Learning about the Details in CEO Compensation

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July 14, 2018

ABSTRACT

I document the richness of CEO compensation packages and show that boards learn about the desirability of the many complex package features through observing how these features are associated with firm performance. I first capture the detailed features of plan-based awards for CEOs of the largest U.S. public firms in a vector with more than 1,300 elements. I then demonstrate the complexity of boards' decisions on adding and dropping the detailed features. I hypothesize that boards learn about the efficacy of complex features by observing their correlation with performance—both at their own firms and at other firms. To test these hypotheses, I measure the similarity between any two compensation packages using a metric that assigns a shorter distance to more similar packages. My results support my learning hypotheses: firms that perform well in the current year award similar packages to their CEOs in the following year, whereas firms that perform poorly significantly change their packages in the following year; moreover, firms adjust their own CEO compensation packages to be more similar to that of well-performing firms, and less similar to that of poorly performing firms. These results hold after controlling for the effects from compensation peer firms, compensation-consultant sharing firms, board interlocking firms, and product market peers. I further show that a focal firm experiences better performance when its CEO compensation package becomes more similar to those used by its well-performing compensation benchmark firms. This paper demonstrates the importance of capturing the multi-dimensional details of CEO plan-based awards and studying changes in compensation packages in a holistic manner.

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I. Introduction

Large U.S. public firms issue multiple grants of plan-based awards to their CEOs each year, and these grants exhibit a tremendous amount of complexity and heterogeneity. An individual grant can have a one year or longer vesting period and be based on different performance metrics. The list of candidate metrics includes items related to a firm's stock returns, accounting performance, and strategic or operational decisions. Performance can be measured across one or multiple years, as well as in absolute or relative terms. Assuming the vesting conditions are met, these awards can be paid out in cash, stock, options, or other related instruments. A board's choices along all of these dimensions plausibly impact the entire set of incentives in its CEO compensation package. Therefore, it is important to consider all the detailed features of CEO compensation packages when analyzing how they are designed and adjusted over time.

In this paper, I first capture the details of CEO compensation packages, retaining their richness and complexity, in a vector with over 1,300 elements. This vector permits the measurement of similarities across packages both within firm and across firms. The comprehensiveness of the details captured and the vector-based distance approach are new to the literature. After formally documenting the complexity in CEO compensation, I use my new measure to study how boards learn about which detailed compensation plan features to include or exclude in order to improve CEO incentives.

Though compensation packages are highly complex with a large number of features, prior research has generally focused on only a small subset of these features at a time.[1]

[1]Besides many prior studies on the total payment and traditional stock and options, Johnson and Tian (2000a,b) demonstrate theoretically that the non-traditional features of executive stock options provide incentives different from the traditional ones. Bettis, Bizjak, Coles, and Kalpathy (2010) show empirically that performance-vesting stock and option grants gained popularity over pure time-vesting stock and option grants. Guay, Kepler, and Tsui (2016) quantify the bonus to stock price sensitivities similar to the sensitivities calculated for stock and options in Core and Guay (1999). Li and Wang (2016) focus on the long-term accounting performance contingent parts of CEO compensation.

However, the many features of compensation packages are unlikely to be independently determined, and their effects on incentives are also unlikely to be independent. This lack of independence, in turn, is likely to confound the inferences of any attempt to study only a few features in isolation. For this reason, it is important to study them jointly, and the methods I develop in this paper will help researchers to do just that.

To jointly study the many details in CEO compensation, I examine the compensation packages of the largest U.S. public firms from 2006 to 2015. The features describing CEO compensation packages fall into the following three broad categories: the payment method, the vesting schedule, and the performance metric. I retain the detailed specifications under each category and keep track of the interaction across categories. I define an element in a CEO compensation package as a unique set of three-way interacted details, in terms of the payment method, the vesting schedule, and the performance metric. I create a vector whose entries correspond to the elements in CEO compensation packages. I use this vector to present all CEO compensation packages in the sample. Specifically, in an individual CEO compensation vector, an entry is set to one only if the corresponding element exists in the CEO compensation package being represented by the vector. The rest of the entries in the same compensation vector are set to zero. This way, I capture, in a unified analytical form, not only the main categories of CEO compensation packages, but also the details within each category, as well as the interaction across categories. The vector has over 1,300 unique entries, meaning that more than 1,300 different elements have been used in at least one CEO compensation package in my sample. This shows the richness of the CEO compensation packages across all firms within the ten-year window I study.

In an individual CEO compensation package, however, only about five elements take non-zero values on average. This gap between the number of all possible elements and those actually used by a single firm at a point in time manifests the immense heterogeneity and uniqueness of the individual compensation packages.

Next, I show that there are considerable adjustments in these details of CEO compensation packages. Within an individual firm, an average of 15 elements are used across the ten-year window from 2006 to 2015. Hence, since the average firm only utilizes five elements in any given year, the average firm completely redesigns its CEO compensation package at least twice during my sample period. Meanwhile, it is unlikely an easy task for a firm's board to simply take the elements that have been used by a certain set of other firms. Specifically, for each individual firm, an average of 40 elements collectively have been used by its compensation benchmark peers in the previous fiscal year. This figure expands to over 150 if a board considers the elements that have been used by all firms that share a compensation consultant with its own firm. Ultimately, over 500 elements have been used by all firms within the sample that disclosed their CEO compensation package details in the previous fiscal year. Moreover, given the very large menu of candidate elements, the board must decide not only which ones to include, but also which ones to exclude. Additionally, a board may further consider the infinite number of innovative elements that have never been used before. Thus, a natural question is, how do boards learn about the desirability of these details and adjust their CEO compensation packages accordingly?

I hypothesize that firms learn about which detailed features to include or exclude in their CEO compensation contracts by observing which packages are associated with what performance, whether it is the firm's own performance (*Learning from Self*) or that of other firms (*Learning from Others*). I present evidence supporting the hypotheses that boards do learn about the efficacy of detailed features through observing the firm performance associated with CEO compensation packages. The empirical results are based on the cosine similarity between the CEO compensation vector of a firm and that of its own or other firms in the previous year. This similarity is larger when two compensation vectors share more common elements, and smaller otherwise.

I first run panel regressions where the dependent variable is the cosine similarity between the firm's current and prior year's compensation packages. The independent variables include performance measures, as well as controls. The main performance measures are the cumulative stock return in the past 12 months and return on assets (ROA), adjusted for the Fama-French 48 industry median. Consistent with my *Learning from Self* hypothesis, the results show that firms performing poorly in the current year are are more likely to have a less similar compensation package in the subsequent year, meaning that they are less likely to retain their current CEO compensation details. The economic magnitude is not negligible—a decrease in stock market return of one standard deviation is associated with a decrease of about 10% of mean in the within-firm year-over-year CEO compensation similarity.

I then run regressions based on the similarity between a firm's current CEO compensation vector and the vector of all other firms in the previous year. Under this setup, the CEO compensation package of one firm in the current year affects its similarities between all other firms' CEO compensation packages in the next year. Because of the lack of independence within the observations related to the same CEO compensation package, standard estimations of OLS models introduce high type-I error rates with this data structure. Therefore, I estimate this regression using the multiple regression quadratic assignment procedure (MR-QAP) to avoid over-rejection of the null hypothesis (see Dekker, Krackhardt, and Snijders (2007)).

Consistent with my *Learning from Others* hypothesis, a firm's compensation package in the current year has greater similarity to that of other firms in the prior year if those firms performed better. The results also demonstrate that a firm's compensation package is more likely to be similar to that of its compensation peer firms, compensation consultant sharing firms, and board interlocking firms in the previous fiscal year. However, the effect of all better performing firms exists on top of these peer effects. The economic magnitude is also large—if a firm performs twice as well as the focal firm, the focal firm would adjust its CEO compensation to be more similar to the other firm's by 15% of the mean.

Lastly, I study the association between a focal firm's performance and the change in the similarity between its CEO compensation and that in other firms. To do this, I construct five indices representing the performance-weighted average similarities between the CEO compensation in the focal firm in the current fiscal year and the CEO compensation in (1) its board-interlocking firms, (2) its compensation peer firms, (3) its compensation consultant sharing firms, (4) its product market peer firms, and (5) all other firms in the sample in the previous fiscal year, respectively. The weights are assigned according to other firms' performance in the previous fiscal year—the CEO compensation similarities between the focal firm and better performers have larger weights, and vice versa. The results demonstrate that an increase in this index based on the focal firm's compensation peer firms corresponds to better stock market and accounting performance in the focal firm.

My paper contributes to the CEO compensation literature in several important ways. First, I introduce a vector capturing the many details in CEO incentive plans, which enables holistic analyses of CEO compensation packages with multiple interacted sets of detailed features. A similar but somewhat different point has been made in prior studies on option grants. For example, Shue and Townsend (2017) emphasize that while many studies focused on Delta or Vega of option grants (e.g. Coles, Daniel, and Naveen (2006)), it is the whole option, not just its Delta or Vega, that shapes the CEO's incentives. Option grants, however, are only one part of the overall compensation package.

It is the package as a whole, and not just the option component, that determines CEO incentives.

Second, I document immense heterogeneity in the richness of CEO compensation packages and shed light on how it evolves. Despite the number of prior studies that mention CEO compensation complexity and its limitations,[2] to the best of my knowledge, the only two studies focusing on this complexity are Kole (1997) and Albuquerque, Carter, and Lynch (2015). Kole (1997) emphasizes the variation under each broad category in compensation contracts and challenges the test of the sensitivity of management compensation to firm performance that focuses on only a subset of features within a category. However, she still tests the selections under each category separately. As my results imply though, it is important to consider the details under all categories and the interactions across categories. Albuquerque, Carter, and Lynch (2015) propose a complexity measure based on the same categories of CEO compensation features captured in my paper. They also consider the interactions across categories, but their measure is just a general count of the incentive terms included in a compensation package. As a result, a pure time-vesting restricted stock grant and a sales-based short-term cash incentive plan contribute to their complexity measure in exactly the same way. Yet, it is hard to argue that a board or a CEO would view these two terms as providing similar incentives. The measure of complexity I construct is more informative because it differentiates the sources of complexity and incorporates more detailed information from the data.

Third, I expand the study on the relation between CEO compensation and firm performance from the typical "one-to-group" scheme to a more straightforward "one-to-one" scheme. Before my work, there are two papers that utilized analyses on pairwise relations to study CEO compensation – Gallani (2016) and Wong, Gygax, and Wang (2015)),

[2]For example, see the discussion on the simplifying assumptions required to facilitate the duration calculation in Gopalan, Milbourn, Song, and Thakor (2014).

but neither collects as many details as I do in my paper. Moreover, both of them study cross-sectional pairwise relations within the same time period; whereas in my paper, I make inferences from the year-over-year changes in CEO compensation packages.

Fourth, I uncover a channel that potentially helps to mitigate the agency problem caused by firms' discretion in selecting their compensation benchmark firms. Prior literature provides evidence that firms select compensation benchmark peers that have higher CEO compensation to rationalize their own CEO pay (e.g., Faulkender and Yang (2010)). My results indicate that firms could benefit from learning about CEO compensation details from better performing compensation peer firms. To the extent that the peer firms' CEO compensation relates to performance, the learning effect could offset this specific type of agency costs.

Furthermore, my paper also helps to shed light on the studies of relative performance evaluation and optimal executive pay. A CEO's compensation package or remuneration level is often compared to that of a set of benchmark firms defined by the researcher or by the focal firm. My results show that a firm's compensation contracts become more similar to that of other well performing firms even if those firms are not specific compensation peers of the focal firm or even firms in the same competitive product market. Thus, researchers that use benchmark firms to study CEO compensation should expect and incorporate the fact that the set of potential benchmark firms is likely much broader than initially thought.

The rest of the paper is organized as follows. Section II describes the data used in this study. Section III explains the formation of the detailed plan-based compensation vector and how it reflects the complexity of CEO compensation. Section IV documents the adjustments in CEO compensation details and illustrates why boards' adding and dropping of certain details are likely not a simple decision-making process. Section V tests and shows evidence supporting the hypotheses that boards adjust the details in

CEO compensation packages through learning about the association between the package details and firm performance. Section VI analyzes the relation between firms' performance and their learning about CEO compensation. Section VII concludes.

II. Data

I collect data on the plan-based awards for CEOs from Incentive Lab, which covers the largest U.S. public firms including all constituents of S&P500 and a significant portion of the S&P400.[3] I focus on the plan-based awards and omit the salary and bonus in this paper, so that I study only the part of a compensation package that indeed provides future incentives to the CEO. These awards include only the newly granted ones within a fiscal year, not the existing ones granted in previous years. I then keep detailed information on the payment method, the vesting schedule, and the award basis (performance metric if any and pure time if none) of these plan-based awards. The sample period starts in 2006, when the Securities and Exchange Commission (SEC) started to require public firms to disclose more details in the Compensation Discussion and Analysis (CD&A) section in their proxy statements. This way the sample is not biased toward firms that voluntarily report more details before this requirement.

I also collect information on the official compensation benchmark peer firms and compensation consultant firms from Incentive Lab. I then collect firm financial data from Compustat, other information about CEOs from ExecuComp, stock market data from the Center for Research in Security Prices (CRSP), board interlocking data from BoardEx, and the information on 10-K Text-based Network Industry Classifications (TNIC), defined in Hoberg and Phillips (2010, 2016), from the Hoberg-Phillips Data

[3]See `https://www.issgovernance.com/solutions/iss-analytics/iss-incentive-lab/`.

Library.[4] Table I reports summary statistics of the firm characteristics of the sample used in this study. The definitions of all variables are in Appendix A.

[Place Table I about here]

III. The Vector of the Details in CEO Plan-Based Awards

In this section, I describe how I capture the multi-dimensional details of an incentive compensation plan in a vector form, which is the analytical form I employ to comprehensively study multiple facets of the incentives faced by a CEO.

After going through the specifications on (1) the payment method, (2) the vesting schedule, and (3) the performance condition (specific performance metric(s) if any and pure time if none) of the plan-based awards retrieved from Incentive Lab, I specify 4,095 candidate elements that may be used to describe them in a vector form. This is based on the details within the above three sets of features as follows.

First, the payment methods have three possibilities: cash, stock, and option. The variations of these three traditional payment methods are classified according to their characteristics rather than the actual instruments, based on the SEC guidance.[5] Specifically, phantom stocks, although usually paid in cash, belong to the stock classification. Similarly, phantom options and stock appreciation rights are classified as options.

Second, the vesting schedule is classified by the combination of two elements: (1) five different lengths of the vesting period—1, 2, 3, 4+, and other unspecified number of years, and (2) three different vesting styles—ratable, cliff, and other. Thus, there are 15 = 5 (*1, 2, 3, 4+, and other unspecified number of years*) × 3 (*ratable, cliff, and other*) possible vesting schedules. Provided that all other vesting conditions are met, under a

[4] See more information on the Hoberg-Phillips Data Library: http://hobergphillips.usc.edu/industryclass.htm.

[5] See the disclosure requirement in SEC [Release Nos. 33-8732A; 34-54302A; IC-27444A; FILE NO. S7-03-06] RIN 3235-AI80: http://www.weirresources.com/files/2006%20SEC%20Executive%20Comp%20&%20Related%20Party%20Disclosure.pdf.

ratable vesting schedule, a pre-specified *portion* of a grant becomes vested within *each period* of a certain period, whereas under a cliff vesting schedule, the *whole* grant becomes vested at the end of the period. Vesting schedules outside of these two styles are classified as "other."

Third, an award may or may not be based on some performance metrics, e.g., the sales for the next three years. If no performance metric is used, I categorize the performance condition as null, and no more detailed specification is needed. If the vesting of the award depends on such performance metrics, I describe it on the following three aspects—(1) whether the performance is absolute or relative, (2) the length of the period to measure the performance, and (3) the exact performance metric(s). The performance is measured within one, three, or some other number of years, which means there are three possible choices on the length of the performance evaluation period. I choose the one-year and three-year performance evaluation period because they are the two most commonly used ones in practice (i.e., in the data). I capture the nineteen most commonly used absolute performance metrics, each of which accounts for at least 0.5% of the absolute performance metrics used by the whole sample, and nine most commonly used relative performance metrics, each of which captures at least 1% of the relative performance metrics used in the sample. The rest of the less popular metrics are lumped together under "other non-individual, absolute" and "other non-individual, relative," respectively. Collectively, there are 30 = 20 (*absolute, 19 specific + 1 other*) + 10 (*relative, 9 specific + 1 other*) possible separate metrics. Put together with the three possible lengths of the performance evaluation period, plus the null metric, this yields 91 = 1 (*null*) + (20 (*absolute*) + 10 (*relative*)) × 3 (*one-year, three-year, or other evaluation period*) possible performance metrics that may be used as the award basis.

Finally, accounting for the specifications on the three sets of features altogether, the vector has $4,095 = 3$ (*payment methods*) $\times 15$ (*vesting schedules*) $\times 91$ (*performance metrics*) candidate elements. For each CEO-year, I assign one to the elements that are included in the CEO incentive plans granted within that year and zero to the rest of the elements. See Appendix B for an example of a CEO plan-based award package and the description of its vector presentation.

Despite the length of the list of candidate elements, it is important to emphasize that I have omitted two other sets of features from the main vector design. The first omitted set of features is whether there are kinks in a performance-based incentive plan. This feature is referred to as the nonlinear relation between the payoff and a continuous performance metric in the following way. When using a certain performance metric in an executive compensation plan, the majority of firms set a threshold, a target, and a maximum performance. The award is paid out at a minimum amount when the threshold is just met, keeps increasing linearly as the performance becomes stronger, and is capped at a maximum amount when the performance hits the maximum or goes beyond. Since this nonlinearity exists in the majority of the relevant cases, I do not include an indicator for whether this feature applies to a certain package. For more discussion on the nonlinearity in executive incentive plans, see related prior research like Bennett, Bettis, Gopalan, and Milbourn (2017) and Murphy (2000).

The second omitted set of features applies only to the subsample of explicit relative performance-based incentive plans – whether the performance peers are defined by an index or by a customized group of individual firms. I omit this set from the main vector design because this feature applies to only a subgroup of performance-based plans. However, given the growing evidence showing the importance of this distinction in the selection of explicit relative performance peers (see Bizjak, Kalpathy, Li, and Young

(2017) and Ma, Shin, and Wang (2017)), I will embed this feature in a revised vector form later for robustness checks.

An important decision to make here is how to assign weights to these individual elements. I choose an equal weighting scheme because it emphasizes the qualitative rather than quantitative difference in the incentives provided by the individual elements. Given the costs associated with designing the executive compensation packages,[6] the fact that an element is added or dropped is sufficient to show the board's intention to shift the CEO's incentive through such an adjustment.

Several potential alternative weighting schemes all have their own limitations. The first alternative is to assign weights to an element by its popularity, either within an industry or the whole sample. This weighting scheme penalizes the most innovative elements, which may be well expected to come from those firms that realize the importance of certain elements before any other firms do. The second alternative is to weight an element by a subjective judgment about its economic importance based on prior knowledge or research. This weighting scheme may assign a too light weight to some potentially important elements that happen to have been ignored by previous research and conventional wisdom. The third alternative is to weight an element by the dollar value attached to it. This actually is a potentially more accurate weighting scheme. Unfortunately, this is not feasible given the current disclosure requirements. Bettis, Bizjak, Coles, and Kalpathy (2016) take an advanced step on estimating the economic value of performance-vesting stocks through simulation. Their results demonstrate a significant difference between this economic value and the reported grant date fair value. However, to the extent that the simulated value may change as the parameter calibration process varies, there is no consensus yet on what dollar value to use. Besides,

[6]75% firms hire at least one compensation consultant at an average expense of over $200,000 (the cost is summarized based on the observations with this information available in Incentive Lab).

given the flexibility firms have when reporting the executive incentive plans, requiring all information to assign a precise dollar value to each element unavoidably results in dropping more observations, which goes against the purpose of capturing fuller CEO compensation details in this paper.

The 4,095 elements constructed in this section are comprehensive enough to describe any single award-plan within the sample, but not all the elements are observed in the real packages. After merging with the other datasets discussed earlier in Section II, the vector describing the 10,409 CEO compensation packages in the sample consists of 1,374 different individual elements.

Figure 1 plots the number of non-zero elements of this vector by year. As shown, 545 elements are needed to describe all CEO compensation packages in 2006. This number peaks at 629 in 2009 and hits the lowest of 527 in 2015. Since the time series is not long enough, it is difficult to infer whether this pattern indicates a convergence in the elements selected by boards or simply regular volatility in the number of elements.

[Place Figure 1 about here]

A much less ambiguous trend shows up in Figure 2, which plots the number of elements included in individual CEO compensation packages by year. In 2006, an average of 4.3 elements are included in a specific CEO compensation package; this number increased monotonically since and reached 6.0 in 2015, which reflects an approximately 40% cumulative increase.

[Place Figure 2 about here]

To associate the complexity to real compensation package details, I tabulate the frequency of the thirty most popular individual elements in the CEO compensation vector in Panel A of Table II. Not surprisingly, vanilla stock and option grants are still the most popular individual elements. However, much fewer firms use them as the only type of incentive device. This is reflected clearly in Panel B of Table II, which tabulates the frequency of the thirty most popular *complete packages*, which are *combinations* of the individual elements. Even the thirty most commonly seen complete packages collectively apply to only 8% of the firms. In aggregate, 7,494 different packages show up in 10,409 firm-year observations, meaning that on average less than two firm-years share the exact same details in their CEO compensation packages, even after considering the same firm in different years. These facts again illustrate the importance of studying the compensation packages as multi-dimensional units–two packages may look alike on some subsets of features, but it is much more difficult to find two identical packages on *all* detailed features.

[Place Table II about here]

IV. Adjustments in the Details of CEO Plan-Based Awards

Having created the vector presentation of the CEO compensation package details in the previous section, in this section, I analyze the adjustments in these details that firms make year over year in this section. Again, to associate the statistics to the real adjustments made in CEO compensation packages, I tabulate in Table III the frequency of the thirty most popular sets of elements *added and dropped* when compared with the same firm's CEO compensation package in the previous fiscal year. Among 8,590 firm-year observations whose CEO compensation packages in the previous year are also observed, 6,793 revealed adjustments in their CEO compensation packages. This means that within-firm year-over-year adjustments occurred in more than 80% of the time. Recall from Table I that CEO turnover occurred in about 10% of the firm-year observations within the sample, so CEO turnover cannot fully explain the number of adjustments in CEO compensation packages. As shown in Table III, the adjustments of CEO compensation details do not follow any common pattern—even the most popular set of adjustments applies to only 0.4% of the observations that adjust their CEO compensation packages. This ratio drops to 0.1% for the 30^{th} popular set of adjustments, and all the top 30 combinations together capture less than 7% of the total adjustment patterns present in the sample.

[Place Tables III about here]

On the one hand, one might expect a high level of homogeneity in adjustments to packages based on prior research on CEO compensation. On the other hand, it may not be surprising that the adjustments made by firms are in fact all over the map given the flexibility that a board has when designing the details in its CEO compensation package. As can be seen in Panel A of Table IV, the average number of elements used in an individual CEO compensation package is 5.2 in a single year, whereas within a specific firm across ten years, this number is 15.2. Assuming that a firm keeps the number of detailed elements in its CEO compensation package constant at the average level, the above statistics mean that about three compensation packages with completely different details would be used within ten years. In other words, the details in a firm's CEO incentive plan could be completely redesigned in five years or less on average.

In Panel B of Table IV, I report the summary statistics on three potential groups of candidate elements faced by the board of an individual firm every year from 2007 to 2015. The first group is from the elements that have been used in the previous fiscal year by all compensation benchmark peers of a firm. An average of 40 non-zero elements exist in this group. Choosing five elements out of 40 is likely a nontrivial exercise for a firm's board. The second group is the elements that have been used in the previous fiscal year by all the firms that had at least one common compensation consultant firm with the focal firm. An average of 154 elements exist in this group. The third group is the elements that have been used in the previous fiscal year by all the firms that had at least one interlocking board member with the focal firm. These numbers might already seem big relative to the five elements included in an individual firm-year's CEO compensation package. Importantly, however, it seems proper to view them as lower bounds of the complexity in the adjustments of CEO compensation packages because the boards may also need to consider the elements that have been excluded by all the peer firms and the firms that share a consultant.

[Place Tables IV about here]

In fact, if a board goes beyond these two groups and reviews the elements included in the rest of the publicly disclosed compensation packages in the previous fiscal year, the average number of non-zero elements is 591 (not reported, but it is calculated as the mean of the numbers shown in Figure 1). This number again should be viewed as a lower bound, because it excludes the elements that are omitted by all firms and the infinite possibilities of innovative elements that have never been used by any firm.

How do boards learn about these details and adjust their CEO compensation packages accordingly? In the rest of this section, I introduce a measure that I use in the next section to address this question. I summarize the adjustments made by firms year-over-year compared to themselves and other firms using a cosine similarity between any two compensation packages defined below.

$$(Cosine)\,Similarity(\vec{\mathbf{a}},\vec{\mathbf{b}}) = \frac{\vec{\mathbf{a}}\vec{\mathbf{b}}'}{\sqrt{(\vec{\mathbf{a}}\vec{\mathbf{a}}')(\vec{\mathbf{b}}\vec{\mathbf{b}}')}} = \frac{\sum_{i=1}^{n} a_i b_i}{\sqrt{\sum_{i=1}^{n}(a_i a_i)\sum_{i=1}^{n}(b_i b_i)}}, \tag{1}$$

where $\vec{\mathbf{a}}$ and $\vec{\mathbf{b}}$ are CEO compensation vectors. The larger the similarity, the more common elements shared by the two compensation packages, and vice versa.

The counterpart of the cosine similarity is the cosine distance defined as:

$$(Cosine)\,Distance(\vec{\mathbf{a}},\vec{\mathbf{b}}) = 1 - (Cosine)\,Similarity(\vec{\mathbf{a}},\vec{\mathbf{b}}), \tag{2}$$

which is simply one minus the similarity metric. Therefore, I use both interchangeably in this paper, but keep the direction consistent when using them interchangeably—

the distance increases and the similarity decreases as more elements differ across two vectors.

Although this cosine similarity measure may be used to capture the similarity between any two compensation vectors, I focus on the similarity between the compensation vector of a focal firm and that of itself and other firms in the previous year, corresponding to the decision-making process discussed earlier. Panel C of Table IV reports the summary statistics of $Similarity(C_{i,t}, C_{i,t-1})$, which is the similarity between a firm's CEO compensation vector at year t and $t-1$, and $Similarity(C_{i,t}, C_{j,t-1})$, which is the similarity between a focal firm's CEO compensation vector and that of other firms in the previous year.

Consider the sample package illustrated in Appendix B as an example, which includes nine non-zero elements. Assume that in the next year, i.e., 2011, one of the elements, say, the cash bonus cliff vesting at year 1 based on the absolute 1-Year EBITDA, is dropped; and a new element, say a stock award cliff vesting at year 3 based on relative 3-year stock return, is added. In this case, the within-firm year-over-year similarity of this firm is: $Similarity(C_{i,t}, C_{i,t-1}) = 8/(\sqrt{9 \times 9}) = 0.89$. In the calculation, 8 is the number of common elements in the CEO compensation vectors in 2010 and 2011; the first 9 is the number of non-zero elements in the CEO compensation vector in 2011; and the second 9 is the number of non-zero elements in the CEO compensation vector in 2010.

Instead of cosine distance, Gallani (2016) and Wong, Gygax, and Wang (2015)) use the Euclidean distance to study the similarity between CEO compensation packages. That is because the three elements included in their vectors are dollar values of the cash, stocks, and options, respectively, which are all continuous. For vectors with dichotomous elements as in my paper, however, the cosine distance better summarizes the qualitative difference between two vectors, which is the purpose of this paper.

In the next section, I test two hypotheses to speak more about the adjustments in CEO compensation details and firm performance.

V. Learning about the Details from Firm Performance

Because the changes in CEO compensation packages impact the CEO's incentives and should eventually influence the shareholders' wealth, it is important to examine whether boards learn about the compensation package details from firm performance and adjust accordingly. In this section, I develop and test the following two hypotheses on whether boards adjust the details in their CEO compensation packages toward good performance.

Hypothesis 1 (Learning from Self): *When a board observes that its firm has performed poorly, it infers or learns that its CEO's pay package was suboptimal and in need of change. Thus, poorly-performing firms are more likely to change the detailed features of their CEO compensation packages, which increases the year-over-year, within-firm distance between the packages. Conversely, well-performing firms are more likely to retain the detailed features of the packages, which keeps the year-over-year similarity higher.*

Hypothesis 2 (Learning from Others): *When a board considers if and how to change the features of its CEO's compensation package, it learns by observing the details of packages and the associated performance at other firms. In terms of the distance between a firm's CEO compensation vector in one year and that of another firm in the previous year, this is reflected in the following way—firms adjust their CEO compensation packages to be more similar to that of the well-performing firms in the previous year than to that of the poorly-performing firms in the previous year.*

In Hypothesis 2, I focus on the other firms' compensation packages in the previous year instead of the contemporaneous packages or earlier years. The reason is that CEO compensation details are not disclosed until a few months after a firm's fiscal year ends. Thus the focal firm's board may not be able to observe the contemporaneous details. The stock market performance may be observed real-time, but the same limitation applies to the observability of the accounting performance. At the same time, given the frequency of adjustments in CEO compensation details, I assume that the major changes should be made immediately after the board observes the relation between other firms' performance and their CEO compensation details.

Testing these hypotheses informs us about the direction in which the details in CEO compensation packages are adjusted. The question has not been well studied before due to the lack of details in the data. This is an important issue, however, given that learning and adjustment can take small steps on different aspects and can only be reflected in the detailed adjustments. It is one thing if the board tries to provide better incentives and yet does not eventually achieve good performance and/or a good pay-performance match for various reasons, but it is an entirely different thing if the board does not even try to adopt the kind of compensation packages that are associated with good performance.

The premise of these hypotheses is that the better performing firms also provide relatively better CEO incentive plans. This is not to say that the best performers have the optimal CEO compensation packages, as it is almost impossible to know that empirically. My hypotheses also do not assume that the incentive package is the only factor that affects firm performance – CEO ability and luck likely both play important roles in a firm's performance. All I need is that at least a meaningful part of the performance is a result of the incentives provided by the compensation packages. This assumption should not be controversial given the amount of both theoretical and empirical work that has been done on this topic.

Three points are worth emphasizing here. First, I assume that even the relatively well-performing firms may still further adjust their CEO compensation packages. Second, because the effectiveness of the incentive plan is inferred from the realized performance, a one-time inefficient adding or dropping of certain elements should not be taken as an evidence of rent extraction or disguise of excess pay. Therefore, some sets of changes may initially seem to be more important than others, but it is difficult to draw any conclusions on this question without more rigorous analyses. Third, the second hypothesis does not predict whether the contemporaneous pairwise distance between the CEO compensation packages of two firms becomes smaller or greater when compared with the contemporaneous pairwise distance in the previous year. The reason is that the relative length of the pairwise distance at time $t-1$ and the pairwise distance at time t is determined by the adjustments taken by both parties from time $t-1$ to time t, which is hypothesized to be a result of observing the performance and characteristics of not only the two firms considered, but all other firms in the sample, too.

Next, I explain the empirical research design based on the similarity measure introduced in Section IV to test Hypotheses 1 and 2 and discuss the results.

A. *Test the Learning from Self Hypothesis*

To test Hypothesis 1 (*Learning from Self*), I run the following panel regression with $Similarity(C_{i,t}, C_{i,t-1})$, the similarity between a firm's CEO compensation vector at year t and $t-1$, as the dependent variable.

$$\begin{aligned} Similarity(C_{i,t}, C_{i,t-1}) = \alpha &+ \beta_1 Ret_{Below_{it-1}} + \beta_2 Ret_{Above_{it-1}} \\ &+ \beta_3 ROA_{Below_{it-1}} + \beta_4 ROA_{Above_{it-1}} + \gamma Z_{it-1} + \eta_i + \eta_t + \epsilon_{it}, \end{aligned} \tag{3}$$

where the main explanatory variables are two different performance measures: (1) 12-month cumulative stock return and (2) return on assets (ROA). Both variables are adjusted by the Fama-French 48 industry median. Further, to differentiate the effects for the firms below industry median and those above, I run a piecewise regression. That is, if a firm's 12-month cumulative stock return at year $t-1$ is below the industry median, $Ret_{Below_{it-1}}$ equals the firm's 12-month cumulative stock return minus the industry median, while $Ret_{Above_{it-1}}$ equals zero. On the contrary, if a firm's 12-month cumulative stock return at year $t-1$ is above the industry median, $Ret_{Below_{it-1}}$ equals zero, while $Ret_{Above_{it-1}}$ equals the industry median adjusted value. $ROA_{Below_{it-1}}$ and $ROA_{Above_{it-1}}$ are defined in a similar fashion for ROA.

Z_{it-1} includes several control variables at the firm level: the natural log of total assets; the ratio of capital expenditures (CAPX) to the total assets at the beginning of the period; the EBIT-to-sales ratio; idiosyncratic volatility, which is defined as the annualized volatility of the residual term from the regression of individual daily stock returns on the value-weighted market daily returns in the last 252 trading days; the market leverage ratio, which is defined as the ratio of the total long term debt to the sum of the total long term debt and the total market value of stocks; sales growth; Tobin's Q, which is defined as the ratio of the market value of total assets to the book value of total assets; the ratio of research and development (R&D) expenditures to the total assets at the beginning of the period; the ratio of advertisement (AD) expenditures to the total assets at the beginning of the period; a dummy variable indicating that the CEO is also the chairman of the board of directors; a the dummy variable indicating that there was a CEO turnover from year $t-1$ to year t. Appendix A includes more details on the formation of these variables. η_i and η_t control for firm and time fixed effects, respectively. Standard errors in this regression are two-way clustered by firm and year (see Cameron and Miller (2015), Petersen (2009), and Thompson (2011)). The sample in this regression is from 2007 to 2015, because the dependent variable requires the information on CEO compensation details across two years, while 2006 is the first year with such information. Therefore, p-values corresponding to the t-statistics are calculated with degrees-of-freedom of 8, which is equal to the sample length (2007 to 2015) minus one. This correction in degrees-of-freedom is suggested by Cameron and Miller (2015).

The coefficients of interest are β_1 through β_4. Taking β_1 as an example, if the coefficient is significantly positive, Hypothesis 1 (*Learning from Self*) is supported regarding the stock market performance for the firms below the industry median. That is, the year-over-year within-firm CEO compensation distance is larger when the firm performed worse in the previous year from the stock market or operating perspective, indicating that the board learns from its own performance and infers that the incentives provided in the last period need more adjustment. Thus, it changes more details in the CEO compensation package. β_2 should be interpreted similarly, but for the firms with stock returns above the industry median. β_3 and β_4 are parallel with β_1 and β_2, but are based on operating performance rather than stock returns.

Table V reports the results of the test of Hypothesis 1 (*Learning from Self*) in Equation (3). The main takeaway is that when the firm's 12-month cumulative return is below the industry median, a worse stock market performance is associated with a higher distance between CEO compensation for the current and the past fiscal year. Specifically, the coefficient on $Ret_{Below_{it-1}}$ in model (6) of the table is 0.103, which means that a decrease in stock market return of one standard deviation (62.15%) is associated with a 0.062 decrease in the within-firm year-over-year CEO compensation similarity, which is almost 10% of the mean value 0.633. This evidence demonstrates that a firm tends to move away from its old CEO compensation package after observing bad performance.

Not surprisingly, when a new CEO was hired, his/her compensation package is less likely to be kept similar to that of the previous CEO, which can be seen from the coefficient on the CEO turnover dummy variable. The coefficients on idiosyncratic risk and sales growth also support Hypothesis 1 (*Learning from Self*). The results tell us that when a firm faces more idiosyncratic risk, the board is significantly less likely to keep its CEO compensation package similar to that in the previous year. This indicates that the board adjusts CEO compensation to better accommodate for the firm's situation each year. Meanwhile, if a firm's sales grow faster than sales at other firms, its board is likely to keep more details unchanged in their CEO compensation, presumably to maintain the relatively high growth rate.

[Place Table V about here]

B. Test the Learning from Others Hypothesis

In this section, I explain the empirical strategy to test Hypothesis 2 (*Learning from Others*). First, I present the regression model that is estimated using the multiple regression quadratic assignment procedure (MR-QAP) test (see Dekker, Krackhardt, and Snijders (2007) and Gallani (2016)). Next, I explain the difference between the structure of the dependent and independent variables in the regression and in standard regression models. Lastly, I briefly summarize the MR-QAP test and explain why this procedure is necessary to draw inferences under this setup.

Because Hypothesis 2 (*Learning from Others*) focuses on the similarity between a focal firm's CEO compensation vector and that of all other firms in the previous year, the dependent variable is a matrix of year-over-year similarities across any two firms in the sample. Specifically, the i,jth entry of this matrix represents the cross-firm similarity between the compensation package of firm i at year t and that of firm j at year $t-1$, i.e., $(Cosine)\, Similarity(C_{i,t}, C_{j,t-1})$. All regressors are also in a matrix form. Each entry of these matrices is based on the characteristics of the focal firm and that of the corresponding other firm. Below in Equation (4) is the regression model, followed by the illustration of explanatory variable matrices.

$$\mathbf{Matrix}[\mathit{Similarity}(C_{i,t},C_{j,t-1})] \equiv \begin{bmatrix} . & Similarity(C_{it-1},C_{jt}) & \dots \\ Similarity(C_{it},C_{jt-1}) & . & \dots \\ \dots & \dots & . \end{bmatrix}$$

$$= \alpha + \beta_1 \mathbf{Matrix}[\mathit{CRET}_{j,t-1}/\mathit{CRET}_{i,t-1}] + \beta_2 \mathbf{Matrix}[\mathit{ROA}_{j,t-1}/\mathit{ROA}_{i,t-1}]$$
$$+ \beta_3 \mathbf{Matrix}[\mathit{CompPeer}_{i,j,,t}] + \beta_4 \mathbf{Matrix}[\mathit{CompConsultant}_{i,t,j,t-1}]$$
$$+ \beta_5 \mathbf{Matrix}[\mathit{BoardInterlock}_{i,j,t}] + \beta_6 \mathbf{Matrix}[\mathit{TNIC2Peer}_{i,j,t-1}]$$
$$+ \beta_{7-12} \mathbf{Matrix}[\mathit{Interaction\ Terms}] + \gamma \mathbf{Matrix}[Z_{i,j,t-1}] + \mathbf{Matrix}[\epsilon_{i,j,t}] \quad (4)$$

All right-hand side (RHS) matrices are represented by their i,jth entries. Specifically, $\mathit{CRET}_{j,t-1}/\mathit{CRET}_{i,t-1}$ is the i,jth entry of the pairwise relative performance matrix based on the 12-month cumulative stock return, which is the ratio of the decile of firm *j*'s cumulative 12-month stock return in the past three Fama-French 48 industry-years to firm *i*'s. $\mathit{ROA}_{j,t-1}/\mathit{ROA}_{i,t-1}$ is the i,jth entry of the pairwise relative performance matrix based on the ROA, which is the ratio of the decile of firm *j*'s ROA in the past three Fama-French 48 industry-years to firm *i*'s. The coefficients of interest are therefore β_1 and β_2—if β_1 is significantly positive, Hypothesis 2 (*Learning from Others*) is supported for stock market performance; if β_2 is significantly positive, Hypothesis 2 (*Learning from Others*) is supported for operating performance. That is, having observed the performance and CEO compensation of all other firms in the previous year, a focal firm's board adds or drops details in its CEO compensation so that it is more similar to those in the better performing firms.

Starting in 2006, the SEC requires firms to disclose the benchmark firms they use to design their CEO compensation. Therefore, I also control for this compensation peer effect—$CompPeer_{i,j,t}$ is the i,jth entry of the official compensation peer matrix, where $CompPeer_{i,j,,t}$ equals 1 if j is reported as a benchmark firm used to design the CEO compensation by firm i. $CompConsultant_{i,t,j,t-1}$ is the i,jth entry of the sharing compensation consultant peer matrix, which equals one if at least one compensation consultant serving firm i at year t also served firm j at year $t-1$. $BoardInterlock_{i,j,t}$ is the i,jth entry of the board interlocking matrix, which equals one if at least one board member of firm i at year t also serves as a board member of firm j at year t. $TNIC2Peer_{i,j,t-1}$ is the i,jth entry of the two-digit Hoberg-Phillips 10-K Text-based Network Industry Classifications (TNIC2) peer indicator matrix, which equals one if the similarity between firm j's product description in its 10-K at year $t-1$ and firm i's at year $t-1$ is above the threshold for firm j to be defined as firm i's TNIC2 product market peer. TNIC2 is the most granular textual product market peer definition in the Hoberg-Phillips database, with a coarseness comparable to that of the two-digit Standard Industrial Classification (SIC) code.[7]

I also control for the interaction between the official compensation peer matrix and the relative performance matrices. This is to address two concerns. First, it is possible that better performing firms are more likely to be chosen as compensation benchmark firms, in which case the relative performance effect could reflect the compensation benchmark effect. Second, it could be that the relative performance effect is driven only by the better performers that are chosen as compensation benchmark firms. Since similar concerns may exist as well in the consultant sharing and board interlocking firms, I also control for the interaction terms of the sharing consultant dummy and board interlocking dummy and the relative performance measures.

[7]See more information on the Hoberg-Phillips Data Library: `http://hobergphillips.usc.edu/industryclass.htm`.

The first control matrix in Z_{ij} is the relative total assets matrix defined in a similar fashion as the performance matrices. In other words, it is a matrix with the i,jth entry $AT_{j,t-1}/AT_{i,t-1}$ being the ratio of the decile of firm j's total assets in the past three Fama-French 48 industry-years to firm i's. This is to address the concern that firms tend to learn from bigger firms, ignoring the performance.

The rest of the control matrices Z_{ij} are formed in a similar way based on the following firm characteristics: the ratio of CAPX to the total assets at the beginning of the period, the EBIT-to-sales ratio, idiosyncratic volatility, the market leverage ratio, sales growth, Tobin's Q, the ratio of R&D expenditures to the total assets at the beginning of the period, and the ratio of AD expenditures to the total assets at the beginning of the period. I standardize these continuous variables to be unit normal each year, then calculate the absolute difference in the standard measure between any two firms. Taking idiosyncratic volatility as an example, I first standardize it by year for the whole sample with a mean of 0 and a standard deviation of 1. Next, I calculate the absolute difference in the standardized idiosyncratic volatility between each pair of firms i and j at year $t-1$. Finally, I assign this value to both the i,jth and the j,ith entry of the matrix of absolute difference in idiosyncratic volatility.

Last but not least, to control for the effect of the focal firm's governance and CEO turnover effects, I include matrices of the focal firm's CEO-chairman and CEO turnover dummies. The i,jth entry the CEO-chairman dummy matrix equals one if the CEO of firm i is also the chairman of the board at year t. The i,jth entry the CEO turnover dummy matrix equals one if the CEO of firm i at year t is different from that of firm i at time $t-1$. The interaction of these two matrices and the relative performance matrices are also controlled for.

The coefficients in the model are estimated in the same fashion as in an OLS regression, but because the data is at a dyadic level, the inference is drawn based on the empirical distribution of the t-statistic from the semi-partialling plus permutation with 1,000 replications. The type I error rate is shown to be significantly lower than the inference based on the asymptotic distribution of the t-statistic. For more information about the Multiple Regression Quadratic Assignment Procedure(MR-QAP) and the specifications used here, see Dekker, Krackhardt, and Snijders (2007).

This regression is run by year for the following reason. Technically speaking, the similarity between the CEO compensation vectors of firm i at year t and that of firm j at an even earlier time, say, year $t-2$ is not missing, but it is not considered in the estimation. However, if I stack the matrices for all nine years together and use the stacked version in Equation (4), the combined matrices will have blocks only on the diagonal, even though the off-diagonal entries should have non-missing values. This also applies to the rest of the right-hand side (RHS) matrices.

Table VI reports the results of the test of Hypothesis 2 (*Learning from Others*) in Equation (4). The coefficients on the matrices $CRET_{j,t-1}/CRET_{i,t-1}$ and $ROA_{j,t-1}/ROA_{i,t-1}$ are significantly positive across all nine years from 2007 through 2015. There is no regression for the fiscal year 2006, because the dependent variable requires information on the CEO compensation details across two years, while 2006 is the first year with such information. This is consistent with the hypothesis that the board adds or drops details in its CEO compensation to be more similar to those at better performing firms. This effect is economically significant. Take the coefficient on $CRET_{j,t-1}/CRET_{i,t-1}$ in 2011 as an example. Assume that the focal firm's 12-month cumulative stock return is at the 5^{th} decile of the past three Fama-French 48 industry-years. Also assume that there are two other firms in the sample, one also ranks at the 5^{th} decile, but the other ranks at the highest decile. All else equal, the similarity between the focal firm's CEO compensation package and that of the top decile firm in the previous year is 0.03 greater than the similarity between the worse performing other firm. This is comparable to 30% of the average cross-firm year-over-year similarity of 0.09.

Another observation is that the coefficients on the interaction terms between the compensation benchmark peer matrix and the relative performance matrix are mostly negative and significantly so in about half of the years in the sample. This implies that the features from the packages of the compensation peer firms could be selected based on some factors other than pure performance and the observable characteristics controlled for in this regression. This is reasonable given the importance of the compensation benchmark firms as well as the difference between public and private information, although this is also consistent with findings that compensation peer firms may also be selected to justify the own firm's CEO compensation—see Bizjak, Lemmon, and Naveen (2008), Bizjak, Lemmon, and Nguyen (2011), and Faulkender and Yang (2010).

For the control matrices, the signs of the coefficients are all as expected. Not surprisingly, the effect from the compensation benchmark firms is significantly positive. If at least one compensation consultant used by a firm has served another firm in the previous year, or if there is at least one interlocking board member, the focal firm's CEO compensation becomes more similar to that other firm. Furthermore, if two firms operate in closely related product markets, they learn from each other about the details in CEO compensation packages, even if they are not formal compensation peers.

The fact that the main relative performance effect holds on top of these control variables indicates that boards learn about the details in CEO compensation packages from those of other well performing firms, even if they are not the focal firm's compensation peers and do not share a compensation consultant firm or an interlocking board member with the focal firm.

[Place Table VI about here]

VI. Learning and Firm Performance

In this section, I study the relation between firms' performance and their learning and adjustments in CEO compensation documented in prior sections. To accomplish this, I define the following Performance-weighted Average Similarity Indices (PSI) for each firm:

$$PSI_{i,t} \equiv \sum_{k=1}^{10} w_k \times \{\bar{S}(C_{i,t}, C_{j,t-1}) | rank(Perf_{j,t-1}) = k\}, \quad (5)$$

where $\{\bar{S}(C_{i,t}, C_{j,t-1}) | rank(Perf_{j,t-1}) = k\}$ is the average similarity between the focal firm i and other firms j, whose performance in fiscal year $t-1$ was ranked in the k^{th} performance decile based on the performance in the past three Fama-French 48 industry-years. w_k represents the weight assigned to the mean similarity, which is equal to $k/\sum_{k=1}^{10} k$. Similar to the analyses in prior sections, I construct two versions of this index—one based on other firms' ROA and another on 12-month cumulative stock return. Furthermore, I construct both versions of indices for five groups of "other firms" related to the focal firm—(1) its board-interlocking (BI) firms, (2) its compensation peer (CP) firms, (3) its compensation consultant sharing (CS) firms, (4) its product market peer (PP) firms, and (5) all other (other) firms in the sample. For example, $PSI_{ROA,CP,i,t}$ is calculated using Equation 5 only for firm js that are firm i's compensation peer (CP) firms, and $rank(Perf_{j,t-1})$ is the decile of firm j's ROA in year $t-1$ ranked in the past three Fama-French 48 industry-years (from year $t-3$ to year $t-1$).

The PSI by construction captures both the focal firm's learning from other firms in a specific group, as well as the extent to which the focal firm learns from the better-performing ones among them. Therefore, the change in this index from one year to the next, i.e., $\Delta PSI_{i,t-1\,to\,t}$ captures the overall enhancement in firm i's learning about the CEO compensation details from other firms. I hypothesize that an enhanced compensation package provides better incentives to the CEO, which is reflected in better firm performance. To test this hypothesis, I run the following panel regression:

$$
\begin{aligned}
Ind.Adj.Perf._{i,t} = & \alpha + \beta_{CP}\Delta PSI_{Perf.,CP,i,t-1\,to\,t} + \beta_{BI}\Delta PSI_{Perf.,BI,i,t-1\,to\,t} \\
& + \beta_{CS}\Delta PSI_{Perf.,CS,i,t-1\,to\,t} + \beta_{PP}\Delta PSI_{Perf.,PP,i,t-1\,to\,t} \\
& + \beta_{other}\Delta PSI_{Perf.,other,i,t-1\,to\,t} + \gamma Z_{it-1} + \eta_i + \eta_t + \epsilon_{it},
\end{aligned} \tag{6}
$$

where the performance $Perf.$ is ROA or 12-month cumulative stock return. To reflect the correspondence between the regressand and the regressors, I regress industry-adjusted ROA (stock return) against ROA-based (stock return) indices. Z_{it-1} includes the same control variables as in Equation 3. Standard errors in this regression are two-way clustered by firm and year (see Cameron and Miller (2015), Petersen (2009), and Thompson (2011)). The sample in this regression is from 2008 to 2015, because constructing the main explanatory variables requires the information on CEO compensation details across three years—two years for the calculation of PSI and one more year to derive the first difference. Since 2006 is the first year with such information, the first year with required information is 2008. Therefore, p-values corresponding to the t-statistics are calculated with degrees-of-freedom of 7, which is the sample length (2008 to 2015) minus one. This correction in degrees-of-freedom is suggested by Cameron and Miller (2015).

Results of different specifications of this regression are shown in Table VII. Among the five indices, I find a significantly positive relation between a focal firm's performance and the change in the PSI based on a focal firm's compensation benchmark firms. The magnitude of this effect is not negligible—if $\Delta PSI_{ROA,CP,t-1\,to\,t}$ ($\Delta PSI_{Ret,CP,t-1\,to\,t}$) increases by one standard deviation of $PSI_{ROA,CP}$ ($PSI_{Ret,CP}$), which is about 0.09 (0.09), then the focal firm's ROA (12-month cumulative stock return) is higher by 0.3% (0.8%) (based on model (6) in Panel A and Panel B of Table VII, respectively).

[Place Table VII about here]

Although this finding does not indicate any causal effects of firms' learning about CEO compensation details on their performance, it further demonstrates the importance of considering the full details in the packages and firms' learning about them in studying the relation between firm performance and CEO compensation.

VII. Conclusion

This paper documents the richness of the details in CEO compensation packages and their adjustments, constructs a compensation vector that enables the study of CEO compensation details comprehensively, despite the complexity, and shows that the adjustment is motivated by the boards' learning from the performance of both their own firms and other firms. CEO compensation is one of the essential instruments used to align the CEO's interest with that of shareholders. Therefore, the results in this paper contribute to the CEO compensation literature in important ways.

By documenting the richness of details in CEO incentive plans, this paper demonstrates the limitation of studying only one or a subset of features when attempting to understand the complete incentives faced by CEOs. The richness of the CEO compensation universe also implies the uniqueness of each individual compensation package. This leads to a strong need for a comprehensive measure of CEO compensation packages that is universally applicable to all packages, and yet differentiates the individual ones. The CEO compensation vector constructed in this paper serves this purpose by incorporating the details on the payment method, the vesting schedule, and the performance metrics, which are the three typical sets of features used to describe an executive incentive plan.

Given the richness and heterogeneity in the details of CEO compensation packages, adjustments in those details are also quite complex. As the first step to a better understanding of the development of these complex details in CEO compensation packages, this paper measures the cosine similarity between a firm's CEO compensation vector and the vectors in the previous year, of both itself and other firms. This similarity summarizes the year-over-year adjustments that boards make in their CEO compensation packages. Regressions at the within-firm level and the cross-firm level both provide evidence that the elements in CEO compensation packages are added and dropped so that a firm's CEO compensation package is more similar to the ones that are associated with good performance. Moreover, I show that a focal firm's enhanced learning from its better-performing compensation benchmark peer firms corresponds to better performance in that focal firm.

Put together, the CEO compensation packages are full of many details on distinct features. When captured appropriately, they can be analyzed comprehensively. The approach developed in this paper should be useful in future analyses of the details of CEO compensation packages.

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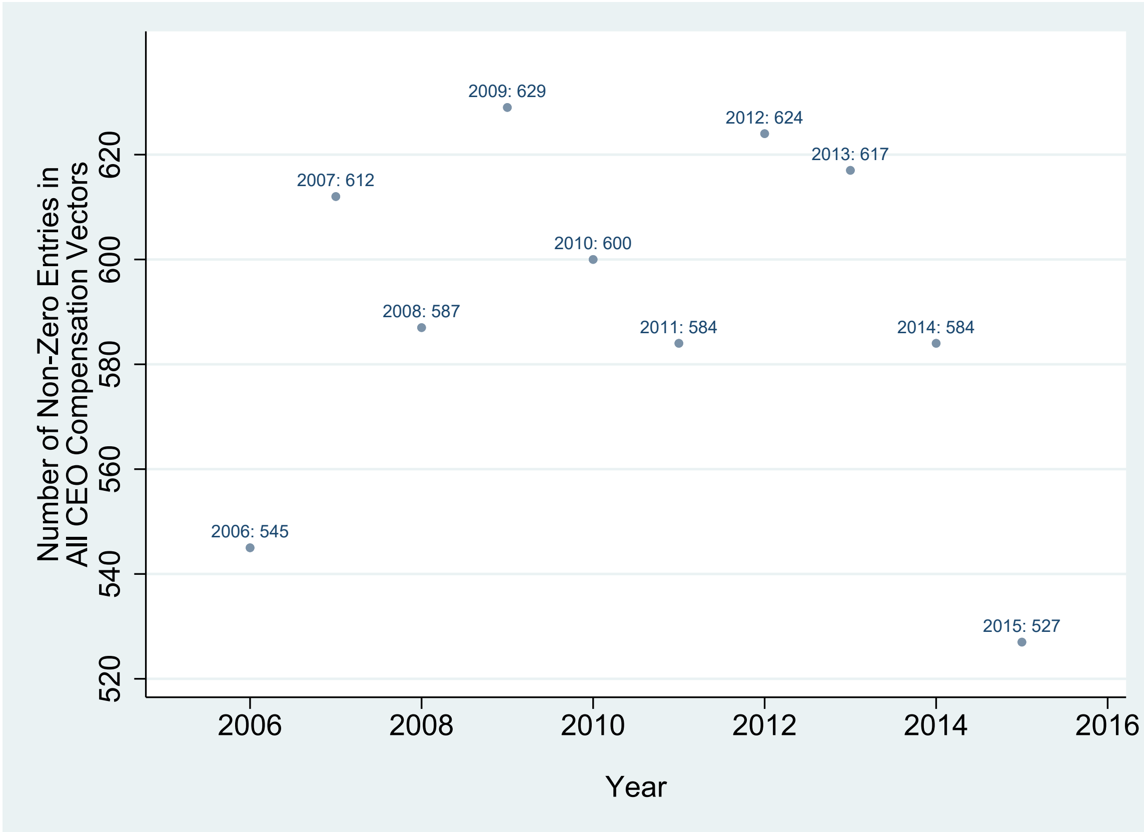

Figure 1. The Number of Non-Zero Entries from *All* CEO Compensation Vectors by Year
This figure shows the number of non-zero entries included in all CEO compensation packages by year, which is measured as the number of non-zero entries from the main vector for the whole sample that apply to at least one firm in the corresponding year. The raw vector consists of details on three dimensions of a typical CEO compensation package: the payment method, the vesting schedule, and the performance metric. The payment method may be cash, stocks, or options. The vesting schedule may be in 1, 2, 3, 4+, and other unspecified number of years, following a ratable, cliff, or other style. Provided that all other vesting conditions are met, under a ratable vesting schedule, a pre-specified *portion* of a grant becomes vested within *each period* of a certain time frame; whereas under a cliff vesting schedule, the *whole* grant becomes vested at the end of the time frame. Vesting schedules outside of these two styles are classified as “other”.

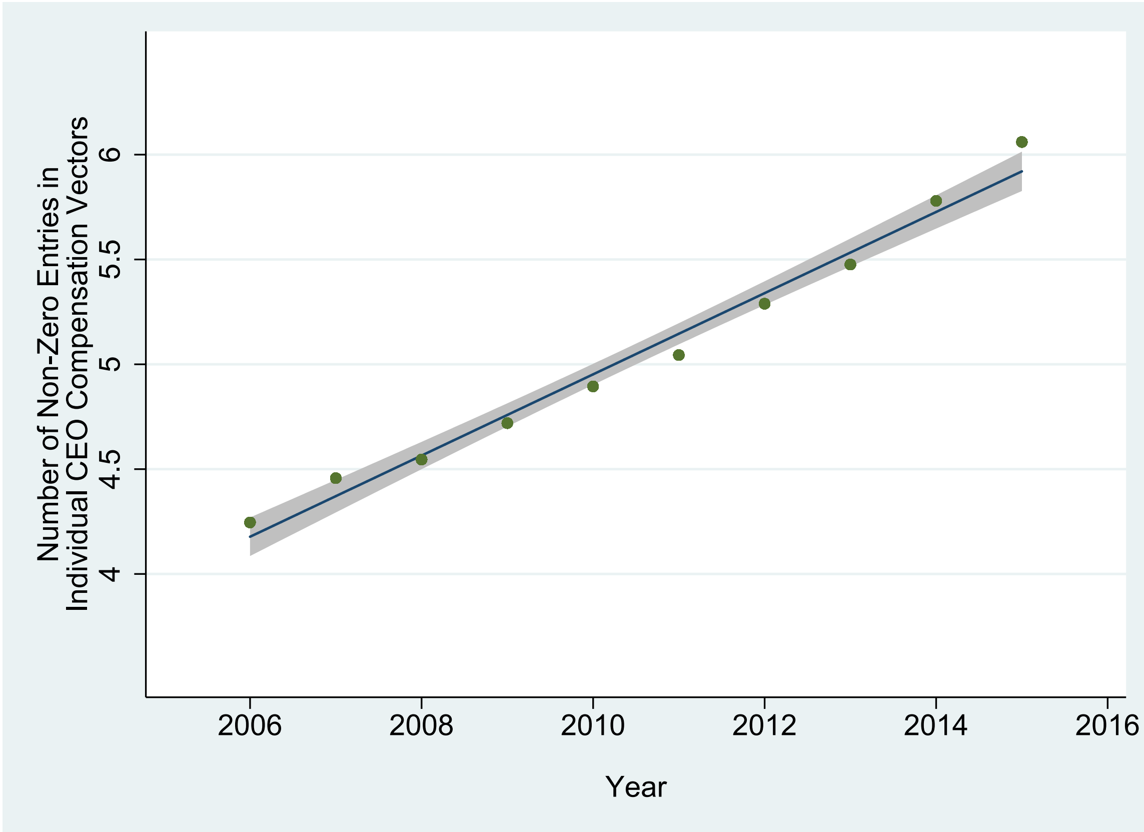

Figure 2. The Number of Non-Zero Entries in *Individual* CEO Compensation Vectors by Year

This figure plots the average number of non-zero entries included in individual CEO compensation packages by year, a fitted trend line of this number, and its 5%-95% confidence intervals. The raw vector consists of details on three dimensions of a typical CEO compensation package: the payment method, the vesting schedule, and the performance metric. The payment method may be cash, stocks, or options. The vesting schedule may be in 1, 2, 3, 4+, and other unspecified number of years, following a ratable, cliff, or other style. Provided that all other vesting conditions are met, under a ratable vesting schedule, a pre-specified *portion* of a grant becomes vested within *each period* of a certain time frame; whereas under a cliff vesting schedule, the *whole* grant becomes vested at the end of the time frame. Vesting schedules outside of these two styles are classified as "other".

Table I Summary Statistics of Firm Characteristics

This table presents the summary statistics of the firm characteristics of the sample used in this paper. These characteristics include the 12-month cumulative stock return, the return on assets (ROA), the total assets and the natural log of it; the ratio of capital expenditures (CAPX) to the total assets at the beginning of the period; the EBIT-to-sales ratio; idiosyncratic volatility, which is defined as the annualized volatility of the residual term from the regression of individual daily stock returns on the value-weighted market daily returns in the last 252 trading days; the market leverage ratio, which is defined as the ratio of the total long term debt to the sum of the total long term debt and the total market value of stocks; sales growth; Tobin's Q, which is defined as the ratio of the market value of total assets to the book value of total assets; the ratio of research and development (R&D) expenditures to the total assets at the beginning of the period; the ratio of advertisement (AD) expenditures to the total assets at the beginning of the period; a dummy variable indicating that the CEO is also the chairman of the board of directors; a the dummy variable indicating that there was a CEO turnover from year $t-1$ to year t.

Variable	N	mean	sd	p5	p25	p50	p75	p95
12-month Cum. Ret.	8,598	0.142	62.15%	-49.69%	-10.60%	10.46%	30.87%	82.44%
ROA	8,598	0.056	9.38%	-6.87%	1.68%	5.06%	9.56%	19.13%
Idiosyncratic Risk	8,598	0.288	18.01%	12.30%	17.43%	23.95%	34.67%	60.69%
Sales Growth	8,598	0.044	20.52%	-23.92%	-2.54%	4.88%	12.20%	31.28%
Tobin's Q	8,598	1.856	1.156	0.957	1.145	1.501	2.147	3.984
EBIT/Sales	8,598	0.153	0.171	-0.011	0.078	0.140	0.225	0.422
Assets ($B)	8,598	29.393	132.253	0.706	2.498	6.095	17.125	92.337
Log(Assets)	8,598	8.830	1.488	6.560	7.823	8.715	9.748	11.433
Market Leverage	8,598	0.284	0.277	0.000	0.084	0.200	0.388	1.000
CAPX/Beg. Assets	8,598	0.047	0.062	0.000	0.012	0.030	0.060	0.149
R&D Exp./Beg. Assets	8,598	0.026	0.058	0.000	0.000	0.000	0.023	0.135
AD. Exp./Beg. Assets	8,598	0.011	0.029	0.000	0.000	0.000	0.007	0.066
CEO-Chairman	8,598	0.571	0.495	0	0	1	1	1
CEO Turnover	8,598	0.103	0.304	0	0	0	0	1

Table II Frequency of Individual Entries and Specific Packages of CEO Compensation Vectors

Panel A tabulates the frequency of the thirty most popular *individual entries* of the CEO compensation vector, which consists of details on three dimensions of a typical CEO compensation package: the payment method, the vesting schedule, and the performance metric. The payment method may be cash, stocks, or options. The vesting schedule may be in 1, 2, 3, 4+, and other unspecified number of years, following a ratable, cliff, or other style. Provided that all other vesting conditions are met, under a ratable vesting schedule, a pre-specified *portion* of a grant becomes vested within *each period* of a certain time frame; whereas under a cliff vesting schedule, the *whole* grant becomes vested at the end of the time frame. Vesting schedules outside of these two styles are classified as "other". Panel B tabulates the frequency of the thirty most popular *complete packages*, i.e., specific combinations, of individual entries in the CEO compensation vector.

Panel A. Frequency of the Thirty Most Popular Individual Entries

Seq.	Freq.	Percentage	Payment Method	Vesting Schedule	Performance Metric
1	2,766	26.57%	Option	4+ Year Ratable	Null
2	2,337	22.45%	Option	3 Year Ratable	Null
3	2,318	22.27%	Cash	1 Year Cliff	Absolute 1 Year Other Non-Individual
4	1,808	17.37%	Stock	4+ Year Ratable	Null
5	1,795	17.24%	Cash	1 Year Cliff	Absolute 1 Year Other Individual
6	1,709	16.42%	Stock	3 Year Cliff	Relative 3 Year Stock Price
7	1,650	15.85%	Cash	1 Year Cliff	Absolute 1 Year Sales
8	1,587	15.25%	Stock	3 Year Ratable	Null
9	1,399	13.44%	Cash	1 Year Cliff	Absolute 1 Year EPS
10	1,374	13.20%	Cash	2 Year Cliff	Absolute 1 Year Other Non-Individual
11	1,366	13.12%	Stock	3 Year Ratable	Null
12	1,181	11.35%	Cash	1 Year Cliff	Absolute 1 Year Operating Income
13	948	9.11%	Cash	2 Year Cliff	Absolute 1 Year Other Individual
14	946	9.09%	Cash	1 Year Cliff	Absolute 1 Year Cash Flow
15	876	8.42%	Cash	2 Year Cliff	Absolute 1 Year Sales
16	737	7.08%	Cash	1 Year Cliff	Absolute 1 Year EBITDA
17	735	7.06%	Cash	1 Year Cliff	Absolute 1 Year Earnings
18	724	6.96%	Cash	2 Year Cliff	Absolute 1 Year EPS
19	587	5.64%	Stock	3 Year Cliff	Absolute 3 Year EPS

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Table II – *Continued from previous page*

20	555	5.33%	Cash	2 Year Cliff	Absolute 1 Year Operating Income
21	525	5.04%	Cash	2 Year Cliff	Absolute 1 Year Cash Flow
22	494	4.75%	Stock	4+ Year Cliff	Null
23	469	4.51%	Cash	2 Year Cliff	Absolute 1 Year EBITDA
24	424	4.07%	Cash	2 Year Cliff	Absolute 1 Year Earnings
25	420	4.03%	Stock	3 Year Cliff	Absolute 3 Year ROIC
26	386	3.71%	Option	4+ Year Other	Null
27	367	3.53%	Stock	3 Year Cliff	Absolute 3 Year Stock Price
28	348	3.34%	Cash	1 Year Cliff	Absolute 1 Year Absolute EBT
29	324	3.11%	Stock	3 Year Cliff	Absolute 3 Year Sales
30	320	3.07%	Cash	1 Year Cliff	Absolute 1 Year ROIC

Panel B. Frequency of the Thirty Most Popular Complete Packages

Seq.	Freq.	Percentage	Compensation Package Description
1	134	1.29%	Plain Options Ratable Vesting in Four or More Years
2	97	0.93%	Plain Stocks Ratable Vesting in Four or More Years
3	72	0.69%	Plain Options and Plain Stocks Ratable Vesting in Four or More Years
4	64	0.61%	Plain Stocks Ratable Vesting in Three Years
5	43	0.41%	Plain Stocks Cliff Vesting in One Year
6	42	0.40%	Plain Options Ratable Vesting in Three Years
7	34	0.33%	Plain Options and Plain Stocks Ratable Vesting in Three Years
8	28	0.27%	Plain Options Cliff Vesting in One Year
9	24	0.23%	Plain Stocks Cliff Vesting in Four or More Years
10	24	0.23%	Plain Stocks Other Vesting in Four or More Years
11	22	0.21%	Plain Options Other Vesting in Four or More Years
12	20	0.19%	Plain Options Ratable Vesting in Four or More Years , plus Plain Stocks Cliff Vesting in Four or More Years
13	19	0.18%	Plain Stocks Cliff Vesting in Three Years
14	18	0.17%	Plain Stocks Other with Vague Vesting Schedule
15	17	0.16%	Cash Cliff Vesting in One Year based on Absolute One-Year Other Indvidual and Nonindividual Performances
16	16	0.15%	Plain Options Ratable Vesting in Three Years , plus Plain Stocks Cliff Vesting in Three Years

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Table II – *Continued from previous page*

17	16	0.15%	Plain Options Ratable Vesting in Four or More Years, plus Cash Cliff Vesting in One Year based on Absolute One-Year Operating Income
18	15	0.14%	Plain Options Ratable Vesting in Four or More Years, plus Cash Cliff Vesting in One Year based on Absolute One-Year EPS
19	14	0.13%	Cash Cliff Vesting in One Year based on Absolute One-Year EBITDA
20	14	0.13%	Cash Cliff Vesting in One Year based on Absolute One-Year Operating Income and Sales
21	13	0.12%	Cash Cliff Vesting in One Year based on Absolute One-Year EPS
22	13	0.12%	Plain Options Ratable Vesting in Four or More Years, plus Cash Cliff Vesting in One Year based on Absolute One-Year Other Indvidual and Nonindividual Performances
23	12	0.12%	Plain Options Ratable Vesting in Four or More Years , plus Plain Stocks Cliff Vesting in Three Years
24	11	0.11%	Plain Options Ratable Vesting in Four or More Years , plus Plain Stocks Ratable Vesting in Three Years
25	10	0.10%	Cash Cliff Vesting in Two Years based on Absolute One-Year EPS
26	10	0.10%	Cash Cliff Vesting in Two Years based on Absolute One-Year EBT
27	9	0.09%	Plain Options Ratable Vesting in Three Years, plus Plain Stocks Cliff Vesting in Four or More Years, plus Stocks Cliff Vesting in Three Years based on Absolute Three-Year ROIC
28	9	0.09%	Plain Options Ratable Vesting in Four or More Years, plus Stocks Cliff Vesting in Four or More Years based on One-Year Absolute Other Non-Individual Performance, plus Cash Cliff Vesting in Two Years based on Absolute One-Year EBITDA and Other Nonindividual Performance
29	8	0.08%	Cash Cliff Vesting in One Year based on Absolute One-Year Other Nonindividual Performance
30	8	0.08%	Plain Options Ratable Vesting in Three Years, plus Stocks Cliff Vesting in Three Years based on Absolute Three-Year ROE and Other Non-Individual Performance, plus Cash Cliff Vesting in One Year based on Absolute One-Year Earnings
Total	836	8.03%	
All Other Packages Combined	9,573	91.97%	

Table III Frequency of the Thirty Most Popular Sets of Adjustments
This table tabulates the frequency of the thirty most popular sets of adjustments, i.e., specific combinations of added and/or dropped entries, of CEO compensation package vectors. The raw vector consists of details on three dimensions of a typical CEO compensation package: the payment method, the vesting schedule, and the performance metric. The payment method may be cash, stocks, or options. The vesting schedule may be in 1, 2, 3, 4+, and other unspecified number of years, following a ratable, cliff, or other style. Provided that all other vesting conditions are met, under a ratable vesting schedule, a pre-specified *portion* of a grant becomes vested within *each period* of a certain time frame; whereas under a cliff vesting schedule, the *whole* grant becomes vested at the end of the time frame. Vesting schedules outside of these two styles are classified as "other". The frequency is calculated based on the number of firm-years in which firms adjusted the details in their CEO compensation packages.

Seq.	Freq.	Percentage	Adjustment Description
1	30	0.44%	Add Plain Stocks Ratable Vesting in Three Years
2	27	0.40%	Add Plain Stocks Ratable Vesting in Four or More Years
3	27	0.40%	Add Cash Cliff Vesting in One Year based on Absolute One-Year Other Indvidual Performances
4	26	0.38%	Add Plain Stocks Cliff Vesting in Three Years
5	22	0.32%	Add Cash Cliff Vesting in One Year based on Absolute One-Year Other Non-Indvidual Performances
6	22	0.32%	Drop Plain Stocks Ratable Vesting in Three Years
7	21	0.31%	Drop Cash Cliff Vesting in One Year based on Absolute One-Year Other Indvidual Performances
8	21	0.31%	Drop Plain Options Ratable Vesting in Four or More Years
9	20	0.29%	Drop Plain Stocks Ratable Vesting in Four or More Years
10	18	0.26%	Drop Plain Stocks Cliff Vesting in Three Years
11	16	0.24%	Add Stocks Cliff Vesting in Three Years based on Relative Three-Year Stock Return
12	16	0.24%	Add Plain Options Ratable Vesting in Four or More Years
13	15	0.22%	Add Cash Cliff Vesting in Two Years based on Absolute One-Year Other Individual Performances
14	14	0.21%	Drop Plain Stocks Cliff Vesting in Four or More Years
15	13	0.19%	Add Cash Cliff Vesting in Two Years based on Absolute One-Year Other Non-Individual Performances
16	13	0.19%	Drop Plain Options Cliff Vesting in One Year
17	12	0.18%	Drop Plain Options Ratable Vesting in Three Years
18	11	0.16%	Drop Cash Cliff Vesting in Two Years based on Absolute One-Year Other Indvidual Performances
19	11	0.16%	Add Cash Cliff Vesting in One Year based on Absolute One-Year Sales

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Table III – *Continued from previous page*

20	10	0.15%	Drop Cash Cliff Vesting in One Year based on Absolute One-Year Other Non-Indvidual Performances
21	9	0.13%	Drop Cash Cliff Vesting in Two Years based on Absolute One-Year Sales
22	9	0.13%	Add Cash Cliff Vesting in One Year based on Absolute One-Year Other Non-Indvidual Performances, plus Drop Cash Cliff Vesting in One Year based on Absolute One-Year Other Non-Indvidual Performances
23	9	0.13%	Add Plain Options Ratable Vesting in Three Years
24	9	0.13%	Drop Plain Options Ratable Vesting in Four or More Years, plus Drop Plain Stocks Ratable Vesting in Four or More Years
25	8	0.12%	Add Cash Cliff Vesting in One Year based on Absolute One-Year Customer Service
26	8	0.12%	Drop Cash Cliff Vesting in Two Years based on Absolute One-Year Leadership/Culture
27	8	0.12%	Add Stocks Cliff Vesting in Three Years based on Absolute Three-Year Stock Return
28	8	0.12%	Add Plain Stocks Ratable Vesting in Two Years
29	8	0.12%	Drop Plain Stocks Cliff Vesting in Three Years
30	7	0.10%	Add Cash Cliff Vesting in One Year based on Absolute One-Year Earnings
Total	448	6.60%	
All Other Adjustments Combined	6,345	93.40%	

Table IV Summary Statistics of the Number of Non-Zero Entries in CEO Compensation Vectors and the Year-over-Year CEO Compensation Similarities

Panels A and B summarizes the number of non-zero entries in different groups of CEO compensation packages. Panel C presents the summary statistics of the within- and cross-firm year-over-year CEO compensation similarities. The CEO compensation vector consists of details on three dimensions of a typical CEO compensation package: the payment method, the vesting schedule, and the performance metric. The payment method may be cash, stocks, or options. The vesting schedule may be in 1, 2, 3, 4+, and other unspecified number of years, following a ratable, cliff, or other style. Provided that all other vesting conditions are met, under a ratable vesting schedule, a pre-specified *portion* of a grant becomes vested within *each period* of a certain time frame; whereas under a cliff vesting schedule, the *whole* grant becomes vested at the end of the time frame. Vesting schedules outside of these two styles are classified as "other". The similarity between two vectors $\vec{\mathbf{a}}$ and $\vec{\mathbf{b}}$ is defined as the cosine similarity $\frac{\sum_{i=1}^{n} a_i b_i}{\sqrt{\sum_{i=1}^{n}(a_i a_i)\sum_{i=1}^{n}(b_i b_i)}}$.

Variable	N	mean	sd	p5	p25	p50	p75	p95
	Panel A. The Number of Non-Zero Entries in the CEO Compensation Vectors by Firm-Year and by Firm across 2006-2015							
Individual Observations	8,598	5.217	2.610	1	3	5	7	10
Within Firm Across Years	1,149	15.243	7.740	4	10	14	20	29
	Panel B. The Number of Non-Zero Entries in the CEO Compensation Vectors of Three Groups of Potential Peers by Firm-Year							
From Compensation Peers per Individual Obs.	6,933	40.517	24.808	12	26	37	50	77
From Consultant-Sharing Peers per Individual Obs.	6,919	154.058	81.479	17	98	149	225	285
From Board Interlocking Peers per Individual Obs.	6,793	20.229	12.909	4	10	18	28	45
	Panel C. Summary Statistics of the within- and cross- Firm Year-over-Year CEO Compensation Similarity							
Within-Firm Year-over-Year $Similarity(C_{i,t}, C_{i,t-1})$	7,278	0.633	0.317	0.000	0.408	0.701	0.913	1.000
Cross-Firm Year-over-Year $Similarity(C_{i,t}, C_{j,t-1})$	6,960,000	0.094	0.146	0.000	0.000	0.000	0.183	0.401

Table V Test of Hypothesis 1 (*Learning from Self*)

This table reports the results of the test of Hypothesis 1 (*Learning from Self*) in Equation (3): $Similarity(C_{i,t}, C_{i,t-1}) = \alpha + \beta_1 Ret_{Below_{it-1}} + \beta_2 Ret_{Above_{it-1}} + \beta_3 ROA_{Below_{it-1}} + \beta_4 ROA_{Above_{it-1}} + \gamma Z_{it-1} + \eta_i + \eta_t + \epsilon_{it}$, where the dependent variable $Similarity(C_{i,t}, C_{i,t-1})$ is the cosine similarity between a firm's CEO compensation vector at year t and $t-1$. The similarity between two vectors $\vec{\mathbf{a}}$ and $\vec{\mathbf{b}}$ is defined as the cosine similarity $\frac{\sum_{i=1}^{n} a_i b_i}{\sqrt{\sum_{i=1}^{n}(a_i a_i)\sum_{i=1}^{n}(b_i b_i)}}$. A piecewise regression is estimated, i.e., if a firm's 12-month cumulative stock return at year $t-1$ is below the industry median, $Ret_{Below_{it-1}}$ equals the firm's 12-month cumulative stock return minus the industry median, while $Ret_{Above_{it-1}}$ equals zero. On the contrary, if a firm's 12-month cumulative stock return at year $t-1$ is above the industry median, $Ret_{Below_{it-1}}$ equals zero, while $Ret_{Above_{it-1}}$ equals the industry median adjusted value. $ROA_{Below_{it-1}}$ and $ROA_{Above_{it-1}}$ are defined in a similar fashion for ROA. $\mathbf{Z_{it-1}}$ includes several control variables at the firm level: the natural log of total assets; the ratio of capital expenditures (CAPX) to the total assets at the beginning of the period; the EBIT-to-sales ratio; idiosyncratic volatility, which is defined as the annualized volatility of the residual term from the regression of individual daily stock returns on the value-weighted market daily returns in the last 252 trading days; the market leverage ratio, which is defined as the ratio of the total long term debt to the sum of the total long term debt and the total market value of stocks; sales growth; Tobin's Q, which is defined as the ratio of the market value of total assets to the book value of total assets; the ratio of research and development (R&D) expenditures to the total assets at the beginning of the period; the ratio of advertisement (AD) expenditures to the total assets at the beginning of the period; a dummy variable indicating that the CEO is also the chairman of the board of directors; a the dummy variable indicating that there was a CEO turnover from year $t-1$ to year t. η_i and η_t control for firm and time fixed effects, respectively. Standard errors in the regression are two-way clustered by firm and year. The sample in the regression is from 2007 to 2015, because the dependent variable requires the information on CEO compensation details across two years, while 2006 is the first year with such information. Therefore, p-values corresponding to the t-statistics are calculated with degrees-of-freedom of 8, which is the sample (2007 to 2015) minus one. This correction in degrees-of-freedom is suggested by Cameron and Miller (2015). t statistics are in parentheses; * corresponds to $p < 0.10$, ** corresponds to $p < 0.05$, and *** corresponds to $p < 0.01$. Model (1) only includes the 12-month cumulative stock return as the performance measure. Model (2) only includes ROA as the performance measure. Model (3) includes both 12-month cumulative stock return and ROA as performance measures. Model (4) includes the 12-month cumulative stock return as the performance measure, and includes its interaction with the CEO-chairman duality and CEO turnover dummies. Model (5) includes ROA as the performance measure, and includes its interaction term with the CEO-chairman duality and CEO turnover dummies. Model (6) includes both 12-month cumulative stock return and ROA as performance measures, and includes their interaction terms with the CEO-chairman duality and CEO turnover dummies.

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Table V – *Continued from previous page*

	Dependent Variable: $Similarity\,(Compensation_{it}, Compensation_{it-1})$					
	(1)	(2)	(3)	(4)	(5)	(6)
Ind. Adj. Ret (Below Ind. Med.)	0.110***		0.102**	0.108**		0.103**
	(3.51)		(3.27)	(3.16)		(3.02)
Ind. Adj. Ret (Above Ind. Med.)	0.00291		0.00199	0.00997*		0.00896*
	(0.49)		(0.33)	(2.15)		(1.91)
Ind. Adj. ROA (Below Ind. Med.)		0.271	0.217		0.190	0.133
		(1.56)	(1.29)		(1.20)	(0.86)
Ind. Adj. ROA (Above Ind. Med.)		0.0608	0.0605		0.0515	0.0506
		(0.99)	(0.98)		(0.69)	(0.74)
Ind. Adj. Ret Below × CEO Turnover				0.00683		-0.0332
				(0.07)		(-0.34)
Ind. Adj. Ret Below × CEO-Chairman				-0.00970		-0.00772
				(-0.13)		(-0.10)
Ind. Adj. Ret Above × CEO Turnover				0.0918**		0.0993**
				(2.96)		(3.11)
Ind. Adj. Ret Above × CEO-Chairman				-0.0226***		-0.0223***
				(-4.14)		(-3.67)
Ind. Adj. ROA Below × CEO Turnover					0.245	0.253
					(1.13)	(1.23)
Ind. Adj. ROA Below × CEO-Chairman					0.0676	0.0771
					(0.33)	(0.36)
Ind. Adj. ROA Above × CEO Turnover					0.0367	0.0232
					(0.41)	(0.25)
Ind. Adj. ROA Above × CEO-Chairman					0.0125	0.0155
					(0.15)	(0.20)
CEO Turnover	-0.0941***	-0.0939***	-0.0922***	-0.105***	-0.0909***	-0.104***
	(-7.06)	(-6.46)	(-6.59)	(-5.93)	(-5.58)	(-5.48)
Idiosyncratic Risk	-0.164***	-0.162***	-0.152***	-0.165***	-0.162***	-0.155***
	(-5.58)	(-5.60)	(-5.33)	(-5.63)	(-5.81)	(-5.79)
Sales Growth	0.0584***	0.0550**	0.0519**	0.0579***	0.0551**	0.0515**
	(3.90)	(3.24)	(3.17)	(3.80)	(3.30)	(3.12)

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Table V – *Continued from previous page*

	Dependent Variable: $Similarity\,(Compensation_{it}, Compensation_{it-1})$					
	(1)	(2)	(3)	(4)	(5)	(6)
CEO-Chairman	-0.00303	-0.00334	-0.00313	0.000280	-0.00309	0.000272
	(-0.24)	(-0.27)	(-0.25)	(0.02)	(-0.21)	(0.02)
Tobin's Q	0.00456	0.00763	0.00300	0.00549	0.00774	0.00406
	(0.91)	(1.73)	(0.58)	(1.05)	(1.86)	(0.68)
EBIT/Sales	0.00270	0.00257	0.00225	0.00269	0.00272	0.00239
	(1.20)	(1.00)	(0.94)	(1.19)	(1.05)	(1.01)
Log(Assets)	-0.00444	-0.00801	-0.00547	-0.00367	-0.00855	-0.00519
	(-0.32)	(-0.59)	(-0.40)	(-0.27)	(-0.63)	(-0.38)
Market Leverage	-0.0121	-0.0144	-0.00570	-0.0111	-0.0142	-0.00446
	(-0.45)	(-0.50)	(-0.20)	(-0.41)	(-0.49)	(-0.16)
CAPX/Beg. Assets	-0.0289	-0.0661	-0.0440	-0.0266	-0.0674	-0.0425
	(-0.18)	(-0.41)	(-0.27)	(-0.16)	(-0.42)	(-0.25)
R&D/Beg. Assets	-0.302*	-0.199	-0.213	-0.310*	-0.222	-0.244
	(-1.93)	(-0.88)	(-1.00)	(-1.95)	(-1.09)	(-1.26)
AD/Beg. Assets	-0.335	-0.350	-0.354	-0.316	-0.353	-0.336
	(-0.64)	(-0.65)	(-0.67)	(-0.61)	(-0.67)	(-0.65)
N	7,278	7,278	7,278	7,278	7,278	7,278
r2	0.353	0.352	0.354	0.354	0.352	0.355
r2_within	0.0225	0.0212	0.0235	0.0239	0.0215	0.0251

Table VI Test of Hypothesis 2 (*Learning from Others*)

This table reports the results of the test of Hypothesis 2 (*Learning from Others*) in Equation (4): $\textbf{Matrix}[Similarity(C_{i,t},C_{j,t-1})] = \alpha + \beta_1 \textbf{Matrix}[CRET_{j,t-1}/CRET_{i,t-1}] + \beta_2 \textbf{Matrix}[ROA_{j,t-1}/ROA_{i,t-1}] + \beta_3 \textbf{Matrix}[CompPeer_{i,j,t}] + \beta_4 \textbf{Matrix}[CompConsultant_{i,t,j,t-1}] + \beta_5 \textbf{Matrix}[BoardInterlock_{i,j,t}] + \beta_6 \textbf{Matrix}[TNIC2Peer_{i,j,t-1}] + \beta_{7-12} \textbf{Matrix}[Interaction\ Terms] + \gamma \textbf{Matrix}[Z_{i,j,t-1}] + \textbf{Matrix}[\epsilon_{i,j,t}]$. The regression is estimated by year, so that the cross-firm entries across more than one year are not misspecified as missing. Panel A reports the results for years 2007 to 2011 and Panel B reports the results for years 2012 to 2015. There is no regression for the fiscal year 2006, because the dependent variable requires information on the CEO compensation details across two years, while 2006 is the first year with such information. The coefficients in the model are estimated in the same fashion as in an OLS regression, but because the data is at a dyadic level, the inference is drawn using the Multiple Regression Quadratic Assignment Procedure(MR-QAP), with the semi-partialling plus permutation and 1,000 replications (see Dekker, Krackhardt, and Snijders (2007)). $Similarity(C_{i,t},C_{j,t-1})$ is the similarity between the compensation package of firm i at year t and that of firm j at year $t-1$. The similarity between two vectors $\vec{\mathbf{a}}$ and $\vec{\mathbf{b}}$ is defined as the cosine similarity $\frac{\sum_{i=1}^{n} a_i b_i}{\sqrt{\sum_{i=1}^{n}(a_i a_i)\sum_{i=1}^{n}(b_i b_i)}}$. $CRET_{j,t-1}/CRET_{i,t-1}$ is the ratio of the decile of firm j's cumulative 12-month stock return in the past three Fama-French 48 industry-years to firm i's. $ROA_{j,t-1}/ROA_{i,t-1}$ is defined similarly for ROA. $CompPeer_{i,j,t}$ equals 1 if j is reported as a compensation benchmark peer of firm i. $CompConsultant_{i,t,j,t-1}$ equals one if at least one compensation consultant serving firm i at year t also served firm j at year $t-1$. $BoardInterlock_{i,j,t}$ equals one if there is at least one interlocking board member between firm i and j at year t. $TNIC2Peer_{i,j,t-1}$ equals one if firm j is defined as firm i's TNIC2 product market peer at year $t-1$. The i,jth entry of the first control matrix is the ratio of the decile of firm j's total assets in the past three Fama-French 48 industry-years to firm i's. The rest of the control matrices Z_{ij} are the absolute difference between firm i and firm j in the following standardized firm characteristics: the CAPX-to-beginning total assets ratio, the EBIT-to-sales ratio, the idiosyncratic volatility, the market leverage ratio, the sales growth, the Tobin's Q, the R&D-to-beginning total assets ratio, and the AD-to-beginning total assets ratio. Empirical p-values are reported below the coefficients. * corresponds to $p < 0.10$, ** corresponds to $p < 0.05$, and *** corresponds to $p < 0.01$.

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Table VI – *Continued from previous page*

	Panel A. The Results for Years 2007 to 2011				
	Dependent Variable: $Similarity(Compensation_{i,t}, Compensation_{j,t-1})$				
	2007	2008	2009	2010	2011
$CRET_{j,t-1}/CRET_{i,t-1}$	0.0075***	0.0041***	0.0087***	0.0397***	0.0333***
	0.000	0.000	0.000	0.000	0.000
$ROA_{j,t-1}/ROA_{i,t-1}$	0.0075***	0.0053***	0.0034***	0.0040***	0.0065***
	0.000	0.000	0.001	0.000	0.000
$CompPeer_{j,i,t}$	0.0397***	0.0372***	0.0450***	0.0389***	0.0360***
	0.000	0.000	0.000	0.000	0.000
$CompConsultant_{j,t-1,i,t}$	0.0228***	0.0248***	0.0253***	0.0198***	0.0301***
	0.000	0.000	0.000	0.000	0.000
$BoardInterlock_{j,i,t}$	0.0190***	0.0202***	0.0209***	0.0250***	0.0273***
	0.000	0.000	0.000	0.000	0.000
$CompPeer_{j,i,t}$	-0.0030**	-0.0018	-0.0063***	-0.0073**	-0.0085**
$\times\ CRET_{j,t-1}/CRET_{i,t-1}$	0.038	0.119	0.000	0.019	0.016
$CompConsultant_{j,t-1,i,t}$	-0.0036***	-0.0022***	-0.0035***	-0.0047***	-0.0138***
$\times\ CRET_{j,t-1}/CRET_{i,t-1}$	0.000	0.000	0.000	0.004	0.000
$BoardInterlock_{j,i,t}$	-0.0001	-0.0017	-0.0012	-0.0051	-0.0067*
$\times\ CRET_{j,t-1}/CRET_{i,t-1}$	0.927	0.186	0.522	0.120	0.062
$CompPeer_{j,i,t}$	-0.0043***	-0.0048***	-0.0037***	-0.0026*	-0.0015
$\times\ ROA_{j,t-1}/ROA_{i,t-1}$	0.000	0.000	0.006	0.056	0.326
$CompConsultant_{j,t-1,i,t}$	-0.0031***	-0.0042***	-0.0021***	-0.0024***	-0.0019**
$\times\ ROA_{j,t-1}/ROA_{i,t-1}$	0.000	0.000	0.000	0.008	0.040
$BoardInterlock_{j,i,t}$	-0.0039**	-0.0034**	-0.0019	-0.0012	-0.0026
$\times\ ROA_{j,t-1}/ROA_{i,t-1}$	0.014	0.033	0.136	0.360	0.146
$TNIC2Peer_{j,i,t-1}$	0.0291***	0.0264***	0.0190***	0.0214***	0.0186***
	0.000	0.000	0.000	0.000	0.000
$Assets_{j,t-1}/Assets_{i,t-1}$	0.0057***	0.0031***	0.0034***	0.0022***	0.0029***
	0.000	0.000	0.000	0.001	0.000
$Diff(CAPEX_{j,i,t-1})$	-0.0001	0.0004	0.0011	-0.0005	-0.0007
	0.968	0.773	0.466	0.739	0.589
$Diff(EBIT_{j,i,t-1})$	0.0039***	0.0029*	0.0039**	0.0046***	0.0002
	0.006	0.099	0.021	0.002	0.878
$Diff(Idio.Risk_{j,i,t-1})$	0.0035***	-0.0003	-0.0010	-0.0019	-0.0024*
	0.002	0.854	0.502	0.230	0.095
$Diff(Leverage_{j,i,t-1})$	0.0019*	0.0013	0.0025**	0.0015	-0.0009
	0.097	0.328	0.040	0.245	0.531
$Diff(SalesGrow_{j,i,t-1})$	0.0041***	0.0004	0.0047***	-0.0001	0.0027*
	0.002	0.745	0.001	0.953	0.083

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$Diff(Tobin'sQ_{j,i,t-1})$	0.0033**	0.0039**	0.0016	0.0007	-0.0009
	0.016	0.036	0.308	0.670	0.539
$Diff(AD_{j,i,t-1})$	0.0035***	0.0026**	0.0019	0.0028**	0.0025*
	0.002	0.036	0.153	0.032	0.067
$Diff(R\&D_{j,i,t-1})$	0.0041***	0.0061***	0.0026*	0.0026*	0.0001
	0.001	0.001	0.083	0.084	0.959
$CEO-Chairman_{i,t}$	0.0367***	0.0341***	0.0329***	0.0477***	0.0546***
	0.000	0.000	0.000	0.000	0.000
$CEO-Turnover_{i,t}$	0.0355***	0.0344***	0.0293***	0.0302***	0.0554***
	0.000	0.000	0.000	0.000	0.000
$CEO-Chairman_{i,t}$	-0.0082***	-0.0033***	-0.0084***	-0.0354***	-0.0307***
$\times\ CRET_{j,t-1}/CRET_{i,t-1}$	0.000	0.002	0.000	0.000	0.000
$CEO-Chairman_{i,t}$	-0.0055***	-0.0062***	-0.0027**	-0.0027**	-0.0062***
$\times\ ROA_{j,t-1}/ROA_{i,t-1}$	0.000	0.000	0.024	0.047	0.002
$CEO-Turnover_{i,t}$	-0.0052**	-0.0035**	-0.0061***	-0.0197***	-0.0240***
$\times\ CRET_{j,t-1}/CRET_{i,t-1}$	0.013	0.019	0.003	0.000	0.000
$CEO-Turnover_{i,t}$	-0.0058***	-0.0081***	-0.0018	-0.0042**	-0.0096***
$\times\ ROA_{j,t-1}/ROA_{i,t-1}$	0.004	0.000	0.324	0.043	0.001

Panel B. The Results for Years 2012 to 2015

	Dependent Variable: $Similarity(Compensation_{i,t}, Compensation_{j,t-1})$			
	2012	2013	2014	2015
$CRET_{j,t-1}/CRET_{i,t-1}$	0.0064***	0.0077***	0.0108***	0.0087***
	0.000	0.000	0.000	0.000
$ROA_{j,t-1}/ROA_{i,t-1}$	0.0065***	0.0084***	0.0078***	0.0101***
	0.000	0.000	0.000	0.000
$CompPeer_{j,i,t}$	0.0419***	0.0402***	0.0443***	0.0606***
	0.000	0.000	0.000	0.000
$CompConsultant_{j,t-1,i,t}$	0.0265***	0.0274***	0.0392***	0.0326***
	0.000	0.000	0.000	0.000
$BoardInterlock_{j,i,t}$	0.0289***	0.0317***	0.0357***	0.0283***
	0.000	0.000	0.000	0.000
$CompPeer_{j,i,t}$	-0.0023	-0.0020*	-0.0025	-0.0052***
$\times\ CRET_{j,t-1}/CRET_{i,t-1}$	0.124	0.093	0.189	0.001
$CompConsultant_{j,t-1,i,t}$	-0.0034***	-0.0035***	-0.0080***	-0.0034***
$\times\ CRET_{j,t-1}/CRET_{i,t-1}$	0.000	0.000	0.000	0.000
$BoardInterlock_{j,i,t}$	-0.0018	-0.0022	-0.0084***	-0.0031**
$\times\ CRET_{j,t-1}/CRET_{i,t-1}$	0.195	0.109	0.000	0.034
$CompPeer_{j,i,t}$	-0.0054***	-0.0039***	-0.0054***	-0.0089***

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Table VI – *Continued from previous page*

$\times$ $ROA_{j,t-1}/ROA_{i,t-1}$	0.001	0.002	0.000	0.000
$CompConsultant_{j,t-1,i,t}$	-0.0034***	-0.0023***	-0.0056***	-0.0043***
$\times$ $ROA_{j,t-1}/ROA_{i,t-1}$	0.000	0.000	0.000	0.000
$BoardInterlock_{j,i,t}$	-0.0040**	-0.0023*	-0.0034**	-0.0029*
$\times$ $ROA_{j,t-1}/ROA_{i,t-1}$	0.018	0.075	0.026	0.085
$TNIC2Peer_{j,i,t-1}$	0.0243***	0.0243***	0.0271***	0.0339***
	0.000	0.000	0.000	0.000
$Assets_{j,t-1}/Assets_{i,t-1}$	0.0047***	0.0034***	0.0043***	0.0054***
	0.000	0.000	0.000	0.000
$Diff(CAPEX_{j,i,t-1})$	0.0014	0.0014	0.0023	0.0056***
	0.368	0.351	0.150	0.001
$Diff(EBIT_{j,i,t-1})$	0.0005	-0.0004	0.0023	0.0044***
	0.714	0.768	0.122	0.002
$Diff(EBIT_{j,i,t-1})$	0.0004	-0.0014	0.0015	0.0004
	0.799	0.406	0.402	0.793
$Diff(Idio.Risk_{j,i,t-1})$	-0.0006	0.0021	0.0002	-0.0019
	0.692	0.169	0.935	0.292
$Diff(SalesGrow_{j,i,t-1})$	0.0015	0.0016	0.0053***	0.0011
	0.362	0.338	0.003	0.569
$Diff(Tobin'sQ_{j,i,t-1})$	0.0018	0.0031*	0.0010	0.0022
	0.269	0.072	0.506	0.242
$Diff(AD_{j,i,t-1})$	0.0028**	0.0033**	0.0030**	0.0042***
	0.026	0.023	0.041	0.007
$Diff(R\&D_{j,i,t-1})$	0.0004	-0.0027*	-0.0031*	0.0001
	0.816	0.084	0.066	0.928
$CEO-Chairman_{i,t}$	0.0360***	0.0420***	0.0462***	0.0513***
	0.000	0.000	0.000	0.000
$CEO-Turnover_{i,t}$	0.0355***	0.0308***	0.0391***	0.0269***
	0.000	0.000	0.000	0.001
$CEO-Chairman_{i,t}$	-0.0059***	-0.0065***	-0.0110***	-0.0092***
$\times$ $CRET_{j,t-1}/CRET_{i,t-1}$	0.000	0.000	0.000	0.000
$CEO-Chairman_{i,t}$	-0.0051***	-0.0087***	-0.0083***	-0.0109***
$\times$ $ROA_{j,t-1}/ROA_{i,t-1}$	0.002	0.000	0.000	0.000
$CEO-Turnover_{i,t}$	-0.0067***	-0.0047**	-0.0112***	-0.0058***
$\times$ $CRET_{j,t-1}/CRET_{i,t-1}$	0.000	0.039	0.001	0.007
$CEO-Turnover_{i,t}$	-0.0057***	-0.0084***	-0.0045*	-0.0048**
$\times$ $ROA_{j,t-1}/ROA_{i,t-1}$	0.006	0.000	0.074	0.040

Table VII Test of the Relation between Learning and Firm Performance

This table reports the results of the tests in Equations (6): $Ind.Adj.Perf._{i,t} = \alpha + \beta_{CP}\Delta PSI_{Perf.,CP,i,t-1\,to\,t} + \beta_{BI}\Delta PSI_{Perf.,BI,i,t-1\,to\,t} + \beta_{CS}\Delta PSI_{Perf.,CS,i,t-1\,to\,t} + \beta_{PP}\Delta PSI_{Perf.,PP,i,t-1\,to\,t} + \beta_{other}\Delta PSI_{Perf.,other,i,t-1\,to\,t} + \gamma Z_{it-1} + \eta_i + \eta_t + \epsilon_{it}$, where the dependent variable is a firm's industry-adjusted ROA (Panel A) or 12-month cumulative stock return (Panel B). The main explanatory variables are the changes in the Performance-weighted average Similarity Indices (PSI) for the focal firm based on (1) its compensation peer (CP) firms, (2) its board-interlocking (BI) firms, (3) its compensation consultant sharing (CS) firms, (4) its product market peer (PP) firms, and (5) all other (other) firms in the previous fiscal year. The index is calculated as $\sum_{k=1}^{10} w_k \times \{\bar{S}(C_{i,t}, C_{j,t-1}) | rank(Perf_{j,t-1}) = k\}$, where $\{\bar{S}(C_{i,t}, C_{j,t-1}) | rank(Perf_{j,t-1}) = k\}$ is the average similarity between the focal firm i and other firms in the k^{th} performance decile in the past three Fama-French 48 industry-years, and w_k represents the weight assigned to the mean similarity, which is equal to $k/\sum_{k=1}^{10} k$. The similarity between two vectors $\vec{\mathbf{a}}$ and $\vec{\mathbf{b}}$ is defined as the cosine similarity $\frac{\sum_{i=1}^{n} a_i b_i}{\sqrt{\sum_{i=1}^{n}(a_i a_i)\sum_{i=1}^{n}(b_i b_i)}}$. $\mathbf{Z_{it-1}}$ includes several control variables at the firm level: the natural log of total assets; the ratio of capital expenditures (CAPX) to the total assets at the beginning of the period; the EBIT-to-sales ratio; idiosyncratic volatility, which is defined as the annualized volatility of the residual term from the regression of individual daily stock returns on the value-weighted market daily returns in the last 252 trading days; the market leverage ratio, which is defined as the ratio of the total long term debt to the sum of the total long term debt and the total market value of stocks; sales growth; Tobin's Q, which is defined as the ratio of the market value of total assets to the book value of total assets; the ratio of research and development (R&D) expenditures to the total assets at the beginning of the period; the ratio of advertisement (AD) expenditures to the total assets at the beginning of the period; a dummy variable indicating that the CEO is also the chairman of the board of directors; a the dummy variable indicating that there was a CEO turnover from year $t-1$ to year t. η_i and η_t control for firm and time fixed effects, respectively. Standard errors in this regression are two-way clustered by firm and year. The sample in this regression is from 2008 to 2015, because constructing the main explanatory variables requires the information on CEO compensation details across three years—two years for the calculation of PSI and one more year to derive the first difference. Since 2006 is the first year with such information, the first year with required information is 2008. Therefore, p-values corresponding to the t-statistics are calculated with degrees-of-freedom of 7, which is the sample length (2008 to 2015) minus one. This correction in degrees-of-freedom is suggested by Cameron and Miller (2015). t statistics are in parentheses; * corresponds to $p < 0.10$, ** corresponds to $p < 0.05$, and *** corresponds to $p < 0.01$.

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Table VII – *Continued from previous page*

	Panel A. Dependent Variable: Industry-Adjusted ROA					
	(1)	(2)	(3)	(4)	(5)	(6)
$\Delta PSI_{ROA,CP,t-1\,to\,t}$	0.0281***					0.0311***
	(3.91)					(3.57)
$\Delta PSI_{ROA,BI,t-1\,to\,t}$		-0.00209				-0.00532
		(-0.19)				(-0.48)
$\Delta PSI_{ROA,CS,t-1\,to\,t}$			0.00676*			0.00190
			(2.04)			(0.30)
$\Delta PSI_{ROA,PP,t-1\,to\,t}$				0.00736		-0.00598
				(0.72)		(-0.43)
$\Delta PSI_{ROA,other,t-1\,to\,t}$					0.0163	-0.00375
					(0.66)	(-0.11)
Idiosyncratic Risk	0.00908	0.00919	0.00926	0.00939	0.00934	0.00880
	(0.45)	(0.46)	(0.46)	(0.47)	(0.47)	(0.44)
Tobin's Q	0.0316***	0.0315***	0.0315***	0.0315***	0.0315***	0.0316***
	(7.87)	(7.76)	(7.71)	(7.75)	(7.75)	(7.91)
EBIT/Sales	0.00149	0.00146	0.00146	0.00147	0.00148	0.00148
	(0.51)	(0.50)	(0.52)	(0.46)	(0.52)	(0.47)
Sales Growth	0.0343***	0.0345***	0.0345***	0.0345***	0.0345***	0.0343***
	(3.86)	(3.90)	(3.88)	(3.81)	(3.87)	(3.84)
Log(Assets)	-0.0475***	-0.0479***	-0.0478***	-0.0478***	-0.0478***	-0.0474***
	(-6.02)	(-6.08)	(-6.09)	(-6.11)	(-6.10)	(-5.98)
Market Leverage	-0.0117	-0.0114	-0.0115	-0.0115	-0.0114	-0.0116
	(-1.40)	(-1.41)	(-1.41)	(-1.42)	(-1.40)	(-1.37)
CAPX/Beg. Assets	-0.0493	-0.0525	-0.0524	-0.0527	-0.0526	-0.0487
	(-1.08)	(-1.15)	(-1.15)	(-1.16)	(-1.15)	(-1.07)
R&D/Beg. Assets	-0.211	-0.207	-0.207	-0.208	-0.208	-0.211
	(-1.28)	(-1.23)	(-1.23)	(-1.23)	(-1.23)	(-1.27)
AD/Beg. Assets	-0.000993	-0.00613	-0.00609	-0.00589	-0.00515	0.000471
	(-0.00)	(-0.02)	(-0.02)	(-0.02)	(-0.02)	(0.00)
CEO Turnover	-0.00249	-0.00231	-0.00230	-0.00229	-0.00233	-0.00248
	(-1.23)	(-1.01)	(-0.99)	(-1.04)	(-1.03)	(-1.15)
CEO-Chairman	0.00395	0.00391	0.00388	0.00391	0.00387	0.00400
	(0.85)	(0.81)	(0.80)	(0.84)	(0.83)	(0.82)
N	6,272	6,272	6,272	6,272	6,272	6,272
r2	0.777	0.777	0.777	0.777	0.777	0.777
r2_within	0.120	0.119	0.119	0.119	0.119	0.120

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Table VII – *Continued from previous page*

	Panel B. Dependent Variable: Industry-Adjusted Cumulative Stock Return					
	(1)	(2)	(3)	(4)	(5)	(6)
$\Delta PSI_{Ret,CP,t-1\,to\,t}$	0.107**					0.0840*
	(2.92)					(1.90)
$\Delta PSI_{Ret,BI,t-1\,to\,t}$		-0.0189				-0.0434
		(-0.74)				(-1.53)
$\Delta PSI_{Ret,CS,t-1\,to\,t}$			0.103			0.0893
			(0.95)			(0.73)
$\Delta PSI_{Ret,PP,t-1\,to\,t}$				0.155**		0.145*
				(3.10)		(2.01)
$\Delta PSI_{Ret,other,t-1\,to\,t}$					0.0797	-0.158
					(0.64)	(-0.95)
Idiosyncratic Risk	1.165	1.164	1.166	1.166	1.165	1.164
	(1.54)	(1.54)	(1.54)	(1.55)	(1.54)	(1.54)
Tobin's Q	-0.129**	-0.130**	-0.130**	-0.130**	-0.130**	-0.130**
	(-3.03)	(-3.02)	(-3.03)	(-3.04)	(-3.03)	(-3.03)
EBIT/Sales	0.00987***	0.00976***	0.00983***	0.00993***	0.00989***	0.00970**
	(3.83)	(3.67)	(3.68)	(3.88)	(3.85)	(3.44)
Sales Growth	-0.0371	-0.0362	-0.0355	-0.0351	-0.0361	-0.0354
	(-0.67)	(-0.65)	(-0.65)	(-0.63)	(-0.65)	(-0.64)
Log(Assets)	-0.264***	-0.266***	-0.265***	-0.266***	-0.266***	-0.264***
	(-5.70)	(-5.70)	(-5.72)	(-5.72)	(-5.72)	(-5.72)
Market Leverage	0.529	0.530	0.529	0.530	0.530	0.528
	(1.69)	(1.70)	(1.70)	(1.70)	(1.70)	(1.69)
CAPX/Beg. Assets	-0.376	-0.385	-0.382	-0.385	-0.386	-0.372
	(-1.69)	(-1.74)	(-1.72)	(-1.72)	(-1.73)	(-1.71)
R&D/Beg. Assets	-0.261	-0.243	-0.253	-0.260	-0.248	-0.270
	(-0.79)	(-0.75)	(-0.77)	(-0.80)	(-0.76)	(-0.82)
AD/Beg. Assets	-4.710	-4.744	-4.734	-4.728	-4.740	-4.695
	(-1.81)	(-1.82)	(-1.84)	(-1.82)	(-1.83)	(-1.80)
CEO Turnover	0.00699	0.00779	0.00783	0.00782	0.00749	0.00822
	(0.48)	(0.56)	(0.55)	(0.55)	(0.52)	(0.59)
CEO-Chairman	0.0344*	0.0344	0.0343*	0.0346	0.0343*	0.0349
	(1.90)	(1.89)	(1.90)	(1.80)	(1.91)	(1.85)
N	6,215	6,215	6,215	6,215	6,215	6,215
r2	0.252	0.252	0.252	0.253	0.252	0.253
r2_within	0.0972	0.0970	0.0971	0.0973	0.0970	0.0976

Appendix A. Variable Definitions

Below are the definitions of variables used in this paper.

12-Month Cum. Ret.	$\prod_{i=1}^{12}(1+ret_i)-1$, where ret is the return from the monthly stock data in CRSP.
ROA	$NI/AT_{Beginning\ of\ Period}$, where NI and AT are the net income and total assets, respectively, from Compustat.
Idiosyncratic Risk	The annualized volatility of the residual term from the regression of ret on $vwretd$, where ret and $vwretd$ are the individual and market return from the daily stock data in CRSP, respectively.
Sales Growth	$log(SALE/SALE_{Beginning\ of\ Period})$, where $SALE$ is net sales from Compustat.
Tobin's Q	$sum(AT, PRCC_F * CSHO, -1 * CEQ)/AT$, where $PRCC_F$, $CSHO$, and CEQ are, respectively, the stock price at the end of fiscal year, the number of shares outstanding at the end of fiscal year, and the common equity book value from Compustat.
EBIT/Sales	$EBIT/SALE_{Beginning\ of\ Period}$, where $EBIT$ is earnings before interest and tax from Compustat.
Market Leverage	$DLTT/sum(DLTT, MKVALT)$, where $DLTT$ and $MKVALT$ are the total long term debt and total market value of stocks from Compustat, respectively.
CAPX/Beg. Assets	$CAPX/AT_{Beginning\ of\ Period}$, where $CAPX$ is capital expenditures from Compustat.
R&D/Beg. Assets	$RD/AT_{Beginning\ of\ Period}$, where RD is R&D expenditures from Compustat. Missing values of this variable are replaced with zeros.
AD/Beg. Assets	$AD/AT_{Beginning\ of\ Period}$, where AD is advertising expenditures from Compustat. Missing values of this variable are replaced with zeros.
CEO-Chairman	A dummy variable equals to one if the CEO is also the chairman of the board of directors and zero otherwise. The information on whether the CEO also carries the chairman title is from ExecuComp.
CEO Turnover	A dummy variable equals to one if there was a CEO turnover from year $t-1$ to year t and zero otherwise. The information on whether the CEO position is taken by a new person is from ExecuComp.

Below is the list of specific absolute and relative performance metrics that are used to form the CEO compensation vectors.

List of Absolute Performance Metrics Included		
Sales	EPS	Other Individual
Operating Income	Cashflow	Earnings
EBITDA	ROIC	Stock Price
ROE	Customer	EBT
Operational	Profit Margin	EBIT
Leadership/Employee/Culture	EVA	ROA
FFO	Other Non Individual	

List of Relative Performance Metrics Included		
Stock Price	ROIC	EPS
Sales	ROE	Unspecified
Operating Income	ROA	Profit Margin
Other Non Individual		

Appendix B. An Example Plan-based Awards and Its Vector Presentation

Below is the information on the CEO incentive plans of Saks Incorporated in fiscal year 2010 and its vector presentation, as well as the corresponding discussions quoted from the proxy statement.

The following quotes are from the CEO compensation discussion in the proxy statement of Saks Incorporated in fiscal year 2010. See the full proxy statement at `https://www.sec.gov/Archives/edgar/data/812900/000119312511118558/ddef14a.htm#toc156206_10`.

> *"... the HRCC established the following performance measures:* ***EBITDA*** *... and* ***Comparable Store Sales*** *... Our compensation programs contain several elements designed to reward executives for the accomplishment of both financial and non-financial performance objectives. For 2010, the HRCC determined that it was appropriate to continue to use the Company's earnings before interest, taxes, depreciation and amortization* ***("EBITDA")*** *excluding certain non-recurring items as a key performance measure for the payment of* ***annual cash bonuses*** *and* ***performance awards****. ..."*
>
> *" ... Long-term incentives: variable element of compensation comprising (i)* ***performance shares and performance units*** *to reward financial performance such as the achievement of EBITDA targets and other key financial measures and strategic corporate initiatives ... the HRCC will grant additional* ***time-based restricted stock awards*** *outside of the annual grants in order to motivate, reward and retain key executives. ..."*
>
> *"... The restricted stock awards vest 100% in* ***three years from the grant date****. ..."*

Therefore, the following entries in the CEO compensation vector are equal to one:

(1) Cash Cliff at Year 1 based on Absolute 1-Year EBITDA
(2) Cash Cliff at Year 1 based on Absolute 1-Year Other Nonindividual Peformance
(3) Cash Ratable at Year 2 based on Absolute 1-Year EBITDA
(4) Cash Ratable at Year 2 based on Absolute 1-Year Other Nonindividual Peformance
(5) Cash Ratable at Year 3 based on Absolute 1-Year EBITDA
(6) Cash Ratable at Year 4 based on Absolute 1-Year Other Nonindividual Peformance
(7) Stock Cliff at Year 3 based on Absolute 1-Year Other EBITDA
(8) Stock Cliff at Year 3 based on Absolute 1-Year Other Nonindividual Peformance
(9) Stock Ratable at Year 3 based on No Performance Basis

The rest of the entries are equal to zero.