to identify the next Michael Jordan, will certainly look favorably upon a prospective player whose team outperformed the competition in a recent college tournament. However, playing each game in a manner similar to Michael Jordan, such as the ability to make game-winning shots, also provides a positive signal about his future potential in the professional league. In fact, we see everyday reminders of the value of such emulative behavior in Gatorade advertisements that remind us how great it would feel to play basketball like Michael Jordan.[3] Many people compete with their neighbors to keep up with the Joneses, but also aspire to keep up with the Kardashians.

The rest of the paper is organized as follows. Section 2 summarizes the main features of the agency model that guides our empirical analyses. Section 3 describes our empirical methods and sample. Section 4 presents the main results. Section 5 identifies and tests characteristics of aspirational peer firms. Section 6 concludes.

[3]The phrase "Be Like Mike" in the title of our study refers to a Gatorade commercial that originally aired in 1992 and was re-aired in 2015. In the commercial, footage of Michael Jordan playing basketball, juxtaposed with video of young kids imitating his moves, was used as a backdrop to the lyrics of a song: "Sometimes I dream that he is me. / You've got to see that's how I dream to be. / I dream I move, I dream I groove. / Like Mike. If I could be like Mike." The commercial embodies the spirit of our study and the results that we document.

2. Theoretical Foundation

In this section we summarize the main features of a simplified version of the agency model developed in Hemmer (2016). Two key features of the model guide our empirical predictions. First, it extends the fundamental one-firm, one-agent dynamic model of Holmström and Milgrom (1987) by including two firms, a focal firm and its aspirational peer, that each have a manager able to control the performance of his or her own firm. Second, it incorporates the approach of Holmström and Milgrom (1987) where the performance feedback is received frequently over time as opposed to only once at the end as in a standard one-shot agency model.

The analysis of this multi-agent problem uses the standard Nash-approach of Holmström (1982) but otherwise follows directly that of Holmström and Milgrom (1987, Sections 2 and 3). Because multiple agents invalidates Theorem 3 (uniqueness) in Holmström and Milgrom (1987), the optimal RPE contract must be found through standard optimization. This is important because it re-introduces the likelihood ratios of Holmström (1982), which are absent in the single-agent setting of Holmström and Milgrom (1987), as the key determinant of the properties of the optimal RPE contract. This makes clear that extrapolating from a single-agent, multiple-performance-measures setting to provide predictions for the multi-agent RPE case we rely on is not as straightforward as it may seem. Still, the key stationarity results of Holmström and Milgrom (1987, Theorems 4 and 5) prevail, and the optimal RPE contract can also be obtained in the limit by solving for the optimal RPE contract in any one sub-period and letting the number of sub-periods grow large as in the single-agent case.

To provide some more specific details, consider a simple agency model populated by an agent of a focal firm and an agent of a peer firm. Assume that both firms have a fixed-length contract horizon that is subdivided into m identical subperiods, indexed by $\tau \in \{1, ..., m\}$. After observing past own and peer performances in a given subperiod τ, the agent of the focal firm exerts (costly) effort to choose the probability p_τ that its firm's performance, drawn from a binomial distribution $\tilde{\omega}_\tau \in \{\omega^-, \omega^+\}$, will be high, $\omega^+ > \omega^-$. The performance of the peer firm, also drawn from a binomial distribution $\tilde{\pi}_\tau \in \{\pi^-, \pi^+\}$, is high $\pi^+ > \pi^-$ with a probability of q_τ, which is fixed and exogenous to the model.[4] Finally, let γ_τ^+ (γ_τ^-) be the conditional probability that peer performance is high (low), π^+ (π^-), whenever the performance of the focal firm is high (low), ω^+ (ω^-).

In order to simplify our analysis, let $\gamma_\tau^+ = a \cdot \gamma_\tau$ and $\gamma_\tau^- = \gamma_\tau$, such that the parameter a captures asymmetries in the structure of the performance covariance. The case of $a = 1$ corresponds to the symmetric case where high and low outcomes for the peer are equally probable conditional on own performance, while $a > 1$ ($a < 1$) corresponds to the case where high (low) peer outcomes are more probable given high (low) outcomes for the focal firm. The advantage of introducing asymmetric sensitivity in this way is that the predictions become particularly crisp while at the same time being perfectly general for this model. Consistent with prior RPE studies, we maintain a focus on the case where the two firms' performances are positively correlated in equilibrium, such that $\gamma_\tau > \frac{1}{2}$. This implies that the agent's explicit control over the focal firm's performance also grants it implicit control over the performance covariances γ_τ^+ and γ_τ^-, such that $\gamma_p^+ = d\gamma_\tau^+ / dp_\tau$ and $\gamma_p^- = d\gamma_\tau^- / dp_\tau$ are not equal to zero. Figure 1 provides a diagram of the sub-period structure for the conditional probabilities of this model.

Because q_τ is outside of the control of the focal agent in this model, it is determined as part of a Nash Equilibrium and can therefore be treated as "fixed and known" in the analysis of the

[4] This binomial structure is the direct counterpart to the two-dimensional Brownian example in Holmström and Milgrom (1987) in which each dimension is specifically meant to be the continuous-time approximation of a single binomial random walk.

focal agent, as per Holmström (1982). As a result, the covariance between the performances of the two firms must implicitly depend on the actions of the focal agent p_τ unless the performances are uncorrelated (i.e., $\gamma_\tau = \frac{1}{2}$).[5] Therefore, the focal agents' *explicit* control over the performance of its firm nearly always grants them *implicit* control over the covariance between own and peer firm performances, such that $\gamma_p = d\gamma_\tau/dp_\tau \neq a$. Finally, with $q_\tau > p_\tau$ and $\gamma_\tau > \frac{1}{2}$, the peer firm is considered to be an aspirational peer because the focal firm aspires to emulate its higher probability q_τ of high performance by influencing the covariance between them. When these two conditions are met, γ_p uniquely identifies the peer firm as having an aspirational characteristic.

Theorem 2 of Hemmer (2016) demonstrates that when performance feedback becomes very frequent (i.e., as $m \to \infty$), the optimal compensation given to the focal firm's agent, $\tilde{S}(\vec{\omega}, \vec{\pi})$, is a more complex function of the history of own firm performance, $\vec{\omega} = [\,\omega_1, ..., \omega_m\,]$, and the history of peer firm performance, $\vec{\pi} = [\,\pi_1, ..., \pi_m\,]$, realized across all m sub-periods within the contract horizon, than what the standard agency theory suggests. Specifically, based on the structure of this basic model, $\tilde{S}(\vec{\omega}, \vec{\pi})$ can be expressed as the following linear function of own and peer firm performance measures:

$$\tilde{S}(\vec{\omega}, \vec{\pi}) \;=\; \beta_0 \;+\; \beta_\Omega \cdot \tilde{\Omega} \;+\; \beta_\rho \cdot \tilde{\rho} \;+\; \beta_\Pi \cdot \tilde{\Pi}, \tag{1}$$

where $\tilde{\Omega}$ and $\tilde{\Pi}$ are the aggregate performances of the focal firm and peer firm, respectively, over the contract horizon; $\tilde{\Pi}$ is the correlation between the historical subperiod performances of the

[5] Based on the model structure (illustrated in Figure 1), the following must hold in every subperiod τ: $q_\tau = p_\tau\gamma_\tau + (1-p_\tau)(1-\gamma_\tau)$. Differentiating this identity with respect to the focal agent's effort p_τ yields $dq_\tau/dp_\tau = (2\gamma_\tau - 1) + (2p_\tau - 1)(d\gamma_\tau/dp_\tau)$. Setting $dq_\tau/dp_\tau = 0$ (i.e., q_τ is fixed and exogenous) and rearranging terms yields $d\gamma_\tau/dp_\tau = (2\gamma_\tau - 1)/(1 - 2p_\tau)$, which is not equal to zero unless $\gamma_\tau = \frac{1}{2}$. Therefore, the performance covariation parameter γ_τ must be an implicit function of the focal agent's action.

focal firm $\vec{\omega}$ and the peer firm $\vec{\pi}$; and β_Ω, β_ρ, and β_Π are measures of the sensitivity of the focal agent's pay to observable performance measures $\tilde{\Omega}$, $\tilde{\rho}$, and $\tilde{\Pi}$, respectively.

The sensitivity of compensation to the three performance measures is proportional to different linear combinations of the likelihood ratios for the four possible sub-period performance outcome combinations: $\{\omega^+,\pi^+\}$, $\{\omega^-,\pi^-\}$, $\{\omega^+,\pi^-\}$, $\{\omega^-,\pi^+\}$. Because the likelihood ratios are straightforward to calculate here, it is also straightforward to show that when peers are chosen as aspirational, the optimal level of compensation is always an increasing function of own firm performance (i.e., $\beta_\Omega > 0$). This preserves the single-agent result from Holmström and Milgrom (1987) in our multi-agent context.

In contrast, the manner by which the relative peer performance measures, $\tilde{\Pi}$ and $\tilde{\rho}$, affect optimal compensation represents an abrupt departure from standard predictions, but provides a theoretical foundation that motivates our empirical analysis. Specifically, peer performance affects the optimal compensation given to the focal agent by placing a positive weight on the correlation $\tilde{\rho}$ between the historical sub-period performances of the focal firm and the peer firm. In this basic model structure, $\tilde{\rho}$ is proportional to $\gamma_p/\gamma_\tau(1-\gamma_\tau)$ (Hemmer 2016, Theorem 4). As a result, $\tilde{\rho}$ will be positive when $\gamma_p > 0$, which is exactly the condition that identifies the peer firm as aspirational from the perspective of the focal firm.

An agent that successfully emulates its aspirational peer firm causes its own firm's performance to be more positively correlated with the aspirational peer firm's performance, which leads to higher performance, on average. It follows that optimal compensation will naturally depend, in part, on this correlation measure in order to incentivize the agent to engage in such emulative actions leading to higher performance. In other words, if the actions of the focal firm's agent affect its own firm's aggregate performance *and* that affects the correlation between own firm and aspirational peer performances, such that $\gamma_p > 0$, then the compensation will be a function of both measures because they both provide informative signals about the agent's actions. The performance correlation over the entire horizon may, in fact, act as a sufficient statistic for all of the information contained in their relative performance histories that is missing from own firm and peer firm aggregate performance measures. This result leads to the following empirical implication:

> **Empirical Implication 1.** *In a setting where performance feedback is frequent relative to the contract horizon, compensation is positively associated with the realized correlation, measured over the contract horizon, between own firm and aspirational peer firm performances (i.e., $\beta_\rho > 0$).*

Finally, the weight on aggregate peer performance β_Π in (1) is directly proportional to the sensitivity of compensation to performance correlation β_ρ *and* the exogenous asymmetry parameter a that drives a wedge between γ_τ^+ and γ_τ^- (Hemmer 2016, Theorm 4). This provides two key implications. First, β_Π directly proportional to β_ρ means that $\beta_\Pi \neq 0$, if, and only if, $\beta_\rho \neq 0$. This implies that if the manager has no influence over the covariance between own and peer performance, such that $\gamma_p = 0$, then no form of relative performance evaluation survives in the optimal contract. In other words, a necessary condition for optimal compensation to depend on aggregate peer performance requires that Empirical Implication 1 be true (i.e., $\beta_\rho > 0$).

Second, if β_ρ is greater than zero, then β_Π is directly proportional to the asymmetry parameter a. In cases where $a > 1$, the peer firm has a larger probability of high performance conditional on high focal firm performance than its probability of low peer performance conditional upon low focal firm performance and vice-versa when $a < 1$. As a result, the *unconditional* performance correlation $\tilde{\rho}$ in (1) no longer acts as a sufficient statistic for all of the information contained in the relative performance histories because they are asymmetrically influenced by differences in the *conditional* probability structure. Therefore, the weight placed on aggregate peer performance β_Π

in (1) is strictly increasing in a. (Hemmer 2016, Theorm 2). This helps filter the asymmetric effect on the two conditional probabilities, which cannot be accomplished by relying on the unconditional correlation $\tilde{\rho}$ alone. This leads to the second empirical implication:

> **Empirical Implication 2.** *If performance feedback is frequent relative to the contract horizon and $\beta_\rho > 0$, then the sensitivity of compensation to realized aggregate performance of an aspirational peer is strictly increasing in the asymmetry a between positive and negative conditional probabilities (i.e., $d\beta_\Pi/da > 0$).*

3. Research Design and Sample

Section 3.1 describes the research design that we use to test our empirical predictions based on the model developed in the previous section. Section 3.2 describes our sample selection procedure and presents descriptive statistics for the final sample.

3.1. Research Design

Our model of aspirational peers as well as traditional RPE models with competitive peers (e.g., Holmström and Milgrom 1987) both derive an optimal compensation contract that is linear in own firm and peer performance measures (see equation 1). Linearity naturally conforms to a regression model, which we use to measure and test the sensitivity of CEO compensation to performance correlation with aspirational peers. Specifically, our primary test is based on the following empirical analog to (1):

$$Comp_{j,t} = \beta_0 + \beta_\Omega \cdot Ret_{j,t} + \beta_\rho \cdot Perf\_Corr_{j,t} + \beta_\Pi \cdot Peer\_Ret_{j,t} + Controls_{j,t} + \varepsilon_{j,t}, \tag{2}$$

where j denotes a unique focal firm and t indicates a unique fiscal year. The dependent variable $Comp_{j,t}$ is the change between fiscal year t and $t{-}1$ in the annual compensation given to firm j's CEO. Annual compensation is defined as the natural logarithm of the sum of salary, bonus, total value of restricted stock granted, total value of stock options granted, long-term incentive payouts and all other compensation (ExecuComp *TDCI*).

The proxies for the three performance measures we examine are based on measures of stock returns, rather than accounting-based fundamental performance measures, such as return on assets. Our choice is guided by the fact that returns provide performance feedback that is observed with a significantly higher frequency than the fiscal year for which the CEO is compensated. This real-time performance feedback allows management to take actions continuously to adjust the firm's strategies in an effort to emulate its aspirational peers. This feature permits the CEO's compensation to depend on performance correlation and is consistent with a key feature of our model. In contrast, accounting-based performance measures are observable only on a quarterly basis, at best, which does not provide real-time performance feedback and prevents a reasonable measurement of performance correlation within the fiscal year.

Prior RPE studies have typically examined both return-based and accounting-based measures because traditional RPE models are silent on the exact nature of the performance metric. In addition, these models predict that performances aggregated across the contract horizon (e.g., annual return, annual ROA) is sufficient for evaluating management. As a result, temporally aggregated stock returns and observed aggregate accounting-based performance are both naturally amenable to empirical tests of RPE theory with competitive peers.

The first performance measure $Ret_{j,t}$ in (2) captures firm j's aggregate own performance and is calculated as the natural logarithm of one plus j's annual buy-and-hold return in fiscal year t.

The corresponding coefficient β_Ω in (2) measures the CEO's pay-for-performance sensitivity and is expected to be positive based on the predictions of our model and traditional RPE models. Thus, finding a positive coefficient on β_Ω is more of a necessary condition than something that helps us empirically discriminate between the influence of aspirational and competitive peer firms.

The second performance measure $Perf\_Corr_{j,t}$ is the performance correlation between short-window stock returns of firm j and stock returns of j's peer firm k during fiscal year t, averaged over all of j's peer firms. For each unique firm-year-peer observation, we partition the fiscal year t into eighty-four equal subperiods representing three consecutive days with valid return observations. For each subperiod within t, denoted by the subscript $\tau \in \{1, ..., 84\}$ we compute the natural logarithm of one plus firm j's three-day buy-and-hold return, $ret^{3\text{-}day}_{j,t,\tau}$. We also compute the subperiod performance for each j's peer firms k, $peer\_ret^{3\text{-}day}_{j,t,k,\tau}$, equal to the natural logarithm of one plus the three-day buy-and-hold portfolio return. We measure $perf\_corr_{j,t,k}$ as the correlation coefficient between $ret^{3\text{-}day}_{j,t,\tau}$ and $peer\_ret^{3\text{-}day}_{j,t,k,\tau}$ based on the eighty-four time-series observations within the fiscal year. $Perf\_Corr_{j,t}$ is computed as the equal-weighted average of $perf\_corr_{j,t,k}$ among all $N_{j,t}$ of j's peers during fiscal year t.

It is important to note that our measurement of $Perf\_Corr_{j,t}$, based on the correlation coefficient between three-day returns, is intended to approximate the degree to which management enacts strategies that mimic its aspirational peer firms. We do not expect that this performance correlation using three-day returns will explicitly enter CEO compensation contracts. Rather, it serves as a proxy for informative signals about management's success in pursuing these strategies that results in an implicit relation with compensation, which is the primary focus of our study.[6] In addition,

[6] An examination of the specific forms of performance correlation implicitly used in RPE is outside the scope of this study. We leave this for future research.

we do not distinguish between idiosyncratic and systematic return correlations because managers may pursue either, or both, if they are part of the aspirational peer firm's strategy.[7]

Our primary coefficient of interest is β_ρ in (2), which measures the CEO's pay-for-performance correlation sensitivity. Based on our empirical prediction developed in the previous section (see Empirical Implication 1), β_ρ is expected to be positive and statistically significant. However, this prediction is conditional upon the nature of the peer firms identified. If they are not considered aspirational peers, then our empirical tests will lack the necessary power to detect a positive coefficient. In addition, most peer groups likely contain a mixture of some aspirational peers with $\beta_\rho > 0$ along with others that are considered non-aspirational (e.g., competitive peers) for which $\beta_\rho = 0$. In this case, the presence of other peer groups potentially dilutes the ability to detect an association at the peer portfolio level. Therefore, our tests of $\beta_\rho > 0$ are ultimately a joint test of our empirical prediction as well as having identified peer groups that contain a non-trivial fraction that are aspirational.

Identifying an appropriate aspirational peer group presents a significant obstacle in our empirical tests. An unfortunate feature of the model guiding our analysis is that the identification of aspirational peers is based on an out-of-equilibrium property, the marginal change in the firm-peer covariance, which is captured by the model parameter γ_p. This property is neither observable nor directly measurable. Therefore, we rely on data provided by Equilar, an executive compensa-

[7] For example, consider the manager of a passive market index fund that is focused on tracking the underlying market index. He or she is provided incentives to take actions (e.g., periodically re-balancing the portfolio to accommodate changes in the index) that increase the correlation of the fund's performance with that of the market index, which primarily represents the systematic component. In contrast, a hedge fund manager may focus on emulating an aspirational peer fund manager in an effort to increase abnormal, risk-adjusted return performance, which primarily represents an idiosyncratic component. Thus, the informativeness of distinguishing between these two return components crucially hinges on the ability to identify the specific nature of the strategies of the aspirational peer that the firms is attempting to emulate. While interesting, it is outside the scope of our study, so again we leave it for future research.

tion consulting firm, to identify our aspirational peer group. Equilar derives its data from firms' self-reported peer groups provided as part of the SEC-mandated Compensation, Discussion and Analysis proxy disclosure. Our empirical tests are based on this form of peer identification as our proxy for aspirational peer firms despite the fact that other peer groups are also included.

The final performance measure $Peer\_Ret_{j,t}$ included in our empirical model captures the average aggregate performance of firm j's peer firms during fiscal year t. For each unique firm-year-peer observation, we compute the aggregate performance of firm j's peer firm k during fiscal year t, $peer\_ret_{j,t,k}$, as the natural logarithm of one plus the annual buy-and-hold return. $Peer\_Ret_{j,t}$ is computed as the equal-weighted average of $peer\_ret_{j,t,k}$ among all $N_{j,t}$ of firm j's peer firms during fiscal year t.

Finally, we include additional explanatory variables, denoted by $Controls_{j,t}$ in (2), as part of the empirical model to control for other determinants of CEO compensation. Following prior studies, we include firm size (Rosen 1982; Smith and Watts 1992), growth opportunities (Smith and Watts 1992; Core and Guay 1999), idiosyncratic return volatility (Aggarwal and Samwick 1999b; Core, Holthausen, and Larcker 1999), the number of peer firms (Dikolli, Hofmann, and Pfeiffer 2013), percentage of peer relationships that are one-way (i.e., peer firm does not consider focal firm as its peer), percentage of peer firms that are larger than the focal firm, percentage of peer firms in a different two-digit SIC industry than the focal firm, CEO tenure (Bertrand and Mullainathan 2001), CEO ownership (Core et al. 1999), an indicator variable for a CEO that is also the board chair (Core et al. 1999), and industry and year fixed-effect parameters (Albuquerque 2009; Jayaraman, Milbourn, and Seo 2015). The appendix contains a complete description of each variable as well as how they are measured.

Our second test examines the role of aggregate peer performance, which has been the primary focus of prior RPE studies with competitive peers, in shaping CEO compensation with respect to aspirational peer firms. Guided by the second empirical implication of our model, the coefficient on aggregate peer performance β_{Π} in (2) is expected to be an increasing function of the difference between the conditional covariance between positive and negative performances if aspirational peer firms influence RPE. This asymmetry is represented by the parameter a in our model.

We construct an empirical proxy for this parameter with an indicator variable $A^{+}_{j,t}$ that is equal to one if firm j has a positive asymmetry ($a > 1$) during fiscal year t and equal to zero otherwise ($a \leq 1$). We define a given firm-year observation as having a positive asymmetry ($A^{+}_{j,t} = 1$) if the average probability of a positive return for j's peer firms, conditional on j also having a positive return, is greater than the average probability of a non-positive peer return, conditional on j also having a non-positive return. Both conditional probabilities are estimated using historical returns from the three prior fiscal years. A detailed description of the measurement of $A^{+}_{j,t}$ appears in the appendix.

We extended the regression model in (2) by allowing the coefficient on aggregate peer performance β_{Π} to change as a function of the covariance asymmetry proxy $A^{+}_{j,t}$ as follows:

$$\begin{aligned} Comp_{j,t} \; = \; & \beta_0 \; + \; \beta_0^{+} \cdot \; A^{+}_{j,t} \; + \; \beta_{\Omega} \cdot Ret_{j,t} \; + \; \beta_{\rho} \cdot Perf\_Corr_{j,t} \\ & + \; \beta_{\Pi} \cdot Peer\_Ret_{j,t} \; + \; \beta_{\Pi}^{A^{+}} \cdot \; (Peer\_Ret_{j,t} \cdot A^{+}_{j,t}) + Controls_{j,t} + \varepsilon_{j,t}. \end{aligned} \tag{3}$$

The coefficient $\beta_{\Pi}^{A^{+}}$ measures the incremental change in the CEO's pay-for-aggregate peer performance sensitivity as the covariance asymmetry increases from non-positive ($A^{+}_{j,t} = 0$) to positive ($A^{+}_{j,t} = 1$). Based on the empirical prediction developed in the previous section (see Empirical Implication 1), we expect a positive and statistically significant value for $\beta_{\Pi}^{A^{+}}$ if aspirational peer firms influence relative performance evaluation. Traditional RPE models with competitive peers do not provide a similar prediction, which further facilitates our identification of the role of aspirational peers as distinct from the role of competitive peers.

Finally, the coefficient β_{Π} measures the magnitude of the CEO's pay-for-aggregate peer performance sensitivity when the covariance asymmetry is negative ($A^{+}_{j,t} = 0$). It is expected to have a negative value regardless of whether the peer is competitive (traditional RPE predictions) or aspirational (our RPE model). Because β_{Π} does not discriminate between the separate effects of both peer groups, we focus our analyses on tests of $\beta^{A^{+}}_{\Pi}$ rather than β_{Π}.

3.2. Sample Description

We begin with an initial sample of 15,170 (260,220) firm-year (firm-year-peer) observations provided by Equilar that are manually matched to both Compustat *gvkey* and CRSP *permno*. We require non-missing data for CEO compensation as well as all variables for the focal firm. In addition, firm-year observations are excluded if the firm had more than one CEO during the fiscal year.

Next, we require each unique firm-year-peer combination to have non-missing peer performance return data to compute all relevant variables as described in the appendix. Finally, all continuous variables are winsorized at one and ninety-nine percent to reduce the influence of outliers. Our final sample contains 7,039 (121,256) firm-year (firm-year-peer) observations with fiscal years ending between 2007 and 2014.

Descriptive statistics for all variables in the final sample are presented in Table 1. Firm-year observations have a mean (median) of 17.2 (16) peer firms. In addition, the mean value of $A^{+}_{j,t}$ is 0.646, which indicates that firm-year observations have a positive conditional probability that is, on average, less than its negative conditional probability.

Table 2 presents Pearson (above the diagonal) and Spearman (below the diagonal) correlation coefficients for all continuous regression variables. Not surprisingly, the correlation between CEO compensation and own firm returns is positive (0.172) and statistically significant. In addition, the performance correlation variable has a positive (0.063) and statistically significant correlation with CEO compensation, which provides preliminary univariate support for our predictions with respect to aspirational peer firms.

4. Results

Table 3 presents results related to our primary test of a positive association between CEO compensation and performance correlation (see Empirical Implication 1 in Section 2). In the first two columns, coefficient estimates are based on the regression in (2) without any control variables included, which conforms with the relation derived in equation (1). The first specification (column one) includes the aggregate own firm performance $Ret_{j,t}$ and aggregate peer firm performance $Peer\_Ret_{j,t}$, but excludes the performance correlation variable $Perf\_Corr_{j,t}$. This specification mirrors traditional RPE specifications examining the role of competitive peers in which the coefficient on own firm performance β_Ω is expected to be positive, while the coefficient on aggregate peer performance β_Π is expected to be negative to account for exogenous common shocks.

The estimated value of the CEO pay-for-performance sensitivity β_Ω is positive and equal to 0.239 (t-statistic of 10.14), which is different from zero based on a 1% level of statistical significance.[8] While this result does not discriminate between the roles of competitive and aspirational peer firms, it is nevertheless consistent with the presence of both and is comparable to results

[8] All test statistics are based on standard errors clustered by firm.

reported in prior RPE studies.

In addition, the estimated coefficient on the aggregate equal-weighted peer performance measure $Peer\_Ret_{j,t}$ is -0.061 (t-statistic of -2.08), which is different from zero based on a 5% level of statistical significance.[9] This result is consistent with traditional RPE predictions, which predict that firms deduct the common component in the competitive peer's performance when determining the CEO compensation.

In column two, we add the performance correlation variable $Perf\_Corr_{j,t}$ to the previous specification to test for an incremental role of aspirational peer firms in performance evaluation. The coefficient β_ρ on the performance correlation measure is equal to 0.324 (t-statistic of 7.82), which is different from zero based on a 1% level of statistical significance. This result is consistent with our predictions that CEOs are compensated in part for their ability to become more correlated with their aspirational peer firms.

In addition, the inclusion of $Perf\_Corr_{j,t}$ in the regression reduces the coefficient on aggregate peer performance β_Π in both magnitude and statistical significance. Specifically, β_Π is -0.018 (t-statistic of -0.59). This represents a 70.5% decrease in the magnitude relative to column one and is not statistically different from zero at conventional levels.

Finally, the last two columns of Table 3 provide results for the fully specified regression, which includes all control variables and fixed-effect parameters. Overall, these results provide confirmation of the conclusions drawn from the abbreviated specifications in the first two columns. The estimated coefficients on aggregate own firm performance β_Ω and performance correlation β_ρ are equal to 0.217 (t-statistic of 9.47) and 0.485 (t-statistic of 8.65), respectively, and both are different

[9]Similar results are obtained for all specifications using value-weighted peer performance measures instead of equal-weighted measures. Specifically, Tables 3 and 4 are replicated using value-weighted performance measures. Results are reported in tables OA.1 and OA.1, respectively, of the online appendix.

from zero based on a 1% level of statistical significance.

Overall, the results presented in Table 3 provide supporting evidence that aspirational peers are used to evaluate CEO performance as we predicted. In addition, the positive coefficient on performance correlation β_ρ fulfills the necessary condition (see Empirical Implication 2 in Section 2) for our next set of tests examining the conditional role of aggregate peer performance.

Table 4 reports coefficient values estimated from the regression in (3), which allows the coefficient on aggregate peer performance to vary with the asymmetry in the conditional probability structure. The estimated values of β_Ω and β_ρ in column one are 0.213 (*t*-statistic of 9.16) and 0.523 (*t*-statistic of 9.16), respectively. Both coefficients are different from zero with a 1% level of statistical significance.

The coefficient $\beta_\Pi^{A^+}$ on the interaction between aggregate peer performance measure and the asymmetric covariance indicator variable is 0.281 (*t*-statistic of 3.28), which is different from zero based on a 1% level of statistical significance. More importantly, the negative coefficient is consistent with our prediction with respect to the influence of aspirational peers. As the asymmetry increases, the CEO pay-for-peer aggregate performance sensitivity also increases because aggregate peer performance supplements the relative evaluation component with additional information about the conditional covariance structure that is not reflected by the unconditional performance correlation measure alone. The coefficient on the aggregate peer performance measure β_Π is -0.201 (*t*-statistic of -2.40), which is different from zero based on a 5% level of statistical significance. The negative value is consistent with RPE predictions with respect to aspirational and competitive peer models.

We test the robustness of the interaction analysis by partitioning our sample into two groups based on whether the observation has a positive or non-positive covariance asymmetry. The second and third columns reports coefficient values for both sub-samples that are estimated from the specification in (2). The fourth column tests for differences in the coefficients between the two sub-samples. Results from this analysis confirm the previous interaction coefficients reported in column one. Overall, the results presented in Table 4 provide additional evidence that firms evaluate and compensate CEOs in part on their ability to increase the performance correlation with their aspirational peer firms.

5. Characteristics of Aspirational Peers

The results of our main tests indicate that, on average, firms benchmark performance in part based on a set of aspirational peers. While this provides encouraging support for our hypothesis, it provides no guidance on the identification of aspirational peers within the set of all peer firms. We conclude our analyses by testing whether several observable dimensions of the relation between a firm and its peer are indicative of an aspirational relationship.

Aspirational peer firms are easy to identify in our model by the parameter γ_p, which increases in the degree to which the peer firm is considered aspirational. Unfortunately, measuring this parameter is not feasible because it relates to an out-of-equilibrium construct. Therefore, we identify γ_p indirectly by utilizing a key outcome of the model in which the pay-for-performance correlation sensitivity, captured by β_ρ in (1) and (2), is an increasing function of γ_p. Large (small) positive values of β_ρ indicate a strong (weak) aspirational relationship between the firm and its peer.

In our sample, firm-year observations have a mean (median) of 17.2 (16) peer firms (see Table 1). Characteristics of the relation between the firm and each individual peer varies along several observable dimensions, such as the relative sizes of the two firms. We utilize this *within* observation variation to examine whether and to what extent characteristics of the firm-peer relation effect the pay-for-performance sensitivity β_ρ. A given characteristic of the firm-peer relation is identified as aspirational if it results in a higher estimated value of β_ρ relative to the estimated value in the absence of that characteristic.

We consider three observable characteristics of the relation between the firm and each of its peers individually. First, we use the directional nature of the firm-peer relation to distinguish between one-way and two-way relationships. The relation is two-way if both firms list the other as a peer and one-way if the peer firm does not reciprocate the relation by also listing the focal firm as its peer. We expect that one-way relationships are indicative of an aspirational peer firm. If the relationship is two-way, then both firms find it beneficial to benchmark performance relative to each other, which is consistent with a competitive peer relation guided by traditional RPE models.

Second, we examine the size (market value of equity) of the peer firm relative to the focal firm. Albuquerque (2009) highlights the importance of size in identifying competitive peer firm groups that are subjected to common shocks. Therefore, firms that are similar in size to its peer are consistent with a competitive relation, while large peer firms may be consistent with an aspirational relation. However, an explicit prediction is difficult because even large firms may aspire to emulate a small firm's strategy (e.g., an oil company may look to a new eco-friendly start-up company for a strategy to reduce its environmental impact in order to improve public perception).

Finally, we consider whether the peer firm is in a different industry that the focal firm. Prior studies use industry to identify competitive peer groups for implicit tests of RPE.[10] On average, 44.1% of a focal firm's peers are in a different two-digit SIC classification (see Table 1). These peer firms are expected to be more reflective of an aspirational relationship.

[10] Representative RPE studies based on industry peer groups include Antle and Smith (1986), Gibbons and Murphy (1990), Jensen and Murphy (1990), Barro and Barro (1990), Janakiraman, Lambert, and Larcker (1992), Aggarwal and Samwick (1999a,b), Garvey and Milbourn (2006), Rajgopal, Shevlin, and Zamora (2006), and Albuquerque (2009, 2014).

We utilize a mixed data sampling regression model (e.g., Ghysels et al. 2005; Ball 2017), which are specifically designed to exploit *within* observation data variation (e.g., within peer portfolio variation in the observed firm-peer relation), to measure and test the effect of each firm-peer characteristic on the CEO's pay-for-performance sensitivity β_ρ. We estimate the following:

$$\begin{aligned} \textit{Comp}_{j,t} = \beta_0 + \beta_\Omega \cdot \textit{Ret}_{j,t} + \sum_{k=1}^{N_{j,t}} \left[\beta_\rho(k) \cdot \tfrac{\textit{perf\_corr}_{j,t,k}}{N_{j,t}} \right] + \beta_\Pi \cdot \textit{Peer\_Ret}_{j,t} \\ + \beta_\Pi^{A^+} \cdot (\textit{Peer\_Ret}_{j,t} \cdot A_{j,t}^{+}) + \textit{Controls}_{j,t} + \varepsilon_{j,t}, \end{aligned} \tag{4}$$

$$\text{subject to:} \quad \beta_\rho(k) = b_\rho^{0} + b_\rho^{\textit{1-way}} \cdot i_{j,t,k}^{\textit{1-way}} + b_\rho^{\textit{larger}} \cdot i_{j,t,k}^{\textit{larger}} + b_\rho^{\textit{diff-ind}} \cdot i_{j,t,k}^{\textit{diff-ind}}. \tag{5}$$

This specification is similar to the model specified in (3) with one important difference. The performance correlations between the focal firm and each peer firm, denoted by $\textit{perf\_corr}_{j,t,k}$, are included as separate explanatory variables instead of including a single performance correlation $\textit{Perf\_Corr}_{j,t}$ with respect to the aggregated peer portfolio.[11] As a result, the regression in (4) permits the estimation of a separate pay-for-performance coefficient, denoted by $\beta_\rho(k)$, for each peer k.

While ideal for identifying the influence of aspirational peer firms, estimating separate coefficients is not feasible because the number of firm-year-peer observations greatly exceeds the number of observations of firm-year CEO compensation. Therefore, we avoid this issue of parameter proliferation by specifying $\beta_\rho(k)$ in (5) as a function of the three observable firm-peer characteristics we examine and four estimated parameters. The first firm-peer characteristic $i_{j,t,k}^{\textit{1-way}}$ is an indicator variable equal to one if the relationship between firm j and its peer k is one-way (i.e., k does not consider j to be its peer) and equal to zero otherwise. The second characteristic $i_{j,t,k}^{\textit{larger}}$ is an indi-

[11] The variable $\textit{perf\_corr}_{j,t,k}$ is defined as the performance correlation between firm j and its peer firm k in fiscal year t. We scale by the total number of j's peer firms in t ($N_{j,t}$) to increase comparability across firm-year observations.

cator variable equal to one if the market value of firm j's peer k is larger than the market value of firm j at the beginning of fiscal year t and equal to zero otherwise. The last characteristic $i_{j,t,k}^{\textit{diff-ind}}$ is an indicator variable equal to one if firm j is in a different two-digit SIC industry as its peer k at the beginning of the fiscal year and equal to zero otherwise.

The four estimated parameters in (5), denoted by a lowercase b, are data-driven measures of how each of the firm-peer characteristics incrementally changes the CEO pay-performance correlation sensitivity $\beta_\rho(k)$. If having a one-way peer, a larger peer, or a peer in a different industry is associated with aspirational peers, then the estimated parameters $b_\rho^{\textit{1-way}}$, $b_\rho^{\textit{larger}}$ and $b_\rho^{\textit{diff-ind}}$, respectively, are expected to be positive and significant. The fourth estimated parameter b_ρ^{0} represents the baseline CEO pay-performance correlation sensitivity from which the other three parameters measure the incremental change in the association.

Table 5 reports parameter values estimated from four versions of the mixed data sampling regression in (4) subject to (5). Columns one through three individually add each of the characteristic indicator variables. For example, column one reports parameter estimates when $\beta_\rho(k)$ is specified as a linear function of the one-way indicator variable $i_{j,t,k}^{\textit{1-way}}$ only. In this version, the parameter b_ρ^{0} represents the baseline CEO pay-performance correlation sensitivity between the firm and a specific peer when the relationship is two-way, and $b_\rho^{\textit{1-way}}$ measures the incremental difference when it is one-way. The estimate value of $b_\rho^{\textit{1-way}}$ is 0.803 (*t*-statistic of 5.74), which is different from zero at a 1% level of statistical significance. In contrast, the baseline parameter b_ρ^{0} is 0.059 (*t*-statistic of 0.61), which is not statistically different from zero. This indicates that one-way relationships have a pay-for-performance correlation sensitivity that is approximately fourteen times greater than two-way relationships, which is economically significant. It is provides evidence that a one-way firm-peer relationship is a hallmark indicator that the relation is aspirational.

Parameter estimates when $\beta_\rho(k)$ is specified as a linear function of the larger peer firm indicator variable $i_{j,t,k}^{larger}$ are presented in column two. The estimated baseline parameter b_ρ^0 is 0.435 (t-statistic of 5.05), which is different from zero at a 1% level of statistical significance. In contrast to the one-way characteristic, the estimated parameter measuring the incremental effect of a larger peer firm characteristic b_ρ^{larger} is only 0.161 (t-statistic of 1.28), which is not statistically significant. Thus, it appears that firm size does not play an important role in distinguishing aspirational peers from other peer groups.

Column three reports parameter estimates when $\beta_\rho(k)$ is specified as a linear function of the different industry indicator variable $i_{j,t,k}^{diff\text{-}ind}$. Similar to the results reported in column one, the estimated parameter $b_\rho^{diff\text{-}ind}$ is 0.423 (t-statistic of 3.89), which is different from zero at a 1% level of statistical significance, and the estimated baseline parameter b_ρ^0 is 0.359 (t-statistic of 4.90). This indicates that peer firms in different industries are associated with a pay-for-performance correlation sensitivity that is approximately twice the sensitivity for peers in the same industry as the focal firm. In addition, it provides evidence that a peer firm from a different industry is an key characteristic that identifies an aspirational relationship.

Finally, column four presents parameter estimates from the full model of $\beta_\rho(k)$ in (5) by including all three characteristics. In this specification, the estimated value for $b_\rho^{diff\text{-}ind}$ is 0.319 (t-statistic of 2.95), which is still different from zero at a 1% level of statistical significance. The estimated value of $b_\rho^{1\text{-}way}$ is 0.711 (t-statistic of 4.97), which is only marginally lower than the estimate in column one. Finally, the larger peer firm parameter b_ρ^{larger} has a small positive magnitude and is not statistically different from zero, which is consistent with the results in column two. Overall, the results from this preliminary analysis of characteristics driving an aspirational firm-peer relationship point to a one-way relationship as the dominant driver of $\beta_\rho(k)$, while peer firms from a different industry also contribute.

6. Conclusions

The predictions tested and results reported in this study of aspirational peer firms represent key departures from those of prior RPE studies, which focus exclusively on tests with respect to firms' competitive peer groups. This difference is a direct result of the strong, yet standard, restrictions imposed on the production technology and the information dynamics in that literature, which are relaxed in the model we use to motivate our analysis: (1) that the sensitivities to positive versus negative shocks are identical, (2) that the variance-covariance of own and peer performance is exogenous, and (3) that either the manager receives no feedback about peer performance over the contracting period, or such feedback is inconsequential to the optimal contract.

The results of our analysis provide new evidence that firms use aspirational peer groups to evaluate and compensate CEOs. It suggests that the mechanism for using this type of benchmark to evaluate performance is to anchor compensation in part to the degree to which the firm's performance is correlated with the performance of its aspirational peer. In addition, the aggregate performance of the aspirational peer, which is the main focus of prior competitive RPE studies, plays only a secondary role that is predicated on asymmetric exposure to good and bad news. It is not simply based the sign of the equilibrium covariance as per the standard RPE prediction.

We also provide evidence consistent with the idea that firms choose aspirational peers. Specifically, we document that non-mutual firm-peer relationships and peers in a different industry are characteristics that are associated with the theoretical implications of being an aspirational peer. This is important, because the theoretical construct that defines aspirational peers in the model motivating our analyses represents an out-of-equilibrium construct that is neither observable nor directly measurable.

Our focus on the role of performance correlation with respect to aspirational peer firms complements the extensive literature on competitive peer firm RPE by identifying and testing a new dimension that provides a more complete picture of how firms evaluate and compensate executives. The method we employ and the corresponding evidence we present provides a platform to examine other characteristics of aspirational peer firms as well as additional economic implications of using them in RPE.

References

Aggarwal, R., Samwick, A., 1999a. Executive compensation, strategic competition, and relative performance evaluation: Theory and evidence. Journal of Political Economy 107, 65–105.

Aggarwal, R., Samwick, A., 1999b. The other side of the trade-off: The impact of risk on executive compensation. Journal of Political Economy 107, 65–105.

Albuquerque, A., 2009. Peer firms in relative performance evaluation. Journal of Accounting and Economics 48, 69–89.

Albuquerque, A., 2014. Do growth-option firms use less relative performance evaluation? Accounting Review 89, 27–60.

Antle, R., Smith, A., 1986. An empirical evaluation of the relative performance evaluation of corporate executives. Journal of Accounting Research 24, 1–39.

Ball, R. T., 2017. Mixed data sampling methods for capital markets research in accounting, working paper.

Barro, J., Barro, R., 1990. Pay, performance and turnover of bank CEOs. Journal of Labor Economics 8, 448–481.

Bearden, W., Etzel, M., 1982. Reference group influence on product and brand purchase decisions. Journal of Consumer Research 9, 183–1948.

Bertrand, M., Mullainathan, S., 2001. Are ceos rewarded for luck? the ones without principals are. Quarterly Journal of Economics 116, 901–932.

Core, J., Guay, W., 1999. The use of equity grants to manage optimal equity incentive. Journal of Accounting and Economics 28, 151–184.

Core, J., Holthausen, R., Larcker, D., 1999. Corporate governance, chief executive officer compensation, and firm performance. Journal of Financial Economics 51, 371–406.

Dikolli, S., Hofmann, C., Pfeiffer, T., 2013. Relative performance evaluation and peer-performance summarization errors. Review of Accounting Studies 18, 34–85.

Garvey, G., Milbourn, T., 2003. Incentive compensation when executives can hedge the market: Evidence of relative performance evaluation in the cross section. Journal of Finance 58, 1157–1582.

Garvey, G., Milbourn, T., 2006. Asymmetric benchmarking in compensation: Executives are rewarded for good luck but not penalized for bad. Journal of Financial Economics 82, 197–225.

Ghysels, E., Santa-Clara, P., Valkanov, R., 2005. There is a risk-return trade-off after all. Journal of Financial Economics 76, 509–548.

Gibbons, R., Murphy, K., 1990. Relative performance evaluation for chief executive officers. Industrial and Labor Relations Review 43, 30–S–51–S.

Hemmer, T., 2016. Optimal dynamic relative performance evaluation, working paper.

Holmström, B., 1982. Moral hazard in teams. Bell Journal of Economics 13, 324–340.

Holmström, B., Milgrom, P., 1987. Aggregation and linearity in the provision of intertemporal incentives. Econometrica: Journal of the Econometric Society 55, 303–328.

Janakiraman, S., Lambert, R., Larcker, D., 1992. An empirical investigation of the relative performance evaluation hypothesis. Journal of Accounting Research 30, 53–69.

Jayaraman, S., Milbourn, T., Seo, H., 2015. Product market peers and relative performance evaluation, working paper.

Jensen, M., Murphy, K., 1990. Performance pay and top-management incentives. Journal of Political Economy 98, 225–264.

Ma, P., Shin, J. E., Wang, C., 2017. Relative performance benchmarks: Do boards get it right?, working paper.

Merton, R., Rossi, A., 1968. Contributions to the theory of reference group behavior. In: Merton, R. (ed.), *Social Theory and Social Structure*, The Free Press, New York.

Rajgopal, S., Shevlin, T., Zamora, V., 2006. CEO's outside employment opportunities and the lack of relative performance evaluation in compensation contracts. Journal of Finance 61, 1813–1844.

Rosen, S., 1982. Authority, control, and the distribution of earnings. Bell Journal of Economics 13, 311–323.

Smith, Jr., C., Watts, R., 1992. The investment opportunity set and corporate financing, dividend and compensation policies. Journal of Financial Economics 32, 263–292.

Appendix: Variable descriptions and measurement

A.1. CEO compensation variable:

$Comp_{j,t}$ — Change in the natural logarithm of total annual compensation for firm j's CEO between fiscal years t and $t{-}1$, where total annual compensation in a given fiscal year is equal to the sum of salary, bonus, total value of restricted stock granted, total value of stock options granted, long-term incentive payouts and all other compensation (ExecuComp *TDC1*).

A.2. Firm-year-peer variables

$ret^{3\text{-}day}_{j,t,\tau}$ — Natural logarithm of one plus firm j's stock return for a three-day subperiod τ within fiscal year t.

$peer\_ret^{3\text{-}day}_{j,t,k,\tau}$ — Natural logarithm of one plus the stock return for firm j's peer k for a three-day subperiod τ within fiscal year t.

$perf\_corr_{j,t,k}$ — Correlation coefficient between firm j's three-day stock returns ($ret^{3\text{-}day}_{j,t,\tau}$) and the three-day stock return for firm j's peer k ($peer\_ret^{3\text{-}day}_{j,t,k,\tau}$), which is estimated using the 84 three-day return windows within j's fiscal year t (i.e., approximately $84 \times 3 = 252$ trading days total within a fiscal year).

$i^{1\text{-}way}_{j,t,k}$ — An indicator variable equal to one (zero) if the relationship between firm j and its peer k is (not) one-way (i.e., k does not also consider j as its peer).

$i^{larger}_{j,t,k}$ — An indicator variable equal to one (zero) if the market value of firm j's peer k is (not) larger than the market value of equity of firm j at the beginning of fiscal year t.

$i^{diff\text{-}ind}_{j,t,k}$ — An indicator variable equal to one (zero) if firm j peer k during fiscal year t.

$peer\_ret_{j,t,k}$ — Natural logarithm of one plus the annual stock return for firm *i*'s peer j measured during *i*'s fiscal year *t*, such that $\sum_{\tau=1}^{84} peer\_ret^{3\text{-}day}_{j,t,k,\tau} = peer\_ret_{j,t,k}$.

$ret^{+}_{j,t,\tau}$ — Indicator variable equal to one if $ret^{3\text{-}day}_{j,t,\tau} \geq 0$ and equal to zero otherwise.

$peer\_ret^{+}_{j,t,k,\tau}$ — Indicator variable equal to one if $peer\_ret^{3\text{-}day}_{j,t,k,\tau} \geq 0$ and equal to zero otherwise.

$\gamma^{+}_{j,t,k}$ — Conditional probability of a positive stock return for firm j's peer k during a three-day subperiod τ, within fiscal year t given that firm j also has a positive return during τ. For a given firm j, peer firm k and fiscal year t, $\gamma^{+}_{j,t,k}$ is estimated using 252 three-day return windows during the three most recent fiscal years prior to t (i.e., *t–1*, *t–2* and *t–3*) as follows:

$$\gamma^{+}_{j,t,k} = \Pr\left(peer\_ret^{+}_{j,t,k,\tau} = 1 \mid ret^{+}_{j,t,\tau} = 1\right) = \frac{\sum_{s=1}^{3}\sum_{\tau=1}^{84}\left[peer\_ret^{+}_{j,t-s,k,\tau} \times ret^{+}_{j,t-s,\tau}\right]}{\sum_{s=1}^{3}\sum_{\tau=1}^{84} ret^{+}_{j,t-s,\tau}}$$

A.2. Firm-year-peer variables (continued)

$\gamma^{-}_{j,t,k}$ Conditional probability of a non-positive stock return for firm j's peer k during a three-day subperiod τ, within fiscal year t given that firm j also has a non-positive return during τ. For a given firm j, peer firm k and fiscal year t, $\gamma^{-}_{j,t,k}$ is estimated using 252 three-day return windows during the three most recent fiscal years prior to t (i.e., *t–1*, *t–2* and *t–3*) as follows:

$$\gamma^{-}_{j,t,k} = \Pr[peer\_ret^{+}_{j,t,\,k,\tau} = 0 \mid ret^{+}_{j,t,\tau} = 0] = \frac{\sum_{s=1}^{3}\sum_{\tau=1}^{84}\left[(1-peer\_ret^{+}_{j,t\text{–}s,\,k,\tau}) \times (1-ret^{+}_{j,t\text{–}s,\tau})\right]}{\sum_{s=1}^{3}\sum_{\tau=1}^{84}(1-ret^{+}_{j,t\text{–}s,\tau})}$$

A.3. Firm-year performance variables

$Ret_{j,t}$ Natural logarithm of one plus firm j's annual stock return in fiscal year t, such that $\sum_{\tau=1}^{84} ret^{3\text{-}day}_{j,t,\tau} = Ret_{j,t}$.

$Perf\_Corr_{j,t}$ Average performance correlations between firm j and its peer firms k during fiscal year t, which is equal to $\sum_{k=1}^{N_{j,t}} perf\_corr_{j,t,k}/N_{j,t}$, where $N_{j,t}$ is the number of firm with non-missing performance measures that firm j considers to be a peer in fiscal year t.

$Peer\_Ret_{j,t}$ Average of aggregate peer performances for all of firm j's peer firms k during fiscal year t, which is equal to $\sum_{k=1}^{N_{j,t}} peer\_ret_{j,t,k}/N_{j,t}$, where $N_{j,t}$ is the number of firms with non-missing performance measures that firm j considers to be a peer in fiscal year t.

$\Gamma^{+}_{j,t}$ $(\Gamma^{-}_{j,t})$ Average across all of firm j's peer firms k during fiscal year t of conditional probability of a positive (non-positive) stock return for j's peer k during a three-day subperiod τ within fiscal year t given that firm j also has a positive (non-positive) return during τ, which is equal to $\sum_{\tau=1}^{N_{j,t}} \gamma^{+}_{j,t,k}/N_{j,t}$ $(\sum_{\tau=1}^{N_{j,t}} \gamma^{-}_{j,t,k}/N_{j,t})$, where $N_{j,t}$ is the number of firms with non-missing performance measures that firm j considers to be a peer in fiscal year t.

$A^{+}_{j,t}$ Positive asymmetric sensitivity to peer performance represented by an indicator variable equal to one if the average conditional probability of positive returns for both firm j and its peer firms $\Gamma^{+}_{j,t}$ is greater than the average conditional probability of non-positive returns for both firm j and its peer firms $\Gamma^{-}_{j,t}$ and equal to zero otherwise.

A.4. Firm-year control variables

$ISV_{j,t}$	Idiosyncratic return volatility for firm j in fiscal year t, which is equal to the standard deviation of residuals from a time-series regression of firm j's monthly returns on two-digit SIC industry returns estimated using the most recent 36 (minimum of 18 required) monthly returns immediately prior to the beginning of fiscal year t. Industry returns are computed as the equal-weighted portfolio return based on firms in the same two-digit SIC, excluding the monthly return of firm j.
$Size_{j,t}$	Change in the size of firm j, between the beginning of fiscal years t and t–1, where firm size is measured by the natural logarithm of the book value of firm j's total assets.
$MTB_{j,t}$	Change in the market-to-book ratio of firm j, between the beginning of fiscal years t and t–1, where the market-to-book ratio is computed as firm j's market value of total assets divided by the book value of total assets. Market value of assets is equal to the book value of total assets minus the book value of equity plus the market value of equity.
$N_{j,t}$	Number of firms with non-missing firm-performance variables that firm j considers to be a peer in fiscal year t.
$\%Peers_{j,t}^{1\text{-}way}$	Fraction of firm j's peer firm relationships during fiscal year t that are one-way (i.e., peer firm does not consider j as a peer), which is computed by $\sum_{k=1}^{N_{j,t}} i_{j,t,k}^{1\text{-}way}/N_{j,t}$.
$\%Peers_{j,t}^{larger}$	Fraction of firm j's peer firms that have a larger market value of equity than j at the beginning of fiscal year t, which is computed by $\sum_{k=1}^{N_{j,t}} i_{j,t,k}^{larger}/N_{j,t}$.
$\%Peers_{j,t}^{diff\text{-}ind}$	Fraction of firm j's peer firms that are in a different two-digit SIC industry during fiscal year t, which is computed by $\sum_{k=1}^{N_{j,t}} i_{j,t,k}^{diff\text{-}ind}/N_{j,t}$.
$Own_{j,t}$	CEO's percentage ownership of firm j, and is equal to the number of shares (excluding options) owned divided by the number of common shares outstanding at the beginning of fiscal year t.
$Chair_{j,t}$	Indicator variable equal to one (zero) if the title of firm j's CEO in fiscal year t indicates (does not indicate) that the CEO is also the board chair.
$Tenure_{j,t}$	The natural logarithm of the tenure of firm j's CEO at the end of fiscal year t, where tenure is defined as the number of days between the last day of fiscal year t and the day when the CEO assumed the position.

Table 1
Sample summary statistics

Variable	Mean	Std. Dev.	Percentile 25th	Percentile 50th	Percentile 75th
$Comp_{j,t}$	0.069	0.455	−0.110	0.066	0.269
$Ret_{j,t}$	0.077	0.383	−0.084	0.124	0.294
$Perf\_Corr_{j,t}$	0.496	0.155	0.380	0.495	0.613
$Peer\_Ret_{j,t}$	0.065	0.298	−0.044	0.128	0.251
$ISV_{j,t}$	0.086	0.042	0.055	0.076	0.107
$Size_{j,t}$	0.076	0.163	−0.006	0.054	0.133
$MTB_{j,t}$	0.003	0.507	−0.139	0.015	0.177
$N_{j,t}$	17.226	8.706	12.000	16.000	20.000
$\%Peers_{j,t}^{1\text{-}way}$	0.624	0.232	0.462	0.650	0.813
$\%Peers_{j,t}^{larger}$	0.558	0.230	0.391	0.556	0.727
$\%Peers_{j,t}^{diff\text{-}ind}$	0.441	0.346	0.100	0.412	0.762
$Own_{j,t}$	0.015	0.039	0.001	0.003	0.010
$Tenure_{j,t}$	7.873	0.673	7.367	7.870	8.350
$Chair_{j,t}$	0.573				
$A_{j,t}^{+}$	0.646				

This table presents summary statistics for all variables based on a sample of 7,039 firm-year observations with a fiscal year ending between 2007 and 2014. $Comp_{j,t}$ is the change in the natural logarithm of total annual compensation for firm j's CEO between fiscal years t and $t–1$. $Ret_{j,t}$ is firm j's aggregate performance in fiscal year t, which is equal to the natural logarithm of one plus firm j's annual stock return in fiscal year t. $Perf\_Corr_{j,t}$ is the equal-weighted average of the correlation coefficients between firm j's three-day stock returns and three-day stock returns of each of j's peer firms estimated from the 84 three-day return windows within j's fiscal year t. $Peer\_Ret_{j,t}$ is the equal-weighted average of the aggregate performances of firm j's peer firms in fiscal year t, where aggregate performance for a given peer firm is equal to the natural logarithm of one plus the annual stock return in fiscal year t. Other variables include: idiosyncratic volatility, $ISV_{j,t}$; firm size, $Size_{j,t}$; market-to-book ratio, $MTB_{j,t}$; number of peer firms, $N_{j,t}$; percentage of peer firms with a 1-way relationship, $\%Peers_{j,t}^{1\text{-}way}$; percentage of larger peer firms, $\%Peers_{j,t}^{larger}$; percentage of peer firms in a different industry, $\%Peers_{j,t}^{diff\text{-}ind}$; CEO ownership, $Own_{j,t}$; an indicator for when the CEO is also the board chair, $Chair_{j,t}$; and CEO tenure, $Tenure_{j,t}$. $A_{j,t}^{+}$ measures the asymmetric sensitivity to peer performance, which is represented as an indicator variable equal to one if the average conditional probability of positive returns for both firm j and its peer firms is greater than or equal to the conditional probability of non-positive returns for both firm j and its peer firms and equal to zero otherwise. The appendix provides the definitions and measurements for all variables.

Table 2

Sample correlation matrix

Variable	$Comp_{j,t}$	$Ret_{j,t}$	$Perf\_Corr_{j,t}$	$Peer\_Ret_{j,t}$	$ISV_{j,t}$	$Size_{j,t}$	$MTB_{j,t}$	$\%Peers_{j,t}^{1\text{-}way}$	$\%Peers_{j,t}^{larger}$	$\%Peers_{j,t}^{diff\text{-}ind}$
$Comp_{j,t}$		$0.172^{\dagger}$	$0.063^{\dagger}$	$0.105^{\dagger}$	$0.072^{\dagger}$	$-0.052^{\dagger}$	$0.120^{\dagger}$	0.011	$0.033^{\dagger}$	−0.012
$Ret_{j,t}$	$0.196^{\dagger}$		$-0.084^{\dagger}$	$0.721^{\dagger}$	$0.061^{\dagger}$	$-0.150^{\dagger}$	$-0.047^{\dagger}$	$-0.059^{\dagger}$	$0.048^{\dagger}$	−0.008
$Perf\_Corr_{j,t}$	$0.048^{\dagger}$	$-0.094^{\dagger}$		$-0.180^{\dagger}$	$-0.231^{\dagger}$	$-0.035^{\dagger}$	−0.005	$-0.323^{\dagger}$	$-0.117^{\dagger}$	$-0.245^{\dagger}$
$Peer\_Ret_{j,t}$	$0.093^{\dagger}$	$0.673^{\dagger}$	$-0.181^{\dagger}$		$0.077^{\dagger}$	$-0.153^{\dagger}$	$-0.033^{\dagger}$	$-0.089^{\dagger}$	0.006	−0.001
$ISV_{j,t}$	$0.081^{\dagger}$	$0.062^{\dagger}$	$-0.233^{\dagger}$	$0.066^{\dagger}$		$-0.055^{\dagger}$	0.006	$0.246^{\dagger}$	$0.301^{\dagger}$	$0.054^{\dagger}$
$Size_{j,t}$	$-0.045^{\dagger}$	$-0.135^{\dagger}$	$-0.025^{\dagger}$	$-0.157^{\dagger}$	$-0.061^{\dagger}$		$-0.146^{\dagger}$	$0.054^{\dagger}$	$-0.153^{\dagger}$	−0.017
$MTB_{j,t}$	$0.134^{\dagger}$	$-0.028^{\dagger}$	−0.019	$-0.056^{\dagger}$	0.011	$-0.102^{\dagger}$		−0.016	$-0.087^{\dagger}$	0.019
$\%Peers_{j,t}^{1\text{-}way}$	0.023	$-0.035^{\dagger}$	$-0.313^{\dagger}$	$-0.054^{\dagger}$	$0.274^{\dagger}$	$0.032^{\dagger}$	−0.007		$0.209^{\dagger}$	$0.295^{\dagger}$
$\%Peers_{j,t}^{larger}$	$0.037^{\dagger}$	$0.065^{\dagger}$	$-0.112^{\dagger}$	0.012	$0.297^{\dagger}$	$-0.194^{\dagger}$	$-0.093^{\dagger}$	$0.205^{\dagger}$		−0.015
$\%Peers_{j,t}^{diff\text{-}ind}$	−0.014	0.001	$-0.260^{\dagger}$	0.010	$0.080^{\dagger}$	−0.019	$0.041^{\dagger}$	$0.300^{\dagger}$	−0.010	

This table presents Pearson (Spearman) correlation coefficients above (below) the diagonal for all continuous variables based on a sample of 7,039 firm-year observations with a fiscal year ending between 2007 and 2014. $Comp_{j,t}$ is the change in the natural logarithm of total annual compensation for firm j's CEO between fiscal years t and t–*1*. $Ret_{j,t}$ is firm j's aggregate performance in fiscal year t, which is equal to the natural logarithm of one plus firm j's annual stock return in fiscal year t. $Perf\_Corr_{j,t}$ is the equal-weighted average of the correlation coefficients between firm j's three-day stock returns and three-day stock returns of each of j's peer firms estimated from the 84 three-day return windows within j's fiscal year t. $Peer\_Ret_{j,t}$ is the equal-weighted average of the aggregate performances of firm j's peer firms in fiscal year t, where aggregate performance for a given peer firm is equal to the natural logarithm of one plus the annual stock return in fiscal year t. Other variables include: idiosyncratic volatility, $ISV_{j,t}$; firm size, $Size_{j,t}$; market-to-book ratio, $MTB_{j,t}$; percentage of peer firms with a 1-way relationship, $\%Peers_{j,t}^{1\text{-}way}$; percentage of larger peer firms, $\%Peers_{j,t}^{larger}$; and percentage of peer firms in a different industry, $\%Peers_{j,t}^{diff\text{-}ind}$. The appendix provides the definitions and measurements for all variables. The superscript † indicates that the correlation coefficient is different from zero with a 5% level of statistical significance.

Table 3
Regressions estimating the sensitivity of CEO pay to performance correlation

Variable	Pred. Sign	(1)	(2)	(3)	(4)
$Ret_{j,t}$	+	0.239***	0.226***	0.240***	0.217***
		(10.14)	(9.53)	(10.40)	(9.47)
$Perf\_Corr_{j,t}$	+		0.324***		0.485***
			(7.82)		(8.65)
$Peer\_Ret_{j,t}$		−0.061**	−0.018	−0.022	0.043
		(−2.08)	(−0.59)	(−0.60)	(1.13)
$ISV_{j,t}$				0.311**	0.711***
				(2.25)	(4.88)
$Size_{j,t}$				−0.002	0.001
				(−0.05)	(0.02)
$MTB_{j,t}$				0.095***	0.090***
				(6.50)	(6.11)
$N_{j,t}$				0.001	0.001
				(1.02)	(0.88)
$\%Peers_{j,t}^{1\text{-}way}$				0.026	0.101***
				(1.18)	(4.26)
$\%Peers_{j,t}^{larger}$				0.045**	0.032
				(2.07)	(1.48)
$\%Peers_{j,t}^{diff\text{-}ind}$				−0.028	−0.020
				(−1.63)	(−1.16)
$Own_{j,t}$				−0.020	0.081
				(−0.13)	(0.55)
$Chair_{j,t}$				−0.010	−0.018**
				(−1.08)	(−2.00)
$Tenure_{j,t}$				−0.020***	−0.016**
				(−2.71)	(−2.27)
Industry fixed-effects:		N	N	Y	Y
Year fixed-effects:		N	N	Y	Y
Adj. R^2		0.030	0.035	0.065	0.074

This table presents coefficient values (t-statistics in parentheses) from the following regression estimated for a sample of 7,039 firm-year observations with a fiscal year ending between 2007 and 2014:

$$Comp_{j,t} = \beta_0 + \beta_\Omega \cdot Ret_{j,t} + \beta_\rho \cdot Perf\_Corr_{j,t} + \beta_\Pi \cdot Peer\_Ret_{j,t} + Controls_{j,t} + \varepsilon_{j,t}.$$

The dependent variable $Comp_{j,t}$ is the change in the natural logarithm of total annual compensation for firm j's CEO between fiscal years t and t–1. $Ret_{j,t}$ is firm j's aggregate performance in fiscal year t, which is equal to the natural logarithm of one plus firm j's annual stock return in fiscal year t. $Perf\_Corr_{j,t}$ is the equal-weighted average of the correlation coefficients between firm j's three-day stock returns and three-day stock returns of each of j's peer firms estimated from the 84 three-day return windows within j's fiscal year t. $Peer\_Ret_{j,t}$ is the equal-weighted average of the aggregate performances of firm j's peer firms in fiscal year t, where aggregate performance for a given peer firm is equal to the natural logarithm of one plus the annual stock return in fiscal year t. Additional variables, represented by $Controls_{j,t}$, include: idiosyncratic volatility, $ISV_{j,t}$; firm size, $Size_{j,t}$; market-to-book ratio, $MTB_{j,t}$; number of peer firm, $N_{j,t}$; percentage of peer firms with a 1-way relationship, $\%Peers_{j,t}^{1\text{-}way}$; percentage of larger peer firms, $\%Peers_{j,t}^{larger}$; percentage of peer firms in a different industry, $\%Peers_{j,t}^{diff\text{-}ind}$; CEO ownership, $Own_{j,t}$; an indicator for when the CEO is also the board chair, $Chair_{j,t}$; CEO tenure, $Tenure_{j,t}$; two-digit SIC industry fixed-effect parameters (not reported); and year fixed-effect parameters (not reported). The appendix provides the definitions and measurements for all variables. One, two, and three stars indicate that the estimated coefficient is different from zero at a 10%, 5%, and 1% level of statistical significance, respectively, based on standard errors clustered by firm.

Table 4
Regressions estimating the asymmetric sensitivity of CEO pay to aggregate peer performance

Variable	Pred. Sign	Full Sample Interaction (1)	Sub-sample Analysis $A^+_{j,t}=1$ (2)	$A^+_{j,t}=0$ (3)	Difference (4)
$Ret_{j,t}$	+	0.213***	0.213***	0.176**	0.037
		(9.16)	(8.78)	(2.55)	(0.52)
$Perf\_Corr_{j,t}$	+	0.523***	0.497***	0.762***	−0.266
		(9.16)	(8.32)	(3.49)	(−1.22)
$Peer\_Ret_{j,t}$		−0.201**	0.081*	−0.147**	0.228***
		(−2.40)	(1.89)	(−2.07)	(2.68)
$Peer\_Ret_{j,t} \cdot A^+_{j,t}$	+	0.281***			
		(3.28)			
$A^+_{j,t}$		−0.049**			
		(−2.45)			
$Controls_{j,t}$ included:		Y	Y	Y	Y
Industry fixed-effects:		Y	Y	Y	Y
Year fixed-effects:		Y	Y	Y	Y
Adj. R^2		0.076	0.076	0.055	

Column (1) of this table reports coefficient values (t-statistics in parentheses) from the following regression estimated for a sample of 7,039 firm-year observations between 2007 and 2014:

$$Comp_{j,t} = \beta_0 + \beta_0^+ \cdot A^+_{j,t} + \beta_\Omega \cdot Ret_{j,t} + \beta_\rho \cdot Perf\_Corr_{j,t} + \beta_\Pi \cdot Peer\_Ret_{j,t} + \beta_\Pi^{A^+} \cdot (Peer\_Ret_{j,t} \cdot A^+_{j,t}) + Controls_{j,t} + \varepsilon_{j,t}.$$

The dependent variable $Comp_{j,t}$ is the change in the natural logarithm of total annual compensation for firm j's CEO between fiscal years t and $t–1$. $Ret_{j,t}$ is firm j's aggregate performance in fiscal year t, which is equal to the natural logarithm of one plus firm j's annual stock return in fiscal year t. $Perf\_Corr_{j,t}$ is the equal-weighted average of the correlation coefficients between firm j's three-day stock returns and three-day stock returns of each of j's peer firms estimated from the 84 three-day return windows within j's fiscal year t. $Peer\_Ret_{j,t}$ is the equal-weighted average of the aggregate performances of firm j's peer firms in fiscal year t, where aggregate performance for a given peer firm is equal to the natural logarithm of one plus the annual stock return in fiscal year t. $A^+_{j,t}$ measures the asymmetric sensitivity to peer performance, which is represented as an indicator variable equal to one if the average conditional probability of positive returns for both firm j and its peer firms is greater than or equal to the conditional probability of non-positive returns for both firm j and its peer firms and equal to zero otherwise. Additional control variables, represented by $Controls_{j,t}$, are not reported, but include: idiosyncratic volatility, $ISV_{j,t}$; firm size, $Size_{j,t}$; market-to-book ratio, $MTB_{j,t}$; number of peer firm, $N_{j,t}$; percentage of peer firms with a 1-way relationship, $\%Peers^{1\text{-}way}_{j,t}$; percentage of larger peer firms, $\%Peers^{larger}_{j,t}$; percentage of peer firms in a different industry, $\%Peers^{diff\text{-}ind}_{j,t}$; CEO ownership, $Own_{j,t}$; an indicator for when the CEO is also the board chair, $Chair_{j,t}$; CEO tenure, $Tenure_{j,t}$; two-digit SIC industry fixed-effect parameters; and year fixed-effect parameters. The appendix provides the definitions and measurements for all variables. Columns (2) and (3) report coefficient values (t-statistics in parentheses) from the following regression estimated for sub-samples with a positive asymmetry ($A^+_{j,t}=1$) and a negative asymmetry ($A^+_{j,t}=0$), respectively:

$$Comp_{j,t} = \beta_0 + \beta_\Omega \cdot Ret_{j,t} + \beta_\rho \cdot Perf\_Corr_{j,t} + \beta_\Pi \cdot Peer\_Ret_{j,t} + Controls_{j,t} + \varepsilon_{j,t}.$$

Column (4) reports the difference in coefficient values reported in columns (2) and (3). One, two, and three stars indicate that the estimated coefficient is different from zero at a 10%, 5%, and 1% level of statistical significance, respectively, based on standard errors clustered by firm.

Table 5

Mixed data sampling regressions estimating the effect of firm-peer relationship characteristics on the CEO pay-for-performance correlation sensitivity

Variable	(1)	(2)	(3)	(4)
b_{ρ}^{0}	0.059	0.435***	0.359***	−0.042
	(0.61)	(5.05)	(4.90)	(−0.37)
$b_{\rho}^{1\text{-}way}$	0.803***			0.711***
	(5.74)			(4.97)
b_{ρ}^{larger}		0.161		0.055
		(1.28)		(0.43)
$b_{\rho}^{diff\text{-}ind}$			0.423***	0.319***
			(3.89)	(2.95)
$Controls_{j,t}$ included:	Y	Y	Y	Y
Industry fixed-effects:	Y	Y	Y	Y
Year fixed-effects:	Y	Y	Y	Y
Adj. R^2	0.079	0.076	0.077	0.080

This table presents parameter values (t-statistics in parentheses) describing the sensitivity of CEO compensation to performance correlation $\beta_{\rho}(k)$, which are estimated from the following regression model using for a sample of 7,039 firm-year observations with a fiscal year ending between 2007 and 2014:

$$Comp_{j,t} = \beta_0 + \beta_{\Omega} \cdot Ret_{j,t} + \sum_{k=1}^{N_{j,t}} \left[\beta_{\rho}(k) \cdot \frac{perf\_corr_{j,t,k}}{N_{j,t}} \right] + \beta_{\Pi} \cdot Peer\_Ret_{j,t} + \beta_{\Pi}^{A^+} \cdot (Peer\_Ret_{j,t} \cdot A_{j,t}^{+}) + Controls_{j,t} + \varepsilon_{j,t},$$

$$\text{subject to:} \quad \beta_{\rho}(k) = b_{\rho}^{0} + b_{\rho}^{1\text{-}way} \cdot i_{j,t,k}^{1\text{-}way} + b_{\rho}^{larger} \cdot i_{j,t,k}^{larger} + b_{\rho}^{diff\text{-}ind} \cdot i_{j,t,k}^{diff\text{-}ind}.$$

The dependent variable $Comp_{j,t}$ is the change in the natural logarithm of total annual compensation for firm j's CEO between fiscal years t and t–1. $Ret_{j,t}$ is firm j's aggregate performance in fiscal year t, which is equal to the natural logarithm of one plus firm j's annual stock return in fiscal year t. $perf\_corr_{j,t,k}$ is the correlation coefficient between firm j's three-day stock returns and the three-day stock return of firm j's peer k estimated from the 84 three-day return windows within j's fiscal year t. In addition, $perf\_corr_{j,t,k}$ is scaled by the total number of firm j's peer firms in fiscal year t in order to facilitate comparison across firm-year observations. $i_{j,t,k}^{larger}$ is an indicator variable equal to one if the market value of firm j's peer k is larger than the market value of firm j at the beginning of fiscal year t and equal to zero otherwise. $i_{j,t,k}^{1\text{-}way}$ is an indicator variable equal to one if the relationship between firm j and its peer k is one-way (i.e., k does not also consider j as its peer) and equal to zero otherwise. $i_{j,t,k}^{diff\text{-}ind}$ is an indicator variable equal to one if firm j is in the same two-digit SIC industry as its peer k at the beginning of the fiscal year and equal to zero otherwise. $Peer\_Ret_{j,t}$ is the equal-weighted average of the aggregate performances of firm j's peer firms in fiscal year t, where aggregate performance for a given peer firm is equal to the natural logarithm of one plus the annual stock return in fiscal year t. Additional control variables, represented by $Controls_{j,t}$, are not reported, but include: idiosyncratic volatility, $ISV_{j,t}$; firm size, $Size_{j,t}$; market-to-book ratio, $MTB_{j,t}$; number of peer firm, $N_{j,t}$; percentage of peer firms with a 1-way relationship, $\%Peers_{j,t}^{1\text{-}way}$; percentage of larger peer firms, $\%Peers_{j,t}^{larger}$; percentage of peer firms in a different industry, $\%Peers_{j,t}^{diff\text{-}ind}$; CEO ownership, $Own_{j,t}$; an indicator for when the CEO is also the board chair, $Chair_{j,t}$; CEO tenure, $Tenure_{j,t}$; two-digit SIC industry fixed-effect parameters; and year fixed-effect parameters. The appendix provides the definitions and measurements for all variables. One, two, and three stars indicate that the estimated coefficient is different from zero at a 10%, 5%, and 1% level of statistical significance, respectively, based on standard errors clustered by firm.

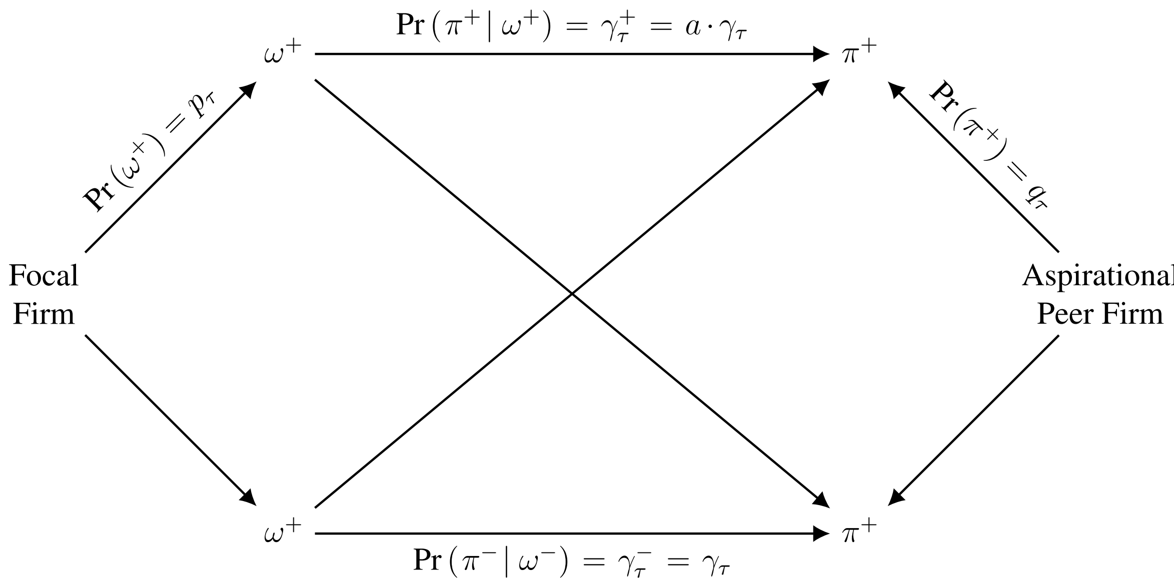

Figure 1. Sub-period structure of the two-firm, two-agent model with an aspirational peer firm.

Online Appendix for:

Does It Pay to "Be Like Mike"? Aspirational Peer Firms and Relative Performance Evaluation

Ryan T. Ball	Jonathan Bonham	Thomas Hemmer
University of Michigan	University of Chicago	Rice University

August 2017

Table OA.1.

Regressions estimating the sensitivity of CEO pay to performance correlation (value-weighted)

Variable	Pred. Sign	(1)	(2)	(3)	(4)
$Ret_{j,t}$	+	0.233***	0.220***	0.239***	0.218***
		(9.99)	(9.40)	(10.49)	(9.63)
$Perf\_Corr_{j,t}$	+		0.336***		0.489***
			(8.29)		(9.10)
$Peer\_Ret_{j,t}$		−0.057*	−0.009	−0.023	0.039
		(−1.79)	(−0.27)	(−0.58)	(0.98)
$ISV_{j,t}$				0.310**	0.704***
				(2.24)	(4.88)
$Size_{j,t}$				−0.002	−0.001
				(−0.04)	(−0.03)
$MTB_{j,t}$				0.095***	0.089***
				(6.50)	(6.04)
$N_{j,t}$				0.001	0.001
				(1.02)	(1.19)
$\%Peers_{j,t}^{1\text{-}way}$				0.026	0.092***
				(1.19)	(3.96)
$\%Peers_{j,t}^{larger}$				0.045**	0.047**
				(2.08)	(2.16)
$\%Peers_{j,t}^{diff\text{-}ind}$				−0.028	−0.012
				(−1.62)	(−0.71)
$Own_{j,t}$				−0.020	0.067
				(−0.13)	(0.45)
$Chair_{j,t}$				−0.010	−0.018**
				(−1.09)	(−2.00)
$Tenure_{j,t}$				−0.020***	−0.017**
				(−2.71)	(−2.33)
Industry fixed-effects:		N	N	Y	Y
Year fixed-effects:		N	N	Y	Y
Adj. R^2		0.030	0.036	0.065	0.075

This table presents coefficient values (t-statistics in parentheses) from the following regression estimated for a sample of 7,039 firm-year observations with a fiscal year ending between 2007 and 2014:

$$Comp_{j,t} = \beta_0 + \beta_\Omega \cdot Ret_{j,t} + \beta_\rho \cdot Perf\_Corr_{j,t} + \beta_\Pi \cdot Peer\_Ret_{j,t} + Controls_{j,t} + \varepsilon_{j,t}.$$

The dependent variable $Comp_{j,t}$ is the change in the natural logarithm of total annual compensation for firm j's CEO between fiscal years t and t–1. $Ret_{j,t}$ is firm j's aggregate performance in fiscal year t, which is equal to the natural logarithm of one plus firm j's annual stock return in fiscal year t. $Perf\_Corr_{j,t}$ is the equal-weighted average of the correlation coefficients between firm j's three-day stock returns and three-day stock returns of each of j's peer firms estimated from the 84 three-day return windows within j's fiscal year t. $Peer\_Ret_{j,t}$ is the equal-weighted average of the aggregate performances of firm j's peer firms in fiscal year t, where aggregate performance for a given peer firm is equal to the natural logarithm of one plus the annual stock return in fiscal year t. Additional control variables, represented by $Controls_{j,t}$, include: idiosyncratic volatility, $ISV_{j,t}$; firm size, $Size_{j,t}$; market-to-book ratio, $MTB_{j,t}$; number of peer firm, $N_{j,t}$; percentage of peer firms with a 1-way relationship, $\%Peers_{j,t}^{1\text{-}way}$; percentage of larger peer firms, $\%Peers_{j,t}^{larger}$; percentage of peer firms in a different industry, $\%Peers_{j,t}^{diff\text{-}ind}$; CEO ownership, $Own_{j,t}$; an indicator for when the CEO is also the board chair, $Chair_{j,t}$; CEO tenure, $Tenure_{j,t}$; two-digit SIC industry fixed-effect parameters (not reported); and year fixed-effect parameters (not reported). The appendix provides the definitions and measurements for all variables. One, two, and three stars indicate that the estimated coefficient is different from zero at a 10%, 5%, and 1% level of statistical significance, respectively, based on standard errors clustered by firm.

Table OA.2.

Regressions estimating the asymmetric sensitivity of CEO pay to aggregate peer performance (value-weighted)

Variable	Pred. Sign	Full Sample Interaction (1)	Sub-sample Analysis $A^+_{j,t}=1$ (2)	$A^+_{j,t}=0$ (3)	Difference (4)
$Ret_{j,t}$	+	0.217***	0.214***	0.204***	0.011
		(9.55)	(9.12)	(2.78)	(0.15)
$Perf\_Corr_{j,t}$	+	0.518***	0.494***	0.677***	−0.182
		(9.61)	(8.67)	(3.47)	(−0.93)
$Peer\_Ret_{j,t}$		−0.291***	0.077*	−0.187**	0.264**
		(−2.96)	(1.91)	(−2.13)	(2.38)
$Peer\_Ret_{j,t} \cdot A^+_{j,t}$	+	0.365***			
		(3.72)			
$A^+_{j,t}$		−0.053***			
		(−2.61)			
$Controls_{j,t}$ included:		Y	Y	Y	Y
Industry fixed-effects:		Y	Y	Y	Y
Year fixed-effects:		Y	Y	Y	Y
Adj. R^2		0.077	0.077	0.056	

Column (1) of this table reports coefficient values (t-statistics in parentheses) from the following regression estimated for a sample of 7,039 firm-year observations between 2007 and 2014:

$$Comp_{j,t} = \beta_0 + \beta_0^+ \cdot A^+_{j,t} + \beta_\Omega \cdot Ret_{j,t} + \beta_\rho \cdot Perf\_Corr_{j,t} + \beta_\Pi \cdot Peer\_Ret_{j,t} + \beta_\Pi^{A^+} \cdot (Peer\_Ret_{j,t} \cdot A^+_{j,t}) + Controls_{j,t} + \varepsilon_{j,t}.$$

The dependent variable $Comp_{j,t}$ is the change in the natural logarithm of total annual compensation for firm j's CEO between fiscal years t and $t–1$. $Ret_{j,t}$ is firm j's aggregate performance in fiscal year t, which is equal to the natural logarithm of one plus firm j's annual stock return in fiscal year t. $Perf\_Corr_{j,t}$ is the value-weighted average of the correlation coefficients between firm j's three-day stock returns and three-day stock returns of each of j's peer firms estimated from the 84 three-day return windows within j's fiscal year t. $Peer\_Ret_{j,t}$ is the value-weighted average of the aggregate performances of firm j's peer firms in fiscal year t, where aggregate performance for a given peer firm is equal to the natural logarithm of one plus the annual stock return in fiscal year t. $A^+_{j,t}$ measures the asymmetric sensitivity to peer performance, which is represented as an indicator variable equal to one if the average conditional probability of positive returns for both firm j and its peer firms is greater than or equal to the conditional probability of non-positive returns for both firm j and its peer firms and equal to zero otherwise. Additional control variables, represented by$Controls_{j,t}$, are not reported, but include: idiosyncratic volatility, $ISV_{j,t}$; firm size, $Size_{j,t}$; market-to-book ratio, $MTB_{j,t}$; number of peer firm, $N_{j,t}$; percentage of peer firms with a 1-way relationship, $\%Peers^{1\text{-}way}_{j,t}$; percentage of larger peer firms, $\%Peers^{larger}_{j,t}$; percentage of peer firms in a different industry, $\%Peers^{diff\text{-}ind}_{j,t}$; CEO ownership, $Own_{j,t}$; an indicator for when the CEO is also the board chair, $Chair_{j,t}$; CEO tenure, $Tenure_{j,t}$; two-digit SIC industry fixed-effect parameters; and year fixed-effect parameters. The appendix provides the definitions and measurements for all variables. Columns (2) and (3) report coefficient values (t-statistics in parentheses) from the following regression estimated for sub-samples with a positive asymmetry ($A^+_{j,t}=1$) and a negative asymmetry ($A^+_{j,t}=0$), respectively:

$$Comp_{j,t} = \beta_0 + \beta_\Omega \cdot Ret_{j,t} + \beta_\rho \cdot Perf\_Corr_{j,t} + \beta_\Pi \cdot Peer\_Ret_{j,t} + Controls_{j,t} + \varepsilon_{j,t}.$$

Column (4) reports the difference in coefficient values reported in columns (2) and (3). One, two, and three stars indicate that the estimated coefficient is different from zero at a 10%, 5%, and 1% level of statistical significance, respectively, based on standard errors clustered by firm.