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Why Have CEO Pay Levels Become Less Diverse?

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Abstract

We document that the cross-sectional variation in CEO pay levels has declined precipitously, both at the economy level and within industry and size groups. We find evidence consistent with one explanation; reciprocal benchmarking (i.e., firms including each other in the set of peers used to benchmark pay). We find support for three factors contributing to the rise in reciprocal benchmarking; the mandatory disclosure of compensation peer groups, say on pay, and proxy advisory influence. Finally, we find that reciprocal benchmarking has meaningful economic consequences; lower external tournament incentives, lower risk-taking, lower stock performance, and higher stock return synchronicity within industries.

Keywords: Variation in executive pay; pay diversity; compensation benchmarking; pay transparency; pay disclosure; tournament incentives

JEL Classifications: G3, G34, G38, M12, M52)

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1 . Introduction

This paper documents a new stylized fact; over the last decade, the cross-sectional variation in CEO pay levels (i.e., the "second moment" of pay) has declined precipitously (see Figure 1). We obtain this result from a wide sample of over 5,000 publicly-listed U.S. firms, spanning from 2002 to 2018. The decline in cross-sectional variation in CEO pay levels (henceforth "pay variation" or "pay dispersion") holds not only at the economy level but also within industries and industry-size groups (see Figure 2). The empirical pattern is robust; it is not sensitive to industry classifications, the exclusion of smaller firms, to the choice of sample period, and to the measurement of total compensation (it holds for both short-term and long-term compensation components).

We provide one explanation for this secular decrease in pay variation; reciprocal benchmarking – i.e., firms including each other in the set of peers used to benchmark pay levels. Reciprocal benchmarking can result in lower pay variation in the cross-section since pay levels are often set based on the pay level of the compensation peer group (with deviations above the median pay level of the compensation peer group being difficult to justify). As illustrated in Figure 3, introducing a common policy of benchmarking compensation to firms within the same industry and of similar size leads to a decrease in pay variation (i.e., a "convergence" of pay levels) within industry-size groups. In the extreme case that all firms within the group used the same benchmarking criterion (e.g., set compensation to the median pay of compensation peers) there would be no variation in pay levels.

Our empirical firm-level tests are based on a broad sample of U.S. public firms including the constituents of the Russell 3000 index from 2002 to 2018. We start by providing descriptive evidence supporting the notion that reciprocal benchmarking has increased significantly in recent years, and that this increase has contributed to less pay variation. Figure 4 plots the compensation peer networks for a random sample of firms in two years of our sample period: 2008 and 2013. The figure shows a decrease in "star formations" (i.e. nodes that are solely connected with a central node) and an increase in "benchmarking clusters" (i.e., clusters of firms referencing one another). Further, the simulation exercise in Figure 5 explores a hypothetical scenario of reciprocal benchmarking in which all firms switch to choosing their

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compensation peer group based on industry and size (this selection criterion – supported by proxy advisers and a number of asset managers – is increasingly common among public firms). The simulation departs from actual compensation values and actual peer groups in 2007 (the first year when firms had to disclose compensation peer groups) and sets subsequent compensation levels at randomized target percentiles of synthetic peer groups based on industry and size. As shown in Figure 5, the result is a significant decrease in pay variation in the economy.

The first set of systematic tests of our hypothesis is conducted at the "group-year level". That is, we compute pay variation for groups of firms in the same industry and in the same size-quintile in a given year (i.e., we construct observations at the industry-size-year level). Our group-year level measure of pay dispersion is the standard deviation of CEO pay scaled by the median level of CEO pay.[1] Our group-year level measure of reciprocal benchmarking is based on the social network literature, and measures the fraction of bidirectional links in a network (Newman, 2010).[2] In our setting, a linkage in the compensation peer network is defined by whether one firm includes the other in its compensation peer group. As such, a double linkage between a pair of firms indicates the presence of reciprocal benchmarking. We find a statistically significant increase in reciprocal benchmarking within industry-size groups and a strong, negative relationship between the CEO pay dispersion and the degree of reciprocal benchmarking within industry-size groups.

To further sharpen identification, we exploit the granularity of our data by conducting a parallel analysis at the firm-year level (which allows us to control for firm-specific determinants of pay). We compute CEO pay variation at the firm-year level as the standard deviation of CEO pay of the firm's compensation peers scaled by the median CEO pay of the peers in that year. In parallel to the group-year level tests, we measure reciprocal benchmarking at the firm-year level as the fraction of compensation peers that reference back the base firm. Consistent with the patterns documented at the group-year level, we find a significant decline in pay variation within firms' compensation peer groups, significant increases in reciprocal benchmarking, and a strong negative relationship between the two, even after

[1] We scale the standard deviation since CEO pay has a non-stationary distribution (i.e. average pay is increasing over time). To compare dispersion across time hence requires a dimensionless measure of dispersion, which is achieved by scaling the standard deviation of pay by its average (Cox and Lewis, 1966).

[2] In the Internet Appendix, we also provide results with two alternative measures of reciprocal benchmarking, *Transitivity* and *Density*. The three measures are illustrated in Figure A.1.

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including year and firm fixed effects.[3]

We examine three potentially confounding drivers of the pattern in Figure 1 (i.e., the secular decline in pay dispersion); i) a change in firms' fundamentals, ii) the increase in pay levels, and iii) a change in the rules governing the public reporting of total compensation. As further discussed below, we find no empirical support for the notion that these three factors induce the downward trend in Figure 1.

We next examine three institutional developments potentially contributing to the recent increase in reciprocal benchmarking. The first one is the recent SEC mandate to publicly disclose the set of firms selected by the board to benchmark executive compensation levels (i.e., the compensation peer groups).[4] The mandatory disclosure of compensation peers could have induced reciprocal benchmarking to the extent that such disclosure reveals whether a firm deviates from the standard practice of benchmarking compensation to industry peers of similar size, a deviation that is often interpreted as poor governance.[5] The second institutional development is "say on pay" (SOP), namely the requirement introduced by the Dodd-Frank Act that the compensation packages of public firms' top executives be subject to shareholder vote. SOP could have induced reciprocal benchmarking to the extent that benchmarking pay to firms in a different industry-size group could elicit a negative voting reaction.[6] The third institutional development is the growth in passive investing and the corresponding increase in the influence of proxy advisory firms (Malenko and Shen, 2016; Spatt, 2021). The reliance of passive investors on proxy advisers could have induced reciprocal benchmarking since proxy advisers' voting recommendations are commonly based on benchmarking pay to firms in the same industry-size group.[7] The Internet Appendix provides several anecdotes

[3]We also compute the two alternative reciprocal benchmarking measures *Transitivity* and *Density* at the firm-level by using the links among a firm's compensation peers. We then repeat the firm-level analyses using those measures and find similar results (see the Internet Appendix).

[4]The SEC mandate (17 CFR § 229.402 section l) came into effect in 2007. Almost no firm voluntarily disclosed its compensation peers before.

[5]Asset managers frequently mention industry and size as objective criteria for appropriate compensation peers and use them to arrive at say on pay vote decisions (e.g., Blackrock, 2019, 2; T. Rowe Price, 2019, 6-7).

[6]While say on pay proposals are not binding, failing to obtain majority support can trigger lawsuits and cause reputational losses for directors (Brunarski, et al., 2017). Prior literature documents that firms respond to weak say on pay votes by changing controversial pay components and reducing executive pay (Ferri and Maber, 2013; Denis, Jochem, and Rajamani, 2020).

[7]ISS (the largest proxy advisory firm) primarily uses industry classifications and relative size thresholds to identify a set of appropriate market peers (ISS, 2012, 2017). Glass Lewis uses Equilar's Market Peers to formulate their say on pay vote recommendations for investors, which are based on the reciprocity of disclosed

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on how these institutional developments conjointly increase reciprocal benchmarking.

The notion that these three institutional developments induce reciprocal benchmarking finds support in the data. First, we examine the effect of the introduction of the SEC mandate to publicly disclose compensation peers. At the group-year level (i.e., industry-size-year), we find that CEO pay dispersion decreases in the years after the disclosure regime came into effect, but not before. We also exploit that the regulatory process of the 2006 SEC rule was relatively quick, leaving no time to modify compensation peer groups in the year in which the mandate became effective (Faulkender and Yang, 2013). This institutional feature allows us to analyze cross-sectional variation in the composition of compensation peer groups prior to the implementation of the rule. Tellingly, we find that industry-size groups with less reciprocal benchmarking according to first-time compensation peer disclosures exhibit more pay dispersion prior to the mandate and more pronounced declines of pay dispersion soon after the mandate. Consistently, in firm-year level analyses we find that the post-2007 gradual increase in reciprocal benchmarking is concentrated among firms that, in their first-time compensation peer disclosures, report peer groups that are less aligned with asset managers' and proxy advisers' policies.

Second, we examine the potential effect of SOP. Using a difference-in-differences framework, we examine whether firms modify their compensation peer groups after receiving a weak SOP vote. We observe significant increases in reciprocal benchmarking in the two years following the weak vote.[8]

Third, we test the potential role of proxy advisors in the secular increase in reciprocal benchmarking. Following Malenko and Shen (2016), we use a regression discontinuity design that exploits the fact that ISS's scrutiny on executive pay policies in 2010 and 2011 was based on an arbitrary performance threshold. We find that firms whose performance falls below the threshold modify their compensation peer groups in ways that result in a strengthening

compensation peer references in the Russell 3000. Some other approaches to select compensation peers are more sophisticated. For example, Equilar determines the 15 companies with the strongest connections to a target firm as judged by incoming peer references and the peers of (incoming) peers. In 2017, ISS Corporate Solutions launched a similar product ("Peer Architect") for its clients. However, these "wisdom of the crowd" (ISS, 2018) and "who you know, and who knows you" (Equilar, 2018) approaches also have the potential to further increase reciprocal benchmarking and nurture the emergence of compensation peer clusters.

[8]The first two anecdotes in the Internet Appendix illustrate the effect of a weak say on pay vote on boards' deliberations, changes to their peer groups and the consequences for reciprocal benchmarking.

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of reciprocal benchmarking.

To further relate reciprocal benchmarking to the growth in passive investing and proxy adviser influence, we examine the effects of ownership concentration and investors' historic reliance on proxy advisers' voting recommendations. In firm-year level analyses, we find that reciprocal benchmarking decreases with block ownership and increases with ownership dispersion. Moreover, we find that reciprocal benchmarking increases with the fraction of investors that routinely vote with proxy adviser recommendations. That is, reciprocal benchmarking appears to be higher when shareholders have weaker monitoring incentives and are more likely to rely on proxy advice.

Our last set of tests analyze whether the documented decline in pay variation has meaningful consequences for firm outcomes. In a first step, we explore whether the decline in pay variation affects managerial incentives, and more specifically "tournament incentives" among top executives in the industry. Following Coles, Li, and Wang (2018), we measure external tournament incentives as the compensation gap between a CEO at one firm and the second highest-paid CEO among its industry peers. As explained by these authors, this gap measures the pay aspiration of the CEO; if successful, the CEO could receive an offer from a higher paying peer or renegotiate her/his pay based on such pay a benchmark. Consistent with lower pay variation resulting in lower values of Coles et al. (2018)'s measure of tournament incentives, we observe a gradual decline in tournament incentives within industries as well as within compensation peer groups. Further, these declines are negatively correlated with the increases in reciprocal benchmarking in industries and peer groups.

A reduction in tournament incentives is important because prior studies (e.g., Coles, Li, and Wang, 2018; Huang, Jiang, and Xie, 2020) show that such incentives have significant effects on key firm outcomes, including on corporate risk-taking and firm performance (external tournament incentives induce managers to improve performance through greater risk-taking). Consistent with this, we find that a firm's equity return volatility and its stock performance is positively related to pay variation in the peer group and negatively related to reciprocal benchmarking. These patterns also hold when we instrument the pay variation in peer groups using idiosyncratic equity shocks to firm's compensation peers (Leary and Roberts, 2014), or when we replace equity return volatility with alternative measures of

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corporate risk-taking used in prior literature (ROA-, earnings- or cashflow volatility).

Finally, we test whether the decline in industry tournament incentives results in greater co-movement of stock returns among industry peers. Based on the asset pricing literature (e.g., Roll, 1988; Chen, Goldstein, and Jiang, 2007), we measure stock return synchronicity based on the extent to which firms' stock returns are explained by industry returns (we focus on industry affiliation as this is the most ubiquitous criteria for compensation peer groups). We find a substantial increase in the co-movement of firms' stock returns with those of their industry peers. The increase is positively related to the increase in industry-level reciprocal benchmarking even after the inclusion of year fixed effects to account for time trends in both variables. Taken together, these results suggest that the decline in pay variation induced by reciprocal benchmarking has meaningful consequences for managerial behavior, firm outcomes, and pricing.

Our study contributes to prior literature that studies the evolution of compensation practices over time. This prior work focuses on the mean of the cross-sectional distribution of CEO pay levels (e.g., Jensen and Murphy, 1990; Hall and Liebman, 1998; Murphy, 1999; Bebchuk and Grinstein, 2005; Gabaix and Landier, 2008; Frydman and Jenter, 2010; Frydman and Saks, 2010; Shue and Townsend, 2017). Instead, we examine the variation in the cross-sectional distribution of CEO pay levels. In contrast to the secular increase in CEO pay, we document a stark decline in pay dispersion in recent years, a decline that appears to be intimately associated with recent institutional developments. In this regard, our paper is part of a nascent literature uncovering the effect of these institutional developments on several aspects of the design of compensation contracts, including the structure of the contract (Cabezon, 2021), the benchmarking to "pseudo-peers" (Kalpathy, Nanda, and Zhao, 2021), and the variation in pay levels (our paper).[9]

Our study also adds to prior literature on compensation benchmarking. This literature examines the motivations underlying peer selection and finds evidence consistent with peer group choices reflecting economic forces in the market for managerial talent (Bizjak, Lemmon, and Naveen, 2008; Albuquerque, De Franco, and Verdi, 2013; Cadman and Carter,

[9]In addition to the focus on the variation in pay levels rather than on other aspects of compensation contracts, our study differs from this contemporaneous work in that we propose one specific mechanism driving the convergence in pay, namely *the rise in reciprocal benchmarking* in compensation peer networks.

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2014). However, other papers suggest that compensation benchmarking leads to pay inflation (Bizjak, Lemmon, and Nguyen, 2011; Elson and Ferrere, 2013; Faulkender and Yang, 2010, 2013). We complement this literature by providing evidence that recent institutional developments have led to an increase in reciprocal benchmarking, a change that appears to have first-order economic consequences.

The results of this study also inform the ongoing regulatory debate on pay transparency (e.g., Mas, 2016; Baker, et al., 2019; Bennedsen, et al., 2018). Our evidence suggests that the disclosure of compensation peers may encourage a one-size-fits-all approach to the selection of these peers. We also show that this approach has first-order economic consequences that are not trivial to interpret from a welfare perspective; weaker tournament incentives, less risk-taking, lower performance, and higher stock co-movement.

Our evidence on the consequences of applying a uniform criterion to select compensation peers should be of interest for regulators and market participants. Over the past two decades, firms have found themselves under growing scrutiny from investors, proxy advisers, regulators and the public to justify their pay policies. Similarly, proxy advisers are put under the spotlight by regulators and corporate lobby groups to publicize and justify their assessment criteria (e.g., Posner, 2018; Financial Times, 2019). Critically, one of these criteria is that firms should benchmark executive compensation against other firms in the same industry and with similar size.

As a final remark, we clarify that we do not claim that reciprocal benchmarking is the only driver of the secular decline in pay dispersion documented in Figure 1. That is, this paper proposes one explanation for this pattern, but there could be others. We hope that our analysis helps promote a debate on the causes and consequences of the secular decline in pay dispersion, a phenomenon about which – to the best of our knowledge – there is currently little awareness. We look forward to future research shedding additional light on this phenomenon.

2. Background, literature and hypothesis

Attracting and retaining managerial talent is a key challenge for companies and their boards. To offer competitive pay to their executives, compensation committees routinely

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engage in compensation benchmarking that ties the benefits offered to executives to those of their labor market competitors. Compensation consultants play an important role in this process by advising the board in choosing compensation peers and compiling their pay information (Murphy and Sandino, 2020).

Responding to investor concerns about powerful CEOs manipulating the peer groups by selecting highly-paid peers, the SEC issued in December 2006 new regulation that mandated firms to disclose the identity of their compensation peers. Researchers have found mixed evidence on the effect of this regulation on firms' opportunistic selection of compensation peer groups. Bizjak, Lemmon, and Nguyen (2011) and Faulkender and Yang (2010, 2013) provide evidence that compensation benchmarking contributes to pay inflation among poorly governed firms while Bizjak, Lemmon, and Naveen (2008), Albuquerque, De Franco, and Verdi (2013), and Cadman and Carter (2014) find that, for the average firm, peer group choices reflect features of the managerial labor market and help with the design of pay packages to attract and retain talent. However, transparency on compensation peers may have other, more complex effects. Choi, Cicero, and Mobbs (2019) report evidence that the compensation peer disclosure regulation by the SEC reveals information to executives about their outside opportunities, and has led to compensation increases and to a greater likelihood of accepting positions at firms included in the compensation peer group.

Mandatory disclosure may also increase the influence of outside parties. Notably, since the disclosure of compensation peers, proxy advisers have begun to include compensation peer groups in their assessments and vote recommendations (proxy advisers' policies usually define compensation peers based on industry affiliation and size).[10] As shown in prior literature, such vote recommendations have a large influence on vote outcomes (e.g., Ertimur, Ferri, and Oesch, 2013; Iliev and Lowry, 2015; Malenko and Shen, 2016). As a consequence, a number of firms conform to proxy advisors' policies to avoid negative voting recommendations (see Larcker, McCall, and Ormazabal, 2013, 2015, and Hayne and Vance, 2019 for examples of proxy advisory influence on stock option repricing and say on pay).

Using a uniform criterion to select compensation peers across the economy – for example,

[10]For example, ISS, the largest proxy advisory firm, has developed its own industry- and size-based peer selection methodology.

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including firms in the same industry and size quintile – faces the usual trade-off of imposing one-size-fits-all rules. On the one hand, such a criterion could reduce the scope for powerful CEOs to manipulate their own pay. On the other hand, however, the rule limits boards' discretion in tailoring pay policies to firm-specific needs. An overlooked aspect of this debate is that an identical selection criterion likely results in an increase in reciprocal benchmarking and an increase in the overlap of compensation peer groups. A uniform peer selection criterion can thus lead to the formation of "clusters" of compensation peers in which firms reference one another. As firms usually set pay levels at the median of their respective compensation peer groups, an increase in reciprocal referencing would result in a convergence of pay levels within these "clusters" of compensation peers.

3 . Data

Our sample for computing CEO pay dispersion at the group-level (i.e., industry-size-year level) contains all US firms in the Russell 3000 index from 2002 to 2018, which includes 5,927 distinct firms. We start in 2002 because prior to that year the executive compensation data readily available in commercial data sets is mainly restricted to the cross-section of firms in the S&P 1500. We obtain CEO compensation data from Execucomp, Equilar, and GMI.

For the firm-level tests, we supplement this sample with compensation peer group data from Equilar, AuditAnalytics and ISS IncentiveLab. Imposing non-missing data on firms' compensation peer groups restricts our sample period for the firm-level tests to 2007 to 2018. The reason is that information on compensation peer groups (which is essential for our analysis) is not available prior to 2007 when the disclosure of compensation peer data was not mandatory. This data requirement also excludes some Russell 3000 firms because small reporting companies with a public equity float of less than $75 million (or, if unavailable, with less than $50 million in annual revenues) are exempted from the requirement to disclose their compensation peer groups (17 CFR § 229.402 section l). We further collect accounting information from COMPUSTAT; stock prices from CRSP; information on firms' corporate governance practices from ISS RiskMetrics, Equilar, GMI, and BoardEx; data on CEO characteristics from Equilar and GMI; institutional ownership information from

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Thomson Reuters; and shareholder vote outcomes from ISS Voting Analytics.

After requiring non-missing data on firm characteristics we obtain a final firm-level sample of 21,138 observations for 3,879 distinct firms from 2007 to 2018, with an annual cross-section of about 2,200 firms per year (see Table 1). Table 1 provides further details about the sample, including yearly coverage and descriptive statistics of the variables used in our tests. The sample contains fewer observations in 2007 because not all firms disclosed compensation peers in the first year of the mandate (see White, 2007; 2008).

4. Pay dispersion and reciprocal benchmarking

4.1. Pay dispersion

We start by descriptively analyzing the evolution of CEO pay dispersion in the cross-section. We conduct this analysis using our initial sample of Russell 3000 firms between 2002 and 2018 (which includes 5,927 distinct firms), as this descriptive test does not require data on compensation peers.[11] For each year, we define pay dispersion as the standard deviation of total CEO pay divided by the median of total CEO pay. Total CEO pay is measured as the sum of salary, bonus, long-term incentive pay (including restricted stocks, stock options and multi-year non-equity incentives) and all other pay (such as pension contributions and the value of perquisites). We scale the standard deviation because executive pay has a non-stationary distribution, that is, its average is increasing over time. To compare dispersion across time requires a dimensionless measure of dispersion, which is achieved by scaling the standard deviation by the average (e.g., Cox and Lewis, 1966).[12]

Figure 1 plots pay dispersion and its 95 percent confidence interval for the Russell 3000 sample firms since 2002. The figure shows that executive pay dispersion remains roughly sim-

[11] Some analyses in the Internet Appendix shows pay trends extending back to 1994. Prior to 2000, coverage drops to Execucomp's S&P 1500 firms due to data availability. Data availability for 2018 is restricted to Execucomp's S&P 1500 firms (all our results are robust to excluding 2018).

[12] Standard deviation and variance are not dimensionless measures of dispersion because both increase mechanically as the magnitude of the underlying data increases. Hence, while the standard deviation may be increasing due to larger magnitude of the underlying values, actual dispersion may be declining if it increases by less than the shift in the distribution. For example, the median CEO pay level in our sample more than doubled between 2002 and 2016 from \$1.8 million to \$3.9 million while the standard deviation of CEO pay remained unchanged at \$6.3 million in 2002 and \$6.4 million in 2016, indicating lower pay dispersion in 2016. We use median pay (rather than mean pay) for scaling the variation in CEO pay because we are interested in the "typical" CEO's pay levels and not in the aggregate level of CEO pay (see Murphy, 2013, 9).

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ilar throughout fiscal years 2002 to 2009 but drops precipitously thereafter. Figure 2, Panel A repeats the analysis at the GICS 2-digit industry level. At the start of our sample, the difference across industries in their within-industry pay dispersion levels is large, ranging from 1.2 (in the materials industry) to 2.7 (in the financial industry). By the end of our sample period, this cross-sectional difference shrinks to values between 0.5 and 1.0. In the time-series, we observe a pervasive decline in within-industry pay dispersion across all 2-digit industry groups. Panel B of Figure 2 repeats the analysis at the industry-size level, using size-quintiles based on firms' market capitalization within a given industry-year. Panel B plots the average of the within industry-size group pay dispersion across years (plotting all groups separately would be confusing). Again, we find a noticeable decline in pay dispersion also within industry-size groups. Panel A of Table 2 confirms that the annual decline is statistically significant also within industry-size groups (t-statistics of 4.6 after including industry $\times$ size fixed effects).

The Internet Appendix presents the results of a battery of additional analyses to better understand the generalizability of the previous pattern. First, we explore the sensitivity of the pattern in Figure 2 to alternative industry classifications. As shown in Figure A.2, repeating the analysis using GICS2, GICS4, SIC1, SIC2, SIC4, FF12 and FF48 yields very similar results. Second, we analyze whether the pattern in Figure 1 is driven by the smaller firms in the Russell 3000. Figure A.3, shows that this is not the case; we find similar pattern as in Figure 1 when we repeat the analysis focusing on S&P 1500 firms and thus excluding the smaller constituents of the Russell 3000. Third, we repeat the analysis separately for short-term compensation (defined as the sum of salary and annual bonus) and long-term compensation (defined as the sum of stock awards, stock options and multi-year non-equity incentives). As shown in Figures A.4 and A.5, the secular reduction in pay dispersion holds for both types of compensation.[13] Fourth, we explore whether the previous patterns are sensitive to expanding our sample period. Figure A.6 shows that the decline in pay dispersion is a relatively new phenomenon; we do not observe such downward trend in the 1990's and in the early 2000's.

[13]Furthermore, Table A.2 confirms that the decline in the variation in pay structure is significantly correlated to the reciprocal referencing within peer groups, even after the inclusion of firm controls, industry $\times$ year, state $\times$ year and firm fixed effects.

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4.2. Reciprocal benchmarking and clusters of compensation peers

We next explore the validity of our conjecture that reciprocal benchmarking is a contributing factor for the decline in pay dispersion documented in Figure 1. We start by providing descriptive evidence supporting the notion that reciprocal benchmarking has increased significantly in recent years, and that this increase leads to less pay variation.

4.2.1. Descriptive evidence

Graphical evidence

We first conduct a graphical exercise to visualize whether there is an increase in reciprocal benchmarking resulting in the formation of "benchmarking clusters" (i.e., clusters of firms referencing each other as compensation peers). Figure 4 plots the compensation peer networks for a random sample of S&P 1500 firms in two years of our sample period: 2008 and 2013. We select 2008 for our early period because a substantial number of firms did not yet disclose compensation peer groups in 2007, the first year of the mandate (White, 2007, 2008). We select 2013 (several years after compensation peer disclosure became mandatory) to ensure that firms had sufficient time to modify their peer groups. To keep the figure readable, we plot the network graphs for a random sample of firms. The drawing procedure is as follows: we sort sample firms by their firm identifier (*gvkey*) and draw every 20th firm. We then add their compensation peers, the references among all selected firms and their peers, and plot the graphs using a Fruchterman-Reingold layout.

Figure 4 shows a marked shift in peer referencing decisions between 2008 and 2013. In the earlier part of the sample, firms frequently picked compensation peers that did not reference any of the firms' other peers. This is visible in the graph in form of "star formations" (see, e.g., bottom right corner of Figure A). Five years later, we observe many fewer of such star formations and many more instances in which the peers of a central node reference other peers (see, e.g., top left corner of Figure B). This visual change is consistent with firms increasingly referencing other firms that reference them back.

Evidence from simulations

To gauge the empirical validity of our reasoning that the increase in reciprocal benchmark-

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ing leads to less economy-wide pay variation, we conduct a simulation exercise. While reciprocal benchmarking should lead to pay convergence *within* groups of firms (e.g., industry-size groups under the industry-size benchmarking criterion), it is theoretically less clear what should occur to pay dispersion *across* groups. The effect of reciprocal benchmarking on pay dispersion is not straightforward ex-ante, as it depends on the number and size of compensation benchmarking groups (e.g., industry-size groups), the remaining connections across groups (along which within-group pay changes can propagate), and the frequency with which compensation peers change year by year (which could be due to, among other reasons, differences in firm growth resulting in changes in the composition of the size quintiles).

In our simulation, we explore a hypothetical scenario in which all Russell 3000 firms switch to choosing their compensation peer group based on industry affiliation and size, namely the methodology used by ISS (the largest proxy advisory firm) to assess compensation practices.[14] The simulation departs from actual compensation values and actual peer groups as disclosed in 2007 (since most of these groups were not defined based on a strict industry-size criterion). Subsequently we benchmark compensation (in year $t+1$) at the pay level (in t) of a synthetic peer group based on ISS's criteria (i.e., industry and size). That is, we simulate that boards include in their compensation peer groups only firms from the same industry and of similar size and then mechanically set CEO pay at a given target percentile of peers' pay (for example, at the median level of these firms).[15] Industry affiliation and size are based on actual data. The simulation allows for the possibility that not all firms use median peer pay level as benchmark; we set each firm's compensation to a random target percentile of the distribution of peers' pay levels.[16]

[14] We choose ISS's peer selection methodology for two reasons. First, ISS is the largest proxy advisory firm. Second, unlike other proxy advisors, ISS publicly discloses its peer group methodology. ISS's methodology selects for each firm at least 14 to at most 24 peers by choosing the most similar-sized firms from the same GICS6-industry and that are within 0.45-2.1 times relative sales (assets for financial firms) and within 0.2-5 times relative market capitalization. In cases when there are less than 14 potential peers from this procedure, ISS supplements peers by widening the industry definition to GICS4, and (rarely) further to GICS2 (see, e.g., ISS, 2012).

[15] We start the exercise in 2007 because this is the first year in which data on compensation peer groups became publicly available due to a new SEC disclosure rules. Starting in 2008, for each firm-year we reproduce the compensation peer group that ISS would have assigned following their peer group methodology based on firm characteristics in that year as obtained from Compustat (ISS, 2012).

[16] The target percentiles are drawn from a normal distribution with mean 50 and standard deviation of 12.5 so that 95 percent of these random numbers lie between 25 and 75, which is the range of pay target percentiles we observe in the data. Our inferences do not depend on this specific choice of the

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Figure 5 shows the simulated pay dispersion at the economy level between 2007 and 2018. As in Figure 1, for each year we plot the pay dispersion of the pooled sample of Russell 3000 constituents (solid line). Also as in Figure 1, we rescale pay dispersion relative to 2007 (because, as previously explained, in that starting year pay dispersion is computed based on actual data on compensation peer groups). To further examine the effect of a uniform industry-size criterion on firms' compensation peer groups, we also compute the change in pay dispersion within compensation peer groups (dashed line). Similar to Figure 1, Figure 5 shows a precipitous and persistent drop in pay dispersion. These results suggest that, although the ISS-compliant synthetic peer groups may vary over time due to differences in firm growth and changes in industry composition, this variation is not large enough to offset the drop in pay dispersion generated by reciprocal benchmarking.[17]

4.2.2. Systematic evidence

Prompted by the previous graphical and simulation-based evidence, we next conduct systematic tests of the hypothesis that reciprocal referencing leads to lower pay dispersion. We conduct these tests at the group-year level and at the firm-year level.

Analysis at the group-year level

The first set of tests is conducted at the group-year level. In particular, we compute our measures for groups of firms in the same GICS6 industry and the same size-quintile in a given year. We use the GICS6 industry classification because GICS is commonly used by proxy advisers and compensation consultants. Our group-year level measure of pay variation, *CEO pay dispersion*, is defined as the standard deviation of CEO pay of the industry-size group scaled by the median level of CEO pay in the group in that year. To measure the degree of reciprocal referencing at the group level, we borrow from the social network literature and

randomization parameters.

[17] As previously explained, in this analysis we set each firm's compensation at a randomized target percentile of the distribution of pay levels within the corresponding synthetic peer group. In Figure A.7, we show the results are qualitatively similar if all firms were to use the same percentile (e.g., the median). Figure A.7 also reveals that the decline in pay variation is largely unaffected by whether boards benchmark compensation to the median pay of their peer group (thick lines) or to an alternative percentile of peers' pay levels, say the 65^{th} percentile (see gray-dashed lines). Figure B in A.7 shows that the choice of the percentile matters for the *first* moment of pay (i.e., average pay) but not for the *second* moment of pay (i.e., pay dispersion), which is the focus of our study (see Figure A in A.7).

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construct *Reciprocity*, which is defined as the ratio of linkages in a given (directed) network that point in both directions to the total number of existing linkages. We compute *Reciprocity* for each industry-size group and each year starting in 2007 – the first year of public disclosure of compensation peers. While *Reciprocity* is a direct measure of our construct of interest (i.e. reciprocal benchmarking), the Internet Appendix includes robustness tests using two alternative measures for the degree of clustering in networks.[18]

Panel A of Table 2 tests whether there is a time-trend in *CEO pay dispersion* and *Reciprocity* at the group-level from 2007 (the first year of mandatory disclosure of compensation peer groups) to 2018. *Time trend* is a linear time variable, defined as t - 2006 (where t is the year of the observation). Models 4 and 8, which include Industry × Size group fixed effects, suggest that the (within-group) average decline in *CEO pay dispersion* is 0.018 per year and the increase in *Reciprocity* is 0.005. Cumulated over the 12-year sample period, the decrease in pay dispersion is 0.216 and the increase in reciprocity is 0.063. These are substantial changes considering that the corresponding (within-group) mean values of *CEO pay dispersion* and *Reciprocity* in 2007 are, respectively, 0.852 and 0.091.[19]

Panel B of Table 2 tests whether there is a statistically significant negative association between *CEO pay dispersion* and *Reciprocity*. Since both variables exhibit general annual trends, we add year fixed effects to ensure that the association is not confounded by time trends. As CEO pay dispersion may be correlated across groups in the cross-section and within groups in the time-series, we cluster standard errors by year and industry-size group. The results reveal a highly significant negative association between *CEO pay dispersion* and *Reciprocity*, which is robust to the inclusion of Industry × Size, Industry × Year, and Size ×

[18]The first alternative metric, *Density*, is defined as the ratio of existing linkages to the number of possible linkages in a network; it is zero for a network without any linkages and one for a complete network. The second alternative metric, *Transitivity*, is defined as the ratio of the number of 'triangles' found in a network over the number of possible 'triads' that exist in the network (triads and triangles are groups of three nodes; triangles are completely connected with each other while triads are not). Transitivity captures the frequency with which connected communities exist within a given network. Newman (2010, Ch. 7) provides further details on all three clustering measures and we illustrate the computation of these metrics in Figure A.1. Figure A.8 shows the relative increases in all metrics at the industry-size group and at the economy-level.

[19]In our context, *Reciprocity* is always less than 1 when computed at the group-level since the number of firms in industry-size groups are typically larger than the average number of compensation peers that firms select.

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Year fixed effects.[20] In model 2, which includes year fixed effects, a one standard deviation increase in reciprocity at the group-level is associated with a decline in CEO pay dispersion of (0.177*-0.237=) 0.04, which relates to a median and standard deviation of CEO pay dispersion at the group-level of 0.58 and 0.41.[21]

Analysis at the individual firm level

To sharpen identification, we further exploit our data by conducting parallel tests at the individual firm-year level. That is, we compute the previous measures of pay dispersion and reciprocity for each firm in a given year using data on the firm's compensation peers. In particular, *CEO pay dispersion* at the firm-year level is defined as the standard deviation of CEO pay of the firm's compensation peers scaled by the median level of CEO pay of these peers in a given year. In turn, *Reciprocity* at the firm-year level is defined as the fraction of compensation peers that reference back the base firm in a given year. This additional analysis allows us to exploit within industry-year variation and to control for firm-specific variation in the determinants of pay levels.[22]

Figure 6 plots *CEO pay dispersion* and *Reciprocity* computed at the firm-year level over the sample period. Consistent with the results at the group-year level, Figure 6 shows that the average firm roughly doubles the fraction of reciprocating peers from 20 percent in 2007 to 40 percent in 2018, while the pay variation within their compensation peer groups simultaneously dropped by one-third (from 0.9 to 0.6). The increase in reciprocity cannot be

[20] We obtain the same inference when we repeat the test using industry-only groups or industry-size group levels based on a broader industry classification (e.g., GICS 2).

[21] Table A.3 repeats the analysis of Table 2 using alternative measures of reciprocal benchmarking in networks, namely *Density* and *Transitivity*; the corresponding economic magnitudes for the associations shown in Panel B are 0.07 and 0.06, respectively.

[22] Specifically, our firm-year level results add fixed effects for industries and firm headquarter states (where CEOs are typically employed) to account for cross-industry differences in CEO pay and geographic segmentation of managerial labor markets. We further interact those fixed effects with years to allow industries and local labor markets to follow distinct time trends. Moreover, we add an extensive array of time-varying controls including on firm size (*log firm value*, an indicator variable for *S&P 1500 index membership*), firm policies (*net leverage*, *investment*, *R&D expenditures*), performance (*market-to-book ratio*, *stock performance*, *sales growth*), CEO characteristics (*CEO age* and *CEO tenure*), governance characteristics (the *fraction of independent directors*, the *number of board committees*, and indicator variables for *CEO-chairman duality*, a *classified board*, and a *lead director*), cumulative *CEO pay growth* as well as an indicator variable for *CEO turnover* in the prior year. To conserve space in Table 3, we suppress all the coefficients of the control variables and show the complete Panel B as Table A.4 in the Internet Appendix. We keep the same set of firm controls throughout the paper.

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driven by firms simply adding more compensation peers to their peer groups, as the average size of the compensation peer groups remains by-and-large stable across the sample period at about 17 peers (see Table A.1).

Table 3 tests the statistical significance of these patterns. Table 3, Panel A, shows that the decrease in *CEO pay dispersion* and the increase in *Reciprocity* over the sample period are highly significant. These patterns hold even after adding a large set of time-varying firm characteristics and firm fixed effects. As in the previous tests at the group-year level, we also find a negative and highly significant relation between *CEO pay dispersion* and an increase in *Reciprocity*. This result is robust to controlling for industry- and state-level time trends and to the inclusion of firm fixed effects (Table 3, Panel B). The economic magnitudes are also significant. In the tightest specification in column 5, a one standard deviation increase in *Reciprocity* is associated with a reduction in the CEO pay variation of (0.220*-0.171=) 0.04 (this decline compares to a median and standard deviation of 0.65 and 0.57 for *CEO pay dispersion*).[23]

In summary, the evidence in Figures 1 to 6 and Tables 2 and 3 draws a consistent picture of declining executive pay variation across the economy, within industry-size groups, and within compensation peer groups alongside an increase in reciprocal benchmarking of compensation practices. Taken together, the evidence is consistent with the notion that firms replace compensation peers that do not meet the industry-size peer selection criteria with others that do. Also in line with this idea, Figure A.9 in Internet Appendix II shows that compensation peers have become more similar in size and industry affiliation, and Internet Appendix I provides several examples from corporate disclosures.

4.3. Alternative explanations

After analyzing our previous evidence one could argue that, while reciprocal benchmarking is likely to be one driver of the pattern in Figure 1 (i.e., the secular decline in pay dispersion), there could be others. We agree. In fact, we do not claim that reciprocal benchmarking is the only or the most important driver of the pattern in Figure 1 and look forward to future research uncovering other potential causes of this secular trend. Thus, instead of

[23] Table A.4 reports the full table that includes the coefficients on control variables. Table A.5 provides firm-level results for the alternative metrics *Transitivity* and *Density*.

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analyzing all the possible explanations for the secular decline in pay dispersion (a task that exceeds the scope of this paper), this section focuses on alternative explanations that could confound our inferences.

4.3.1. Changes in firms' fundamentals

One potential explanation of the pattern in Figure 1 is that over the last decade there has been a gradual change in the fundamentals of the Russell 3000 constituents, which in turn has driven a change in the characteristics of executive compensation contracts. This change in fundamentals could be the result of index reconstitution (i.e., recently created firms entering the index and incumbent firms being excluded) or the result of an evolution among incumbent firms.

We analyze empirically these two possibilities. First, to reduce any effects due to firms entering and exiting our sample, Panel C of Figure A.10 excludes firms that have less than 10 years of consecutive coverage; the resulting pattern is similar to that in Figure 1. Second, we explore whether the pattern in Figure 1 is driven by changes in firm characteristics that prior literature has shown to be important determinants of pay levels. For example, the decline in pay dispersion could simply reflect that firms are getting more similar in size or profitability. We do not find any evidence in support of this alternative explanation; as shown in Figure A.11, we do not observe any downward trend parallel to that in Figure 1 in the dispersion of firm characteristics over the sample period.[24]

4.3.2. Secular increase in pay levels

Prior literature explains that pay levels have increased substantially over the last decades (e.g., Gabaix and Landier, 2008). This could affect our inferences to the extent that our measure of pay dispersion is scaled by the (median) compensation level. We conduct two analyses to understand whether the pattern in Figure 1 merely reflects a secular increase in pay levels rather than a change in the distribution of CEO pay levels.

First, in Figure A.12, we examine any changes in the "shape" of the CEO pay distribution over time. In particular, we plot for each year several percentiles of the CEO pay

[24]To further mitigate this concern, we control for firm characteristics in all firm-level tests.

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distribution. Since percentiles are not dimensionless measures (i.e., they increase alongside the growth in CEO pay), we scale them by median pay in the respective year to interpret them in terms of multiples-of-median pay. We observe that the right tail of the pay distribution (i.e., the 90th and 95th percentiles) has dropped by 45-50 percent over the sample period (from about 7.6 and 4.9 to 3.6 and 2.8 respectively). Importantly, the lower percentiles have however remained stable across years. For example, as a multiple-of-median pay, the 25th (10th) percentile was 0.47 (0.26) in 2002 and 0.53 (0.25) in 2018. Furthermore, the interquartile range (IQR) – the difference between the 25th and 75th percentile – has dropped by about one-third from 1.77 times median pay in 2002 to 1.26 times median pay in 2018. Second, Figure A.13 plots the skewness of CEO pay between 2002 and 2018. The figure shows a gradual and persistent decline in the skewness of the CEO pay distribution since the SEC disclosure mandate. In sum, the evidence in Figures A.12 and A.13 suggest a compression of the "shape" of the CEO pay distribution, which is inconsistent with the notion that the pattern in Figure 1 merely reflects a secular increase in pay levels that arises from dividing by the median pay level.[25]

4.3.3. Changes in the measurement of pay levels

The SEC requires firms to report the grant date fair value of equity compensation for the named executive officers in the Summary Compensation Table of the proxy statement as part of their "Total Compensation." However, from December 15, 2006 until December 20, 2009, the SEC required firms to replace this value with the stock and option expense (ASC 718 expense) recognized by the firm (the rule was reversed after 2009).[26]

This change in the measurement of pay levels is unlikely to affect our inferences. First, the reporting change affects only three years of our sample period and does not explain the gradual decline in pay dispersion after 2009, or why the pay decline would be associated with reciprocal benchmarking. Second, our firm-level tests include Year and Industry × Year fixed effects and thus controls for the potential effect of changes to reporting rules on

[25] To further mitigate this concern, we also control in our firm-level tests for firms' cumulative CEO pay growth.

[26] See SEC's 2006 "Executive compensation disclosure" release No. 33-8765 [71 FR 78338] and SEC's 2009 "Proxy disclosure enhancements" release No. 33-9089 [74 FR 68334]. See also Cadman, Carrizosa, and Peng (2020) for more details.

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pay dispersion. Third, we also observe a decline in pay dispersion among the components of the compensation package unaffected by the change in the rule governing the reporting of total compensation, namely salary and annual bonus (see Table A.2).

5. Institutional developments driving reciprocal benchmarking

We next examine the empirical validity of three institutional developments potentially contributing to the recent increase in reciprocal benchmarking; i) the SEC's mandate to disclose compensation peer groups as of 2007, ii) the introduction of "say on pay", and iii) the growth in passive investing along with an increase in reliance on proxy advisory firms.

5.1. The SEC's mandate to disclose compensation peer groups

To analyze the potential effect of the 2006 SEC disclosure rule, we first test whether there is a change in CEO pay dispersion at the group-year level before and after the introduction of the SEC rule that mandated the public disclosure of compensation peers as of 2007. Table 4 presents the results. For the period 2004-2007, models 1 and 2 show no trend in pay dispersion; the coefficient on *Time trend* (a linear time variable) is insignificant in the univariate model (-0.002 with t-statistics of -0.17) and remains close to zero when including Industry $\times$ Size fixed effects (0.001 with a t-statistic of 0.02). These results are in stark contrast with those corresponding to the 2008-2011 period (i.e., models 3 and 4); the univariate model finds an annual decrease in pay dispersion of -0.050 percent (t-statistic of -5.91) and -0.052 (t-statistic of -2.36) when including Industry $\times$ Size fixed effects.[27] Models 5 and 6 pool the observations and introduce an indicator variable for the period 2008-2011 (*Post*). The results confirm that the difference in the previous patterns is statistically significant.

A direct comparison of reciprocal benchmarking before versus after the introduction of the rule is not possible because there is no available data on compensation peers prior to

[27] We include 2007 in the pre-disclosure period because pay dispersion in 2007 is yet unlikely to be affected by the SEC disclosure rule. This is because compensation committees obtain information about peers' prior fiscal year pay approximately two quarters prior to the end of their fiscal year (Pearl Meyer and Partners, 2014; Meridian, 2015; WillisTowersWatson, 2019). As such, a compensation package of a firm with December fiscal year end (disclosed in April 2007) was probably designed in September 2006 based on available information on peers' pay levels as of June 2006, namely before the implementation of the new disclosure requirements.

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the SEC disclosure mandate. However, our setting offers the opportunity to test the effect of the rule by exploiting cross-sectional variation in the composition of compensation peer groups prior to the implementation of the rule. As explained by Faulkender and Yang (2013, p. 809), the regulatory process of the 2006 SEC rule was relatively quick, leaving no time to modify compensation peer groups in the year in which the mandate came into effect. As such, the first-time disclosures in 2007 reflect pre-disclosure choices of compensation peers. If the SEC disclosure mandate increased the pressure to implement an industry-size based benchmarking policy, we expect that industry-size groups with less reciprocal benchmarking according to first-time disclosures of compensation peers exhibit larger pay dispersion prior to the mandate and more pronounced declines of pay dispersion soon after the mandate.

Models 7 and 8 of Table 4 test whether this is the case; we interact *Time trend* with *Low initial reciprocal benchmarking*, an indicator variable for industry-size groups with above-median levels of initial reciprocal benchmarking (i.e., reciprocal benchmarking measured in 2007). Consistent with a greater need to adjust compensation benchmarking under the disclosure regime, model 7 reveals that industry-size groups with lower initial levels of reciprocity exhibit significantly stronger declines in pay dispersion in the years after peer group disclosure becomes mandatory. This pattern is robust to adding Industry $\times$ Size fixed effects (model 8).

In parallel, we analyze firm-level cross-sectional variation in the increase in *Reciprocity* after the SEC mandate. Again, if the SEC mandate increased the pressure on firms to conform with an industry-size based benchmarking policy, we would expect firms with poorer initial compliance to react more strongly in the years immediately following the regulatory change. We hence limit the test to the initial three years after the mandate and explore the following sources of cross-sectional variation measured in 2007 (i.e. the first year of disclosure): i) the initial level of reciprocal benchmarking (models 1 and 2); ii) the initial level of compliance with the benchmarking criteria commonly used by asset managers (models 3 and 4); and iii) the initial level of compliance with the peer selection methodology adopted by ISS (models 5 and 6).

Accordingly, we regress *Reciprocity* on the interaction of *Time trend* with the following three variables. *Low initial reciprocating benchmarking* is an indicator variable that equals

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one (zero) if a firm has a below-median (above-median) degree of reciprocity in its peer group in 2007. Based on the publicly disclosed policies of the largest asset managers (e.g., Blackrock, 2019, 2; T. Rowe Price, 2019, 6-7), we define *Low initial compliance with asset managers' criteria* as an indicator variable that equals one (zero) if the firm has in 2007 an above-median (a below-median) fraction of peers that fall outside a firm's GICS2 industry code or have a market capitalization of more than 2 times that of the firm's. Finally, based on the publicly disclosed policies of the largest proxy adviser (ISS, 2012), we define *Low initial compliance with proxy adviser criteria* as an indicator variable that equals one (zero) if the firm has an above-median (a below-median) fraction of peers that are non-compliant with ISS's compensation peer selection methodology (see footnote 14 for details).

Table 5 presents the results. We observe a significant positive time trend in reciprocity (the magnitude of the change ranges between 0.059 and 0.062) following the disclosure mandate. The trend is particularly pronounced among firms with lower initial levels of reciprocal benchmarking and among firms less compliant with asset managers' and/or proxy advisers' benchmarking policies. The differences between subsamples are substantial; the coefficient on the interaction between *Time trend* and the three indicator variables capturing cross-sectional variation ranges between 0.015 and 0.017.

Taken together, the evidence in Tables 4 and 5 indicate that pay dispersion started to decline only after the disclosure mandate and that the decrease in pay dispersion and the increase in reciprocal benchmarking are more pronounced among firms with lower levels of reciprocal benchmarking at the time when the mandate took effect. While this does not necessarily establish that the SEC mandate triggered the pattern in Figure 1, the evidence is consistent with the notion that the rule has played a role in the decline of pay variation and the accompanying increase in reciprocal benchmarking.

5.2. Say on pay

Introduced in 2011 as part of the Dodd-Frank Wall Street Reform and Consumer Protection Act, "say on pay" (SOP) stipulates that any publicly listed corporation in the U.S. must submit the compensation of its top executives to shareholders for an advisory vote. Firms are required to disclose the results and report on their response to the voting results. Prior litera-

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ture provides evidence that boards make substantial changes to compensation practices after obtaining weak shareholder support in SOP proposals (e.g., Ferri and Maber, 2013; Ertimur, Ferri, and Oesch, 2013; Correa and Lel, 2016; Denis, Jochem, and Rajamani, 2020). There is also evidence that SOP has labor market consequences for directors. For example, Brunarski, et al. (2017) find that directors at firms receiving low SOP support experience reductions in external directorships, compensation committee positions and director compensation.

Since the introduction of SOP, the appropriate composition of compensation peer groups is one of the criteria used by proxy advisers and asset managers to evaluate firms' pay practices. The policies of proxy advisers and asset managers often mention benchmarking based on industry and size as the appropriate way to select compensation peers (e.g., Equilar, 2015, 14; Blackrock, 2019, 2; T. Rowe Price, 2019, 6-7). After receiving a weak SOP vote, boards may therefore feel pressured to follow this benchmarking criterion, thereby inducing an increase in reciprocal benchmarking. The Internet Appendix provides two anecdotes consistent with the notion that SOP induces firms to select compensation peers with the same industry affiliation and of similar size.

To analyze the effect of SOP on firms' peer choices, we conduct a firm-year level analysis of changes in reciprocal benchmarking in a narrow two-year window after a firm's first weak SOP vote. The dependent variable, *Reciprocity*, is defined as in prior firm-year level tests (i.e., the fraction of reciprocating firms in the compensation peer group). On the right-hand side, *Weak-vote* equals one if the firm ranks in the lowest decile of the distribution of SOP vote support in that year (in our sample, the lowest decile includes SOP proposals that obtained less than 75 percent of the votes).[28] We interact this variable with *Post*, namely an indicator variable for the years after the weak SOP vote.

Table 6 presents the results. Models 1 and 2 are restricted to observations with *Weak-vote=1*, while models 3 and 4 also include control firms that never received a weak SOP vote

[28] Vote support in SOP proposals is highly skewed. In our sample covering over 13,000 such votes, the mean (median) support is 90.9 percent (95.8 percent) and only 2 percent of SOP proposals obtain less than 50 percent support. However, proxy advisory firms and compensation consultants consider vote support below 70 percent already as a negative view of firms' compensation practices. ISS, for example, adopted a policy in November 2011 to provide case-by-case voting recommendations on compensation committee members if a company's prior year say on pay vote outcome was below 70 percent. In 2016, Glass Lewis and ISS established so-called "red zones" that trigger greater scrutiny when opposition votes exceed 20-25 percent. (The results in Table 6 are robust to using 70 percent as a weak-vote threshold.)

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(i.e. with *Weak-vote=0*). The specifications also include Industry × Year and State × Year fixed effects as well as a large set of firm controls, including annualized stock returns, sales growth and market-to-book ratio (see captions of Table 3 for the complete list of included controls). We include these control variables because weak SOP votes typically follow poor performance (e.g., Ferri and Maber, 2013; Fisch, Palia, and Solomon, 2017). As shown in Table 6, we observe significant increases in *Reciprocity* in the two years after a firm experiences a weak SOP vote (t-statistics of 3.5 or above). The result is not sensitive to the inclusion of control firms and fixed effects (columns 3 and 4).

5.3. Growth in passive investing and reliance on proxy advisory firms

The third institutional development potentially affecting reciprocal benchmarking is the growth in passive investing along with an increased reliance on proxy advisory firms. Passive investing has experienced a spectacular growth in recent years thanks to popular investment vehicles such as index funds and ETFs (e.g., Sushko and Turner, 2018). While passive investing offers significant advantages to investors (notably diversification and low management fees), such an investment strategy generates relatively weak incentives to monitor portfolio firms (Almazan, Hartzell, and Starks, 2005). As such, a number of passive institutional investors rely partially or completely on proxy advisors' voting recommendations.[29] This is important in our setting, as proxy advisors commonly scrutinize the constituents of firms' compensation peer groups when examining whether firms offer their executives above market-level compensation. In particular, proxy advisers compare firms' executive compensation levels to the median pay of peer groups defined by industry affiliation and size. Peer selections that deviate from these criteria are often considered a poor governance practice by proxy advisers and investors.[30]

[29] Prior literature provides abundant evidence of this. For example, Brav, Cain, and Zytnick (2019) report that institutional investors are much more likely to follow general ISS recommendations than retail investors. Iliev and Lowry (2015) find that over 25 percent of mutual funds almost entirely rely on ISS recommendation. In the context of say on pay votes, Ertimur, Ferri, and Oesch (2013) show that proxy advisor recommendations are the key determinant vote outcomes while Malenko and Shen (2016) estimate that a negative ISS vote recommendation reduces shareholder support by 25 percentage points.

[30] ISS uses its peer selection methodology not just used for its "multiple of median test" but also as an input in various other pay screens that underpin its pay-related vote recommendations; specifically, its quantitative pay-for-performance screen, relative degree of alignment screen, financial performance assessment, and qualitative review of the pay-for-performance analysis (see §15, 17, 19, 24 in ISS, 2019).

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We therefore explore whether the recent growth in passive investing and the reliance on proxy advisory firms is a contributing factor to the increase in reciprocal benchmarking. To do so, we conduct two tests. First, we make use of the quasi-experiment suggested by Malenko and Shen (2016) to estimate the influence of a negative ISS vote recommendation. Second, we investigate whether reciprocal benchmarking varies with ownership dispersion and with shareholders' propensity to vote with ISS.

5.3.1. Quasi-experiment

Following Malenko and Shen (2016), we use a regression discontinuity design based on ISS's decision to subject firms to greater scrutiny based on an arbitrary performance cut-off. As shown by Malenko and Shen (2016), such greater scrutiny has a material effect; firms falling below the performance cut-off exhibit a higher probability of receiving a negative vote recommendation by ISS and receive 25 percentage points lower shareholder support.

More specifically, we exploit ISS's 2010-2011 policy to subject firms to an in-depth review of their compensation policies if both their 1- and 3-year total shareholder return is below the median of peers in their 4-digit GICS group (ISS, 2014, p. 4). We compare companies below the threshold to those above the threshold using a 10 percent bandwidth around the performance threshold and examine if those below the threshold increase reciprocal benchmarking in their peer groups by a larger degree than those above the threshold. Since ISS followed this policy only in its 2010-2011 proxy season, we limit the sample for this test to 2009-2012 (i.e., we include one pre- and one post-year to the policy's existence).

Table 7 presents the results from the analysis. *Below ISS performance cutoff* is an indicator variable that equals one for firms that fall below ISS's performance threshold in 2010 or 2011 while *Post* is an indicator variable equal to one for 2011 or 2012. All models control for stock performance, sales growth and the market to book ratio (see captions of Table 3 for a complete list of controls). Additionally, we include either Year or Indusry $\times$ Year and State $\times$ Year fixed effects to control for the general trend in reciprocal benchmarking. We find a statistically significant positive coefficient on *Below ISS performance cutoff* $\times$ *Post* across all specifications. The results from model 3 (the tightest specification) suggest that firms that fall below the performance cutoff increase *Reciprocity* (i.e., the fraction of reciprocating

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peers in their peer groups) by 5.3 percentage points. This is a meaningful increase compared to the median value of reciprocity at the start of the reporting mandate of 20 percent.

5.3.2. Cross-sectional tests

Iliev and Lowry (2015) analyze the effect of proxy adviser recommendations on mutual fund voting. The authors find that when mutual fund investors own a large equity block in a firm – and hence have a greater incentive to monitor the firm's corporate governance practices – they rely less on the vote recommendation by proxy advisers. Building upon this finding, we next relate variation in firm-level reciprocal benchmarking to ownership concentration and investors' reliance on proxy advisors. We define five firm-level measures. *Institutional ownership* is the sum of shareholdings reported by 13F-filing institutions in a firm divided by its total shares outstanding. *Ownership concentration* is the Herfindahl-Hirschman index of ownership using the fraction of shares owned in a given firm by 13F-filing institutional shareholders. *Ownership of largest blockholder* is defined as the size of the largest equity block by a single owner. *Propensity to vote with ISS* is the fraction of times that a firm's mutual fund investors historically voted with ISS across all their shareholdings, with each fund weighted by the fraction of shares it owns in the firm. Finally, *Propensity to vote with ISS when management and ISS disagree* is the fraction of times that a firm's mutual fund investors voted with ISS when ISS and the firm's management disagreed on a vote recommendation (see Larcker, McCall, and Ormazabal, 2013, 2015 for prior literature using the latter two measures).

Table 8 presents the results. In models 1 to 4, we observe that institutional ownership is positively related to *Reciprocity* (i.e., our firm-level measure of reciprocal benchmarking). In contrast, greater ownership concentration – measured by using the Herfindahl-Hirschman Index or by using the largest ownership block size – is negatively associated with *Reciprocity*. Table 8 also reveals a positive relationship between the degree of reciprocal benchmarking and the probability that investors vote alongside ISS recommendations. Overall, these results indicate that firms with shareholders that have weaker monitoring incentives and that are more likely to rely on proxy advice exhibit higher reciprocal benchmarking, presumably because these firms are more likely to adopt the selection criteria favored by proxy advisers (i.e., compensation peers with the same industry affiliation and of similar size).

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6 . Economic consequences

Our last set of tests focus on the potential economic consequences of an increase in reciprocal benchmarking. In particular, we examine the possibility that the documented increase in reciprocal benchmarking reduces external tournament incentives and, thereby, affects corporate risk-taking, firm performance, and stock return co-movement within industry groups.

6.1 . Tournament incentives

As a first step to analyze the economic consequences of the secular decline in pay variation documented in section 4, we focus on the effect of such decline on managerial incentives. Pay dispersion naturally relates to external tournament incentives, defined as the pay gap between a CEO's compensation level and the highest compensation level in her industry.[31] As explained by Coles, Li, and Wang (2018), this pay gap reflects managers' compensation growth opportunities. That is, if the manager delivers outstanding performance, she could receive an offer from a higher-paying industry peer. To retain the executive, the incumbent firm may then have to match this pay offer. The argument also holds if the offer does not materialize, as the executive could use the pay at higher-paying industry peers as an external benchmark for renegotiating her compensation contract with the board. Figure 7 confirms that external tournament incentives decrease significantly over the sample period. The metric *Industry tournament incentives* is defined as the gap between the firm's CEO pay and that of the second-highest paid CEO in the firm's industry, scaled by the firm's CEO pay (Coles, Li, and Wang, 2018). We also compute *Peer group tournament incentives* as the gap between the firm's CEO pay and that of the second-highest paid CEO in the firm's compensation peer group, scaled by the firm's CEO pay. Figure 7.A shows a clear decline in industry tournament incentives after the introduction of mandatory reporting of compensation peers; Figure 7.B documents that this decline also holds for the tournament incentives within compensation peer groups.[32]

[31] The literature distinguishes between "external" and "internal" tournament incentives. The former refers to the gap between the pay of the firm's CEO and that of other firms' CEOs. The latter refers to the gap between the pay of the firm's CEO and that of other executives in the firm.

[32] The analysis in Figure 7 uses GICS6 industries for consistency with the rest of our tests. Appendix Figure A.14 shows that using FF30 industries (i.e., the industry classification used in Coles, Li, and Wang, 2018) results in a similar pattern. The analysis in Figure 7.B starts in 2007 because there is no public disclosure of compensation peers prior to that year.

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Table 9 tests the empirical association between *Reciprocity* and the previous two measures of external tournament incentives. Models 1 to 3 show a negative and highly significant association between industry tournament incentives and reciprocity. In economic terms, a one standard deviation increase in reciprocal benchmarking in model 3 is associated with a decline in industry tournament incentives of (0.220*-3.358=) -3.14, which compares to a median/standard deviation in tournament incentives of 4.27/10.1. We find similar results for reciprocity and peer group tournament incentives in models 4-6. In model 6, a one standard deviation increase in reciprocal benchmarking is associated with a decrease of (0.220*-1.238=) -0.27, which compares to a median/standard deviation in peer group tournament incentives of 1.17/1.97.[33]

6.2. Corporate risk-taking and firm performance

As a second step to analyze the economic consequences of the secular decline in pay variation, we focus on the effect of such decline on firm risk and firm performance. Our focus on these two outcomes is grounded on prior research documenting that external tournament incentives induce managers to improve performance through greater risk-taking (Coles, Li, and Wang, 2018).

As is standard in the literature, we measure corporate risk-taking via firms' realized equity return volatility (e.g., Guay, 1999; Gormley, Matsa, and Milbourn, 2013; Low, 2009; Shue and Townsend, 2017). For each firm-year, we measure *Risk taking over next fiscal year* as the standard deviation of the firm's daily idiosyncratic stock returns estimated as the residuals from the Fama-French 3-factor model over the 12 months following the current fiscal year (multiplied by 100 for ease of interpretation). In Appendix Table A.6, we show similar results for alternative measures of firm risk used in prior literature: future ROA volatility, cash flow volatility, and earnings volatility (see John, Litov, and Yeung, 2008; Acharya, Amihud, and Litov, 2011; Ljungqvist, Zhang, and Zuo, 2017).

Table 10, Panel A, presents the relation between *Risk taking over next fiscal year* and *Pay group pay dispersion* (i.e., our measure of pay dispersion in the compensation peer group).

[33]The results are unaffected when re-defining the tournament incentives as the pay gap to the highest-paying (rather than second-highest paying) industry firm or compensation peer and are very similar when computing industry tournament incentives using alternative GICS-, SIC- or FF-based industry classifications.

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As shown in models 1-2 of Panel A, we find a positive association between these two variables: the greater the pay dispersion in the peer group, the greater the corporate risk-taking over the next fiscal year. To sharpen identification, we conduct variants of this test using an instrumental variable (IV) approach. We instrument a firm's peer group pay dispersion using idiosyncratic equity shocks among its compensation peers. Following Leary and Roberts (2014), idiosyncratic equity shocks are estimated from a Fama-French 3 factor model augmented with FF48 industry factors (for details see the variable appendix). The rationale is that equity shocks at peer firms affect their grant-date value of stock and option awards. Therefore, idiosyncratic equity shocks to compensation peers affect their CEO pay, which in turn changes the pay dispersion in the peer group. Yet, they are relatively exogenous to the base firm as they occur at other firms and are not driven by common factors of variation.

Table 10, Panel A, reports the results from the IV analysis. Columns 3 and 4 present the results from the reduced-form estimation.[34] The non-zero coefficient on *Peers' idiosyncratic equity shock* suggests that the IV approach is valid. Based on model 4, a one standard deviation increase in peers' idiosyncratic equity shocks leads to an increase in risk-taking over the next year of (0.517*0.351=) 0.181. This magnitude compares to a median/standard deviation of risk-taking of 0.487/0.516. Columns 5 and 6 present the results from the 2SLS estimation. The results from the first-stage confirm that *Peers' idiosyncratic equity shock* is a strong instrument for *Pay group pay dispersion*. Based on model 6, a one standard deviation increase in the instrument leads to a (0.515*0.084=) 0.043 increase in the fitted value of *Peer group pay dispersion*, which in turn leads to an increase in risk-taking of (0.043*4.193=) 0.179.

Table 10, Panel B, conducts parallel tests focusing on firm performance. The dependent variable, *Stock performance over next fiscal year* is defined as the year-on-year stock price change (including any dividend distributions) over fiscal year $t + 1$ (multiplied by 100 for ease of interpretation). As shown in Panel B, we observe a positive and robust relationship between peer group pay dispersion and stock performance over the subsequent fiscal year. The reduced-form estimates in column 4 indicate that a one standard deviation increase

[34] Angrist and Krueger (2001, p. 79) and Angrist and Pischke (2009, Ch. 4.6) explain that reduced-form estimates are useful for gauging whether 2SLS results are consistent with the expected causal effect of the instrument. A reduced-form estimate of zero would indicate that 2SLS estimates are driven mostly by omitted variables or regression misspecification.

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in the instrument leads to an improvement in the stock performance in the following fiscal year of (0.515*3.015=) 1.553 percentage points. The results from the 2SLS estimation suggests that a one standard deviation increase in peers' idiosyncratic equity shocks leads to a (0.515*0.084=) 0.043 increase in the instrumented version of *Peer group pay dispersion*, which in turn leads to an increase in stock performance of (0.043*36.25=) 1.568 percentage points.

6.3. Industry return comovement

To conclude our analysis of the economic consequences of the documented patterns, we next explore whether the decrease in pay dispersion (along with the increase in reciprocal benchmarking) results in higher stock return synchronicity within industry groups (i.e., individual firms' stock returns being increasingly explained by industry returns). Finding a higher stock return co-movement would be consistent with the decrease in tournament incentives and idiosyncratic volatility documented in our prior tests.

Our measure of return synchronicity is based on extant asset pricing literature (e.g., Roll, 1988; Chen, Goldstein, and Jiang, 2007). We first obtain a firm-year specific R-squared from a model that regresses a firm's daily stock return in a given year on the market factor and its value-weighted industry factor. To ensure that any increase in the R-squared is not due to a growing importance of the market factor, we subtract the R-squared obtained from the market model. This "incremental R-squared" represents the additional explanatory power of the industry factor, hence measuring within-industry stock return co-movement. We then take the industry-year average of this metric (multiplied by 100 for ease of interpretation) and refer to this variable as *Industry return synchronicity*.

Table 11 reports the results, Panels A and B use GICS2- and GICS6- industry classifications, respectively. Models 1 and 2 of both panels indicate a secular increase in return synchronicity. On average, the annual increase is 0.538 (0.394) for GICS2 (GICS6). These results relate to a median and standard deviation of stock return synchronicity in 2007 (the first year of the analysis) of 2.31 and 3.72 (4.85 and 5.61) for GICS2 (GICS6).

Models 3 and 4 of both panels reveal a strong negative association between *Industry return synchronicity* and *CEO pay dispersion* (as previously defined), even after including year and 1-digit GICS industry fixed effects. In Panel A, model 4, a one standard deviation

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increase in CEO pay dispersion at the GICS2-industry level is associated with a decrease in industry return synchronicity of (0.472*-5.646=) -2.66, which relates to a median and standard deviation of 2.31 and 3.72. In Panel B, model 4, the corresponding economic magnitude at the GICS6-industry level is (0.740*-1.707=) -1.26, which relates to a median and standard deviation of 6.31 and 6.61.

Finally, models 5 and 6 of both panels document a strong positive association between *Industry return synchronicity* and *Reciprocity* (as previously defined), even after the addition of fixed effects. In model 6 of Panel A, a one standard deviation increase in reciprocal benchmarking at the GICS2-industry level is associated with greater industry return co-movement of (0.029*66.23=) 1.92, which relates to a median and standard deviation of 2.31 and 3.72 respectively. In model 6 of Panel B, the corresponding economic magnitude at the GICS6-industry level is (0.149*10.5=) 1.56, which compares to a median and standard deviation of 6.31 and 6.61.[35]

Taken together, the findings in Tables 9, 10, and 11 are consistent with the notion that a reduction in pay variation (along with an increase in reciprocal benchmarking) has meaningful economic consequences. We observe that the change results in a reduction in managers' external tournament incentives, lower risk-taking, lower firm performance, and higher co-movement of firms' stock returns within industries.

7. Conclusions

Using a wide sample of over 5,000 publicly-listed U.S. firms spanning from 2002 to 2018, this paper documents a new stylized fact; over the last decade, the cross-sectional variation in CEO pay levels (i.e., the "second moment" of pay) has declined precipitously. We provide one explanation for this secular decrease in pay variation; reciprocal benchmarking – i.e., firms including each other in the set of peers used to benchmark pay levels.

We examine the empirical validity of this explanation by conducting tests at the industry-size-year and at the firm-year level and find a strong negative association between reciprocal

[35] Table A.7 repeats the analysis with the two alternative metrics for reciprocal benchmarking, *Transitivity* and *Density*, and report very similar results.

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benchmarking and CEO pay dispersion. We find evidence that three institutional developments have contributed to the increase in reciprocal benchmarking; the SEC mandate to publicly disclose compensation peers; "say on pay" regulation; and the growth in passive investing coupled with an increasing reliance on proxy advisory firms. We also provide evidence that the increase in pay dispersion alongside the increase in reciprocal benchmarking has meaningful economic consequences; we find that these patterns are associated with a decrease in CEOs' external tournament incentives, which in turn leads to less risk-taking, lower performance, and higher return synchronicity within industries.

Our evidence on the consequences of applying a uniform criterion to select compensation peers should be of interest for regulators and market participants. First, our results speak to the ongoing debates around the appropriateness of corporate pay practices and around proxy advisors' evaluation criteria (e.g., Posner, 2018; Financial Times, 2019). Benchmarking executive compensation against firms in the same industry and with similar size is one such criterion. Second, our results inform the regulatory debate on pay transparency (e.g., Mas, 2016; Baker, et al., 2019; Bennedsen, et al., 2018). Our evidence suggests that the disclosure of compensation peers may encourage a one-size-fits-all approach to the selection of these peers. We also show that this approach has first-order economic consequences that are not trivial to interpret from a welfare perspective.

We do not claim that reciprocal benchmarking is the only driver of the secular decline in CEO pay dispersion that we document. That is, this paper proposes one explanation for this pattern, but there could be others. We hope that our analysis helps promote a debate on the causes and consequences of this decline in pay dispersion, a phenomenon about which – to the best of our knowledge – there is currently little awareness. We look forward to future research shedding additional light on this phenomenon.

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References

Acharya, V. V., Y. Amihud, and L. Litov. 2011. Creditor rights and corporate risk-taking. *Journal of Financial Economics* 102:150–166.

Albuquerque, A. M., G. De Franco, and R. S. Verdi. 2013. Peer choice in CEO compensation. *Journal of Financial Economics* 108:160–181.

Almazan, A., J. C. Hartzell, and L. T. Starks. 2005. Active institutional shareholders and costs of monitoring: Evidence from executive compensation. *Financial Management* 34:5–34.

Angrist, J. D., and A. B. Krueger. 2001. Instrumental variables and the search for identification: From supply and demand to natural experiments. *Journal of Economic Perspectives* 15:69–85.

Angrist, J. D., and J.-S. Pischke. 2009. *Mostly Harmless Econometrics: An Empiricist's Companion*. Princeton University Press.

Baker, M., Y. Halberstam, K. Kroft, M. Alexandre, and D. Messacar. 2019. Pay transparency and the gender gap. Working paper.

Bebchuk, L., and Y. Grinstein. 2005. The Growth of Executive Pay. *Oxford Review of Economic Policy* 21:283–303.

Bennedsen, M., E. Simintzi, M. Tsoutsoura, and D. Wolfenzon. 2018. Do firms respond to gender pay gap transparency? *The Journal of Finance,* forthcoming.

Bizjak, J., M. Lemmon, and L. Naveen. 2008. Does the use of peer groups contribute to higher pay and less efficient compensation? *Journal of Financial Economics* 90:152–168.

Bizjak, J., M. Lemmon, and T. Nguyen. 2011. Are all CEOs above average? An empirical analysis of compensation peer groups and pay design. *Journal of Financial Economics* 100:538–555.

Blackrock. 2019. Blackrock investment stewardship's approach to executive compensation. Available at: https://www.blackrock.com/corporate/literature/publication/blk-commentary-our-approach-to-executive-compensation.pdf.

Brav, A., M. D. Cain, and J. Zytnick. 2019. Retail Shareholder Participation in the Proxy Process: Monitoring, Engagement and Voting. Working paper.

Brunarski, K. R., T. C. Campbell, Y. S. Harman, and M. E. Thompson. 2017. Do directors suffer external consequences for failing to align executive pay practices with shareholder preferences? Evidence from say on pay votes. Working paper.

Electronic copy available at: https://ssrn.com/abstract=3716765

Cabezon, F. 2021. Executive Compensation: The Trend Toward One Size Fits All. Working paper.

Cadman, B. D., R. Carrizosa, and X. Peng. 2020. Compensation disclosure and corporate governance through shareholder voting. *Journal of Management Accounting Research* 32:27–48.

Cadman, B. D., and M. E. Carter. 2014. Compensation peer groups and the relation to executive compensation. *Journal of Management Accounting Research* 26:57–82.

Chen, Q., I. Goldstein, and W. Jiang. 2007. Price Informativeness and Investment Sensitivity to Stock Price. *Review of Financial Studies* 20:619–650.

Choi, D., D. Cicero, and S. Mobbs. 2019. CEO Marketability, Employment Opportunities, and Compensation: Evidence from Compensation Peer Citations. Working paper.

Coles, J. L., Z. F. Li, and A. Y. Wang. 2018. Industry tournament incentives. *Review of Financial Studies* 31:1418–1459.

Correa, R., and U. Lel. 2016. Say on pay laws, executive compensation, pay slice, and firm valuation around the world. *Journal of Financial Economics* 122:500–520.

Cox, D. R., and P. A. Lewis. 1966. *The statistical analysis of series of events*. Springer.

Denis, D. K., T. Jochem, and A. Rajamani. 2020. Shareholder governance and CEO compensation: The peer effects of say on pay. *Review of Financial Studies* 33:3130–3173.

Edmans, A., X. Gabaix, and D. Jenter. 2017. Executive Compensation: A Survey of Theory and Evidence. In B. Hermalin and M. Weisbach (eds.), *Handbook of the Economics of Corporate Governance,*, vol. Vol. 1, pp. 383–539. Elsevier Science North Holland.

Elson, C. M., and C. K. Ferrere. 2013. Executive superstars, peer groups and overcompensation: Cause, effect and solution. *Journal of Corporation Law* 38:487–523.

Equilar. 2015. Peer group benchmarking: An analysis of S&P 1500 companies – Featuring commentary from Pay Governance. White paper.

Equilar. 2018. Equilar Market Peers: A powerful approach to creating peer groups. Available at: https://marketing.equilar.com/equilar-market-peers.pdf.

Ertimur, Y., F. Ferri, and D. Oesch. 2013. Shareholder votes and proxy advisors: Evidence from say on pay. *Journal of Accounting Research* 51:951–996.

Faulkender, M., and J. Yang. 2010. Inside the black box: The role and composition of compensation peer groups. *The Journal of Finance* 96:257–270.

Electronic copy available at: https://ssrn.com/abstract=3716765

Faulkender, M., and J. Yang. 2013. Is disclosure an effective cleansing mechanism? The dynamics of compensation peer benchmarking. *Review of Financial Studies* 26:806–839.

Ferri, F., and D. A. Maber. 2013. Say on pay votes and CEO compensation: Evidence from the UK. *Review of Finance* 17:527–563.

Financial Times. 2019. US SEC increases scrutiny of proxy advisers. August 21, 2019.

Fisch, J. E., D. Palia, and S. D. Solomon. 2017. Is say on pay all about pay? The impact of firm performance. *Harvard Business Law Review* 8:101–129.

Frydman, C., and D. Jenter. 2010. CEO Compensation. *Annual Review of Financial Economics* 2:75–102.

Frydman, C., and R. E. Saks. 2010. Executive Compensation: A New View from a Long-Term Perspective, 1936-2005. *Review of Financial Studies* 23:2099–2138.

Gabaix, X., and A. Landier. 2008. Why has CEO Pay Increased So Much? *Quarterly Journal of Economics* 123:49–100.

Gormley, T. A., D. A. Matsa, and T. T. Milbourn. 2013. CEO compensation and corporate risk-taking: Evidence from a natural experiment. *Journal of Accounting and Economics* 56:79–101.

Guay, W. R. 1999. The sensitivity of CEO wealth to equity risk: an analysis of the magnitude and determinants. *Journal of Financial Economics* 53:43–71.

Hall, B. J., and J. B. Liebman. 1998. Are CEOs Really Paid Like Bureaucrats? *Quarterly of Journal of Economics* 113:653–691.

Hayne, C., and M. D. Vance. 2019. Information Intermediary or De Facto Standard Setter? Field Evidence on the Indirect and Direct Influence of Proxy Advisors. *Journal of Accounting Research* 57:969–1011.

Huang, Q., F. Jiang, and F. Xie. 2020. A dark side of industry tournament incentives. Working paper.

Iliev, P., and M. Lowry. 2015. Are mutual funds active voters? *Review of Financial Studies* 28:446–485.

ISS. 2012. Evaluating for Performance Alignment: ISS's Quantitative and Qualitative Approach. Technical note. Available at: https://www.issgovernance.com/file/files/EvaluatingPayForPerformance_final_updated_02172012.pdf.

Electronic copy available at: https://ssrn.com/abstract=3716765

ISS. 2014. Evaluating Pay for Performance Alignment – Institutional Shareholder Services' Quantitative and Qualitative Approach. Available at: https://www.issgovernance.com/file/publications/evaluatingpayforperformance.pdf.

ISS. 2017. U.S. peer group selection methodology and issuer submission process. Technical note. Available at: https://www.issgovernance.com/file/policy/uspeergroupfaq.pdf.

ISS. 2018. Peer selection and the wisdom of the crowd. Technical note. Available at: https://www.issgovernance.com/library/ peer-selection-and-the-wisdom-of-the-crowd/.

ISS. 2019. U.S. Compensation Policies – Frequently Asked Questions. Available at: https://www.issgovernance.com/file/policy/active/americas/US-Compensation-Policies-FAQ.pdf.

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

John, K., L. Litov, and B. Yeung. 2008. Corporate governance and risk-taking. *The Journal of Finance* 63:1679–1728.

Kalpathy, S., V. Nanda, and Y. Zhao. 2021. Phantom Menace: The Role of Pseudo Peers in CEO Compensation. Working paper.

Larcker, D. F., A. L. McCall, and G. Ormazabal. 2013. Proxy advisory firms and stock option repricing. *Journal of Accounting and Economics* 56:149–169.

Larcker, D. F., A. L. McCall, and G. Ormazabal. 2015. Outsourcing shareholder voting to proxy advisory firms. *Journal of Law and Economics* 58:173–204.

Leary, M. T., and R. Roberts, Michael. 2014. Do Peer Firms Affect Corporate Financial Policy? *Journal of Finance* 69:139–178.

Ljungqvist, A., L. Zhang, and L. Zuo. 2017. Sharing risk with the government: How taxes affect corporate risk taking. *Journal of Accounting Research* 55:669–707.

Low, A. 2009. Managerial risk-taking behavior and equity-based compensation. *Journal of Financial Economics* 92:470–490.

Malenko, N., and Y. Shen. 2016. The role of proxy advisory firms: Evidence from a regression-discontinuity design. *Review of Financial Studies* 29:3394–3427.

Mas, A. 2016. Does transparency affect CEO pay setting? Evidence from the Passage of the 1934 Securities and Exchange Act. Working paper.

Meridian. 2015. Compensation committee calendar. Available at: http://www.meridiancp.com/compensation-committee-calendar/.

Electronic copy available at: https://ssrn.com/abstract=3716765

Murphy, K. J. 1999. Executive compensation. In O. C. Ashenfelter and D. Card (eds.), *Handbook of Labor Economics,*, vol. Vol. 3, pp. 2485–2563. Elsevier Amsterdam.

Murphy, K. J. 2013. Executive compensation: Where we are, and how we got there. In G. M. Constantinides, M. Harris, and R. M. Stulz (eds.), *Handbook of the Economics of Finance,*, vol. Vol. 2A, pp. 211–356. Elsevier Science North Holland.

Murphy, K. J., and T. Sandino. 2020. Compensation Consultants and the Level, Composition and Complexity of CEO Pay. *The Accounting Review* 95:311–341.

Newman, M. E. 2010. *Networks: An introduction*. Oxford University Press.

Pearl Meyer and Partners. 2014. Managing an effective compensation committee calendar for community banks. Available at: https://www.pearlmeyer.com/managing-effective-compensation-committee-calendar-community-banks.pdf.

Posner, C. 2018. The Battle Over Proxy Advisory Firms Continues. Available at: https://cooleypubco.com/2018/10/15/battle-over-proxy-advisors/.

Roll, R. 1988. R^2. *The Journal of Finance* 43:541–566.

Shue, K., and R. R. Townsend. 2017. How do quasi-random option grants affect CEO risk-taking? *The Journal of Finance* 72:2551–2588.

Spatt, C. S. 2021. Proxy Advisory Firms, Governance, Market Failure, and Regulation. *The Review of Corporate Finance Studies* 10:136–157.

Sushko, V., and G. Turner. 2018. The implications of passive investing for security markets. *BIS Quarterly Review* March:113–131.

T. Rowe Price. 2019. Proxy voting guidelines. Available at: https://www.troweprice.com/content/dam/trowecorp/Pdfs/C35H15KRK_Final.pdf.

White, J. W. 2007. Speech by SEC Staff: Where's the Analysis?, 2nd Annual Proxy Disclosure conference, San Francisco, Oct 9, 2007.

White, J. W. 2008. Executive Compensation Disclosure: Observations on Year Two and a Look Forward to the Changing Landscape for 2009, 3rd Annual Proxy Disclosure conference, New Orleans, Oct 21, 2008.

WillisTowersWatson. 2019. Three essentials for drafting a compensation committee calendar. Available at: https://www.willistowerswatson.com/en-US/insights/2019/01/3-essentials-for-drafting-a-compensation-committee-calendar.

Electronic copy available at: https://ssrn.com/abstract=3716765

Appendix A: Variable appendix

Variable	Definition	Source
I. Pay variables		
CEO pay dispersion (economy-, industry- or industry-size level)	Standard deviation of CEO pay scaled by the median level of CEO pay in a given year. At the economy-level, this is computed across all sample firms in a given year. At the industry-level, this is computed across all firms within the same GICS6-industry in a given year. At the industry-size level, this is computed across all firms that are in the same GICS6 × Size group, with size quintiles based on firms' market capitalization within a given industry-year.	Execucomp; Equilar; AuditAnalytics; GMI; Compustat
CEO pay dispersion (firm-level) (also referred to as: *Peer group pay dispersion*)	Standard deviation of CEO pay of a firm's compensation peers scaled by the median level of CEO pay of the compensation peers in a given firm-year.	Execucomp; Equilar; AuditAnalytics; Compustat
Industry tournament incentives	Defined as the difference between the second highest CEO pay in a firm's GICS6 industry and the firm's own CEO pay, divided by the firm's own CEO pay.	Execucomp; Equilar; GMI; AuditAnalytics; Compustat
Peergroup tournament incentives	Defined as the difference between the second highest CEO pay in a firm's compensation peer group and the firm's own CEO pay, divided by the firm's own CEO pay.	Execucomp; Equilar; GMI; AuditAnalytics
Below ISS performance cutoff	Indicator variable that is 1 if a firm underperforms the 1- and 3-year median total shareholder return of its Russell 3000 4-digit GICS industry peers.	Equilar; CRSP; Compustat
Peers' idiosyncratic equity shock	The maximum idiosyncratic equity shock received by a firm's compensation peers in fiscal year t. The idiosyncratic equity shock is estimated following the methodology as in (Leary and Roberts, 2014, p. 149). Specifically, for each peer firm i, we regress its monthly stock returns over the fiscal years $[t-5, t-1]$ on the market portfolio returns and on the equally-weighted FF48 industry portfolio returns (the FF48 industry portfolio returns exclude peer i's own returns). The estimated factor loadings are then used to compute peer i's monthly residuals (i.e., its equity shocks) over the fiscal year t, which are then compounded to estimate the realized annual equity shock for peer firm j.	Compustat; CRSP; Equilar
II. Reciprocal benchmarking / clustering variables		
Reciprocity (economy-, industry-, industry-size, or firm-level)	The fraction of references that are bidirectional in the graph that includes all the compensation peer references among a given set of firms. At the economy-level, the set of firms is all sample firms in a given year. At the industry-level, the set of firms is all firms within the same GICS6-industry in a given year and their compensation peer references. At the industry-size level, the set of firms is all firms within the same GICS6 industry × Size quintile group (with size quintiles based on firms' market capitalization within a given industry-year). At the firm-level, reciprocity is computed as the fraction of compensation peers that reference back the focal firm in a given firm-year.	Equilar; AuditAnalytics; ISS IncentiveLab
Density (economy-, industry-, industry-size, or firm-level)	The number of references that exist divided by the number of references that could exist in the graph that includes all the compensation peer references among a given set of firms. At the economy-level, the set of firms is all sample firms in a given year. At the industry-level, the set of firms is all firms within the same GICS6-industry in a given year and their compensation peer references. At the industry-size level, the set of firms is all firms within the same GICS6 industry × Size quintile group (with size quintiles based on firms' market capitalization within a given industry-year). At the firm-level, the set of firms is a focal firm and all its compensation peers in a given firm-year.	Equilar; AuditAnalytics; ISS IncentiveLab

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Appendix A: Variable appendix *(cont'd)*

Variable	Definition	Source
Transitivity (economy-, industry-, industry-size, or firm-level)	The number of triangles divided by the number of triads that exist in a given graph that includes all the compensation peer references among a set of firms. Triads are groups of three nodes that are connected in some way while triangles are triads that are completely connected. (Transitivity quantifies the number of tightly-knit communities, i.e. clusters, in a larger network; cf. Newman, 2010, Ch. 7.) At the economy-level, the set of firms is all sample firms in a given year. At the industry-level, the set of firms is all firms within the same GICS6-industry in a given year and their compensation peer references. At the industry-size level, the set of firms is all firms within the same GICS6 industry × Size quintile group (with size quintiles based on firms' market capitalization within a given industry-year). At the firm-level, the set of firms is a focal firm and all its compensation peers in a given firm-year.	Equilar; AuditAnalytics; ISS IncentiveLab

III. Moderator and outcome variables

Weak-vote	Indicator variable that equals one if a firm is in the lowest decile of SOP vote support in a given year at least once in the sample period, else zero.	ISS Voting Analytics
Institutional ownership	Sum of shareholdings reported by 13F filing institutions divided by total shares outstanding.	Thomson Reuters
Ownership concentration (HHI)	Herfindahl-Hirschman index of ownership using the fraction of shares owned by 13F filing institutional shareholders.	Thomson Reuters
Ownership of largest blockholder	Shareholdings of largest blockholder as disclosed in 13F filings.	Thomson Reuters
Propensity to vote with the ISS	The fraction of times that a firm's given mutual fund investors voted with ISS in the past, averaged across all shareholdings, with each fund weighted by the fraction of shares it owns in the firm. (Data availability starts in 2003.)	TR Mutual fund holdings; ISS mutual fund voting; ISS Voting Analytics
Propensity to vote with the ISS when management and ISS disagree	The fraction of times that a firm's mutual fund investors voted with ISS in the past when ISS and the firm management disagreed on the vote recommendation, averaged across all shareholdings, with each fund weighted by the fraction of shares it owns in the firm. (Data availability starts in 2003.)	Thomson Reuters Mutual fund holdings; ISS Mutual fund voting; ISS Voting Analytics
Stock performance over next fiscal year	Year-on-year stock price change (including any dividend distributions) from the end of fiscal year t to the end of fiscal year $t+1$.	CRSP
Risk-taking over next fiscal year	The standard deviation of residuals of a firm's daily stock returns over its next fiscal year estimated from the Fama-French 3-factor model.	CRSP
ROA volatility over next 3 years	The standard deviation of a firm's return on assets over fiscal years $[t+1, t+3]$.	Compustat
Cash flow volatility over next 3 years	The standard deviation of a firm's cash flow (i.e., earnings before interest and taxes minus extraordinary items plus depreciation over assets) over fiscal years $[t+1, t+3]$.	Compustat
Earnings volatility over next 3 years	The standard deviation of a firm's earnings before interest and taxes over assets over fiscal years $[t+1, t+3]$.	Compustat
Industry return synchronicity (computed either at the GICS6 or GICS2 level)	First, we obtain the firm-year specific R-squared from a regression in which a firm's daily returns in a given year is regressed against the daily market factor. Second, we repeat the first step but add to the market factor also a value-weighted GICS-industry factor (i.e., the value-weighted average return of all GICS6 or GICS2 industry peers), and collect the R-squares from this market-plus-industry model. Third, we compute the "incremental R-square" for each firm-year by subtracting the market-model R-squared from the market-plus-industry model R-squared. Finally, we take the equally-weight average of the incremental R-squares in a given year across all firms in an industry (either GICS6 or GICS2).	CRSP

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Appendix A: Variable appendix *(cont'd)*

Variable	Definition	Source
Low initial reciprocal benchmarking	An indicator variable that equals one (zero) if a firm has a below-median (above-median) degree of reciprocity in its peer group in 2007, computed either at the firm-level or at the industry-size group level.	Equilar; AuditAnalytics; ISS IncentiveLab
Low initial compliance with asset managers' criteria	An indicator variable that equals one (zero) if the firm has in 2007 an above-median (a below-median) fraction of peers that are from outside its GICS2 industry or that have more than twice its market capitalization.	Equilar; AuditAnalytics; ISS IncentiveLab; Compustat
Low initial compliance with proxy adviser criteria	An indicator variable that equals one (zero) if the firm has an above-median (a below-median) fraction of peers that are not compliant with ISS's compensation peer group methodology. ISS's methodology (see, e.g., ISS, 2012) selects for each firm (at least) 14 to (at most) 24 peers by choosing the most similar-sized firms from the same GICS6-industry and that are within 0.45-2.1 times relative sales (assets for financial firms) and within 0.2-5 times relative market capitalization. In cases when there are less than 14 potential peers from this procedure, ISS supplements peers by widening the industry definition to GICS4, and (rarely) further to GICS2.	Equilar; AuditAnalytics; ISS IncentiveLab; Compustat
IV. Firm, board and CEO characteristics		
Log firm value	Log of market value of equity plus book assets minus book equity and deferred taxes (e.g., Edmans, Gabaix, and Jenter, 2017).	Compustat
Size	Total book assets.	Compustat
Sales	Net sales or revenue.	Compustat
Market-to-book ratio	The ratio of market value of equity to book value of equity.	Compustat
Cash holdings	Cash and short-term investments, divided by total assets.	Compustat
Net leverage	Current liabilities plus long-term debt minus cash and short-term investments, divided by total assets.	Compustat
Investments	Capital expenditures divided by total assets.	Compustat
R&D indicator	Indicator variable that is 1 if firm has disclosed any R&D expenditures, else 0.	Compustat
Stock performance	Buy-and-hold stock return over fiscal year. (Averaged across share classes when a firm has multiple classes of shares outstanding.)	CRSP
Sales growth	Year-on-year fractional change in net sales.	Compustat
S&P 1500 membership	Indicator variable that is 1 if firm is part of the S&P 1500 index, else 0.	Compustat
Fraction of independent directors	Fraction of directors that are classified as independent.	Equilar; BoardEx
Lead director	Indicator variable that is 1 if firm has a designated lead director in a given year, else 0.	Equilar; BoardEx
Classified board	Indicator variable that is 1 if the board is classified, else 0. For S&P 1500 firms taken from RiskMetrics. For non-S&P 1500 firms, identified via annual director voting at annual meetings.	RiskMetrics; ISS Voting Analytics
Number committees	Number board committees.	Equilar; BoardEx
CEO pay growth	Cumulative CEO pay growth in a given firm, rescaled to the first year in the sample.	Execucomp; Equilar; AuditAnalytics; GMI
CEO age	Age of the CEO.	Equilar; Execucomp; GMI
CEO tenure	Tenure of the CEO in years.	Equilar; Execucomp; GMI
CEO-chairman duality	Indicator variable that is 1 if the firm has a CEO that serves as the board's chairman too, else 0.	Equilar; BoardEx
CEO turnover	Indicator variable that is 1 if the firm has a new CEO taking over within the last one year, else 0.	Equilar; Execucomp; GMI

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Figure 1. CEO pay dispersion

This figure shows the dispersion in CEO pay levels among Russell 3000 firms between 2002 and 2018. CEO pay dispersion is defined as the median-scaled standard deviation of CEO pay in a given year. The shaded area shows the 95 percent confidence interval. To show the relative decline, CEO pay dispersion is rebased to 2002.

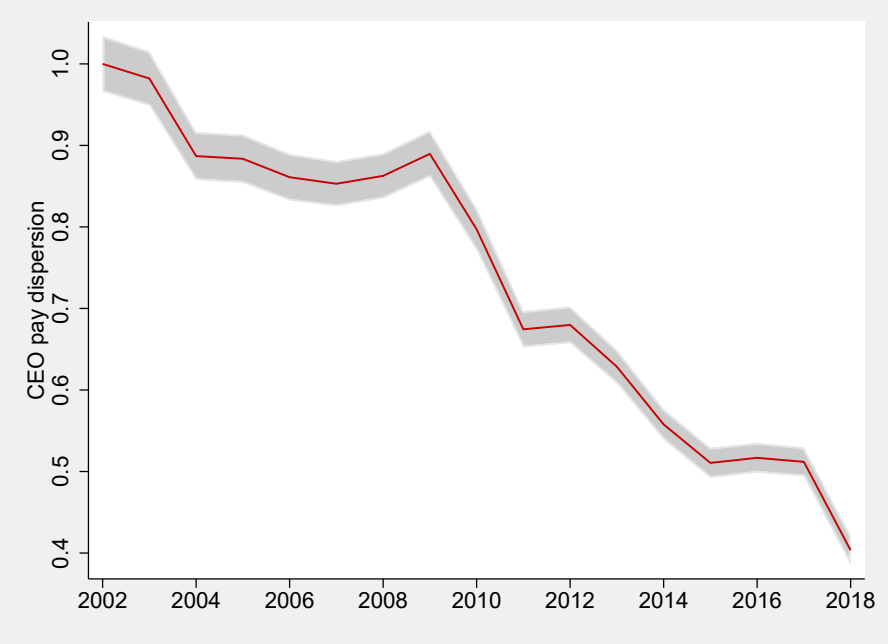

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Figure 2. Within-industry CEO pay dispersion

The figures show CEO pay dispersion for Russell 3000 firms within industry- and industry-size groups. Pay dispersion is defined as the median-scaled standard deviation of CEO pay within a given group and year. Figure A shows within-industry variation with industry groups based on GICS2 industry definitions. Figure B shows the pay dispersion within industry-size groups, averaged for each year and rebased to 2002, with firm size quintiles determined by firms' market capitalization in a given industry-year, and industry based on GICS2 industry definitions.

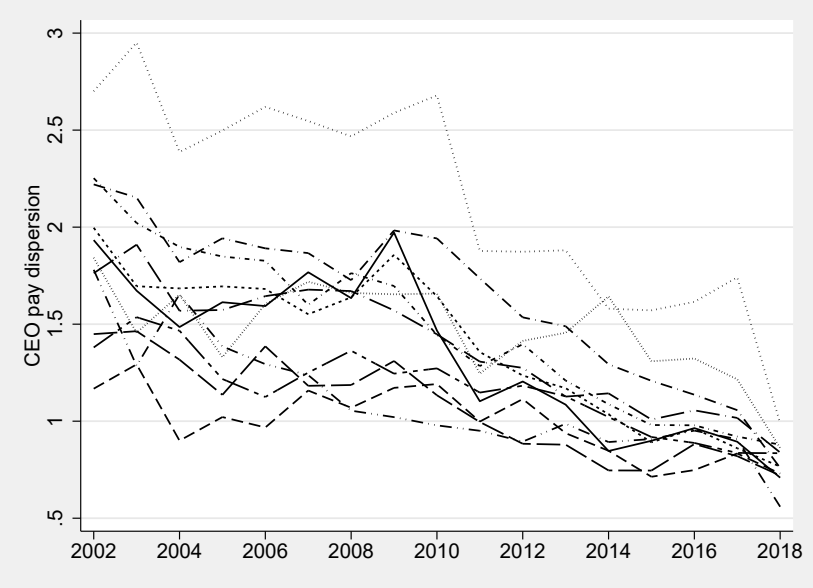

Figure A. Within-industry CEO pay dispersion

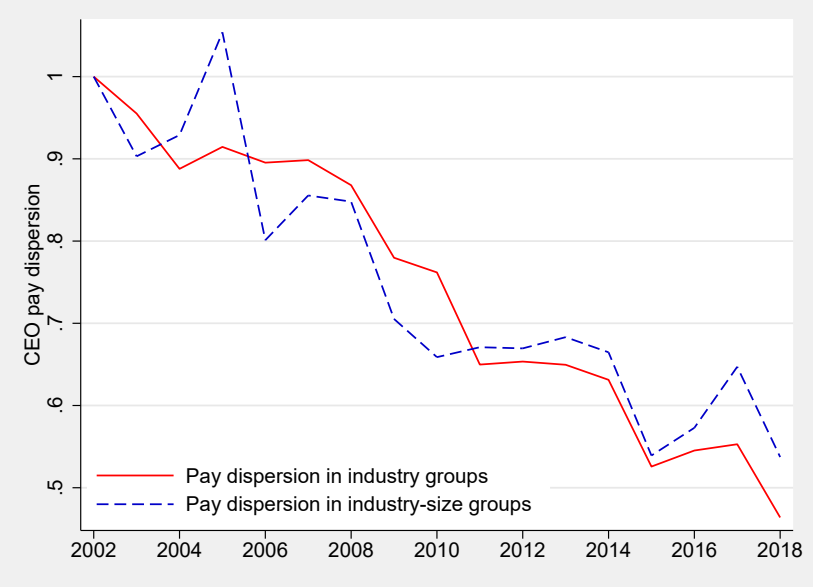

Figure B. Averaged within-industry and within industry-size CEO pay dispersion

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Figure 3. Illustration of reciprocal benchmarking

This stylized figure illustrates how the adoption of a common industry- and sized-based benchmarking policy affects compensation peer networks. Figure A shows two industry-size firm groups prior to the adoption of a common benchmarking policy. Firms reference across industry-size groups and hence pay changes in one group affect pay levels in the other group. Figure B illustrates the extreme case when peer referencing completely follows an industry- and size-based benchmarking policy, which fosters closed industry-size compensation networks. Firms typically set executive pay levels at or near the median of their compensation peers (Bizjak, Lemmon, and Naveen, 2008; Denis, Jochem, and Rajamani, 2020). Under the scenario in Figure B, if firms set own pay to the median of their peers, then executive pay fully converges within each industry-size group to the median with no pay dispersion within industry-size groups

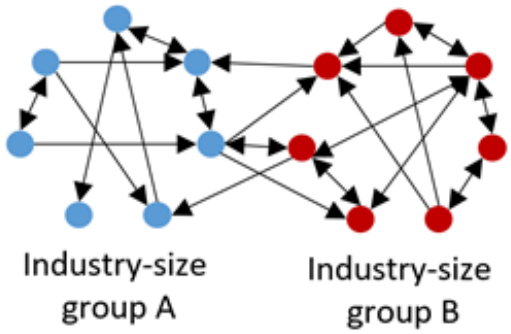

Figure A. Low degree of reciprocal benchmarking prior to the adoption of a common benchmarking policy

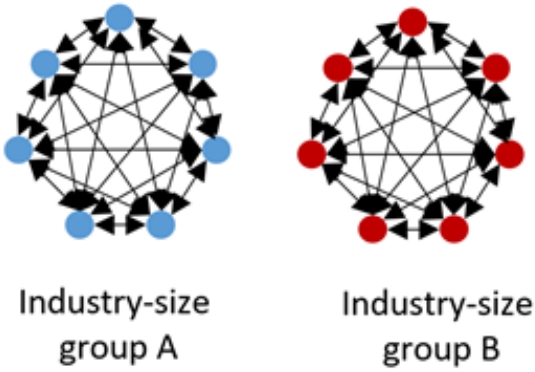

Figure B. High degree of reciprocal benchmarking after the adoption of a common benchmarking policy

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Figure 4. Changes in compensation peer group networks

The graphs show compensation peer references among a random sample of S&P 1500 firms and their peers in 2008 and 2013. Firms are systematically randomly sampled by sorting firms by their *gvkey* identifier and then taking every 20th firm. Then, all their compensation peers and the references among them are added to the dataset. The graphs are drawn using the Fruchterman-Reingold algorithm which moves nodes that are more closely connected towards one another.

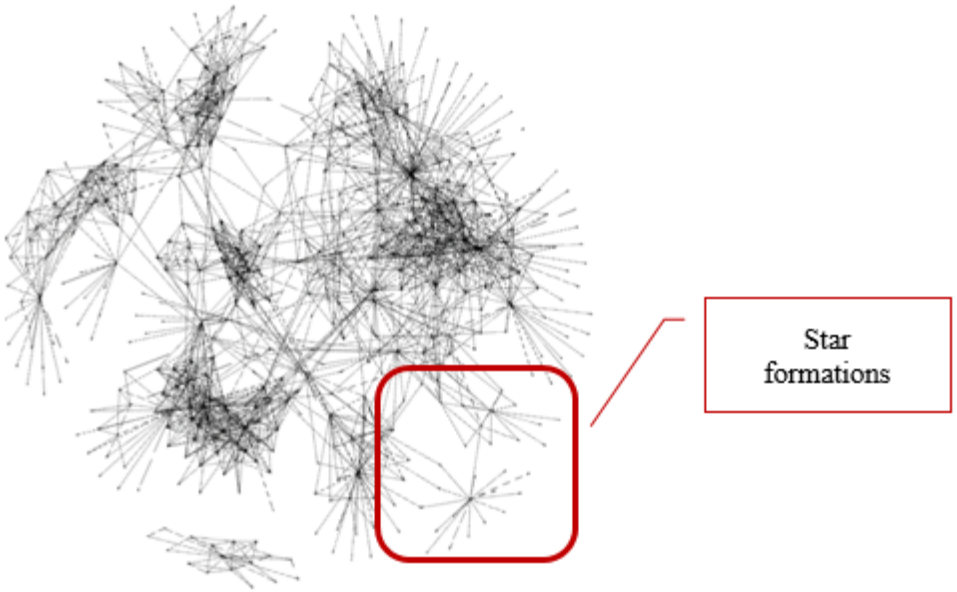

Figure A. Compensation peer group network in 2008

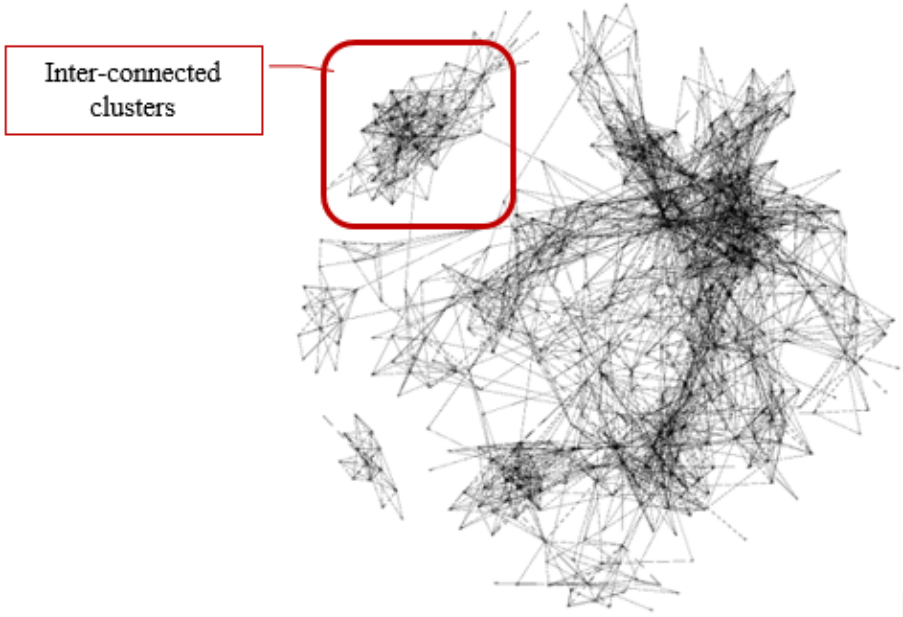

Figure B. Compensation peer group network in 2013

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Figure 5. Simulation

This figure shows the simulated trajectory of economy-wide CEO pay dispersion and pay dispersion within compensation peer groups of Russell 3000 firms. The simulation assumes that firms base their compensation peer selection on industry and size criteria only. In particular, peer selection follows ISS's peer group methodology (see footnote 14 for details); we call this the "ISS-compliant synthetic peer group." The solid (dashed) line shows the trajectory of CEO pay dispersion in the economy (in the average peer group) if firms set next year's pay at their target pay percentile of their ISS-compliant synthetic compensation peer groups. Each firm's target pay percentile is drawn from a normal distribution with mean 50 and standard deviation of 12.5. (Appendix Figure A.7 shows results for CEO pay dispersion and average CEO pay with constant target percentiles.)

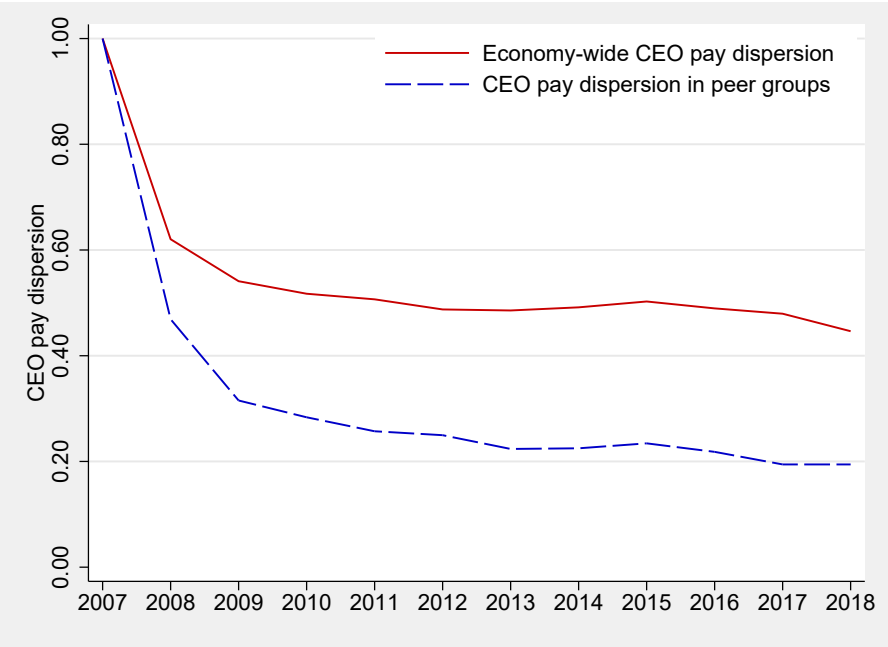

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Figure 6. Firm-level measure of reciprocal benchmarking and CEO pay dispersion

This figure shows reciprocal benchmarking and CEO pay dispersion within firms' compensation peer groups (averaged across all firms in a given year) for firms with data throughout the sample period. *Reciprocity* is the fraction of compensation peers that reference back the base firm, averaged across firms in a given year. *CEO pay dispersion* is the standard deviation of compensation peers' CEO pay, scaled by the median CEO pay of those compensation peers. The shaded area shows the 95 percent confidence intervals.

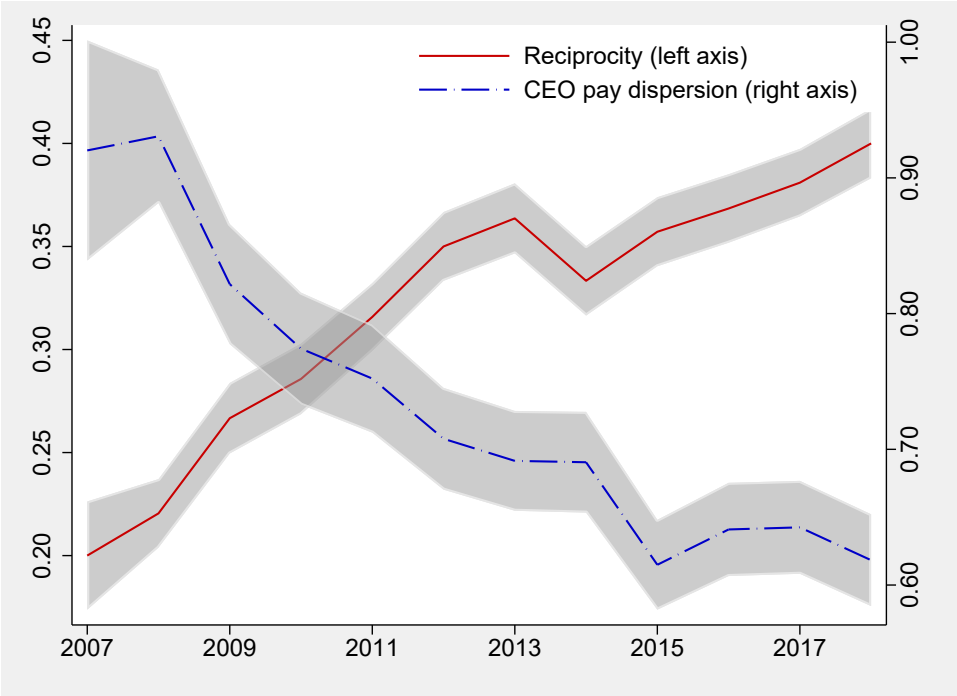

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Figure 7. Tournament incentives

This figure shows the evolution of tournament incentives over the sample period. Figure A shows industry tournament incentives between 2002 and 2018 at the GICS6-industry level. *Industry tournament incentives* is defined as the difference between the CEO pay of the highest (or the second-highest) paying firm in a given industry and the focal firms' CEO pay, scaled by average pay in the industry in that year. Figure B shows tournament incentives within firms' compensation peer groups since 2007 (the first year in which firms had to disclose compensation peer groups). *Peer group tournament incentives* is defined as the difference between the CEO pay of the highest (or the second-highest) paying firm in a firm's compensation peer group and the focal firms' CEO pay, scaled by focal firms' CEO pay.

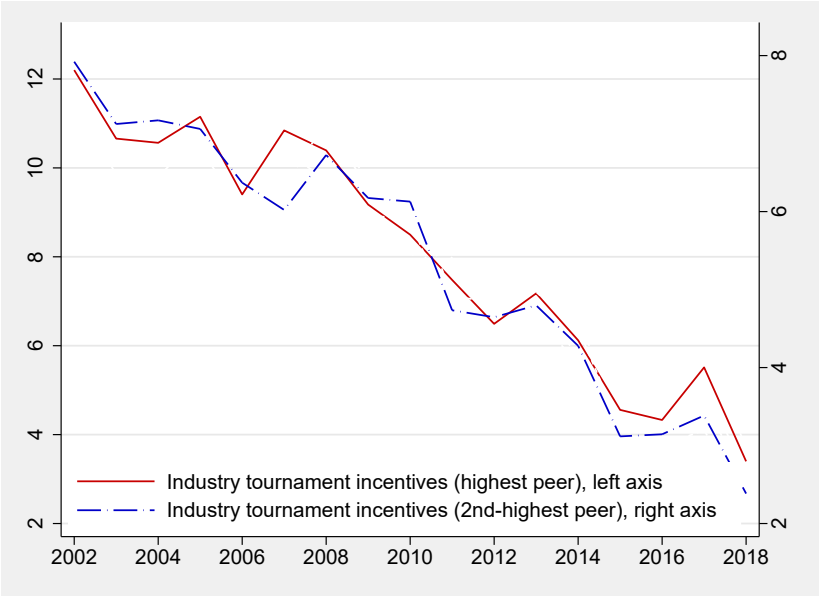

Figure A. Industry tournament incentives

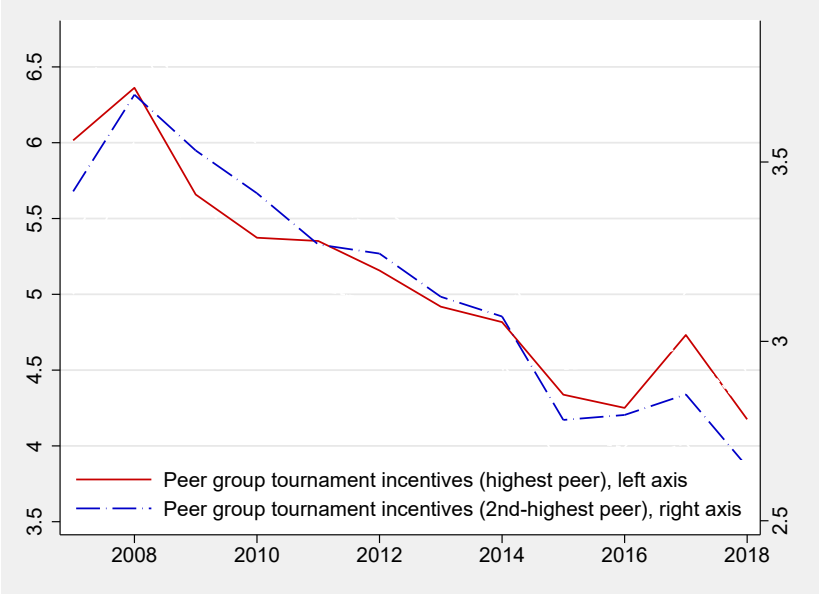

Figure B. Peer group tournament incentives

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Table 1: Descriptive statistics

This table shows the coverage and firm characteristics for the firm-year level sample. The sample includes firm-year observations from 2007 to 2018. See Appendix A for variable definitions.

	P5	Median	Mean	P95	Std. Dev.	N
CEO pay ($ thousands)	655.9	3,727.5	5,586.5	16,008	6,827.3	23,902
Reciprocity	0.000	0.250	0.295	0.722	0.223	25,264
Firm value ($ billion)	0.249	3.164	15.43	66.89	44.54	25,081
Size ($ billion)	0.131	2.098	10.97	45.90	35.06	25,109
Sales ($ billion)	0.052	1.083	5.054	21.99	12.93	25,107
Market-to-book	0.911	1.440	1.908	4.739	1.364	25,055
Net leverage	-0.549	0.100	0.083	0.603	0.340	25,003
Investments	0.000	0.024	0.040	0.140	0.052	25,044
R&D indicator	0.000	0.000	0.410	1.000	0.492	25,327
Stock performance	-0.555	0.077	0.126	0.937	0.523	24,639
Sales growth	-0.256	0.055	0.096	0.509	0.310	24,444
Fraction independent directors	0.563	0.833	0.789	0.912	0.124	24,833
Inside chair	0.000	1.000	0.538	1.000	0.498	24,875
Classified board	0.000	0.000	0.453	1.000	0.498	24,602
Lead director	0.000	0.000	0.481	1.000	0.499	24,884
Number of board committees	3.000	4.000	3.904	6.000	1.131	24,875
CEO cumulative pay growth	0.402	1.111	1.683	4.491	1.790	23,882
CEO age	45.00	45.00	56.51	69.00	7.235	24,583
CEO tenure	0.000	6.000	7.653	22.00	7.128	24,595
CEO turnover	0.000	0.000	0.109	1.000	0.313	23,754

Number of observations with complete data for all variables: 21,138

Coverage by year:	**Year**	**Firms**	**Year**	**Firms**	**Year**	**Firms**
	2007	617	2011	2,371	2015	2,213
Distinct total	2008	1,991	2012	2,413	2016	2,194
firms: 3,879	2009	2,215	2013	2,378	2017	2,179
	2010	2,329	2014	2,413	2018	2,197

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Table 2: Group-level measures of pay dispersion and reciprocity

Panel A shows the time trend in *CEO pay dispersion* and *Reciprocity* in compensation peer networks computed at the industry-size-year level. The window of analysis is 2007 (the first year of the peer group disclosure mandate) to 2018. Panel B shows the within-year association between the two variables, both computed at the industry-size-year level. Industry is defined based on GICS6-industry classifications and size groups are based on quintiles of market capitalization within industry-year. *Time trend* is a linear trend variable defined as the fiscal year minus 2006. *Reciprocity* is computed at the industry-size-year level and defined in the variable appendix. t-statistics (in parentheses) are based on standard errors that are two-way clustered at the year and industry-size level.

Panel A: Time trends

Dependent variable:	*CEO pay dispersion*				*Reciprocity*			
Level:	Industry-size-year level				Industry-size-year level			
Window of analysis:	2007-2018				2007-2018			
Model:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Time trend	-0.016***	-0.017***	-0.017***	-0.018***	0.005***	0.005***	0.005**	0.005***
	(-5.346)	(-4.529)	(-5.168)	(-4.629)	(3.034)	(3.816)	(3.003)	(3.237)
Industry FE	No	Yes	No	n/a	No	Yes	No	n/a
Size FE	No	No	Yes	n/a	No	No	Yes	n/a
Industry × Size FE	No	No	No	Yes	No	No	No	Yes
Observations	3,807	3,807	3,807	3,802	3,555	3,555	3,555	3,444
R-squared	0.009	0.170	0.024	0.307	0.007	0.143	0.214	0.598

Panel B: Association pay dispersion and reciprocity

Dependent variable:	*CEO pay dispersion*			
Level:	Industry-size-year level			
Window of analysis:	2007-2018			
Model:	(1)	(2)	(3)	(4)
Reciprocity	-0.276***	-0.237***	-0.105***	-0.114***
	(-3.856)	(-3.404)	(-2.201)	(-2.381)
Year FE	No	Yes	Yes	n/a
Industry × Size FE	No	No	Yes	Yes
Industry × Year FE	No	No	No	Yes
Size × Year FE	No	No	No	Yes
Observations	3,174	3,174	3,174	3,174
R-squared	0.014	0.039	0.212	0.284

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Table 3: Firm-level reciprocal benchmarking and pay dispersion

Panel A shows the time trend in *CEO pay dispersion* and *Reciprocity* within firms' peer groups. The level of observation is firm-year. The window of analysis is 2007 (the first year of the peer group disclosure mandate) and 2018. *CEO pay dispersion* computed at the firm-year level is the standard deviation of CEO pay in a given firm's compensation peer group divided by the median pay in the compensation peer group. *Reciprocity* computed at the firm-year level is the percentage of compensation peers that reference back the base firm. *Time trend* is a linear trend variable defined as the fiscal year minus 2006. Panel B shows the within-year association between the two variables. Firm controls include *log firm value*, *market-to-book ratio*, *net leverage*, *investments*, *R&D indicator*, *S&P 1500 indicator*, *stock performance*, *sales growth*, *CEO age*, *CEO tenure*, *cumulative CEO pay growth*, *fraction of independent directors*, the *number of board committees* and indicator variables for a *CEO turnover* within the prior 12 months, for *CEO-chairman duality*, for the existence of a *classified board* and the existence of a *lead director*. All variables are defined in the variable appendix. t-statistics (in parentheses) are based on standard errors clustered at the firm level.

Panel A: Time trends

Dependent variable:	*CEO pay dispersion*				*Reciprocity*			
Level:	Firm-year level				Firm-year level			
Window of analysis:	2007-2018				2007-2018			
Model:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Time trend	-0.029***	-0.026***	-0.028***	-0.032***	0.006***	0.005***	0.006***	0.013***
	(-19.96)	(-16.02)	(-16.70)	(-15.47)	(11.19)	(7.438)	(8.794)	(17.44)
Firm controls	No	Yes	Yes	Yes	No	Yes	Yes	Yes
Industry FE	No	Yes	n/a	n/a	No	Yes	n/a	n/a
State FE	No	Yes	n/a	n/a	No	Yes	n/a	n/a
Industry × State FE	No	No	Yes	n/a	No	No	Yes	n/a
Firm FE	No	No	No	Yes	No	No	No	Yes
Observations	25,020	20,540	20,482	20,645	25,307	20,664	20,603	20,768
R-squared	0.025	0.158	0.248	0.428	0.008	0.317	0.489	0.783

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Table 3: Firm-level reciprocal benchmarking and pay dispersion *(cont'd)*

Panel B: Association pay dispersion and reciprocity

Dependent variable:	*CEO pay dispersion*				
Level:	Firm-year level				
Window of analysis:	2007-2018				
Model:	(1)	(2)	(3)	(4)	(5)
Reciprocity	-0.335***	-0.148***	-0.114***	-0.147***	-0.171***
	(-14.57)	(-5.750)	(-4.424)	(-5.571)	(-4.416)
Firm controls	No	Yes	Yes	Yes	Yes
Year FE	No	Yes	Yes	n/a	n/a
Industry FE	No	No	Yes	n/a	n/a
State FE	No	No	Yes	n/a	n/a
Industry × Year FE	No	No	No	Yes	Yes
State × Year FE	No	No	No	Yes	Yes
Firm FE	No	No	No	No	Yes
Observations	25,020	21,024	20,540	20,460	20,082
R-squared	0.017	0.089	0.166	0.269	0.527

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Table 4: The SEC Rule on Compensation Disclosure. Group-level analysis.

This table analyzes time trends in CEO pay dispersion in the years around the introduction of the SEC disclosure mandate on compensation peers. Observations are at the industry-size-year level. Industry is defined based on GICS6 classifications and size groups are based on quintiles of market capitalization within industry-year. *CEO pay dispersion* is the standard deviation of CEO pay at the industry-size-year group level divided by median pay at the group-level. *Time trend* is a linear trend variable defined as the fiscal year minus 2006. *Post* is an indicator variable that is 1 for fiscal years after 2007, else 0. *Low initial reciprocal benchmarking* is an indicator variable that equals one (zero) if the average firm in an industry-size group has a below-median (above-median) degree of reciprocity in its peer group in 2007. *t*-statistics (in parentheses) are based on standard errors that are two-way clustered at the year and industry-size level.

Dependent variable:	*CEO pay dispersion*							
Level:	Industry-size-year level							
Sample:	Pre SEC rule 2004-2007		Post SEC rule 2008-2011		Pooled obs. 2004-2011		Pooled obs. 2004-2011	
Model:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Time trend	-0.002	0.001	-0.050***	-0.052*			-0.020*	-0.023*
	(-0.174)	(0.019)	(-5.911)	(-2.365)			(-2.275)	(-2.107)
Post					-0.130***	-0.149***		
					(-4.697)	(-3.645)		
Low initial reciprocal benchmarking							0.157**	–
							(2.731)	
Low initial reciprocal benchmarking × *Time trend*							-0.154**	-0.150*
							(-2.883)	(-1.959)
Industry × Size FE	No	Yes	No	Yes	No	Yes	No	Yes
Observations	1,141	1,115	1,144	1,129	2,285	2,270	2,168	2,162
R-squared	0.000	0.492	0.004	0.517	0.005	0.373	0.013	0.368

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Table 5: The SEC Rule on Compensation Disclosure. Firm-level analysis.

This table analyzes time trends in reciprocal benchmarking in the initial years after the introduction of the SEC disclosure mandate on compensation peers. Observations are at the firm-year level. *Reciprocity* is the fraction of compensation peers that reference back the base firm. *Time trend* is a linear trend variable defined as the fiscal year minus 2006. *Low initial reciprocal benchmarking* is an indicator variable that equals one (zero) if a firm has a below-median (above-median) degree of reciprocity in its peer group in 2007. *Low initial compliance with asset managers' criteria* is an indicator variable that equals one (zero) if the firm has in 2007 an above-median (a below-median) fraction of peers that are from outside its GICS2 industry or that have more than twice its market capitalization. *Low initial compliance with proxy adviser criteria* is an indicator variable that equals one (zero) if the firm has an above-median (a below-median) fraction of peers that are not compliant with ISS's compensation peer group methodology. Firm controls are the same as in Table 3. *t*-statistics (in parentheses) are based on standard errors clustered at the firm level.

Dependent variable:	*Reciprocity*					
Level:	Firm-year level					
Window of analysis:	2007-2009					
Sample:	Firms with 2007-disclosed peer groups					
Model:	(1)	(2)	(3)	(4)	(5)	(6)
Time trend	0.065***	0.062***	0.067***	0.059***	0.063***	0.059***
	(11.58)	(8.517)	(14.24)	(8.753)	(12.90)	(8.312)
Low initial reciprocal benchmarking × *Time trend*	0.017**	0.015*				
	(2.461)	(1.930)				
Low initial compliance with asset managers' criteria × *Time trend*			0.012	0.016**		
			(1.637)	(2.006)		
Low initial compliance with proxy adviser criteria × *Time trend*					0.020***	0.017**
					(2.813)	(2.130)
Firm controls	No	Yes	No	Yes	No	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,681	1,414	1,650	1,411	1,681	1,414
R-squared	0.860	0.869	0.860	0.870	0.860	0.869

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Table 6: Say on Pay Voting

This table analyzes changes to reciprocal benchmarking in the two years after a firm receives a weak say on pay vote. The window of analysis is 2011 (the first year of mandatory say on pay voting) to 2018. *Reciprocity* is the fraction of compensation peers that reference back the base firm. *Weak-vote* is an indicator variable that equals one if a firm is in the bottom decile of say on pay vote support in a given year at least once in the sample period, else zero. *Post* is an indicator variable that equals one in the two years after the weak say on pay vote. Firm controls are the same as in Table 3. Industry fixed effects are based on GICS6 industry classification. *t*-statistics (in parentheses) are based on standard errors clustered at the firm level.

Dependent variable:	*Reciprocity*			
Level:	Firm-year level			
Window of analysis:	2011-2018			
Sample:	Weak-vote firms only; [0,2] around event year		Weak-vote and control firms; [0,2] around event year	
Model:	(1)	(2)	(3)	(4)
Weak-vote	–	–	0.013	-0.000
			(1.506)	(0.006)
Weak-vote × *Post*	0.040***	0.039***	0.040***	0.028***
	(9.025)	(3.595)	(9.030)	(4.970)
Firm controls	No	Yes	No	Yes
Industry × Year FE	No	Yes	No	Yes
State × Year FE	No	Yes	No	Yes
Observations	2,319	1,810	17,697	15,099
R-squared	0.007	0.519	0.005	0.366

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Table 7: Proxy Adviser Influence

This table examines changes to reciprocal benchmarking after higher ISS scrutiny of firms' compensation policies. *Reciprocity* is the fraction of compensation peers that reference back the base firm. *Below ISS performance cutoff* is an indicator variable which is one, if a firm underperforms the 1- and 3-year median total shareholder return of its Russell 3000 4-digit GICS industry peers (ISS, 2014, 4), else 0. *Post* is an indicator variable that equals one in the years after the firm fell below ISS's performance cutoff. Since this ISS policy only existed in 2010-2011, we limit the sample to 2009-2012 to include one pre- and one post-year to the policy's existence, and include only firms that are close to (within a 10 percent bandwidth of) the performance cutoff. Firm controls are the same as in Table 3. Industry fixed effects are based on GICS6-industry classification. *t*-statistics (in parentheses) are based on standard errors clustered at the firm level.

Dependent variable:	*Reciprocity*		
Level:	Firm-year level		
Window of analysis:	2009-2012		
Sample:	± 10 percent bandwidth around performance cutoff		
Model:	(1)	(2)	(3)
Below ISS performance cutoff	-0.097**	-0.051	-0.050
	(-2.141)	(-1.395)	(-1.223)
Below ISS performance cutoff × *Post*	0.101***	0.052**	0.053**
	(3.648)	(2.316)	(2.018)
Firm controls	Yes	Yes	Yes
Year FE	Yes	Yes	n/a
Industry FE	No	Yes	n/a
State FE	No	Yes	n/a
Industry × Year FE	No	No	Yes
State × Year FE	No	No	Yes
Observations	2,153	2,147	2,074
R-squared	0.161	0.390	0.393

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Table 8: Ownership Characteristics

This table analyzes the relation between reciprocal benchmarking and ownership characteristics. *Fraction of reciprocating peers* is the fraction of compensation peers that reference back the base firm. *Institutional ownership* is the fraction of outstanding shares owned by institutional investors. *Ownership concentration* is the Herfindahl-Hirschman index of ownership using the fraction of shares owned by institutional shareholders. *Propensity to vote with ISS* is the fraction of times that a firm's mutual fund investors voted with ISS in the past across all their shareholdings, with each fund weighted by the fraction of shares it owns in the firm. *Propensity to vote with ISS when management and ISS disagree* is the fraction of times that a firm's mutual fund investors voted with ISS when ISS and the firm management disagreed on a vote recommendation, weighted by the fraction of owned shares. Firm controls are the same as in Table 3. Industry fixed effects are based on GICS6-industry classification. t-statistics (in parentheses) are based on standard errors clustered at the firm level.

Dependent variable:	*Reciprocity*							
Level:	Firm-year level							
Sample:	2007-2018							
Model:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Institutional ownership	0.288***	0.149***	0.261***	0.135***				
	(16.99)	(7.528)	(16.26)	(7.153)				
Ownership concentration	-1.440***	-0.535***						
	(-11.20)	(-4.856)						
Ownership of largest blockholder			-0.641***	-0.225***				
			(-11.82)	(-4.221)				
Propensity to vote with ISS					0.393***	0.186***		
					(8.222)	(3.756)		
Propensity to vote with ISS when mgmt. and ISS disagree							0.510***	0.329***
							(5.511)	(3.271)
Firm controls	No	Yes	No	Yes	No	Yes	No	Yes
Industry × Year FE	No	Yes	No	Yes	No	Yes	No	Yes
State × Year FE	No	Yes	No	Yes	No	Yes	No	Yes
Observations	18,865	16,429	18,865	16,429	19,514	17,468	19,514	17,468
R-squared	0.068	0.384	0.063	0.383	0.012	0.359	0.003	0.358

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Table 9: Tournament incentives

This table analyzes the relation between reciprocal referencing in compensation peer groups and external tournament incentives. In models 1-3, *Industry tournament incentives* is defined as the pay gap to the second highest-paying firm in the GICS6 industry, scaled by own-firm CEO pay (Coles, Li, and Wang, 2018). In models 4-6, *Peer group tournament incentives* is defined as the pay gap to the second highest-paying firm in the compensation peer group, scaled by own-firm CEO pay. *Reciprocity* is the fraction of compensation peers that reference back the base firm. Firm controls are the same as in Table 3. Industry fixed effects are based on GICS6 industry classification. In models 1-3, *t*-statistics (in parentheses) are based on standard errors clustered at the GICS6-industry level. In models 4-6, t-statistics are based on standard errors clustered at the firm level.

Dependent variable:	*Industry tournament incentives*			*Peer group tournament incentives*		
Level:	Firm-year level			Firm-year level		
Model:	(1)	(2)	(3)	(4)	(5)	(6)
Fraction of reciprocating peers	-10.37***	-3.446***	-3.358***	-1.817***	-1.188***	-1.238***
	(-8.730)	(-5.460)	(-5.726)	(-20.38)	(-10.94)	(-10.93)
Firm controls	No	Yes	Yes	No	Yes	Yes
Year FE	No	Yes	n/a	No	Yes	n/a
Industry FE	No	Yes	n/a	No	Yes	n/a
State FE	No	Yes	n/a	No	Yes	n/a
Industry × Year FE	No	No	Yes	No	No	Yes
State × Year FE	No	No	Yes	No	No	Yes
Observations	23,855	20,618	20,549	23,730	20,520	20,440
R-squared	0.051	0.388	0.467	0.041	0.165	0.212

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Table 10: Pay dispersion, risk-taking, and firm performance

This table analyzes the relation between corporate risk-taking, stock performance, and peer group pay dispersion. *Risk-taking over the next fiscal year* is measured using the realized equity return volatility over the next fiscal year, which is defined as the standard deviation of residuals estimated from a Fama-French 3-factor model using a firm's daily stock returns over fiscal year $t+1$ (multiplied by 100 for ease). *Stock performance over next fiscal year* is the year-on-year stock price change (including any dividend distributions) from the end of fiscal year t to the end of fiscal year $t+1$ (multiplied by 100 for ease). *Peer group pay dispersion* is the median-scaled standard deviation of the CEO pay levels of a given firm's compensation peers. *Peers' idiosyncratic equity shock* is the maximum idiosyncratic equity shock among a firm's compensation peers estimated from a Fama-French 3 factor model augmented with FF48 industry factors (Leary and Roberts, 2014; see variable appendix for details). Firm controls include *size*, *market-to-book*, *sales growth*, *net leverage*, *cash holdings*, *R&D expenditure*. Industry fixed effects are based on FF12 industry classification. t-statistics (in parentheses) are based on standard errors clustered at the firm level.

Panel A: Risk-taking

Dependent variable:	*Risk taking over next fiscal year*					
Level:	Firm-year level		Firm-year level		Firm-year level	
Window of analysis:	2007-2018		2007-2018		2007-2018	
Type:	OLS		Reduced-form IV		2SLS	
Model:	(1)	(2)	(3)	(4)	(5)	(6)
Peer group pay dispersion	0.464***	0.191***				
	(16.48)	(7.789)				
Peers' idiosyncratic equity shock			0.734***	0.351***		
			(34.61)	(15.94)		
Peer group pay *dispersion*					5.630***	4.193***
					(16.46)	(9.201)
Firm controls	No	Yes	No	Yes	No	Yes
Industry × Year FE	No	Yes	No	Yes	No	Yes
State × Year FE	No	Yes	No	Yes	No	Yes
Observations	20,640	19,256	20,715	19,323	20,637	19,253
R-squared	0.025	0.415	0.089	0.426	n/a	n/a
First-stage diagnostics:						
Coeff. (*Peers' idiosyncratic equity shock*)					0.131***	0.084***
t-stat. (*Peers' idiosyncratic equity shock*)					(18.60)	(10.80)
Kleinbergen Papp F-statistic					(345.9)	(116.7)

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Table 10: Pay dispersion, risk-taking, and firm performance *(cont'd)*

Panel B: Firm performance

Dependent variable:	*Stock performance over next fiscal year*					
Level:	Firm-year level		Firm-year level		Firm-year level	
Window of analysis:	2007-2018		2007-2018		2007-2018	
Type:	OLS		Reduced-form IV		2SLS	
Model:	(1)	(2)	(3)	(4)	(5)	(6)
Peer group pay dispersion	3.203***	1.743**				
	(3.887)	(2.045)				
Peers' idiosyncratic equity shock			8.423***	3.015***		
			(9.961)	(3.299)		
$\widehat{\text{Peer group pay dispersion}}$					64.27***	36.25***
					(8.895)	(3.176)
Firm controls	No	Yes	No	Yes	No	Yes
Industry × Year FE	No	Yes	No	Yes	No	Yes
State × Year FE	No	Yes	No	Yes	No	Yes
Observations	20,607	19,272	20,682	19,339	20,604	19,269
R-squared	0.001	0.198	0.008	0.200	n/a	n/a
First-stage diagnostics:						
Coeff. (*Peers' idiosyncratic equity shock*)					0.132***	0.084***
t-stat. (*Peers' idiosyncratic equity shock*)					(18.66)	(10.82)
Kleinbergen Papp *F*-statistic					(348.1)	(117.1)

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Table 11: Industry return synchronicity

This table shows the time trend in industry return synchronicity and its relation with industry-level CEO pay dispersion and industry-level reciprocal benchmarking of compensation peer networks. *Industry return synchronicity* is defined as the R-squared of a market-plus-industry factor model minus the R-squared of a market-factor model, computed separately for each firm-year and averaged across all firms in a given industry and year. For ease of interpretation, the dependent variable is multiplied by 100. *Time trend* is defined as the fiscal year minus 2006. *CEO pay dispersion* is the median-scaled standard deviation of CEO pay in a given industry. *Reciprocity* is computed based on the compensation peer group network of a given industry in a given year and is defined as the fraction of references that are bidirectional. All variables are computed at the GICS2-industry level in Panel A and the GICS6-industry level in Panel B. Fixed effects include year and 1-digit GICS industry level. t-statistics (in parentheses) are based on standard errors that are two-way clustered at the industry- and year-level.

Panel A: Industry return synchronicity at the GICS2-level

Dependent variable:	*Industry return synchronicity*					
Level:	GICS2 industry-year level					
Model:	(1)	(2)	(3)	(4)	(5)	(6)
Time trend	0.538***	0.538***				
	(3.905)	(2.777)				
CEO pay dispersion			-5.738**	-5.646*		
			(-2.635)	(-2.205)		
Reciprocity					59.93**	66.23***
					(2.736)	(3.713)
Year FE	n/a	n/a	No	Yes	No	Yes
Industry FE	No	Yes	No	Yes	No	Yes
Observations	132	132	132	132	132	132
Avg. # of firms per year	2,897	2,897	2,897	2,897	2,897	2,897
R-squared	0.087	0.751	0.242	0.276	0.290	0.353

Panel B: Industry return synchronicity at the GICS6-level

Dependent variable:	*Industry return synchronicity*					
Level:	GICS6 industry-year level					
Model:	(1)	(2)	(3)	(4)	(5)	(6)
Time trend	0.394***	0.394***				
	(7.323)	(7.154)				
CEO pay dispersion			-2.622***	-1.707*		
			(-3.127)	(-1.973)		
Reciprocity					11.17**	10.50**
					(2.791)	(2.551)
Year FE	n/a	n/a	No	Yes	No	Yes
Industry FE	No	Yes	No	Yes	No	Yes
Observations	823	823	823	823	796	796
Avg. # of firms per year	2,897	2,897	2,897	2,897	2,897	2,897
R-squared	0.042	0.169	0.086	0.211	0.063	0.230

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INTERNET APPENDIX

— Intended for online publication —

Internet Appendix I: Anecdotal Evidence

- Anecdotal evidence of peer group revisions and consequences to reciprocal benchmarking

Internet Appendix II: Figures and Tables

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Appendix I: Anecdotal evidence of peer group revisions and consequences to reciprocal benchmarking

1. AUTODESK, INC. *(GICS 45: Information Technology industry)*

At its 2012 annual meeting, Autodesk Inc. received 54 percent shareholder support in its advisory vote for its executives' compensation packages (the "say on pay" vote), which ranked that year in the bottom five percent of say on pay vote support in the Russell 3000. In the same year, Autodesk Inc. had also received an "against" vote recommendation by ISS for its say on pay vote. In its research report, ISS singled out two areas of concerns about compensation: pay for performance alignment and peer group benchmarking policies. On the latter concern, ISS specifically criticized that Autodesk Inc.'s compensation peers did not fit with ISS's relative-size criteria and compared Autodesk's CEO pay to the median of its own peer group:

> *"The company's fiscal 2012 pay review and determination group comprises mainly of companies that are larger in terms of revenues. Moreover, several peers are more than two times larger in terms of revenue, and fiscal 2012 CEO pay was 2.18 times ISS's peer group median. Making pay determinations based on companies that are primarily larger in terms of revenue may escalate pay irrespective of company performance."* (ISS research report on Autodesk, 18 May 2012, p.13)

In a proxy filing for a Special Meeting in January 2014, Autodesk Inc. summarized the actions it had taken in response to shareholders' disapproval in prior say on pay votes:

> *"Continuing with its focus on instituting best practices for executive compensation, the Committee took a number of actions during fiscal 2012 aimed at evolving and improving Autodesk's executive compensation programs. These actions included: i Designing a Performance Stock Unit program; ii Revising Autodesk's compensation peer group to more closely align with companies of Autodesk's financial size and performance; and iii Mandating stock ownership for all executive officers."* (Autodesk DEF14A, Dec 3, 2013, p.18)

Autodesk continues that after another disappointing say on pay vote in fiscal year 2013 with just 64.7 percent support, its management had contacted its largest stockholders, representing over 60% of the outstanding shares, to understand their views and concerns about Autodesk's executive compensation policies. In response, the compensation committee decided to (among other things):

> *"regularly review and identify compensation peer group companies of appropriate size and pay philosophy"'* and to *"further refine Autodesk's compensation peer group"* so to have *"companies in the compensation peer group more closely match Autodesk based on key financial criteria, such as revenue and market capitalization."* (ibid., pp.19-20).

The revised compensation peer group in 2013 reduced the number of non-ISS compliant peers from 9 to 5, in that process also increasing the fraction of reciprocal references by 16 percentage points. The following year, Autodesk Inc. removed an additional four peers and added six new ones to further increase the fit of the compensation peer group with its own size. **Thereafter, Autodesk had only two non-ISS compliant peers remaining in its peer group with 12 of its 14 compensation peers representing 'reciprocal references'** (i.e., the peers also referenced Autodesk in their respective compensation peer groups). After two consecutive "against" say on pay vote recommendations, ISS again issued a "for" vote recommendation for Autodesk's say on pay vote in 2014 and shareholder support climbed from 64.7 percent in 2013 to 88.3 percent in 2014. Over the whole sample period, Autodesk increased reciprocal benchmarking in its peer group from a low of 18 percent in 2007 to 76 percent in 2018, with an intermediate high of 86 percent in 2015.

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2. MINERALS TECHNOLOGIES, INC. *(GICS 15: Materials industry)*

In its 2012 annual meeting, Minerals Technologies Inc. received 56.4 percent shareholder vote support in its say on pay vote, thereby ranking in the Russell 3000 bottom five percent of say on pay vote outcomes in that year. In the same year, the company had also received an "against" vote recommendation by ISS for its say on pay vote. In its research report, ISS pointed to two areas with a high level of concern: pay for performance evaluation and peer group benchmarking policies. In regards to the latter, it commented:

> *"The proxy states that the company intends to have direct remuneration at the 75th percentile of comparators for the high levels of performance that the company targets. Shareholders should note, however, as illustrated in 'Company Selected Peers' [a chart on p.5 of the report that shows that only 1 of the 14 peers is smaller in revenues] the company's competitive benchmarking peer group includes a number of companies that are significantly larger in terms of revenue. Above-median benchmarking and the inclusion of larger companies may have the effect of increasing compensation without providing a strong link to performance."* (ISS research report on Minerals Technologies, May 2, 2012, p. 13)

In response, Minerals Technologies writes in its subsequent proxy filing in April 2013 that it consulted with major shareholders and with ISS and implement changes to its peer group so that it aligned more in firm size and industry classification:

> *"At our 2012 Annual Meeting, our shareholders approved the 2011 compensation of our named executive officers with 56.4% of the shares voting on the matter at the meeting voting in favor. While our 2012 "Say-on-Pay" proposal passed, there were a significant number of votes against the proposal, which likely resulted from a negative recommendation the proposal received from Institutional Shareholder Services (ISS). We conducted an extensive outreach program in connection with our 2012 Say-on-Pay proposal, including contacting all of our top 25 shareholders, to explain the compensation program to our shareholder base. We were pleased that, as a result, a majority of our shareholders voted in favor of the proposal. Since our 2012 annual meeting of shareholders, we have continued our extensive engagement with our shareholders, including contacting all of our top 45 shareholders, as well as with ISS to determine how our corporate governance and compensation practices can be improved. While many of our shareholders were pleased with the overall design of our compensation program, other shareholders had suggestions for improvement. Our Board of Directors and Compensation Committee carefully reviewed these suggestions, and made the following changes to our executive compensation program during 2012:*
>
> - *Most significantly, we performed a careful analysis of the peer companies we use to provide benchmarks regarding remuneration through our executive compensation program at a level appropriate for the markets we compete in. This has resulted in significant changes to the composition of our peer group to ensure that we use the most appropriate comparators for designing our program and making appropriate compensation decisions. See page 49 for further discussion of our peer group."*

> [On page 49 then]
>
> *"As a result of our outreach to our shareholders in 2012, we substantially revised the comparator group used for determining our compensation program. The Company's primary business competitors are foreign companies, privately held firms or subsidiaries of publicly-traded companies. Accordingly, compensation data for most of our primary business competitors is not publicly available. Therefore, based on information and analysis provided by the Committee's independent executive compensation consultant, Steven Hall & Partners, we identified the following group of comparator companies for reference in setting compensation. We selected these companies because they are primarily in the specialty chemical industry, they provide a broad measure of compensation in the market in which we compete for talent, they are similar to the Company in the scope of their operations, and they reflect a generally accepted range of revenue and market capitalization for an appropriately-sized peer group. Our independent compensation consultant has reviewed and supports this peer group."* (DEF14A filing by Minerals Technology Inc., April 3, 2013; pp. 4, 49)

For the following fiscal year, ISS again recommended a "for" vote recommendation for the company's say on pay vote and shareholder vote support climbed to 87.0 percent. **The 2012 peer group restructuring led to an increase reciprocal benchmarking from 21 percent to 52 percent.**

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3. AMERICAN ELECTRIC POWER COMPANY INC. *(GICS 55: Utilities)*

American Electric Power is an example of cases where a compensation committee decided to align its peer group more closely with "the majority practice in the utility industry" without any external shareholder pressure. (Its most recent say on pay vote at the time from 2012 had a support rate by shareholders of 95.3 percent, which was approximately the median support among Russell 3000 firms.)

In its proxy filing sent on March 12, 2014, the company describes the process by which it creates a compensation peer group (while noting that its most recent peer group consisted of almost equally industry-peers and non-industry peers) and how to target executive pay relative to its peers.

> *"The HR Committee, supported by its independent compensation consultant, annually reviews AEP's executive compensation relative to a peer group of companies that represent the talent markets with which AEP must compete to attract and retain executives. The companies included in the Compensation Peer Group were chosen from utilities and industrial companies that were comparable in size to AEP. At the end of 2012, the HR Committee used the Compensation Peer Group consisting of the 14 utility industry companies and the 12 general industry companies shown in the table below in setting the compensation for our named executive officers for 2013. [..] The standard benchmark is the median value of compensation paid by the Compensation Peer Group. The HR Committee considers percentiles other than the median and may select any percentile as a benchmark if, in their judgment, such other benchmarks provide a better comparison based on the specific scope of the job being matched. Broader energy and general industry data is used when sufficient data is not available in the Compensation Peer Group to provide a comparison, but this was not the case in 2013 with respect to any of the named executive officers."* (DEF14A filing by American Electric Power, March 12, 2014, pp. 29-30)

It then described the motivation for an extensive revision of its compensation peer group that occurred in September 2013 and **which removed all peers from other industries so to retain only same-industry and similar-sized peers**:

> *"As part of the HR Committee's independent compensation consultant's comprehensive review of the Company's executive compensation in September 2013, the consultant noted that the Company's practice of using a mix of electric utility and general industry peers differed from the majority practice in the utility industry. Therefore, the HR Committee approved changing the composition of the Company's peer group. It retained all of the existing utility peer companies, added three utility peer companies, and removed all of the general industry companies, thereby creating a compensation peer group consisting entirely of utility companies. The HR Committee made these changes because it determined that an all utility peer group provides more meaningful compensation comparisons and because other similar utility companies are the primary competitors for the company's executive talent. Recent consolidations and mergers in the utility industry increased the size of a number of the utility peer companies. This provided for a sufficiently sized peer group of companies with revenues in a suitable range as compared to the Company's. The peer group set forth below serves as our peer group for 2014." (ibid, pp. 30)*

The revision of its peer group decreased the number of non-ISS compliant peers from 14 in 2012 to just 1 in 2013, while simultaneously increasing the fraction of reciprocal references from 46.4 percent to 83.3 percent. In subsequent years, American Electric Power maintained high levels of shareholder support in say on pay votes of 94 percent or above.

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Figure A.1: Illustration of graph clustering metrics

This figure illustrates the clustering metrics *Reciprocity*, *Density* and *Transitivity* in a simple graph of six nodes. *Reciprocity* is the number of linkages that are bidirectional to the number of overall linkages. *Density* is the number of existing linkages to the number of potential linkages. *Transitivity* is the number of triangles to the number of triads, where triads are groups of three nodes that are connected and triangles are triads that are completely connected. For further information on these measures, see, e.g., Newman (2010, Ch.7).

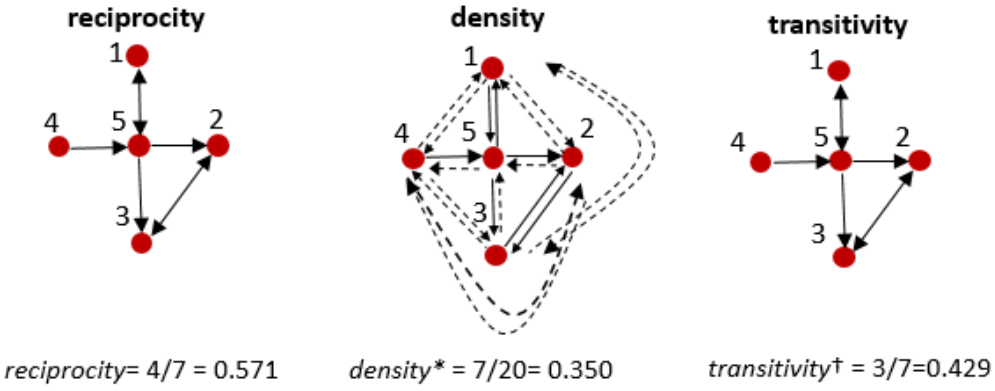

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Figure A.2: CEO pay dispersion for alternative industry classifications

The figures show the average CEO pay dispersion for Russell 3000 firms in industry- and industry-size groups. *CEO pay dispersion* is defined as the median-scaled standard deviation of CEO pay in a given year and industry (or industry-size) group. Figure A shows CEO pay dispersion for different industry classifications, averaged for each year and rebased to 2002. Figure B shows CEO pay dispersion of industry-size groups for different industry classifications, averaged for each year, and rebased to 2002. Firm-size quintiles are determined by firms' market capitalization in a given industry-year.

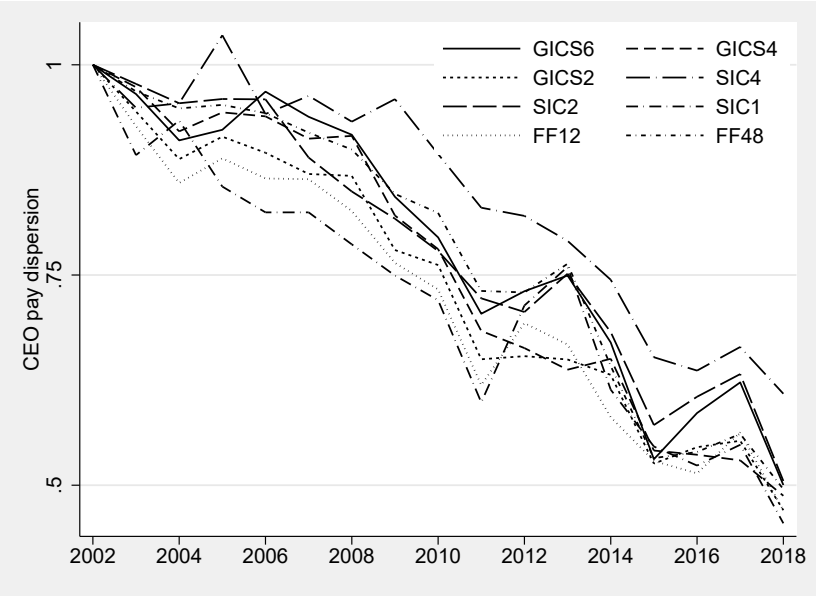

Figure A. CEO pay dispersion in industries under various industry classifications

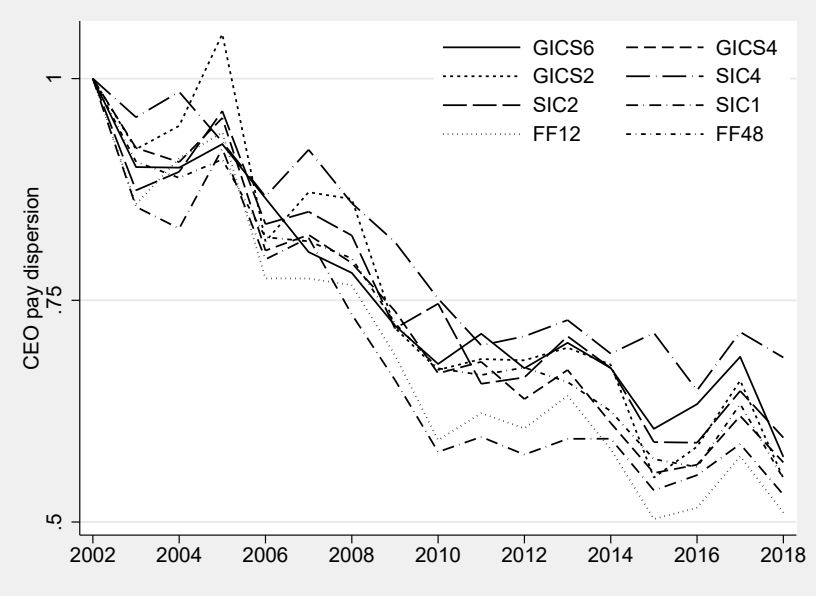

Figure B. CEO pay dispersion in industry-size groups under various industry classifications

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Figure A.3: CEO pay dispersion of S&P 1500 firms

This figure shows the CEO pay dispersion in the economy and within GICS2-industries for S&P 1500 firms between 2002 and 2018. CEO pay dispersion is defined as the median-scaled standard deviation of CEO pay in a given year in either the economy (Figure A) or in a given industry-year (Figure B). In Figure A, we rebase CEO pay dispersion to 2002 to show its relative decline; the shaded area shows the 95 percent confidence interval.

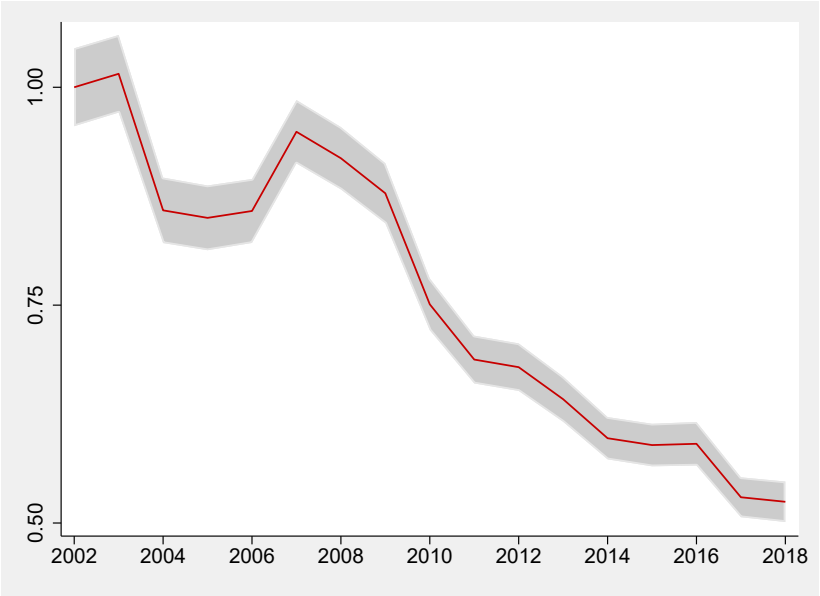

Figure A. CEO pay dispersion for S&P 1500 firms

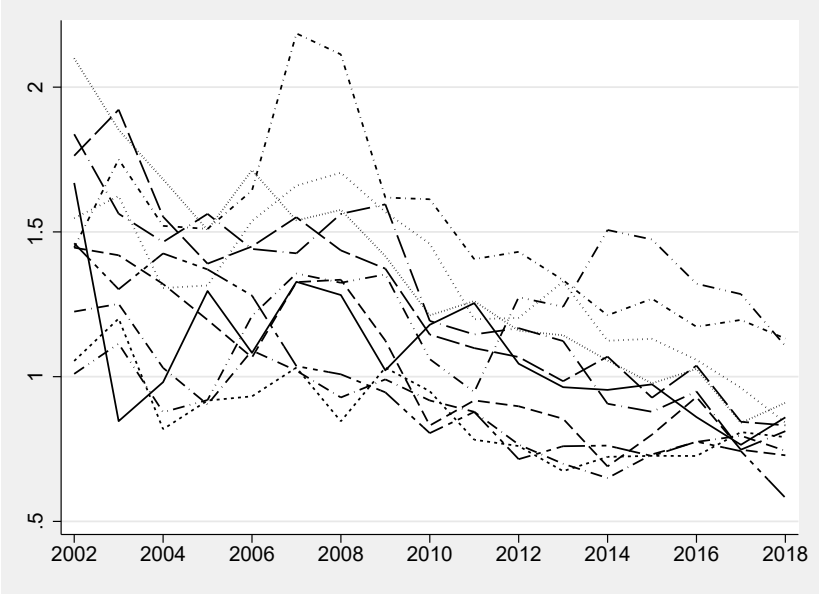

Figure B. Within-industry CEO pay dispersion for S&P 1500 firms

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Figure A.4: Variation in short- and long-term incentives

The figures show the variation of short- and long-term incentives of S&P 1500 firms between 1994 and 2018. Short-term incentives shown in Figure A are defined as salary plus annual bonus. The long-term incentives shown in Figure B are defined as stock awards plus stock options awards plus multi-year non-equity incentives (available in Execucomp since 2006). The solid lines show the median-scaled standard deviation of the dollar value of incentives. The dashed lines show variation in incentive-to-total-pay ratios; hence (since ratios are already scaled), variation is defined via the standard deviation of the ratio.

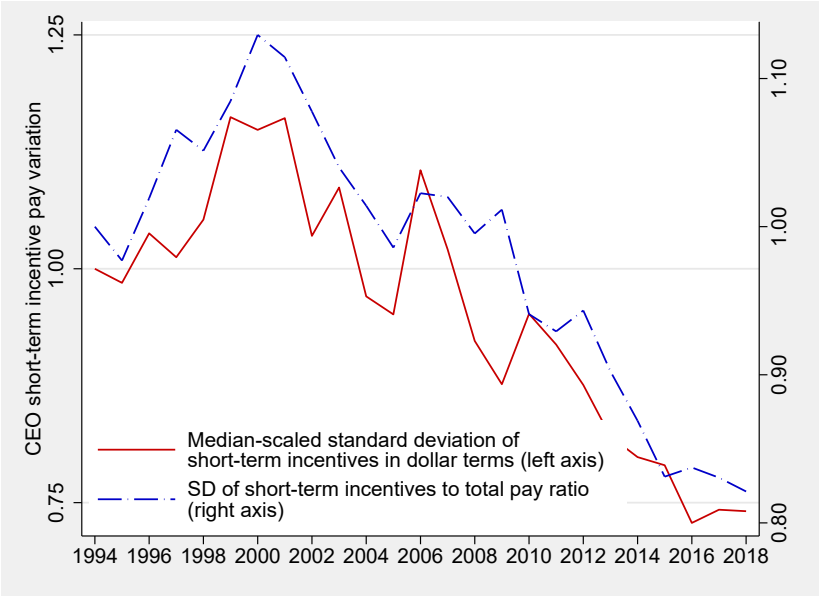

Figure A. Variation in short-term incentive pay

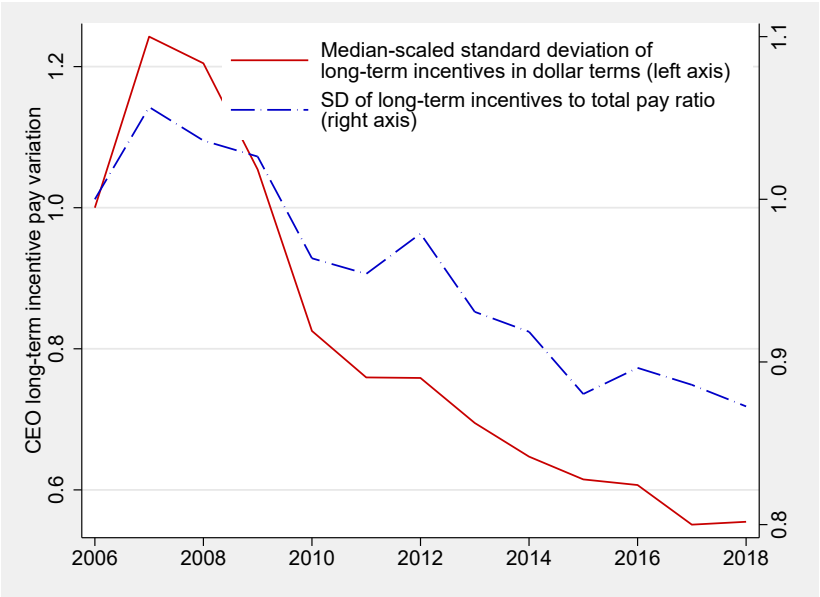

Figure B. Variation in long-term incentive pay

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Figure A.5: Variation in short- and long-term incentives within compensation peer groups

This figure shows variation in short- and long-term incentive pay ratios within compensation peer groups between 2007 and 2018. The short-term incentive ratio is defined as salary plus annual bonus, divided by total pay. The long-term incentive ratio is defined as stock awards plus stock options awards plus multi-year non-equity incentives, divided by total pay. We take the standard deviation of peers' incentive ratios (rather than the median-scaled standard deviation) since the variable is already scaled by total pay. The sample consists of S&P 1500 firms and their S&P 1500 compensation peers with data from Execucomp.

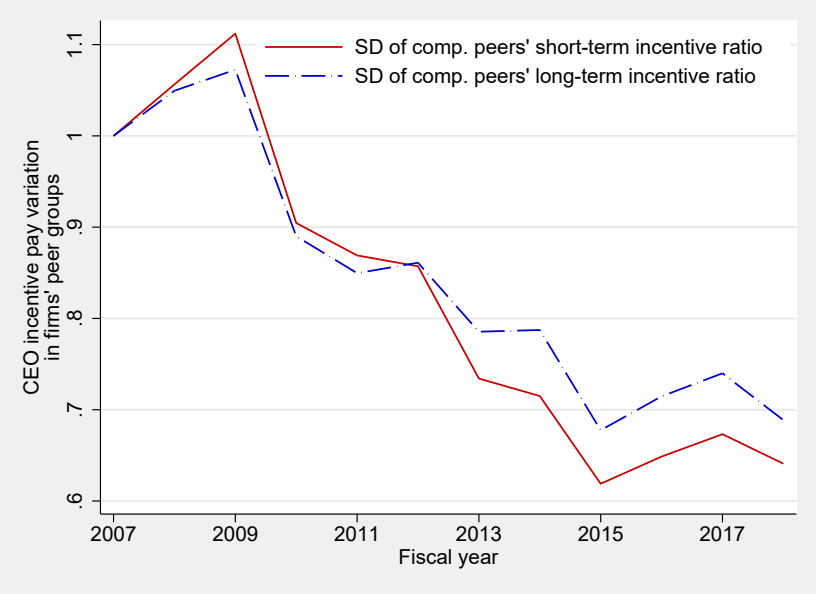

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Figure A.6: CEO pay dispersion since 1994

This figure shows the CEO pay dispersion in the economy and within GICS2-industries for Russell 3000 firms between 1994 and 2018. CEO pay dispersion is defined as the median-scaled standard deviation of CEO pay in a given year in either the economy (Figure A) or in a given industry-year (Figure B). In Figure A, we rebase CEO pay dispersion to 2002 to show its relative decline; the shaded area shows the 95 percent confidence interval.

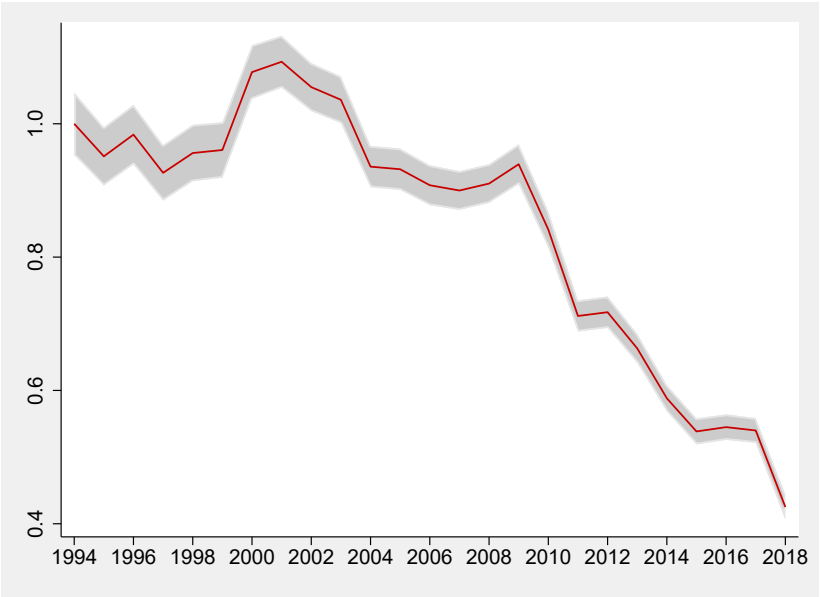

Figure A. CEO pay dispersion since 1994

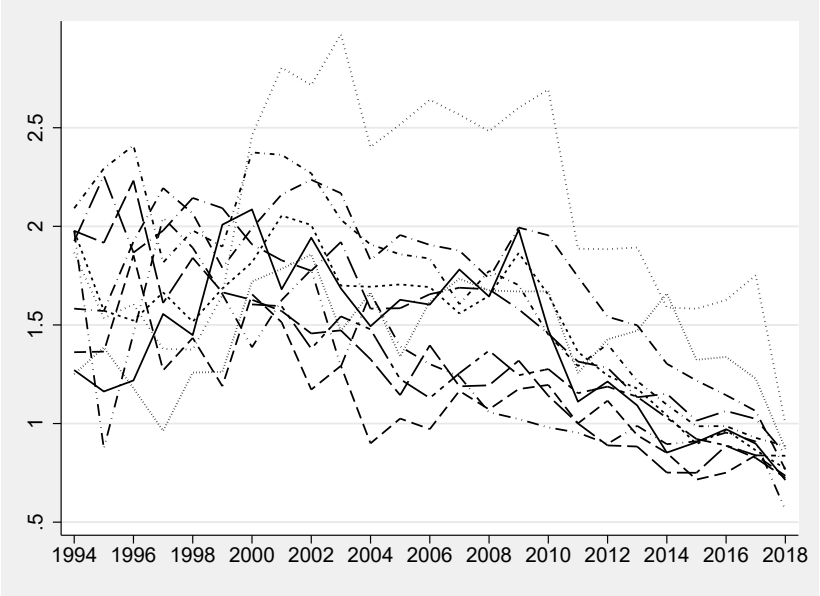

Figure B. Within-industry CEO pay dispersion since 1994

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Figure A.7: Additional simulation results

The solid red line in Figure A shows simulated CEO pay dispersion across all Russell 3000 firms (i.e. economy-wide pay dispersion), rescaled to 2007, if all firms targeted CEO pay levels at the 50th percentile of their ISS-compliant peer groups. The blue long-dashed line shows averaged pay dispersion within Russell 3000 firms' ISS-compliant peer groups when target pay is set at the 50th percentile. Figure B shows median pay in the simulation across all Russell 3000 firms (i.e., median pay level in the economy) and median pay within the average ISS-compliant peer group, rescaled to 2007. In both figures, the gray-dashed lines show the results if firms used other constant target pay percentiles in the simulation (the 35th, 40th, 45th, 55th, 60th, or 65th percentile); in Figure B, higher gray-dashed lines represent higher target pay percentiles.

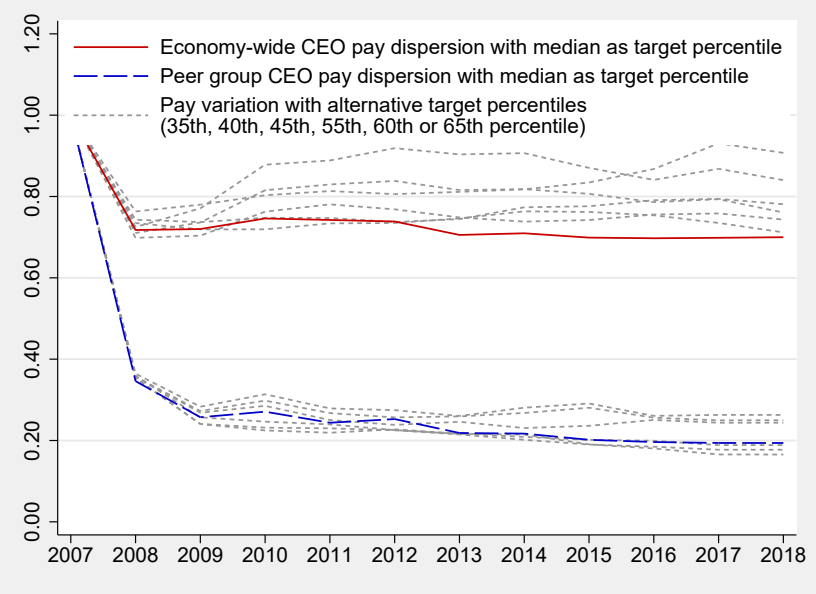

Figure A: Simulated CEO pay dispersion (i.e. 2nd moment) under various target percentiles

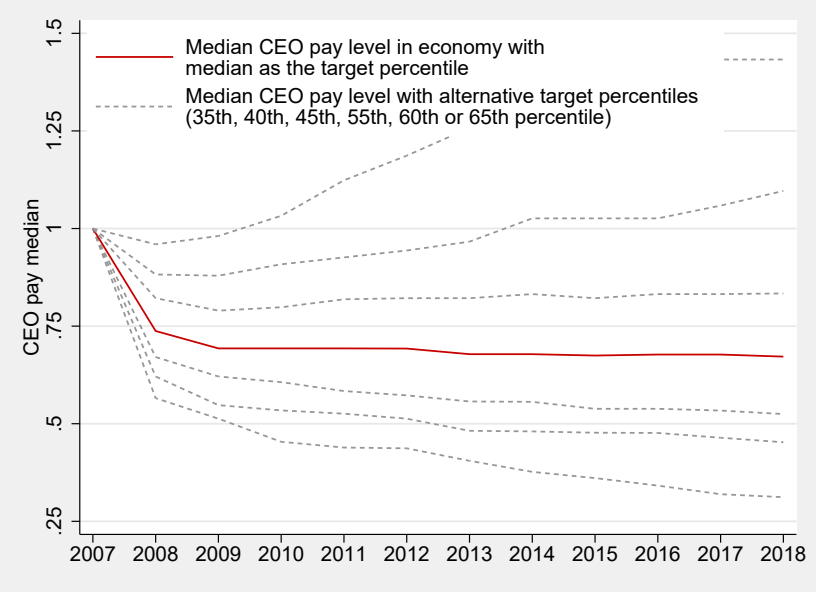

Figure B: Simulated median CEO pay (i.e. 1st moment) under various pay target percentiles

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Figure A.8 Alternative measures of reciprocal benchmarking

This figure shows the change in the three reciprocal benchmarking measures *Reciprocity*, *Transitivity* and *Density*, rebased to the first year in which compensation peer group references are made public. Figure A shows the reciprocal benchmarking measures for the compensation peer network that consists of all Russell 3000 sample firms. Figure B shows reciprocal benchmarking measures for industry-size groups, averaged across all groups in a given year.

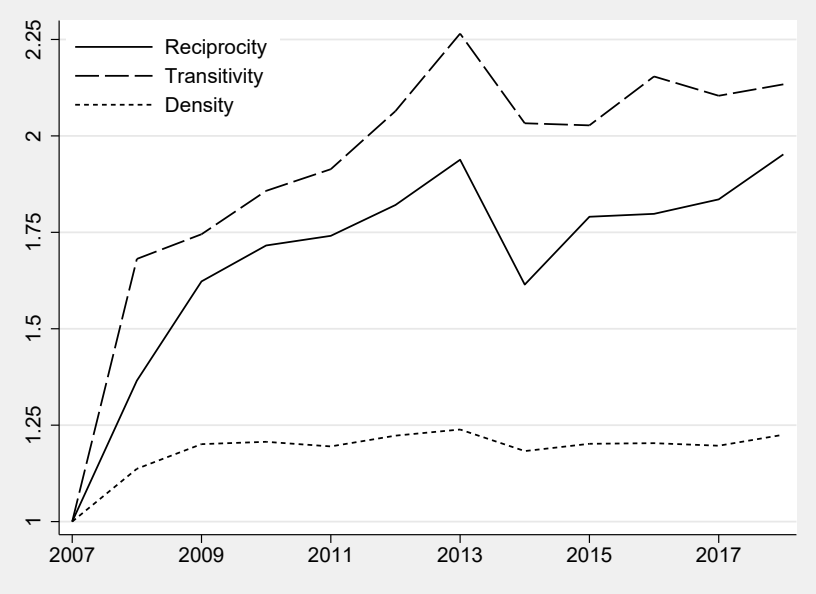

Figure A. Reciprocal benchmarking measures for the network of Russell 3000 sample firms

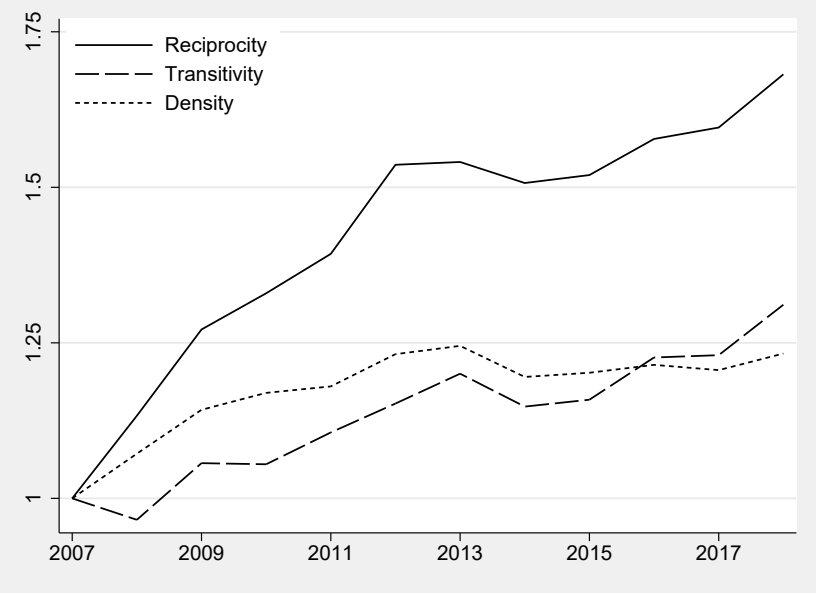

Figure B. Reciprocal benchmarking measures for industry-size groups

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Figure A.9: Compensation peer similarity

This figure shows the trajectory of *Fraction of dissimilar compensation peers*, which is the fraction of compensation peers that are at least two times the market cap or asset size of the base firm and from a different SIC1-industry, averaged across firms in a given year. The measures is rebased to 2007.

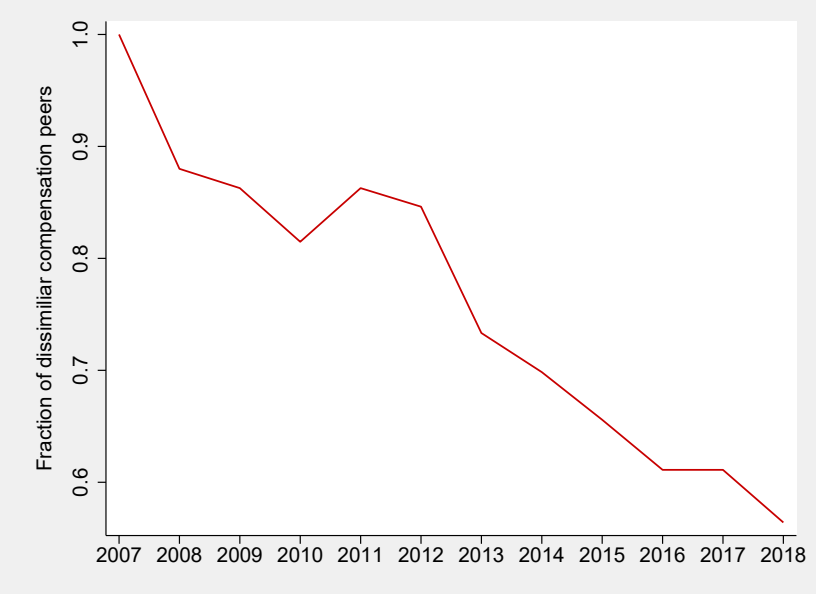

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Figure A.10: CEO pay dispersion, excluding firms entering and exiting the R3000

This figure shows the CEO pay dispersion in the economy and within-industries for Russell 3000 firms that have 10 or more consecutive years of data. CEO pay dispersion is defined as the median-scaled standard deviation of CEO pay in a given year in either the economy (Figure A) or in a given industry-year (Figure B). In Figure A, we rebase CEO pay dispersion to 2002 to show its relative decline; the shaded area shows the 95 percent confidence interval.

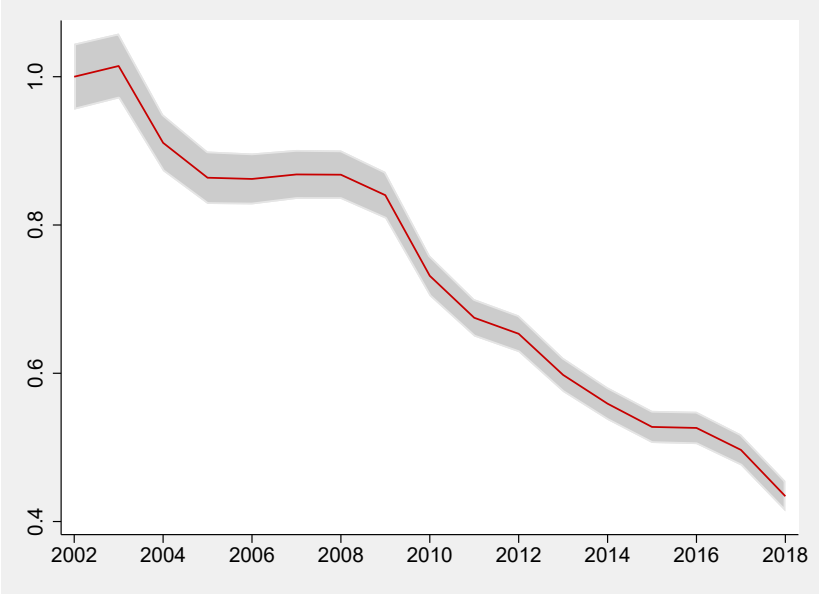
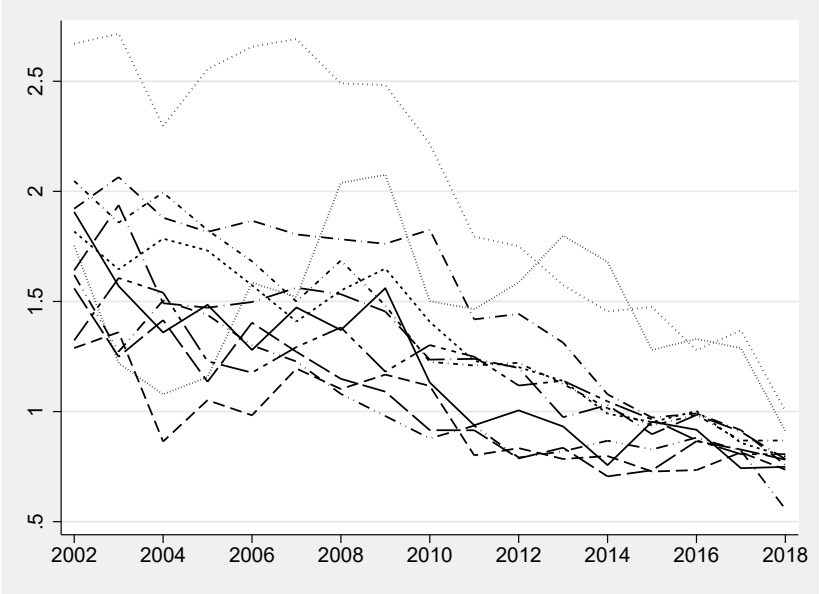


Figure A. CEO pay dispersion for firms with at least 10 consecutive years of data



Panel B: Within-industry CEO pay dispersion for firms with

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at least 10 consecutive years of data

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Figure A.11: Variation in firm characteristics over time

Figure A shows the median-scaled standard deviations for total assets and market value of equity, and the standard deviations of the (already-scaled variables) leverage ratio, profitability ratio, Tobin's Q, stock performance, and idiosyncratic risk for Russell 3000 firms between 2002 and 2018, rescaled to 2002. Figure B shows this information for S&P 1500 firms. For comparison, the figure superimposes CEO pay dispersion computed as in Figure 1 (in solid, red line).

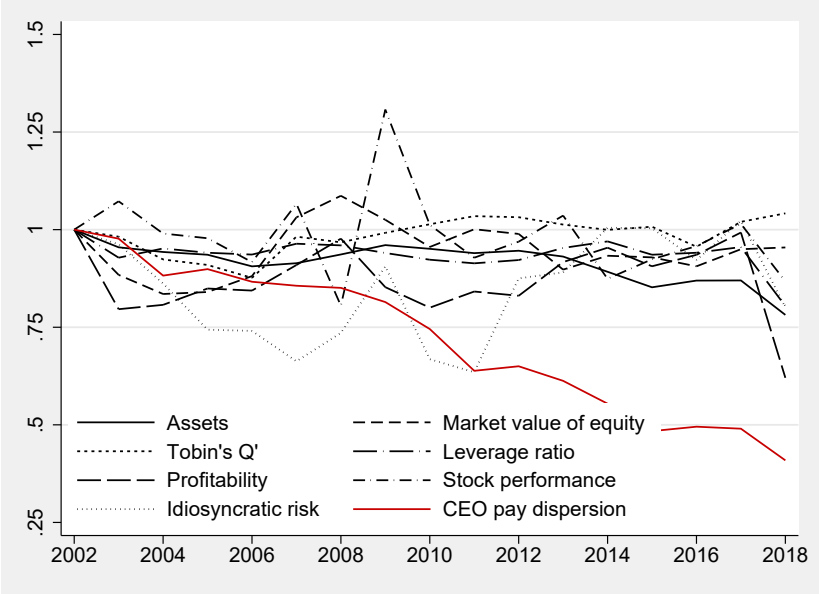

Figure A: Variation in firm characteristics over time (R3000)

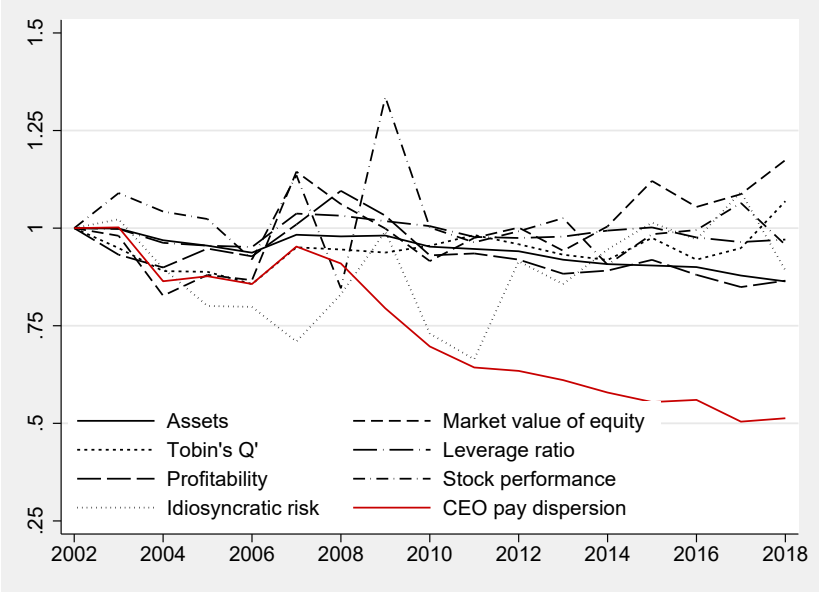

Figure B: Variation in firm characteristics over time (S&P 1500)

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Figure A.12: CEO pay distribution

This figure shows changes in the distribution of CEO pay for Russell 3000 firms. All percentiles are scaled by median pay in the respective year to interpret them as multiples of the median pay level. The median-scaled interquartile range is plotted against the right axis.

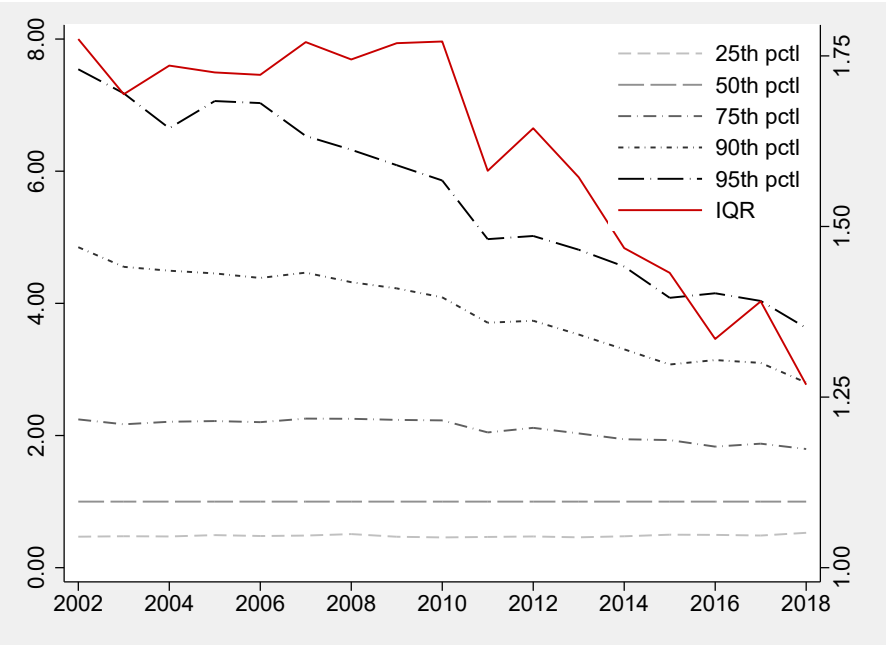

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Figure A.13: Skewness of CEO pay

This figure plots the cross-sectional skewness of CEO pay, rebased to 2002, as an alternative measure of dispersion. To mitigate the effect of outliers, CEO pay is winsorized at the 1 percent level before computing annual skewness.

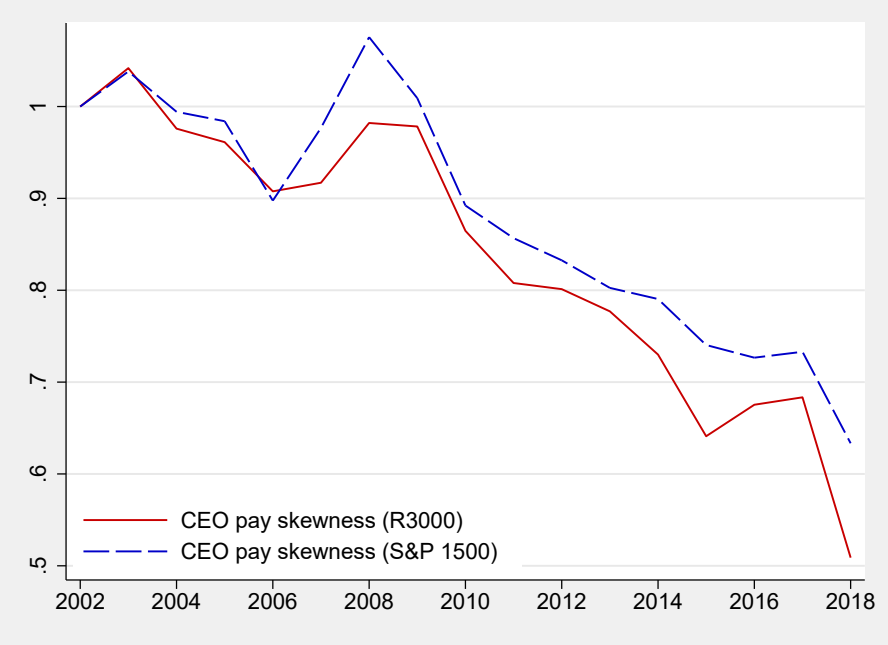

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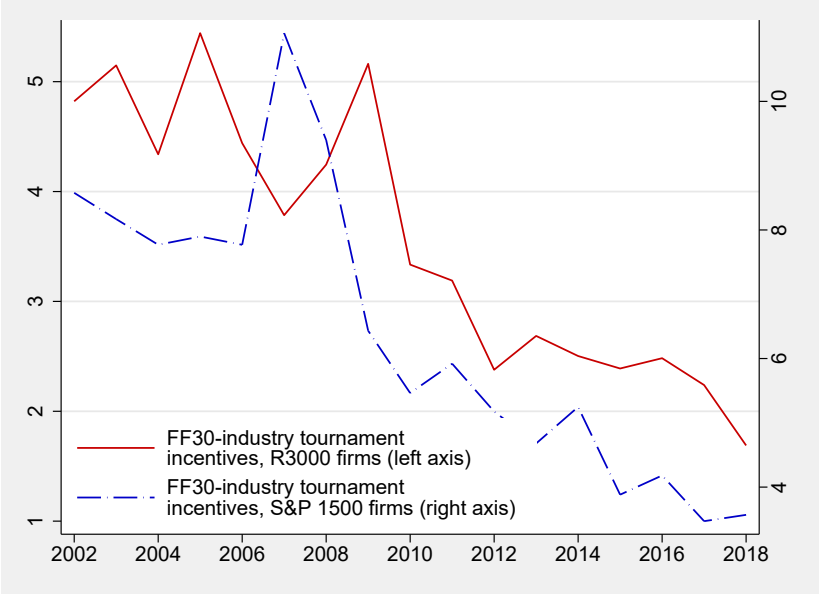
Figure A.14: Industry tournament incentives using FF30 industries

This figure shows industry tournament incentives between 2002 and 2018 at the FF30 industry level following Coles, Li, and Wang (2018). *Industry tournament incentives* is defined as the difference between the CEO pay of the second-highest paying firm in a given Fama-French 30 industry and the focal firm's CEO pay, scaled by the median pay level in that industry and year.



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Appendix Table A.1: Compensation peer group size

This table shows the distribution of compensation peer group sizes across years.

	P5	P25	Median	P75	P95	Mean	Std. dev.	N
2007	7	12	16	22	44	19.7	14.2	617
2008	6	11	15	20	37	17.9	12.6	1,992
2009	5	12	15	20	35	17.5	12.1	2,218
2010	6	12	16	21	33	18.0	13.1	2,332
2011	7	13	17	21	33	18.8	13.4	2,371
2012	7	13	17	21	32	18.3	10.2	2,413
2013	8	14	17	20	32	18.1	11.2	2,379
2014	8	14	17	20	30	18.0	12.6	2,230
2015	9	14	17	20	30	18.5	15.9	2,213
2016	9	14	17	20	30	18.5	15.0	2,194
2017	10	14	16	20	28	18.3	13.8	2,179
2018	9	14	17	20	28	18.0	11.8	2,197
Total	7	13	16	20	32	18.2	13.0	25,335

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Appendix Table A.2: Variation in short- and long-term incentive pay

This table shows the relationship between measures of reciprocal benchmarking and the variation in incentive pay ratios of compensation peers. The sample consists of S&P 1500 firms and their S&P 1500 compensation peers with data from Execucomp. *Variation in short-term incentive pay ratio* is the standard deviation of compensation peers' short-term incentive ratios (which is defined as salary plus bonus divided by total CEO pay). *Variation in long-term incentive pay ratio* is the standard deviation of compensation peers' long-term incentive ratios (which is defined as the sum of stock awards, option awards and non-equity incentives divided by total CEO pay). We omit the scaling by median pay since the dependent variables are already ratios. *Reciprocity*, *Transitivity* and *Density*, computed at the peer group level, are defined in the variable appendix. Firm controls are the same as in Table 3. Industry fixed effects are based on GICS6-industry classification. *t*-statistics (in parentheses) are based on standard errors clustered at the firm-level.

Panel A: Variation in short-term incentive pay ratio

Dependent variable:	*Variation in short-term incentive pay ratio*					
Level:	Firm-year level					
Sample:	2007-2018					
Model:	(1)	(2)	(3)	(4)	(5)	(6)
Reciprocity	-0.055***	-0.018***				
	(-13.37)	(-2.982)				
Transitivity			-0.113***	-0.064***		
			(-19.66)	(-7.523)		
Density					-0.104***	-0.068***
					(-16.02)	(-7.588)
Firm controls	No	Yes	No	Yes	No	Yes
Industry × Year FE	No	Yes	No	Yes	No	Yes
State × Year FE	No	Yes	No	Yes	No	Yes
Firm FE	No	Yes	No	Yes	No	Yes
Observations	19,180	15,724	19,180	15,724	19,180	15,724
R-squared	0.027	0.628	0.058	0.630	0.038	0.630

Panel B: Variation in long-term incentive pay ratio

Dependent variable:	*Variation in long-term incentive pay ratio*					
Level:	Firm-year level					
Sample:	2007-2018					
Model:	(1)	(2)	(3)	(4)	(5)	(6)
Reciprocity	-0.052***	-0.026***				
	(-11.88)	(-3.982)				
Transitivity			-0.113***	-0.073***		
			(-18.81)	(-8.078)		
Density					-0.110***	-0.079***
					(-16.15)	(-8.363)
Firm controls	No	Yes	No	Yes	No	Yes
Industry × Year FE	No	Yes	No	Yes	No	Yes
State × Year FE	No	Yes	No	Yes	No	Yes
Firm FE	No	Yes	No	Yes	No	Yes
Observations	19,180	15,724	19,180	15,724	19,180	15,724
R-squared	0.022	0.608	0.052	0.611	0.037	0.589

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Appendix Table A.3: Alternative measures of reciprocal benchmarking. Group-level analysis.

Panel A show the time trend of two alternative reciprocal benchmarking measures of compensation peer networks, *Transitivity* and *Density*, measured at the industry-size group level, between 2007 (the first year of the peer group disclosure mandate) and 2018. Panel B shows the within-year association between the two reciprocal benchmarking measures and *CEO pay dispersion* measured at the industry-size group level. Industry is defined based on GICS6 classifications and size groups are based on quintiles of market capitalization within industry-year. *Time trend* is a linear trend variable defined as the fiscal year minus 2006. All variables are computed at the industry-size-year level and defined in the variable appendix. *t*-statistics (in parentheses) are based on standard errors that are two-way clustered at the year and industry-size level.

Panel A: Time trends

Dependent variable:	*Transitivity*				*Density*			
Level:	Industry-size-year level				Industry-size-year level			
Window of analysis:	2007-2018				2007-2018			
Model:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Time trend	0.004***	0.005***	0.004***	0.005***	0.006***	0.007***	0.006***	0.007***
	(3.318)	(3.365)	(3.384)	(3.594)	(5.025)	(4.945)	(5.076)	(5.008)
Industry FE	No	Yes	No	n/a	No	Yes	No	n/a
Size FE	No	No	Yes	n/a	No	No	Yes	n/a
Industry × Size FE	No	No	No	Yes	No	No	No	Yes
Observations	3,355	3,355	3,355	3,344	3,355	3,355	3,355	3,344
R-squared	0.011	0.149	0.179	0.693	0.011	0.221	0.074	0.589

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Appendix Table A.3: Alternative measures of reciprocal benchmarking. Group-level analysis. *(cont'd)*

Panel B: Association pay dispersion and reciprocal benchmarking

Dependent variable:	*CEO pay dispersion*				*CEO pay dispersion*			
Level:	Industry-size-year level				Industry-size-year level			
Window of analysis:	2007-2018				2007-2018			
Model:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Transitivity	-0.498***	-0.434***	-0.287***	-0.293***				
	(-4.808)	(-4.047)	(-3.436)	(-3.472)				
Density					-0.508***	-0.481***	-0.104	-0.144*
					(-5.656)	(-5.198)	(-1.617)	(-2.018)
Year FE	No	Yes	Yes	n/a	No	Yes	Yes	n/a
Industry × Size FE	No	No	Yes	Yes	No	No	Yes	Yes
Industry × Year FE	No	No	No	Yes	No	No	No	Yes
Size × Year FE	No	No	No	Yes	No	No	No	Yes
Observations	3,174	3,174	3,174	3,174	2,411	2,411	2,411	2,407
R-squared	0.014	0.039	0.212	0.284	0.034	0.067	0.245	0.344

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Appendix Table A.4: Reciprocal benchmarking and pay dispersion

This table provides the complete results from the models shown in Table 3, Panel B. Industry fixed effects are based on GICS6-industry classification. See Appendix A for variable definitions. *t*-statistics (in parentheses) are based on standard errors clustered at the firm level.

Dependent variable:	*CEO pay dispersion*				
Level:	*Firm-year level*				
Sample:	2007-2018				
Model:	(1)	(2)	(3)	(4)	(5)
Reciprocity	**-0.335*** (14.57)**	**-0.148*** (-5.750)**	**-0.114*** (-4.424)**	**-0.147*** (-5.571)**	**-0.171*** (-4.416)**
Log firm value		-0.049***	-0.056***	-0.056***	0.015
		(-10.79)	(-11.43)	(-11.07)	(0.879)
Market-to-book ratio		0.045***	0.037***	0.031***	-0.000
		(7.587)	(5.710)	(4.552)	(-0.045)
Net leverage		-0.058**	-0.018	-0.016	0.052
		(-2.445)	(-0.740)	(-0.626)	(1.286)
Investments		-0.137	0.287**	0.308**	0.073
		(-1.180)	(1.985)	(2.068)	(0.339)
S&P 1500 membership		-0.013	-0.016	-0.011	–
		(-0.755)	(-0.987)	(-0.687)	–
R&D indicator		-0.094***	-0.025	-0.028	0.110**
		(-6.543)	(-1.263)	(-1.415)	(1.996)
Stock performance		-0.005	0.001	-0.005	-0.005
		(-0.499)	(0.111)	(-0.570)	(-0.507)
Sales growth		-0.001	0.009	0.010	-0.008
		(-0.067)	(0.610)	(0.596)	(-0.510)
Fraction of independent directors		-0.093**	0.009	-0.004	0.004
		(-2.270)	(0.219)	(-0.091)	(0.093)
CEO-chairman duality		0.033**	0.013	0.015	0.006
		(2.251)	(0.911)	(1.096)	(0.393)
Classified board		-0.017	0.001	-0.003	0.054***
		(-1.303)	(0.052)	(-0.259)	(2.820)
Lead director		-0.011	0.001	0.003	0.000
		(-0.779)	(0.106)	(0.206)	(0.017)
Number board committees		-0.020***	-0.008	-0.009*	-0.000
		(-4.047)	(-1.585)	(-1.900)	(-0.062)
Cumulative pay growth		0.012***	0.006**	0.005	-0.003
		(3.809)	(2.151)	(1.476)	(-0.861)
CEO age		-0.004***	-0.001	-0.001	-0.001
		(-3.853)	(-1.216)	(-1.290)	(-0.848)
CEO tenure		0.003***	0.002	0.002	0.000
		(3.134)	(1.538)	(1.538)	(0.125)
CEO turnover		0.013	-0.006	-0.010	-0.012
		(1.027)	(-0.466)	(-0.790)	(-0.957)
Year FE	No	Yes	Yes	n/a	n/a
Industry FE	No	No	Yes	n/a	n/a
State FE	No	No	Yes	n/a	n/a
Industry × Year FE	No	No	No	Yes	Yes
State × Year FE	No	No	No	Yes	Yes
Firm FE	No	No	No	No	Yes
Observations	25,020	21,024	20,540	20,460	20,082
R-squared	0.017	0.089	0.166	0.269	0.527

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Appendix Table A.5: Alternative measures of reciprocal benchmarking. Firm-level analysis.

Panel A shows the time trend in the two alternative reciprocal benchmarking measures of compensation peer groups, *Transitivity* and *Density*, measured at the firm-year level, between 2007 (the first year of the peer group disclosure mandate) and 2018. Panel B shows the within-year relationship between the two reciprocal benchmarking measures and *CEO pay dispersion* in firms' compensation peer groups. Industry is based on GICS6 classifications and size groups are based on quintiles of market capitalization within industry-year. *Time trend* is a linear trend variable defined as the fiscal year minus 2006. All variables are computed at the firm-year level and defined in the variable appendix. *t*-statistics (in parentheses) are based on standard errors clustered at the firm level.

Panel A: Time trends

Dependent variable:	*Transitivity*				*Density*			
Level:	Firm-year level				Firm-year level			
Window of analysis:	2007-2018				2007-2018			
Model:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Time trend	0.006***	0.005***	0.005***	0.008***	0.002***	0.002***	0.002***	0.004***
	(13.73)	(8.663)	(8.924)	(14.45)	(6.029)	(3.551)	(3.444)	(7.495)
Firm controls	No	Yes	Yes	Yes	No	Yes	Yes	Yes
Industry FE	No	Yes	n/a	No	No	Yes	n/a	No
State FE	No	Yes	n/a	No	No	Yes	n/a	No
Industry × State FE	No	No	Yes	No	No	No	Yes	No
Firm FE	No	No	No	Yes	No	No	No	Yes
Observations	25,276	20,655	20,596	20,762	25,276	20,655	20,596	20,762
R-squared	0.012	0.378	0.527	0.786	0.002	0.257	0.437	0.755

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Appendix Table A.5: Alternative measures of reciprocal benchmarking. Firm-level analysis. *(cont'd)*

Panel B: Association pay dispersion and reciprocal benchmarking

Dependent variable:	*CEO pay dispersion*					*CEO pay dispersion*				
Level:	Firm-year level					Firm-year level				
Window of analysis:	2007-2018					2007-2018				
Model:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Transitivity	-0.577***	-0.522***	-0.440***	-0.380***	-0.454***					
	(-20.65)	(-18.40)	(-8.723)	(-10.01)	(-8.686)					
Density						-0.626***	-0.591***	-0.588***	-0.465***	-0.604***
						(-18.98)	(-17.94)	(-11.41)	(-11.87)	(-11.34)
Firm controls	No	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes
Year FE	No	Yes	Yes	n/a	n/a	No	Yes	Yes	n/a	n/a
Industry FE	No	No	Yes	n/a	n/a	No	No	Yes	n/a	n/a
State FE	No	No	Yes	n/a	n/a	No	No	Yes	n/a	n/a
Industry × Year	No	No	No	Yes	Yes	No	No	No	Yes	Yes
State × Year	No	No	No	Yes	Yes	No	No	No	Yes	Yes
Firm FE	No	No	No	No	Yes	No	No	No	No	Yes
Observations	24,989	24,989	20,618	20,452	20,077	24,989	24,989	20,618	20,452	20,077
R-squared	0.034	0.057	0.512	0.276	0.530	0.028	0.054	0.514	0.278	0.532

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Table A.6: Alternative measures for corporate risk-taking

This table repeats the analysis in Table 11 using three alternative measures for corporate risk-taking as dependent variables. In Panel A, *ROA volatility over the next 3 years* is defined as the standard deviation of a firm's return on assets over fiscal years $[t+1, t+3]$. In Panel B, *Cash flow volatility over the next 3 years* is defined as the standard deviation of a firm's cash flow (i.e., earnings before interest and taxes minus extraordinary items plus depreciation over assets) over fiscal years $[t+1, t+3]$. In Panel C, *Earnings volatility over the next 3 years* is defined as the standard deviation of a firm's earnings before interest and taxes over assets over fiscal years $[t+1, t+3]$. All dependent variables are multiplied by 100 for ease of interpretation. *Peer group pay dispersion* is the median-scaled standard deviation of the CEO pay levels of a given firm's compensation peers. It is instrumented using *Peers' idiosyncratic equity shock*, which is the maximum idiosyncratic equity shock among a firm's compensation peers estimated from a Fama-French 3 factor model augmented with FF48 industry factors (Leary and Roberts, 2014; see the variable appendix for further details). Firm controls and industry fixed effects are as in Table 10. t-statistics (in parentheses) are based on standard errors clustered at the firm-level.

Panel A: ROA volatility

Dependent variable:	*ROA volatility over next 3 years*					
Level:	Firm-year level					
Window of analysis:	2007-2018			2007-2018		
Type:	2SLS			Reduced-form IV		
Model:	(1)	(2)	(3)	(4)	(5)	(6)
Peer group pay equity shock	24.61***	16.81***	16.90***			
	(8.967)	(6.328)	(6.375)			
Peers' idiosyncratic reciprocating peers				3.127***	1.687***	1.737***
				(15.98)	(10.30)	(10.33)
Firm controls	No	Yes	Yes	No	Yes	Yes
Year FE	No	Yes	n/a	No	Yes	n/a
Industry FE	No	Yes	n/a	No	Yes	n/a
State FE	No	Yes	n/a	No	Yes	n/a
Industry × Year FE	No	No	Yes	No	No	Yes
State × Year FE	No	No	Yes	No	No	Yes
First-stage diagnostics						
Coeff. (*Peers' idosyncr. equity shock*)	0.128	0.101	0.103	n/a	n/a	n/a
t-stat. (*Peers' idosyncr. equity shock*)	11.49	8.005	8.150	n/a	n/a	n/a
KP F-stat. (*Peers' idosyncr. equity shock*)	132.1	64.03	66.49	n/a	n/a	n/a
Observations	14,031	13,096	13,045	14,087	13,146	13,094
R-squared	n/a	n/a	n/a	0.055	0.199	0.209

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Table A.6: Alternative measures for corporate risk-taking *(cont'd)*

Panel B: Cashflow volatility

Dependent variable:	*Cashflow volatility over next 3 years*					
Level:	Firm-year level					
Window of analysis:	2007-2018			2007-2018		
Type:	2SLS			Reduced-form IV		
Model:	(1)	(2)	(3)	(4)	(5)	(6)
Peer group pay dispersion	10.20***	6.943***	7.014***			
	(10.28)	(5.818)	(5.857)			
Peers' idiosyncratic equity shock				1.391***	0.587***	0.604***
				(18.69)	(10.02)	(10.08)
Firm controls	No	Yes	Yes	No	Yes	Yes
Year FE	No	Yes	n/a	No	Yes	n/a
Industry FE	No	Yes	n/a	No	Yes	n/a
State FE	No	Yes	n/a	No	Yes	n/a
Industry × Year FE	No	No	Yes	No	No	Yes
State × Year FE	No	No	Yes	No	No	Yes
First-stage diagnostics						
Coeff. (*Peers' idosyncr. equity shock*)	0.137	0.085	0.087	n/a	n/a	n/a
t-stat. (*Peers' idosyncr. equity shock*)	12.67	6.930	6.980	n/a	n/a	n/a
KP *F*-stat. (*Peers' idosyncr. equity shock*)	160.4	47.99	48.66	n/a	n/a	n/a
Observations	14,258	13,347	13,292	14,319	13,401	13,347
R-squared	n/a	n/a	n/a	0.065	0.328	0.337

Panel C: Earnings volatility

Dependent variable:	*Earnings volatility over next 3 years*					
Level:	Firm-year level					
Window of analysis:	2007-2018			2007-2018		
Type:	2SLS			Reduced-form IV		
Model:	(1)	(2)	(3)	(4)	(5)	(6)
Peer group pay dispersion	24.61***	16.81***	16.90***			
	(8.967)	(6.328)	(6.375)			
Peers' idiosyncratic equity shock				3.127***	1.687***	1.737***
				(15.98)	(10.30)	(10.33)
Firm controls	No	Yes	Yes	No	Yes	Yes
Year FE	No	Yes	n/a	No	Yes	n/a
Industry FE	No	Yes	n/a	No	Yes	n/a
State FE	No	Yes	n/a	No	Yes	n/a
Industry × Year FE	No	No	Yes	No	No	Yes
State × Year FE	No	No	Yes	No	No	Yes
First-stage diagnostics						
Coeff. (*Peers' idosyncr. equity shock*)	0.133	0.094	0.095	n/a	n/a	n/a
t-stat. (*Peers' idosyncr. equity shock*)	12.57	7.660	7.690	n/a	n/a	n/a
KP *F*-stat. (*Peers' idosyncr. equity shock*)	157.9	58.71	59.14	n/a	n/a	n/a
Observations	15,132	14,134	14,079	15,195	14,190	14,136
R-squared	n/a	n/a	n/a	0.076	0.360	0.368

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Table A.7: Industry return synchronicity – additional result

Panel A shows the time trend in industry return synchronicity and its relation with industry-level CEO pay dispersion at the GICS2- and GICS6-industry level. Panel B shows the relation between the industry return synchronicity and the three reciprocal benchmarking measures *Reciprocity*, *Transitivity* and *Density* of compensation peer networks computed at the GICS2 or GICS6-industry level in a given year. *Industry return synchronicity* is defined as the R-squared of a market-and-industry factor model minus the R-squared of a market-factor model, computed separately for each firm-year and averaged across all firms in a given GICS2 or GICS6 industry and year (for further details, see the variable appendix). For ease of interpretation, the dependent variable is multiplied by 100. *CEO pay dispersion* is the median-scaled standard deviation of CEO pay in a given industry and year. Fixed effects include year and 1-digit GICS industry level. *t*-statistics (in parentheses) are based on standard errors that are two-way clustered at the industry- and year-level.

Panel A: Industry return synchronicity, time trend and pay dispersion

Dependent variable:	*Industry return synchronicity*							
Level:	GICS2 industry-year level				GICS6 industry-year level			
Window of analysis:	2007-2018				2007-2018			
Model:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Time trend	0.538***	0.538***			0.394***	0.394***		
	(3.905)	(2.777)			(7.323)	(7.154)		
CEO pay dispersion			-5.738**	-5.645*			-2.622***	-1.707*
			(-2.635)	(-2.205)			(-3.127)	(-1.973)
Year FE	n/a	n/a	No	Yes	n/a	n/a	No	Yes
Industry FE	No	Yes	No	Yes	No	Yes	No	Yes
Observations	132	132	132	132	823	823	823	823
Avg. # of firms per year	2,897	2,897	2,897	2,897	2,897	2,897	2,897	2,897
R-squared	0.087	0.751	0.242	0.276	0.042	0.169	0.086	0.211

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Appendix Table A.7: Industry return synchronicity – additional result *(cont'd)*

Panel B: Industry return synchronicity and reciprocal benchmarking

Dependent variable:	*Industry return synchronicity*											
Level:	GICS2 industry-year level						GICS6 industry-year level					
Window of analysis:	2007-2018						2007-2018					
Model:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Reciprocity	59.93**	66.29**					11.17**	10.50**				
	(2.736)	(2.301)					(2.791)	(2.551)				
Transitivity			58.20**	63.40**					14.93***	12.71**		
			(2.291)	(2.245)					(3.527)	(3.040)		
Density					72.04***	68.50***					28.88***	23.82***
					(4.580)	(3.713)					(4.869)	(3.885)
Year FE	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Industry FE	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Observations	132	132	132	132	132	132	796	796	796	796	743	743
Avg. # of firms per year	2,897	2,897	2,897	2,897	2,897	2,897	2,897	2,897	2,897	2,897	2,897	2,897
R-squared	0.290	0.353	0.296	0.403	0.377	0.429	0.063	0.230	0.092	0.242	0.199	0.318

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