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Why Have CEO Pay Levels Become Less Diverse?

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Abstract

This paper documents a new stylized fact; the cross-sectional variation in CEO pay levels has declined precipitously in recent years. We offer one explanation for this decline: firms are increasingly benchmarking CEO compensation to industry peers closest in size, thereby creating pay clusters. Our empirical tests provide support for this explanation and suggest that the rise of industry-size benchmarking is driven by the combination of three institutional factors: the mandatory disclosure of compensation peer groups, proxy advisory influence, and say on pay regulation. Our findings highlight a consequence of adopting a one-size-fits-all standard in the pay setting process.

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Abstract

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Keywords: Variation in executive pay; pay dispersion; compensation benchmarking; industry-size benchmarking; pay transparency; pay disclosure; proxy advisors; say on pay

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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 has declined precipitously (see Figure 1). Using a wide sample of publicly listed U.S. firms, spanning from 1996 to 2023, we document a decline of almost 40 percent in the cross-sectional variation in CEO pay from 2007 until recent times. The decline in cross-sectional variation in CEO pay levels (henceforth "pay dispersion") is due to convergence in pay towards the median in both tails of the pay distribution, and holds not only at the economy level but also within industries, industry-size groups, and firms' compensation peer groups.

The pattern is empirically robust. The downward trend is also observable in demanding regression analyses at different levels of data aggregation. The lower pay dispersion is neither due to a decline in the use of stock options nor due to an increase in the similarity of firm fundamentals; we find the same pattern when we exclude from total compensation the value of granted stock options or the portion of compensation associated with the main determinants of CEO pay (i.e., dispersion in "abnormal pay").

We propose one explanation for this secular decline in pay dispersion: the growing use of industry-size benchmarking, driven by heightened scrutiny of CEO compensation from regulators, shareholders, and proxy advisors. Increasingly benchmarking CEO compensation to industry peers closest in size can result in lower pay dispersion across firms, as such a policy generates "clusters" of compensation peers in which firms benchmark to one another. Because firms typically target CEO pay at the median of their peer group, this practice compresses pay variation within clusters – which, as we show below, can also reduce economy-wide pay dispersion.

We examine the factors driving the growth of industry-size benchmarking and find that it is largely driven by three recent institutional developments: the 2006 SEC rule mandating the disclosure of peer groups used for compensation benchmarking, the growing influence of proxy advisors that favor industry-size benchmarks for CEO pay, and the introduction of say on pay regulation. These developments increased pressure on boards to adopt industry-size

benchmarking to conform to a standardized pay setting process.

To examine the empirical validity of our proposed explanation for the decline in pay dispersion, we conduct three sets of analyses. As a first step, we simulate the evolution of pay dispersion under the assumption that all firms adopt an industry-size-based benchmark. Simulated pay dispersion declines substantially, lending support to the notion that industry-size benchmarking contributes to the observed reduction in pay dispersion. This simulation is informative because the effect of clustered compensation networks on economy-wide pay dispersion is not ex-ante obvious: it depends on the number and size of industry-size groups, changes in the cross-sectional distribution of firm size and industry affiliation (which can be driven by entry, exit, growth, or other dynamics), and residual cross-group connections through which pay shocks may propagate.

In our second set of tests, we use regression analyses to examine whether the decrease in pay dispersion goes hand in hand with the increasing tendency to benchmark CEO compensation to the industry peers closest in size. Over time, compensation peer groups exhibit less dispersion in size, are less likely to deviate from the industry-size criterion, and show greater compliance with the industry-size-based peer selection methodology adopted by ISS (the largest proxy advisory firm). These patterns are strongly associated with our results on pay dispersion both in the time-series and in the cross-section.

In a third set of tests, we provide plausibly causal evidence on how three recent institutional developments – the 2006 SEC rule that mandated the disclosure of the peers used for compensation benchmarking, the growing influence of proxy advisors, and the introduction of say on pay regulation – have jointly contributed to the rise of industry-size benchmarking.

Regarding the 2006 SEC pay disclosure mandate, we find that the decline in pay dispersion starts after the implementation of the disclosure mandate, not before. Also consistent with the disclosure mandate playing a role, we observe that the increasing tendency to adopt industry-size benchmarking is stronger among firms whose compensation peer groups exhibit larger deviations from this criterion right before the introduction of the regulation (which was relatively unexpected). In a series of falsification tests, we do not find a decline in pay dis-

persion in settings in which the SEC's disclosure mandate plays a less prominent role; among non-US public firms, among private U.S. firms, and among senior executives outside the top 5 in public U.S. firms (whose pay is typically not determined via compensation benchmarking).

Regarding the role of proxy advisors, we document that a firm's probability of including a potential peer varies with the degree of conformity the peer has with ISS's policy for compensation benchmarking, which we measure using peer rankings produced by ISS's publicly disclosed methodology. More importantly for explaining the documented increase in industry-size benchmarking, we find that this association strengthens significantly over the sample period. The association also shows a discontinuity around an arbitrary peer group size cutoff used in ISS's peer selection methodology, reinforcing the causal role of ISS's industry-size criterion. In placebo tests, this discontinuity is absent in years prior to the introduction of ISS's policy. Further supporting the influence of proxy advisors, we find that firms are more likely to add or drop peers in line with ISS's recommendations from the prior year, even when we restrict the analysis to observations around arbitrary cutoffs where the peers are otherwise comparable.

Finally, we show that industry-size benchmarking becomes more prevalent as passive ownership increases, consistent with the notion that passive investors – who face higher costs of active engagement – rely more heavily on proxy advisor guidance.

Regarding the influence of say on pay (SOP) regulation, we find that, following weak SOP vote support, firms increase the conformity of their compensation peer groups with the industry-size benchmarking criterion.[1] To sharpen identification, we exploit exogenous variation in the frequency of SOP voting; conceivably, a higher frequency of SOP votes puts more pressure on firms to accommodate compensation practices to standard criteria. We compare firms whose shareholders voted for an annual SOP vote frequency to those whose shareholders voted for a 3-year SOP vote frequency by a narrow margin. We find that firms whose shareholders narrowly favored annual SOP voting exhibit greater conformity in the

[1]To illustrate the dynamics between board, shareholders, and proxy advisors around a weak SOP vote, we provide two anecdotes in the internet appendix in which boards discuss weak SOP vote outcomes, the subsequent changes to their compensation peer groups, and the underlying rationales thereof.

years after the vote (but not before) with the industry-size benchmarking criterion than those in which the voting outcome was narrowly in favor of an SOP vote every 3 years. These results support a causal role for SOP advisory votes in encouraging the adoption of industry-size benchmarking.

Our findings highlight the implications of applying industry-size benchmarking in the executive pay setting process. On the one hand, standardized criteria, coupled with increased transparency, may facilitate the evaluation of pay practices and promote greater accountability. Moreover, uniformity in pay setting may enhance perceptions of fairness in CEO compensation design, a key concern for directors and investors (Edmans, Gosling and Jenter, 2023). On the other hand, institutional pressure from regulators and investors to make CEO pay more transparent and standardized may lead boards to prioritize compliance over customization. As a result, firms may adopt a "one-size-fits-all" approach that sacrifices alignment with firm- and executive-specific needs, potentially leading to suboptimal incentive structures and inefficiencies.

Our study contributes to the literature examining the evolution of compensation practices over time. This prior work focuses on average CEO pay (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 dispersion of CEO pay. In contrast to the secular increase in average CEO pay, we document a stark decline in the dispersion of CEO pay in recent years. We propose one driver – industry-size benchmarking – but there could be others.

A notable recent contribution to this literature is Cabezon (2025), who documents that the *structure* of compensation contracts, such as the fraction of pay in equity, has become more similar across firms since 2006. However, greater similarity in the structure of pay does not imply less dispersion in pay levels. Moreover, Cabezon's analysis is not concerned with compensation peer groups but with the average similarity between a focal firm's contract and the contracts of all other firms in the economy. In contrast, our study investigates the rise of industry-size benchmarking and the institutional forces behind its growing prevalence.

Our results also contribute to the regulatory debate on pay transparency in corporate pay-setting processes (e.g., Mas, 2016; Baker et al., 2019; Bennedsen et al., 2022; Babenko, Bennett and Wang, 2025). We show how regulations designed to enhance shareholder oversight combined with the influence of proxy advisors on executive pay (e.g., Malenko and Malenko, 2019; Malenko, Malenko and Spatt, 2025) can contribute to the adoption of one-size-fits-all compensation practices. We thereby highlight a potential unintended consequence of well-intentioned governance reforms.

Finally, our study 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, 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 on how recent institutional developments have contributed to the rise of industry-size benchmarking. While this trend makes opportunistic peer selection more difficult, it may also result in less tailored and potentially suboptimal pay design.

2. Background and hypothesis

To offer competitive pay to their executives, compensation committees routinely engage in compensation benchmarking, tying executives' pay to that of their labor market competitors. One common benchmark is the median pay of industry peers closest in size, henceforth referred to as "industry-size benchmarking." Anecdotal evidence suggests that industry-size benchmarking has significantly expanded in recent years (e.g., Lan, 2019; Equilar, 2023).

2.1. The effect of industry-size benchmarking on pay dispersion

The adoption of industry-size benchmarking likely increases reciprocity in compensation peer groups. This can lead to the formation of "pay clusters", where firms benchmark their CEO

compensation against one another. As firms usually target their peers' median pay level, reciprocal referencing can result in a convergence of pay levels within these groups.

Nonetheless, a convergence in pay levels *within* groups (e.g., within industry-size groups) need not necessarily translate into an overall decrease in pay dispersion across the economy. Pay dispersion could increase *across* groups if within-group pay levels exhibited diverging pay growth trends. The net effect is difficult to predict and depends on multiple factors, such as the number of firms in an industry-size group and the number of residual across-group connections along which compensation changes can propagate.

2.2. Institutional factors contributing to industry-size benchmarking

Understanding the institutional factors contributing to industry-size benchmarking requires an analysis of the potential costs and benefits of this practice for investors. On the cost side, the application of industry-size benchmarks across the economy likely introduces the usual disadvantages associated with one-size-fits-all approaches. Notably, imposing such criterion limits boards' discretion in tailoring pay policies to firm-specific needs, leading to deviations from optimal pay levels and potentially affecting hiring, retention, and incentives.

On the benefit side, industry-size benchmarking could offer several advantages to investors. It could reduce the scope for powerful CEOs to manipulate their own pay. Moreover, monitoring the benchmarking practices of all portfolio companies could be more costly for large investors than portfolio firms deviating from optimal peers. Thus, it is plausible that certain investors are better off with a universal application of industry-size benchmarks. Consistent with this, such compensation assessment policies are often found in the guidelines of large asset managers (see, e.g., Blackrock, 2019, 2; T. Rowe Price, 2019, 6-7).

Boards and their compensation committees could give into investors' request to use industry-size benchmarking due to reputational concerns (e.g., to avoid withhold votes at director elections or to avoid low say on pay vote outcomes). Further, explaining to investors a deviation from industry-size benchmarks might not be straightforward, as the selection of compensation peer groups is often based on confidential information.

The costs and benefits of industry-size benchmarking for investors and directors have

likely been shaped by recent institutional developments. We consider three such developments: greater pay transparency due to the 2006 SEC rule mandating the disclosure of the peers used for compensation benchmarking, the growing influence of proxy advisors, and the introduction of the advisory ("say on pay") vote on executive compensation. As discussed below, these institutional changes likely contribute to the increase in industry-size benchmarking in an interrelated and complementary way, with each development likely relying on the others to amplify its effect.

(i) The 2006 SEC rule on compensation disclosure

The SEC issued in December 2006 new regulation that mandated firms to disclose the identity of their compensation peers.[2] The SEC rule thereby facilitated transparency about the CEO pay setting process and promoted greater scrutiny of firms' peer selection practices by investors and third parties such as proxy advisors.[3] Transparency and heightened scrutiny likely increased the costs for directors to deviate from the industry-size benchmarking criterion. These costs were likely amplified by other institutional factors that we discuss next.

(ii) Proxy advisors

As shown in prior literature, proxy advisors' voting recommendations have a significant influence on vote outcomes (e.g., Ertimur, Ferri and Oesch, 2013; Iliev and Lowry, 2015; Malenko and Shen, 2016). This research also documents that – to avoid negative vote recommendations – corporate boards make compensation design choices in line with proxy advisors' policies (e.g., Larcker, McCall and Ormazabal, 2013, 2015; Malenko and Shen, 2016 and Hayne and Vance, 2019). Industry-size benchmarking is likely one of those choices, as proxy advisors justify their vote recommendations based on assessments that incorporate such a criterion (ISS, 2012a; GlassLewis, 2020). For example, ISS has developed its own industry-

[2]Almost no firm voluntarily disclosed its compensation peers prior to 2007. Despite the mandate, some firms continued to not disclose in 2007 (see White, 2007, 2008).

[3]Of course, transparency on compensation peers may have other, more complex effects. For example, Choi, Cicero and Mobbs (2022) report evidence that the compensation peer disclosure regulation by the SEC reveals information to executives about their outside opportunities and has led to pay increases and to a greater likelihood of executives accepting positions at firms included in the compensation peer group.

and size-based peer selection methodology. The methodology is used in its "multiple-of-median test", which relates the level of a firm's CEO pay to the median CEO pay of an industry- and size-matched set of firms.[4]

Further, the rise in proxy advisor influence is frequently credited to the growth in passive investing that is driven by popular investment vehicles such as index funds and ETFs (e.g., Sushko and Turner, 2018). While passive investing offers significant advantages such as diversification and low management fees, it also weakens incentives to monitor portfolio firms (Almazan, Hartzell and Starks, 2005). One way for passive fund managers to reduce the cost of monitoring their portfolio is to rely on proxy advisor recommendations. Consistent with this, recent research suggests that fund managers' reliance on proxy advisors is determined by their weighing of the costs and benefits of active voting (Iliev and Lowry, 2015).

(iii) Say on pay

In 2011, the U.S. introduced "Say on Pay" (SOP) regulation. SOP stipulates that publicly listed firms must regularly submit the compensation of their top executives to shareholders for an advisory vote. Firms are required to disclose the corresponding vote outcomes and to respond to potential shareholder discontent.

Prior literature 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, Badgett et al. (2022) find that directors at firms receiving low SOP support experience reductions in external directorships, compensation committee positions, and director compensation. Dey, Starkweather and White (2024) find that directors engage with shareholders about their pay policies after receiving low SOP support, and that the outreach is

[4]ISS uses these matched firms also as an input in other pay screens that underpin pay-related vote recommendations: 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, 2019b).

more substantive when directors face a greater risk of losing ISS support. SOP could have therefore increased the pressure on directors to adopt industry-size benchmarking favored by influential investors and proxy advisors. The internet appendix provides two anecdotes consistent with this possibility.

3. Evolution of pay dispersion over time

3.1. Sample and data

Our first sample includes the universe of firms covered by Execucomp between 1996 and 2023. The sample consists of a total of 3,976 distinct firms with an average of 1,975 firms per year. We start in 1996 as the SEC phased in the EDGAR system for the electronic submission of public filings between 1993 and 1996 (Gao and Huang, 2020).[5]

Our second sample includes S&P 1500 firms and their compensation peers and is used for firm-level tests. Since there was no public disclosure of compensation peers prior to 2007, the sample covers the years 2007 to 2023. We obtain data on the identity of compensation peers from AuditAnalytics, Equilar, and ISS. To avoid that outliers or missing peer group data affect our inferences, we require that each peer group contains at least 5 and at most 76 peers (which are the 1st and 99th percentiles of peer group sizes, respectively). To maximize data coverage on compensation peers, we collect pay information from various sources including Execucomp, ISS's Executive Compensation Analysis (ECA), Equilar, Capital IQ, and GMI, and exclude observations with insufficient data (i.e., when pay data is missing for more than 25 percent of compensation peers). We collect accounting information from Compustat, stock prices from CRSP, institutional ownership information from Refinitiv, and shareholder vote outcomes and vote recommendations from ISS's Voting Analytics and ECA databases. These data requirements result in an average of 1,240 firms per year and 2,175 distinct firms between 2007 and 2023, using pay information for an average of 2,982 compensation peers per year. Table 1 provides further details on the characteristics of our two

[5]Prior findings suggest that the staggered phase-in affected the dispersion of CEO pay levels between 1994 and 1996 as total CEO pay dropped significantly more in the upper tail of the compensation distribution following an increase in media coverage (Babenko, Bennett and Wang, 2025).

samples.

3.2. Graphical analysis

We first conduct a graphical analysis of the evolution of pay dispersion at the economy-, industry-size and firm-levels. For each year, we measure pay dispersion as the standard deviation of *Pay*, computed as the CEO's total compensation (`TDC1` in Execucomp) scaled by its sample median in that year. A value of, say, 0.5 (1.5) for *Pay* hence implies that a CEO receives half (1.5 times) the median CEO pay level in that year. We scale `TDC1` by its median because the level of executive pay measured in dollars is non-stationary (it increases over time) and because comparing dispersion across time requires a dimensionless measure (see, e.g., Cox and Lewis, 1966).[6] We refer to the standard deviation of median-scaled `TDC1` as *Pay dispersion*.

Figure 1 plots the evolution of *Pay dispersion* computed at the economy-level (Panel A), at the industry-size group level (Panel B), and within firms' compensation peer groups (Panel C). We also add two variants of *Pay dispersion*. First, we compute the dispersion of CEO compensation excluding stock options. We refer to this variant as *Pay dispersion (ex-options)*. Stock options were prominent during the dot-com boom (1998-2002) when high equity valuations also inflated the value of stock option packages (Murphy, 2013) but lost much of their appeal after the introduction of FAS 123-R in 2005/2006. We examine pay excluding stock options since a reduction in option usage could have contributed to the decline in pay dispersion.[7] Second, we compute the dispersion of CEO "abnormal" com-

[6]Standard deviation is not a dimensionless measure of dispersion; it increases proportionally with the magnitude of the underlying data (mathematically, $SD(c \cdot X) = c \cdot SD(X)$). Hence, actual dispersion declines if the standard deviation does not increase proportionately. For example, median CEO pay in our sample almost quadrupled between 1996 and 2023 (from \$1.6 million in 1996 to \$6.2 million in 2023) while the standard deviation of CEO pay increased by less than half (from \$7.4 million in 1996 to \$10.9 million in 2023). We use median pay rather than mean pay for scaling because we are interested in the 'typical' CEO's pay level and not in the aggregate level of CEO pay (see Murphy, 2013, 9). Furthermore, firms often target the median of their compensation peer group and many of ISS's executive pay screens relate a firm's pay level to the median of a benchmark group.

[7]We use the median of CEO pay excluding stock options (rather than the median of total CEO pay) for the scaling of *Pay dispersion (ex-options)*. We do so to avoid that *Pay dispersion (ex-options)* declines mechanically due to a lower use of stock options in the later part of the sample period. As a consequence of this definition, the gap between *Pay dispersion* and *Pay dispersion (ex-options)* persists over time. Furthermore, the larger gap between *Pay dispersion* and *Pay dispersion (ex-options)* in Figure 1C – relative

pensation. Abnormal compensation is calculated as the residual from annual cross-sectional regressions of unscaled CEO pay on firm size, Tobin's Q, sales growth, return on assets, stock return, and idiosyncratic volatility. We compute *Pay dispersion (abnormal)* as the standard deviation of the scaled residuals.

Figure 1A shows that *Pay dispersion* increased between 1996 and 2000, peaking during the dot-com boom in the late 1990s (solid line). The metric declines sharply after the dot-com bust (from 2.7 in 2000 to 2.1 in 2002), remaining relatively unchanged afterwards until 2007. After that year, we observe a gradual decline until recently (from 2.1 in 2007 to 1.3 in 2023; a decline of 38 percent). The dashed line shows that the secular decline post 2007 is similarly pronounced for *Pay dispersion (ex-options)* (i.e., when removing any potential effects of stock options). The measure almost perfectly overlaps with pay dispersion after 2002, while the spike around the dot-com bubble largely disappears. We thus conclude that the decline in the value of stock options may have contributed to the decline in pay dispersion in the early 2000s but it cannot explain the sustained decline in pay dispersion between 2007 and 2023.[8,9] The decline is also observable after adjusting pay for firm fundamentals which commonly determine pay. The timing and magnitude of the decline in *Pay dispersion (abnormal)* (dotted line) is similar to that in *Pay dispersion*. This suggests that the decline in pay dispersion is not driven by a convergence in firm fundamentals which could have contributed to similar pay levels across firms.[10] We obtain similar patterns of declining pay

to Figures 1A and 1B – is driven by higher stock option usage among compensation peers of S&P 1500 firms.

[8] Another possibility is that FAS 123-R reduced stock option usage only gradually after 2006. This possibility is not supported by the data. Firms rapidly reduced their use of stock options: the median Execucomp firm had stock options as a fraction of total pay at 29 percent in 2003, reduced it to 11 percent in 2006, and had zero percent stock option pay from 2007 onwards. Between 2003 and 2007, *Pay dispersion* and *Pay dispersion (ex-options)* however remained steady between 2.0 and 2.1. Further, the irrelevance of stock option pay for the median firm as of 2007 is inconsistent with FAS 123-R explaining the steady decline that starts in 2008. In Figure IA.1 in the internet appendix, we further show that the post-2007 decline in *Pay dispersion* is identical for high and low option-use industries.

[9] In Figure IA.2, we also consider the possibility that the decline in pay dispersion may be related to a decrease in the frequency of "mega grants" (i.e., large one-time equity grants). We find no empirical support for this. First, mega grants have not become less frequent between 2007 and 2023, and the pay dispersion decline is almost identical when excluding all firm-year observations with mega grants. Second, we also find a 34 percent decline in non-equity pay dispersion between 2007 and 2023 after excluding all stock- and option-based pay.

[10] In Figure IA.3, we plot the dispersion of an extensive set of firm fundamentals across time. The figure shows no evidence that firms have become more similar along dimensions that typically determine pay levels.

dispersion in industry-size groups (Figure 1B) and when computing pay dispersion at the firm-year level within firms' disclosed compensation peer groups (Figure 1C).[11,12]

Finally, we replicate the analysis using two alternative measures of realized pay. As a first measure, we use Execucomp's `TOTAL_ALT2`, in which the grant-date fair values of stock and option awards are replaced with the value of vested stock and the value realized from option exercises during the fiscal year. As a second measure, we implement the realized pay metric proposed by Carter and Pawliczek (2023) (see variable appendix for details). Figure IA.5 in the internet appendix shows that the dispersion patterns in realized pay, available since 2006, closely mirror those reported in Figure 1.

In Figure 2, we explore from which tail of the pay distribution the decline originates. We group observations by CEO pay percentiles each year and calculate for each group the fractional change in *Pay* from the start to the end of each period – 1996 to 2006 (Panel A) and 2007-2023 (Panel B) – before and after the 2006 SEC disclosure rule. Figure 2B shows increases in pay for the lower percentiles accompanied by decreases in pay for higher percentiles, suggesting that the distribution of pay has become narrower from 2007 to 2023. For example, the figure shows that pay of CEOs at the 25th percentile increased between 2007 and 2023 from 0.45 times median pay to 0.52 times median – an increase of 16 percent. During the same time period, CEOs at the 75th percentile saw their pay drop from 2.25 times median pay to 1.79 times median – a decline of 20 percent. In contrast to the post-2007 pay convergence, Figure 2A shows decreases in pay for the lower percentiles and minimal changes for the higher percentiles, suggesting a widening of the pay distribution before the implementation of the SEC disclosure rule in 2006.[13]

[11] Note that *Pay dispersion* in Figure 1C is larger than in Figure 1A. This is due to differences in firm sizes between the two samples: Figure 1C includes only focal firms that are S&P 1500 constituents whereas Figure 1A also includes smaller, non-S&P 1500 firms. Because larger firms tend to have larger compensation peers, this size difference contributes to higher values of pay dispersion in Figure 1C.

[12] In Figure IA.4, we plot pay dispersion separately for each GICS2 industry and find substantial pay dispersion declines in all GICS2 industries (the min/median/max decline is 38/48/59 percent since 1996 and 5/48/59 percent since 2007). We also plot in Figure IA.4 pay dispersion using alternative industry definitions and find that the decline does not depend on our choice for industry classification.

[13] Figure IA.6 shows the trajectory of two alternative dispersion measures between 1996 and 2023 – the skewness and the median-scaled interquartile range of the CEO pay distribution. Consistent with Figure

3.3. Regression analysis

To explore the robustness of the previous patterns, we conduct a regression analysis of the time variation in pay dispersion at the industry-size-year level and at the firm-year level. Consistent with Figure 1, models 1-3 in Table 2A show that the decline in pay dispersion is statistically significant and robust to including industry-size fixed effects. Average annual decreases in pay dispersion within industry-size groups range from 0.015 to 0.051 depending on whether compensation is adjusted for option compensation or firm fundamentals. The coefficient estimates imply cumulative declines between 21 and 69 percent in the respective pay dispersion measures between 2007 and 2023. We find similar results in models 4-6 when creating, for each firm, a separate peer group consisting of industry- and size-matched peers.[14]

Table 2B further corroborates these results by examining pay dispersion among the peers selected by firms for compensation benchmarking. Examining pay dispersion at the firm-level allows us to control for firm characteristics and to add industry-size and firm fixed effects. Consistent with Figure 1, Table 2B shows a significant decline in pay dispersion within firms' compensation peer groups.[15]

3.4. Pay dispersion in other settings

To complete our exploratory analysis of the evolution of pay dispersion, it seems natural to examine whether the patterns in Figure 1 also hold in other settings. We repeat the analysis from Figure 1 for the following alternative groups: CEOs of non-U.S. public firms, CEOs of private U.S. firms, and non-top 5 senior executives in U.S. firms.

2, the two dispersion measures show that the pay distribution narrowed only after the implementation of the SEC disclosure rule in 2006.

[14] The benefit of using firm-specific groups consisting of industry- and size-matched peers is that it avoids arbitrary size-quintile cutoffs and resembles more closely the way in which firms pick peers for compensation benchmarking.

[15] To control for the potentially confounding effect of compensation consultants, the analysis in Table IA.1 adds consultant fixed effects and the fraction of peers that hire the same compensation consultant as the focal firm. Our inferences are unaffected.

Figure 3A plots pay dispersion among CEOs of public U.S. firms alongside pay dispersion among CEOs in public firms in other developed economies (the UK, continental Europe, Canada, Australia and the 'rest-of-the-world').[16] We find that, while CEO pay dispersion in the U.S. was much higher than in other regions at the start of the sample period, it had dropped by 2023 to average international levels. Remarkably, the figure also shows that the U.S. is the only jurisdiction that has experienced such a decline in pay dispersion.

Figure 3B compares pay dispersion among CEOs of public U.S. firms to pay dispersion among CEOs of private U.S. firms and to pay dispersion among non-top 5 senior executives in public U.S. firms.[17] The evolution of pay dispersion in these two other placebo groups is very different from that among CEOs of public U.S. firms – dispersion has increased among the CEOs of private U.S. firms and has remained constant among non-top 5 senior executives in the U.S.

One potential explanation for the stark contrast of the patterns in Figure 3 and those in Figure 1 is that compensation practices in these other settings are not shaped by the unique combination of institutional developments described in section 2. The compensation of non-top 5 senior executives in U.S. firms is generally not determined by compensation benchmarking and is not subject to SOP voting. Moreover, the 2006 SEC rule to disclose compensation peers does not apply to private firms nor to firms incorporated in foreign countries, and the market for proxy advising is less concentrated in other parts of the world than in the U.S. (Hitz and Lehmann, 2018; Spatt, 2021).

[16] The figure starts in 2001 as this is the earliest year with compensation data in BoardEx. As BoardEx has little coverage for Australia and Canada, we use for those two countries data from NRG Metrics, which is limited to 2011-2019. The 'rest-of-the-world' sample is based on BoardEx's Rest-Of-World (ROW) dataset. As the number of public firms vary widely across jurisdictions, the figure includes 95 percent confidence intervals (Sheskin, 2011, 217-218).

[17] Data for senior employee and private-firm CEO pay comes from Capital IQ People Intelligence. Specifically, we obtain 'total executive compensation' for i) CEOs of private U.S. firms, and ii) for U.S. senior employees with a firm pay-rank outside the top 5. For the latter, we remove employees whose title indicated that they are part of the board, that they belong to the C-suite (i.e. have a "Chief" title) or who have a "President" title (as the use of president and CEO overlaps in some organizations). The most common titles in the employees sample representing over 95 percent are then in order of frequency: senior key executive; other key executive; secretary; head of sales; head of corporate development; head of human resources; head of marketing; top key executives; treasurer; operations professional; controller. The employee sample covers about 122,000 person-year observations of 37,000 distinct employees; data coverage for U.S. private-firm CEOs starts in 2006 and covers 2,954 distinct CEOs across 2,464 private U.S. firms.

4. Industry-size benchmarking

We next examine if the documented decrease in pay dispersion is due to an increase in industry-size benchmarking.

4.1. Simulation analysis

To explore whether industry-size benchmarking can reduce pay dispersion, we begin with a simulation. We start from actual data on CEO pay and compensation peer groups for the cross-section of sample firms in 2007 – the first year of mandatory disclosure of compensation peer groups. For subsequent years we create for each firm a synthetic compensation peer group replicating the peer selection methodology published by ISS to assess compensation practices, which is based on industry and size. The methodological details are shown in Appendix B. We then set each firm's compensation for year $t+1$ at a randomized target percentile of the pay distribution within the firm's synthetic peer group in year t.[18] As previously explained, the outcome of the simulation is difficult to predict because, while industry-size benchmarking mechanically decreases variation *within* compensation peer groups, it could also result in more variation across such groups.

Figure 4 plots the simulated pay dispersion over the sample period alongside actual pay dispersion. Similar to Figure 1A, simulated pay dispersion declines significantly. The magnitude of the decrease is similar in both data series (45 percent in the simulated data versus 38 percent in the actual data). The simulation hence suggests that an increase in industry-size benchmarking has the potential to explain the observed pay dispersion decline since 2007.

[18] We use randomized target percentiles to allow for the possibility that not all firms use the median peer pay level as their benchmark. The target percentiles are drawn from a normal distribution with mean 60 and standard deviation of 10 so that 95 percent of these random numbers lie between 40 and 80, which is the range of target pay percentiles observed in the data. In Figure IA.7 in the internet appendix, we show similar results if all firms were to use identical target percentiles (e.g., the median or the 60th percentile). We find that higher target percentiles increase average pay and lead to escalating pay (also known as the "pay ratcheting effect"; e.g., Elson and Ferrere, 2013) but do not matter for pay dispersion that we are concerned with in this study.

4.2. Graphical analysis

We next explore whether industry-size benchmarking has increased. Figure 5A plots five measures capturing the degree to which compensation peers are selected based on industry and size: (i) the standard deviation of peers' relative book value of assets; (ii) the standard deviation of peers' relative market value of assets; (iii) the number of GICS6 industries from which a firm draws its compensation peers; (iv) the fraction of compensation peers that are significantly different in size (i.e., a peer is much larger (>200%) or much smaller (<50%) than the focal firm in terms of book value of assets and market value of assets); and (v) the fraction of compensation peers from a different GICS1-industry and with a significantly different size (defined as before). For clarity, we rescale the data relative to the start of the sample period. As shown in Figure 5A, we find a decline in all five metrics over time, supporting the notion that firms increasingly include compensation peers of similar industry and size.[19]

We next examine whether the rise in industry-size benchmarking has led to the formation of clusters of firms that benchmark their pay against one another. Such a finding would support the idea that an increase in industry-size benchmarking decreases pay dispersion via reciprocal benchmarking (see section 2.1). We construct three measures based on the network literature (see, e.g., Newman, 2010, Ch.7).[20] *Reciprocity* is the fraction of existing network linkages that are bilateral (i.e., point in both directions). *Transitivity* is the number of triangles divided by the number of triads that exist in a graph (triads are groups of three nodes that are connected in some way while triangles are triads that are completely connected). *Cluster coefficient* is the number of triangles divided by the number of possible triads (intuitively, it measures how close a network is to a complete graph). To address potential limitations of the network measures, we also include *Frac-*

[19] Table IA.2 confirms that compensation peer groups have not increased in size over time; hence, less similar peers are replaced by firms more similar in industry and size. Furthermore, since firms typically experience greater shareholder scrutiny when benchmarking their CEO pay against that of larger firms, we also examine the relative sizes of replaced peers. Figure IA.8 shows that the decline in size dispersion is entirely due to the replacement of larger peers, which suggests a deliberate choice by boards, potentially due to heightened shareholder scrutiny.

[20] As the goal is to measure how inter-connected a group of firms is, each measure is computed for a firm's network of its compensation peers that includes not only the base firm's peer connections but also the connections among the peers (established via their respective peer groups).

tion of reciprocal references, defined as the fraction of a firm's compensation peers that reference back the focal firm.[21] As before, we rescale the data relative to the start of the sample period. The results, shown in Figure 5B, suggest that compensation peer groups have become significantly more clustered over time. This supports the idea that industry-size benchmarking induces less pay dispersion through an increase in reciprocal benchmarking.[22]

4.3. Regression analysis

We next conduct a regression analysis of the industry-size benchmarking and network clustering measures in Figure 5A and 5B. As this analysis is conducted at the firm-year level, we can include controls for the focal firm, industry-size, and firm fixed effects.

We include four metrics of conformity of the peer group with industry-size benchmarking: *Dispersion in relative book values* and *Dispersion in relative market values* are the standard deviations of peers' relative book value of assets (BVA) or market value of assets (MVA). *Deviation from industry-size benchmarking* refers to the fraction of peers with a different GICS1 code or that are much larger (>200%) or much smaller (<50%) than the focal firm in BVA and MVA. *ISS conformity* refers to the fraction of a firm's compensation peers that are included in the list of the firm-specific synthetic compensation peers generated by ISS's peer selection methodology, which is based on size and industry affiliation (see Appendix B for details).[23]

Table 3A analyzes the conformity of peer groups to industry-size benchmarking. The re-

[21] On average, firms select 18 compensation peers while industry-size groups are typically larger than 18. Hence, all potential linkages among a firm and its industry-size peers cannot be realized. This creates practical upper limits for some of the clustering measures.

[22] In Figure IA.9, we repeat the analysis in Figure 5B for alternative aggregation levels: the economy-level and several industry levels (GICS2, GICS4, GICS6). That is, for each year, we create a network of *all* firms in the economy (*all* firms in a given industry) along with all peer group references among them and then compute the clustering measures. Figure IA.9 shows an increase in the clustering of compensation networks at all aggregation levels, further supporting the emergence of increasingly closed pay benchmarking clusters among public firms.

[23] We construct synthetic peer groups because we do not have data on ISS-recommended peer groups for firms. While this approach introduces some measurement error, it has the advantage of approximating the focal firm's expectation about the composition of its ISS-recommended peer group, which conceivably is what drives its compensation peer group choices (ISS voting recommendations containing the peer groups are released only after firms decide on the pay contracts for its executives).

sults in models 1 to 4 corroborate that there is a significant decrease in the dispersion of firm size within compensation peer groups. Further, models 5 and 6 show a significant decrease in the fraction of peers that clearly deviate from industry-size benchmarking. Consistently, models 7 and 8 show that the likelihood of including peers that conform with ISS's peer selection methodology increases significantly over time. Table 3B analyzes network clustering measures. In parallel to Figure 5B, the results reveal a statistically significant trend in all four metrics.

Finally, we test in Table 4 whether there is a statistical association between pay dispersion and industry-size benchmarking not only in the time-series but also in the cross-section. The analysis is conducted at the firm-year level and includes firm controls, industry-year fixed effects, and firm fixed effects. We find that pay dispersion within compensation peer groups is significantly related to dispersion in size, deviations from industry-size benchmarking, and to the fraction of peers that meet proxy advisors' selection criteria or that engage in reciprocal benchmarking.[24]

5 . Institutional developments driving peer selection

We next examine the potential drivers of the rise in industry-size benchmarking. We consider the following institutional developments: (i) the SEC's mandate to disclose compensation peer groups, (ii) the growing influence of proxy advisors, and (iii) the introduction of say on pay.

[24] We note the potential for interesting heterogeneity based on the number of firms in an industry: When an industry has many firms, firms that only match on industry have many potential peers to pick from. Hence, initially, there is a lower likelihood for reciprocal benchmarking and therefore greater pay dispersion. However, with industry-size benchmarking, firms are required to select peers that are also similar in size. This then shrinks the number of permissible peers within the industry and results in larger increases in reciprocal benchmarking and larger pay dispersion declines in such industries as compared to industries with fewer firms. We investigate this idea in Table IA.3. Indeed, we find that industries with a larger number of firms have initially higher levels of pay dispersion than those with a lower number of firms. As industry-size benchmarking however becomes more prominent over time, this is then followed by steeper declines in pay dispersion.

5.1. The 2006 SEC rule on compensation peer disclosure

We start by testing whether the decline in pay dispersion documented in section 3 occurs only after the implementation of the disclosure rule, not before. Table 5A presents results of the analysis at the industry-size level. We find no significant declines in pay dispersion in the pre-disclosure period (i.e., 2003-2006; models 1-2). In contrast, we find a significant decline in pay dispersion in the post-disclosure period (i.e., 2007-2010; models 3-4). Tests based on pooling data from both subsamples reveal that the differences between the 2003-2006 and 2007-2010 subperiods are statistically significant (models 5-6). This is consistent with the univariate trends around 2007 shown in Figure 1B.

In addition, we test whether the post-2007 patterns documented in the previous sections are concentrated among firms that initially deviated more from industry-size benchmarking.[25] We measure the degree of deviation using the first disclosures on compensation peers published in 2007. As explained by Faulkender and Yang (2013, 809), the regulatory process of the 2006 SEC rule was relatively quick, leaving no time to modify compensation peer groups in anticipation of the rule. As such, the 2007 disclosures likely reflect ex-ante (i.e., absent the disclosure requirement) choices of compensation peers.[26]

Table 5B presents the results of the firm-level analysis. The dependent variables are as in Table 3A: size dispersion, deviation from industry-size benchmarking, and conformity with ISS's synthetic peer group. On the right-hand side, *Low initial conformity* is an indicator variable for firms with below-median conformity with the industry-size benchmark in 2007 (where conformity is defined as having peers from the same GICS2 industry and from within 50-200% of a firm's market value of assets). The results in Table 5B show that the pay dispersion decline in the period immediately after the disclosure mandate is concentrated among firms with lower initial conformity with the industry-size benchmark. In combination with the earlier results in section 3 – i.e., on the timing of the decline in

[25] A direct comparison of compensation peer groups before versus after the introduction of the rule is not possible because there is no available data on compensation peers prior to the SEC disclosure mandate.

[26] Some firms did not disclose compensation peers in 2007 despite the mandate (see White, 2007, 2008) and are therefore excluded from our tests. If firms without disclosures had less compliant peer groups in 2007 (and this is why they chose to not yet report peer groups in 2007), then the coefficients in Table 5B should be interpreted as a lower bound on the true effect.

the univariate (Figure 1); the timing of the changes in the CEO pay distribution (Figure 2); and the absence of a pay dispersion decline around 2007 in other settings that are not impacted by the disclosure mandate (see Figure 3) – this evidence supports the notion that the 2006 SEC disclosure mandate played a causal role in the observed decline in pay dispersion.

5.2. Proxy advisor influence

We next examine the role of proxy advisors in the documented increase in industry-size benchmarking. We conduct three sets of tests. First, we study the influence of ISS's policy on the composition of the compensation peer groups. Second, we study the influence of ISS's policy on firms' inclusion and exclusion decisions about specific potential or current peers. Third, since passive fund managers are more likely to rely on proxy advisor recommendations, we examine the impact of passive ownership in the adoption of industry-size benchmarking.

5.2.1. Composition of compensation peer groups and ISS policy

Our first set of tests examine whether the composition of firms' compensation peer groups is related to ISS's peer selection methodology. For each firm, ISS ranks all potential peers based on whether they are in the same industry and of similar size. It then selects the first n peers in the ranking, where n varies from 14 to 24 depending on the number of firms in the industry of the subject firm (in most cases, n=24; see Appendix B for details).

We conduct two tests. We start by examining whether the position in the ranking generated by ISS's methodology is associated with the likelihood that a given firm is included by the focal firm in its compensation peer group. For each focal firm, we include all potential peers from the same GICS2 industry and rank them based on ISS's publicly disclosed methodology. We refer to peers' positions in this ranking as *ISS rank* (where *ISS rank* equal to 1 implies the most closely matched peer and higher ranks indicate a lower fit). We then test the association between this variable and *Included in peer group*, which equals one if the firm is included in the focal firm's compensation peer group, and zero otherwise. We

restrict the analysis to the period 2012-2023 as ISS published its methodology in December 2011. Our tests include firm-year and peer-year fixed effects which control for unobserved time-varying firm and peer characteristics such as factors leading both ISS and firms to independently include or exclude a peer.[27] We further add variables to account for the relative differences in firm characteristics between a focal firm and each of its potential peers.

Table 6A presents the results. The negative coefficient on *ISS rank* confirms the predictive power of the ISS rankings: a higher ISS rank for a potential peer (indicating a lower fit with ISS's criteria) decreases the probability that the firm includes the peer into its peer group. As ISS's influence could have increased due to the growth of passive investing and the introduction of SOP, we also examine whether ISS's peer selection policy has become more influential over time. The negative and significant coefficients on the interaction variable *ISS rank* $\times$ *Trend* confirms the increasing importance of ISS's policy on peer selection over time: with each passing year, the probability that a potential peer is chosen after improving its rank in ISS's methodology by one increases by 0.5 percentage points (models 1-3). This is an economically large effect considering that the unconditional probability of selection for any given peer is 0.75 percent. These results hold in univariate tests as well as in multivariate tests that include demanding fixed effects.

To mitigate the concern that using the universe of potential GICS2-peers could result in inflated significance levels (as it increases the sample size), we repeat the analysis while focusing only on the 18 top-ranked peers (which is the size of the average peer group; see Table IA.2). The signs of the coefficients in models 4-6 are consistent with those in models 1-3. In sum, the results in Table 6A suggest that the conformity with the industry-size peer benchmarking criteria used by ISS matters for peer selection and has become increasingly important over time.

In Figure 6, we present the results of a variant of the previous analysis. To sharpen identification, we exploit the fact that ISS uses an arbitrary cutoff for the number of firms to be included in its recommended compensation peer group for a focal firm. As previously

[27] We can add peer-year fixed effects as peers are typically chosen by multiple firms in a given year.

explained, this number varies from 14 to 24 (see Appendix B for details).[28] For each focal firm, we first compute the number of potential peers in conformity with ISS's criteria (which depends on the number of similar-sized firms in the same industry) and then rank these potential peers from 1 up to 100 following ISS's methodology. We then plot in Figure 6 the probability that a potential peer is included in the focal firm's actual compensation peer group based on the distance between the peer's position in the ranking with respect to the cutoff used by ISS (i.e., between 14 and 24). For example, for a focal firm with an ISS recommended peer group consisting of 24 peers, a potential peer ranked 23rd (25th) would have a relative rank of -1 (1). Figure 6 shows that, in line with Table 6A, the probability of inclusion in the peer group declines with the ISS rank. Critically, we also observe a large discontinuity in the probability of inclusion precisely at ISS's peer group size cutoff – from 22.9 percent at relative rank 0 to 14.9 percent at relative rank 1. The confidence interval in the figure indicates that this decline is statistically significant.[29]

Table 6B presents a multivariate version of this test. For each focal firm, the sample consists of potential peers that were ranked just below, at, or just above the ISS size threshold – i.e., potential peers with relative ranks -1, 0 or 1. We regress *Included in peer group* (as previously defined) on indicator variables for whether a potential peer firm is just at ISS's threshold (e.g., the 24th ranked firm) or just above it (e.g., 25th ranked firm).[30] The coefficients on the indicator variables capture the incremental probability that a potential peer at or just above the ISS size threshold is included in the focal firm's actual compensation peer group relative to a potential peer ranked just below the ISS size threshold for the firm. We further expand the sample period to include years from 2007 to 2011. We do

[28] Most firms have an ISS peer group size of either 24 (64 percent) or 14 (22 percent), with roughly equal proportions for peer group sizes between 15 and 23.

[29] We note that ISS publishes annually for each firm a "proxy advisory report" in which it names all the peers that it considers appropriate for a firm as given by its methodology. It seems likely that compensation committees and their consultants are aware of those reports, thereby increasing the likelihood that the named peers are picked.

[30] Given an ISS peer group size of, say, 24, differences in firm characteristics between 24th and 25th ranked peers are likely random. Table IA.4 provides a balance table for the peer firms whose ranks fall just above versus just at the size cutoff used in ISS's recommended peer groups. It shows few significant differences other than in size (which is the criteria used by ISS to construct the ranking).

so to exploit another institutional feature of our setting: ISS announced its peer selection methodology for the first time in its "U.S. Corporate Governance Policy 2012 Update" on December 20, 2011 (see Gibson, 2011). The specific timing of this policy change allows us to analyze whether the discontinuity appears only as of 2012 – i.e., the first year in which ISS implemented its peer selection methodology. Table 6B shows that this is indeed the case: we do not find that the size cutoff matters prior to ISS's policy change in 2012 (see models 1-5). In contrast, we find a statistically significant drop in the likelihood of being selected when a potential peer has a rank just above ISS's recommended peer group size after 2012 (see models 6-10).

5.2.2. Peer group additions/exclusions and ISS policy

Our second set of tests examines whether the exclusion or addition of a peer to ISS's recommended peer group is followed by the exclusion or addition of the same peer in the firm's disclosed compensation peer group in the following year. The analysis, shown in Table 7, is conducted at the firm-peer-year level.

We first focus on exclusions. We regress *Dropped peer*$_{t+1}$, an indicator variable whether a peer in t is excluded from a firm's compensation peer group in year $t+1$, on *Dropped by ISS in t*, an indicator variable whether ISS had included a firm in $t-1$ but had dropped it in year t from its recommended peer group. The specification includes a host of control variables to control for the most common reasons why firms are usually excluded.[31] Like in Table 6, we also add firm-year and peer-year fixed effects to control for unobserved time-varying firm and peer characteristics.

To further tighten identification, we focus the analysis in model 4 on a narrow window around the peer group size cutoff used by ISS. Specifically, we define *Just dropped below ISS cutoff* as an indicator variable for whether the peer was inside ISS's peer group size cutoff in $t-1$ (i.e., relative rank -4 to 0) and just outside the cutoff in year t (i.e., relative rank 1 to

[31] The vector of control variables includes indicator variables for whether a peer had met ISS's peer selection criteria in the previous year, for whether a peer got delisted (e.g., as a result of a merger, bankruptcy or liquidation) and several variables capturing the year-over-year changes in relative characteristics that may have decreased the fit between the subject and peer firms (see Appendix A for variable definitions).

5).[32] Firms in the vicinity of the size cutoff should be almost identical in firm characteristics and therefore should have – absent any ISS influence – a similar probability of being included in the focal firm's compensation peer group.

In parallel to the previous tests, we also analyze whether a firm is more likely to *add* a peer to its compensation peer group after ISS adds the peer to its recommended peer group in the prior year. Because it relates to additions (rather than exclusions), we include for each focal firm the universe of potential GICS2-peers with non-missing data (which results in a much higher number of observations). In parallel to the above tests on deletions, we also define an indicator variable *Just rose above ISS cutoff*.

Table 7 presents the results of the analysis. Models 1-3 show that firms are more likely to exclude a peer from their benchmark groups when the peer is excluded from their corresponding ISS peer groups in the prior year. Using the narrow subset of peers in the vicinity of the ISS rank cutoff, we find that peers that fall just below the ISS cutoff are also more likely to be excluded from firms' compensation peer groups in the following year (model 4). This is consistent with the notion that firms exclude peers that do not conform with ISS's selection criteria. Models 5-8 show consistent patterns for additions. In model 8, a potential peer that was ranked just outside ISS's recommended peer group in year $t-1$ (i.e., relative rank 1-5) but ranked just inside ISS's peer group in year t (i.e., relative rank -4 to 0) is more likely to be added by the focal firm to its peer group in the following year. This further supports the idea that ISS's industry-size based rankings play a causal role in firms' adoption of industry-size benchmarking policies.

5.2.3. ISS and role of passive ownership

Our final test on proxy advisor influence analyzes whether industry-size benchmarking is more pronounced among firms more exposed to passive ownership. As described in section 2.2, passive fund managers with dispersed portfolios and low-fee services are more likely to

[32] We take a window of ±5 ranks around the cutoff, to which we refer as "relative rank 0". We choose a window of ±5 ranks since reducing it further leaves too few instances in which a potential peer was ranked just inside the cutoff in one year and ranked just outside of it the next year.

economize on their monitoring of portfolio firms and to vote along proxy advisor recommendations. We therefore expect boards of firms with more passive owners to adopt peer selection practices that show greater conformity with industry-size benchmarking.

Our measures of the influence of passive investors on a given firm are grounded in prior literature showing that such influence is a function of investors' level of ownership and based on their incentives to monitor. *Fraction shares owned by institutional investors* is the fraction of shares owned by 13F-filing institutional investors in a given firm-year. *Fraction shares owned by quasi-indexers* is the fraction of shares in a firm-year owned by quasi-indexers (as classified by Bushee and Noe, 2000 and Bushee, 2001). *Fraction shares owned by index mutual funds* is the fraction of shares owned by mutual funds that follow index investing (as defined in Appel, Gormley and Keim, 2016). Finally, to more directly measure proxy advisory influence on firm investors, *Propensity to vote with ISS* is the fraction of shares owned by mutual funds that in prior years voted following ISS's advice when ISS and the firm's management gave conflicting voting advice (Larcker, McCall and Ormazabal, 2013, 2015). Similar to Table 4, we include industry-year fixed effects in all models so that the analysis examines cross-sectional associations.

Table 8 presents the results. Models 1-4 show that firms with greater ownership by institutional investors also engage in more industry-size benchmarking and have greater compliance with ISS's peer selection methodology. Consistently, industry-size benchmarking is also significantly and positively correlated with ownership by quasi-indexers (models 5-8), with ownership by index mutual funds (models 9-12), and with the propensity of a firm's mutual fund owners to vote alongside ISS recommendations (models 13-16). We note that the coefficients increase in magnitude as the proxies for passive ownership become more focused on passive investing and voting alongside ISS. While descriptive, the results of these tests are consistent with the notion that passive ownership promotes the adoption of industry-size benchmarking through proxy advisory influence.

5.3. Say on pay

To empirically identify the role of say on pay (SOP) in the documented increase in industry-size benchmarking, we exploit two sources of variation: (i) weak SOP votes and (ii) close SOP frequency votes.

5.3.1. Weak SOP votes

In the first set of tests, we examine whether firms receiving a weak SOP vote are more likely to subsequently select peers based on the industry-size criterion. We conduct the analysis at the firm-year level. To avoid confounding effects, we focus on firms' first say on pay votes in 2011 or 2012.[33] We take a three-year window around each firm's first SOP vote. The "treatment" group includes firms with weak SOP vote support. The control group includes firms without weak SOP votes that are matched to treated firms based on industry and stock returns (stock performance is a frequent determinant of say on pay vote outcomes). This results in 139 and 199 firms in the treatment and control groups, respectively.

The dependent variables measure industry-size benchmarking as in our prior tests. On the right-hand side, *Weak SOP support* is an indicator variable for whether the firm ranks in the lowest decile of the SOP vote distribution (in our sample, the lowest decile includes SOP votes that received less than 75 percent support).[34] Given the delay between shareholder voting and compensation contracting, we interact this variable with annual indicator variables for the first, second, and third year following the weak SOP vote. The specification also includes firm controls, industry-year, and firm fixed effects.

Table 9 presents the results. We find that, following a weak SOP vote, compensation peer groups exhibit less dispersion in size, are less likely to deviate from the industry-size

[33] SOP regulation became mandatory for the first annual shareholder meeting after January 1, 2011. Since SOP votes are backwards looking, the first vote concerned pay policies for fiscal years 2010 or 2011.

[34] 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 70-80 percent already as a negative view of firms' compensation practices. In 2016, Glass Lewis and ISS established so-called "red zones" that trigger greater scrutiny when opposition votes exceed 20-25 percent. Further, ISS provides case-by-case voting recommendations on compensation committee members if a company's prior year say on pay vote outcome was below 70 percent.

benchmark and are more likely to conform with ISS's criteria.[35] The results also show that the effect is not restricted to the year immediately after obtaining weak SOP support but that peer group changes take place over several years, which likely reflects the lag between CEO contracting and voting (see the anecdotes in the internet appendix).

5.3.2. Close SOP frequency vote

To further sharpen identification, Table 10 presents a variant of the previous tests that exploits plausibly exogenous variation in the frequency of SOP voting. Specifically, at the introduction of SOP voting, firms were required to also vote on the frequency of future SOP consultations (the choices were every 1, 2, or 3 years). Conceivably, a higher frequency of SOP voting puts more pressure on firms to follow industry-size benchmarking. In the majority of firms, shareholders supported an annual SOP vote (77%) while shareholders in most remaining firms (22%) supported having SOP votes at a 3-year frequency (only 1% approved a 2-year frequency). However, in 67 cases among Russell 3000 firms, investor support was almost equally distributed among the two options. Following prior research by Cuñat, Gine and Guadalupe (2012), we exploit the quasi-random variation in the close shareholder votes of such firms to enhance the empirical identification of the effect of SOP voting on industry-size benchmarking.

In Table 10, we compare firms whose shareholders narrowly voted in favor of a 1-year SOP vote frequency with those whose shareholders narrowly voted for a 3-year SOP vote frequency. In line with the prior literature, we define a narrow shareholder vote as one in which the difference between the support for the two options was within 5 percentage points.[36] We use a narrow 3-year post window after the first SOP frequency vote (which occurred in calendar years 2011-2013) so that firms with a 3-year SOP vote frequency have benchmarking policies that are affected only by a single (their first) SOP vote whereas firms with an annual SOP vote frequency have held several SOP votes during that period. Focusing on

[35] Table IA.5 further shows that firms with weak SOP vote support initially exhibit higher levels of pay dispersion in their peer groups which decreases significantly in the years after the weak vote.

[36] As close SOP frequency votes are rare, we expand the sample in this test from S&P1500 firms to Russell 3000 firms. Of the 67 firms with close say on pay votes, 31 firms are part of the S&P1500. In 35 firms (32 firms), shareholders voted for SOP votes each year (every three years).

firms with close SOP vote events allows us to maximize the randomness in vote outcomes. As shown in Table IA.6 in the internet appendix, the sample firms with 1- and 3-year SOP vote schedules are identical in firm characteristics.

The dependent variables are identical to those in Table 9. On the right-hand side, *Annual SOP vote frequency* is an indicator for whether a 1-year SOP vote frequency was narrowly chosen over a 3-year SOP vote frequency. *Post* is an indicator variable for the fiscal years after a firm's first SOP frequency vote. The multivariate specifications include firm controls and industry-year fixed effects.[37]

The results, presented in Table 10, are in line with those in Table 9. Relative to firms whose shareholders narrowly opted for a 3-year SOP vote frequency, firms with annual SOP votes exhibit larger declines in their peers' size dispersion and greater conformity with the industry-size benchmark and ISS's industry-size criteria after the vote. As shown in Figure 7, we do not find such patterns in the period prior to the implementation of SOP (i.e., the parallel trends assumption seems to hold). This evidence supports a causal relationship between SOP voting and industry-size benchmarking.

6 . Conclusion

Using a large sample of public U.S. firms from 1996 to 2023, this paper documents a new stylized fact; over the last decade, the cross-sectional variation in CEO pay levels has declined precipitously. The decline in pay dispersion is present not only at the economy-level but also within industry-size groups and within firms' compensation peer groups. Further, it is empirically robust: it cannot be explained by a decline in the use of stock options nor by an increased similarity in firm fundamentals. We propose one explanation for this secular decrease in pay dispersion – the growth in industry-size benchmarking. We show that the decline in pay dispersion coincides with a growing tendency to benchmark CEO compensation against industry peers of similar size. This practice fosters the formation of compensation clusters, where reciprocal referencing among firms drives convergence toward similar pay levels.

[37] We use GICS1 industries for the fixed effects given the low number of firms per industry in the sample.

We provide evidence that three institutional developments have contributed to the growth in industry-size benchmarking: the 2006 SEC rule mandating disclosure of compensation peers that increased transparency about the pay setting process; the growing influence of proxy advisors; and shareholder advisory votes on executives' compensation packages (say on pay). Our evidence suggests that the disclosure of compensation peers combined with greater pressure on boards by shareholders and proxy advisors promotes a one-size-fits-all approach to the selection of these peers, resulting in a decline of CEO pay dispersion.

Less variation in executive pay could have a wide range of consequences. Most evidently, to the extent that it is driven by a one-size-fits-all rule, the decline in pay dispersion might reflect a deviation from optimal pay levels, which potentially affects hiring and retention. Other consequences could be less obvious. For example, the need to conform to an industry-size benchmarked pay level could induce changes in the characteristics of the compensation contract, thereby affecting incentives. Moreover, when pay levels are relatively similar, external tournament incentives are low. Based on prior literature (e.g., Coles, Li and Wang, 2018) a reduction in such incentives could affect corporate risk-taking, firm performance, and product market competition. Consequently, stock return synchronicity may increase within industry groups (Roll, 1988; Chen, Goldstein and Jiang, 2007; Wurgler, 2000).

The increase in industry-size benchmarking is one driver of the documented pay dispersion decline, yet there could be others. We hope that our analysis helps promote a debate on the causes and consequences of the decline in pay dispersion, a phenomenon about which – to the best of our knowledge – there is currently little awareness.

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Appendix A: Variable appendix

Variable	Definition	Source
I. Pay variables		
Pay dispersion (economy-, industry- or industry-size level)	Standard deviation of *Pay* where *Pay* is defined as CEO pay (`TDC1` in Execucomp) scaled by its median value in that year and winsorized at the 1st and 99th percentiles. When computed at the economy-level, pay dispersion is computed across all sample firms in a given year. When computed at the industry-level, pay dispersion is computed across firms within the same GICS6-industry in a given year. When computed at the industry-size level, pay dispersion is computed across firms that are in the same GICS6 × Size quintile group, where size quintiles are based on firms' lagged market values.	Execucomp; Compustat
Pay dispersion (firm-level)	Standard deviation of *Pay* for S&P 1500 firms where *Pay* is defined as the CEO's pay scaled by its median value in that year and winsorized at the 1st and 99th percentiles. At the firm-level, pay dispersion is computed across a firm's compensation peers (compensation peers are the firms disclosed by a focal firm in its proxy statement for the purpose of benchmarking pay levels). Data on the identity of compensation peers is obtained from AuditAnalytics, Equilar, and ISS IncentiveLab. We require that each peer group contains at least 5 and at most 76 peers (the 1st and 99th percentiles of peer group sizes, respectively). Pay information is obtained first from Execucomp (`TDC1`) and supplemented for non-Execucomp firms from ISS's Executive Compensation Analysis (ECA) database, Equilar, Capital IQ, and GMI. Observations with missing pay data for more than 25 percent of compensation peers are excluded.	Execucomp; ISS ECA; Equilar; AuditAnalytics; GMI
Pay dispersion (abnormal)	Standard deviation of *Abnormal pay*. *Abnormal pay* is computed as the residual from the following cross-sectional regression (estimated for each year separately): $\textit{CEO pay}_{i,t} = \alpha_t + \beta_t * \textit{firm characteristics}_{i,t-1} + \gamma_{s,t} + \epsilon_{i,t}$ where *CEO pay* is the unscaled reported pay, winsorized at the 1st and 99th percentiles. The suffixes i, t, s refer to firm i, year t and industry-size quintile s. The vector of *firm characteristics* includes firm size, stock return, sales growth, Tobin's Q, and idiosyncratic return volatility. The residuals from the annual regressions are then scaled by the median CEO pay in the year. The dispersion is computed as the standard deviation of the scaled residuals (depending on the level of aggregation - i.e., either across all firms in the economy, across all firms in an industry-size group, or across all compensation peers of a firm).	Execucomp; Compustat; CRSP; ISS ECA; Equilar; AuditAnalytics; GMI
Pay dispersion (ex-options)	Standard deviation of *Pay (ex-options)*. *Pay (ex-options)* is computed as `TDC1` minus the value of stock options granted (either the Black-Scholes option value or, if missing, as the grant date fair value) scaled by its median value in that year and winsorized at the 1st and 99th percentiles. Pay dispersion is computed as the standard deviation of scaled values depending on the level of aggregation (i.e., either across all firms in the economy, across all firms in an industry-size group, or across all compensation peers of a firm in a given year).	Execucomp
Realized pay (v1)	Realized pay as defined by Execucomp in item `TOTAL_ALT2`. `TOTAL_ALT2` is defined as `TOTAL_SEC` (i.e., total compensation as reported to SEC in that year) except that stock and option awards are valued using their realized values – i.e., the value of options exercised in the year and the value of stocks vested during the year. The measure is winsorized at the 5th and 95th percentiles.	Execucomp
Realized pay (v2)	Realized pay following a definition developed by Carter and Pawliczek (2023). As described in Carter and Pawliczek (2023), we make the following adjustments to the pay reported to SEC: *Realized pay (v2) = Non-equity pay + End-of-year value of stock and option grants made in the year + Change in the value of outstanding and unvested equity grants from prior years + Change in the value of stock grants vested during the year* where non-equity pay is the total reported pay minus the fair value of stock and option grants reported to the SEC. The measure is winsorized at the 5th and 95th percentiles.	Execucomp; CRSP
Cumul. pay growth	Cumulative CEO pay growth between first year in sample and current year.	Execucomp

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

Variable	Definition	Source
II. Compensation peer / peer group variables		
Dispersion in relative book values	Standard deviation of the relative book values in a focal firm's compensation peer group. Relative book value is the ratio of a peer's total book value of assets to the total book value of assets of the focal firm. The measure is winsorized at the 1st and 99th percentiles.	Compustat
Dispersion in relative market values	Standard deviation of the relative market values in a focal firm's compensation peer group. Relative market value is the ratio of peer's market value of assets (defined as total book value of assets minus book value of equity plus market value of equity at fiscal year end) to the market value of assets of the focal firm. The measure is winsorized at the 1st and 99th percentiles.	Compustat
Deviation from industry-size benchmarking	Fraction of compensation peers that are from outside the GICS1 industry or that are much larger (>200%) or much smaller (<50%) than the focal firm in book and market value of assets. The measure is winsorized at the 1st and 99th percentiles.	Compustat
ISS conformity	Fraction of firm's actual compensation peers that are included in a synthetic compensation peer group for the firm based on ISS's peer selection methodology (see Appendix B for details). The measure is winsorized at the 1st and 99th percentiles.	AuditAnalytics; ISS IncentiveLab; Equilar; Compustat, CRSP
Fraction of reciprocal peers	Fraction of compensation peers that reference back the focal firm, winsorized at the 1st and 99th percentiles.	AuditAnalytics; ISS IncentiveLab; Equilar
Peer group reciprocity	The fraction of the existing network linkages that are bilateral (i.e., point in both directions). At the firm-level, the network for a given firm is created by first adding the focal firm and all its compensation peers as nodes, and then by adding all the references between the focal firm and all its peers and the refences among the peers as defined in their respective compensation peer groups. The measure is winsorized at the 1st and 99th percentiles.	AuditAnalytics; ISS IncentiveLab; Equilar
Peer group transitivity	The number of triangles divided by the number of triads that exist in a network. Triads are groups of three nodes that are connected in some way; triangles are triads that are completely connected. A higher number indicates a greater connectivity among the members of the network. The measure is winsorized at the 1st and 99th percentiles.	AuditAnalytics; ISS IncentiveLab; Equilar
Peer group cluster coefficient	The number of triangles divided by the number of *possible* triads. A higher number indicates a more complete graph. The measure is winsorized at the 1st and 99th percentiles.	AuditAnalytics; ISS IncentiveLab; Equilar
Low initial conformity	An indicator variable that is one for firms with below-median conformity with the industry-size peer benchmark in 2007, else 0. Conformity with the industry-size benchmark is measured as the fraction of compensation peers that are from the same GICS2 industry and that are within 50-200% of a firm's relative market value of assets.	Compustat; CRSP; AuditAnalytics; ISS IncentiveLab; Equilar
ISS rank	Rank that ISS assigns to all potential same-GICS2 industry peers based on its peer selection methodology (see Appendix B for details).	Compustat; CRSP
Included in peer group	Indicator variable that is one if a firm is part of the actual compensation peer group of a given firm.	Compustat; AuditAnlystics; ISS IncentiveLab; Equilar
Relative market value	Market value of assets of peer scaled by focal firm's market value of assets, winsorized at the 1st and 99th percentiles.	Compustat
Relative Tobin's Q	Tobin's Q of peer scaled by focal firm's Tobin's Q, winsorized at the 1st and 99th percentiles.	Compustat
Relative sales	Total sales of peer scaled by focal firm's total sales, winsorized at the 1st and 99th percentiles.	Compustat

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

Variable	Definition	Source
Different industry	Indicator variable that is one if potential peer is from a different GICS4-industry.	Compustat
At threshold	Indicator variable that is equal to one for the potential peer that has the highest ISS rank and that is still included in ISS's recommended peer group for a given focal firm in a given year, else 0. (E.g., when ISS's recommended peer group has 24 peers, then it is coded 1 for the potential peer that is ranked 24th in ISS's methodology, else 0.)	Compustat, CRSP
Above threshold	Indicator variable that is equal to one for the potential peer whose ISS rank is just above the peer group size of ISS's recommended peer group for a given focal firm in a given year, else 0. (E.g., when ISS's recommended peer group has 24 peers, then it is coded 1 for the potential peer that is ranked 25th in ISS's methodology, else 0).	Compustat, CRSP
Dropped peer (t+1)	Indicator variable that is one if a firm is a compensation peer for a given focal firm in year t but is no longer a compensation peer for the focal firm in year $t+1$.	AuditAnlystics; ISS IncentiveLab; Equilar
Added peer (t+1)	Indicator variable that is one if a firm is not a compensation peer for a given focal firm in year t but is added as a compensation peer for the focal firm in year $t+1$.	AuditAnlystics; ISS IncentiveLab; Equilar
Dropped (added) by ISS at t	Indicator variable that is one for a potential peer that was dropped from (added to) ISS's recommended peer group for a given focal firm in year t.	Compustat; CRSP
Just dropped below ISS cutoff	An indicator variable that is equal to one if a firm's potential peer was just included in its ISS recommended peer group (i.e. relative rank between -4 and 0) in year $t-1$ but was just excluded from its ISS recommended peer group in year t (i.e., relative rank between 1 and 5).	Compustat; CRSP
Just rose above ISS cutoff	An indicator variable that is equal to one if a firm's potential peer was just excluded in its ISS recommended peer group (i.e. relative rank between 1 and 5) in year $t-1$ but was just included from its ISS recommended peer group in year t (i.e., relative rank between -4 and 0).	Compustat; CRSP
In ISS peer group	Indicator variable that is one if a potential peer was in ISS's recommended peer group for a focal firm in a given year.	Compustat; CRSP
Peer delisted	Indicator variable that is equal to one if a potential peer was delisted from the stock exchange in year t as a result of merger, bankruptcy or liquidation.	Compustat; CRSP
Change in relative market value	Change in the relative market value of assets for a given peer between year $t-1$ to year t. Relative market value of assets is defined as the market value of assets of the peer scaled by the market value of assets of the focal firm. The measure is winsorized at the 1st and 99th percentiles.	Compustat
Change in relative sales	Change in relative sales is the change in the relative sales of the peer from year $t-1$ to year t. Relative sales is defined as total sales of the peer scaled by total sales of the focal firm. The measure is winsorized at the 1st and 99th percentiles.	Compustat
Weak SOP support	Indicator variable that is one for firms that receive voting support in their say on pay votes in the bottom decile of the SOP vote distribution (which corresponds to 75 percent vote support).	ISS Voting Analytics
Annual SOP vote frequency	Indicator variable that is one if a firm has an annual say on pay voting frequency and zero if a firm has a say on pay vote frequency of every three years.	ISS Voting Analytics
Fraction shares owned by institutional investors	The fraction of a firm's shares that are owned by institutional investors. The measure is winsorized at the 5th and 95th percentiles.	Refinitiv 13F holdings
Fraction shares owned by quasi indexers	The fraction of a firm's shares that are owned by mutual funds that are classified as quasi-indexers per Bushee and Noe (2000); Bushee (2001). The measure is winsorized at the 5th and 95th percentiles.	Refinitiv 13F holdings; Brian Bushee's investor classification

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

Variable	Definition	Source
Fraction shares owned by index mutual funds	Defined as in Appel, Gormley and Keim (2016), p.116: The fraction of a firm's shares that are owned by mutual funds that are flagged as passively managed. A mutual fund is flagged as passively managed if its fund name includes a string that identifies it as an index fund. The strings used to identify index funds are: Index, Idx, Indx, Ind_ (where _ indicates a space), Russell, S & P, S and P, S&P, SandP, SP, DOW, Dow, DJ, MSCI, Bloomberg, KBW, NASDAQ, NYSE, STOXX, FTSE, Wilshire, Morningstar, 100, 400, 500, 600, 900, 1000, 1500, 2000, and 5000. The measure is winsorized at the 5th and 95th percentiles.	Refinitiv 13F holdings; CRSP mutual fund
Propensity to vote with ISS	The fraction of times that a firm's mutual fund investors voted alongside ISS in prior years 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 and ends in 2017.) The measure is winsorized at the 5th and 95th percentiles.	Refinitiv 13F holdings; ISS voting analytics; ISS mutual fund voting
IV. Other firm characteristics		
Log total assets	Natural logarithm of total book value of assets (rescaled to 2023 real USD).	Compustat
Tobin's Q	Total book value of assets minus book value of equity plus the market value of equity at the end of the fiscal year scaled by the total book value of assets, winsorized at the 1st and 99th percentiles.	Compustat
Sales growth	Change in total sales from year $t-1$ to year t divided by total sales in fiscal year $t-1$, winsorized at the 1st and 99th percentiles.	Compustat
Stock return	Daily stock returns compounded over a firm's fiscal year, winsorized at the 1st and 99th percentiles.	CRSP
Idiosyncratic volatility	Annualized standard deviation of the residuals of a firm's returns from the Fama-French 4-factor model estimated using its daily returns over its fiscal year, winsorized at the 1st and 99th percentiles.	CRSP

Appendix B: ISS's methodology for the selection of compensation peers

On December 20, 2011, ISS published a whitepaper that included a new approach to establish peer groups that are used for compensation analysis and pay-for-performance screens (Gibson, 2011). The whitepaper was republished with minor revisions on February 17, 2012 (ISS, 2012a).

In that whitepaper, ISS disclosed its new methodology for the selection of a comparison peer group that consists of the following steps:

1. Create an initial list of potential peers from the two-digit GICS universe as the subject company that satisfies the following two criteria:
   - potential peers are between 0.45 and 2.1 times the subject company's annual sales (assets for financial firms).
   - potential peers have a market capitalization of between 0.2 times and 5 times the subject company's market capitalization.
2. Narrow down the initial list of potential peers to those companies that are in the subject company's six-digit GICS category and rank them from 1 to N using the absolute relative distance in sales so that the subject company stays near the median of the selected group.
3. Take the top 24 potential peers for the subject firm's peer group. If this peer group has fewer than 14 peers, then supplement peers by repeating step (ii) for firms in the subject firm's four-digit GICS. If thereafter there are still fewer than 14 peers, repeat step (ii) for firms in the subject firm's two-digit GICS.

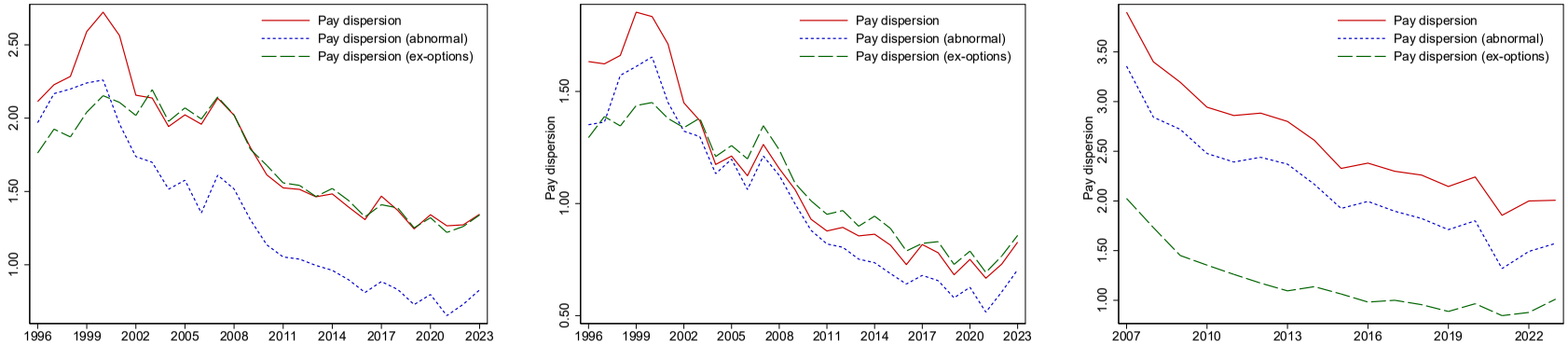
In some rare cases, firms do not end up with 14 peers. An example of this are companies that much larger than others in its industry (referred to as "super-mega non-financial companies" by ISS); in such cases, realizing the importance of firm size on CEO pay, ISS relaxes the industry criterion so to pair these firms with peers that are similar-sized.

Over the years, ISS has made some modifications to its selection methodology. Some of the changes added complexity while not truly affecting the industry and size match outcomes. For example, one such change was to tighten the initial industry selection filter from GICS6 to GICS8 (if insufficient peers are identified, this was again relaxed to GICS6, GICS4 and GICS2 as described in step (iii) above). Another change allowed firms from the GICS8 industry of the subject firm's own chosen compensation peers as potential peers with some priority given to what ISS calls "first-degree peers" (those that referenced back the subject firm) and those with numerous connections (i.e. those often chosen as a peer).

Despite such changes, repeated disclosures by ISS describing analyses of their peer group method show that there are little effective changes to the tightness of the industry-size restrictions. For example, in 2012, ISS reports that for the 2013 proxy season, 90 percent of peer groups maintain the subject company within 20 percent of the peer group median size and no peer groups had 2-digit GICS peers (ISS, 2012b, 15). In 2019, ISS reports a 2017 analysis that there were still no 2-digit GICS peers and 85 percent of peer groups maintain the subject firm within 20 percent of the peer group median size (ISS, 2019a, 3). In 2023, it reports the same statistics as in 2019 (ISS, 2023, 4-5).

Figure 1: Pay dispersion

The figures show the trajectory of CEO pay dispersion at three levels of aggregation – for the overall economy between 1996 and 2023 (Figure 1A), for the average industry-size group between 1996 and 2023 (Figure 1B), and within the average compensation peer group between 2007 and 2023 (Figure 1C). *Pay dispersion* is measured as the standard deviation of Pay (defined as `TDC1` in Execucomp scaled its median value in the year). *Pay dispersion (ex-options)* is the standard deviation of CEO pay (defined as `TDC1`) minus the value of stock options granted scaled by its median value in that year. *Pay dispersion (abnormal)* is computed as the standard deviation of pay residuals that are scaled by the median CEO pay in the year; the pay residuals are obtained from annual cross-sectional regressions of unscaled CEO pay on the economic determinants of pay (see variable appendix for details). In Figure 1B, industry is defined by GICS6 industry affiliation and size is based on quintiles of market value of assets.



1.A Economy-wide pay dispersion

1.B Pay dispersion with industry-size groups

1.C Pay dispersion in firms' compensation peer groups

Figure 2: Distributional changes in pay dispersion

The figure shows the percentage changes in CEO pay (measured as a multiple of the median CEO pay in a given year) at different pay percentiles between two points in time; between 1996 and 2006 in Panel A, and between 2007 and 2023 in Figure B. For example, Figure B shows that the pay of CEOs at the 25th percentile increased between 2007 and 2023 by 16 percent (from 0.45 times median pay to 0.52 times median) while the pay of CEOs at the 75th percentile dropped by 20 percent (from 2.25 times median pay to 1.79 times median).

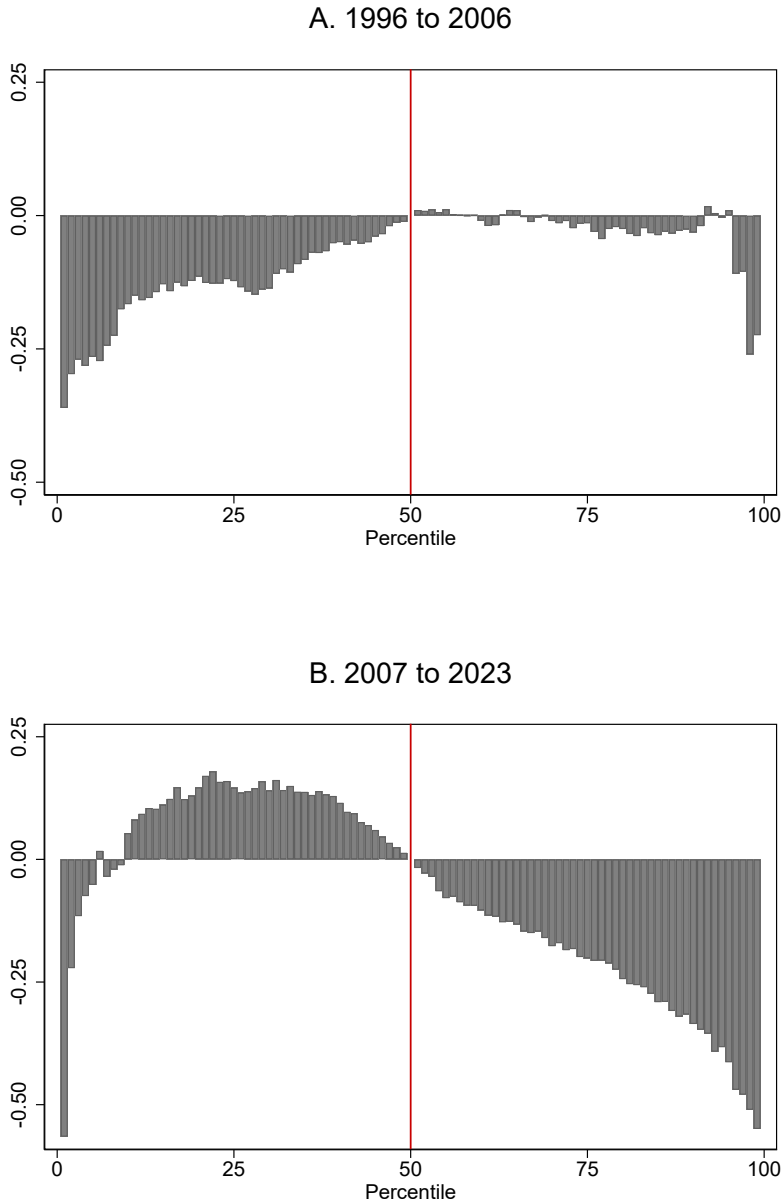


Figure 3: Pay dispersion in different settings

This figure plots CEO pay dispersion in different settings. *Pay dispersion* is measured as the standard deviation of *Pay* which is defined as total CEO pay scaled by the median value of total CEO pay in that year within the corresponding group (i.e., country/region; public/private firms; or non-Top5 senior employees). Panel A shows CEO pay dispersion in several countries/regions. Data for US firms is from Execucomp. UK, European and "rest-of-world" firms are from BoardEx. Australian and Canadian firms are from NRG Metrics (available for 2011-2019). Panel B contrasts the pay dispersion of CEOs in public U.S. firms to the pay dispersion among CEOs in private U.S. firms and the pay dispersion among non-Top5 senior employees in public and private U.S. firms. Data for senior employee and private-firm CEO pay comes from Capital IQ People Intelligence. For each Capital IQ firm, we keep the CEO of private firms and their total executive compensation, as well as the employees with non-zero total executive compensation and a pay rank outside the top 5. We remove employees whose title indicated that are part of the board, that they belong to the C-suite (i.e. have a "Chief" title) or which have a "President" title (as the use of president and CEO overlaps in some organizations). The most common remaining titles in the senior employees sample (representing over 95 percent) are then in order of frequency: senior key executive; other key executive; secretary; head of corporate development; head of sales; head of human resources; top key executives; head of marketing; other professional and operations professional; treasurer; controller. The senior employees sample covers 37,000 distinct employees; data coverage for U.S. private-firm CEOs start in 2006 and covers 2,954 distinct CEOs across 2,464 private U.S. firms.

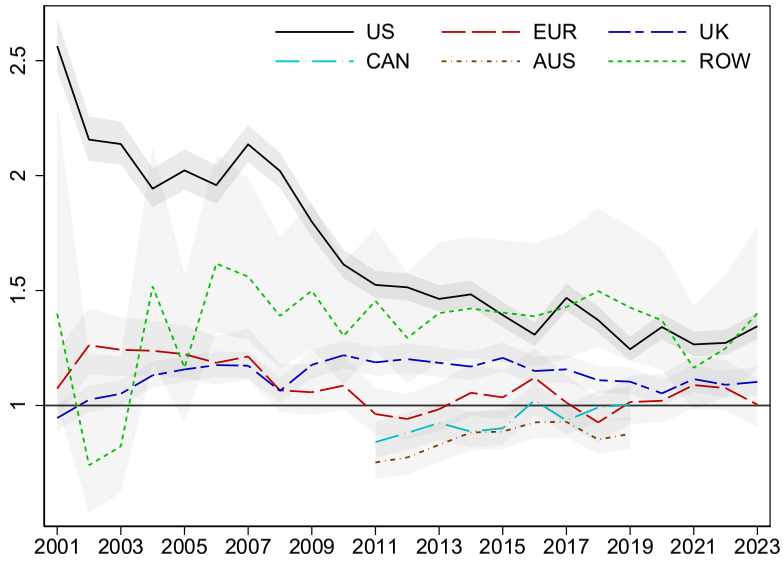


Figure 3A: International data

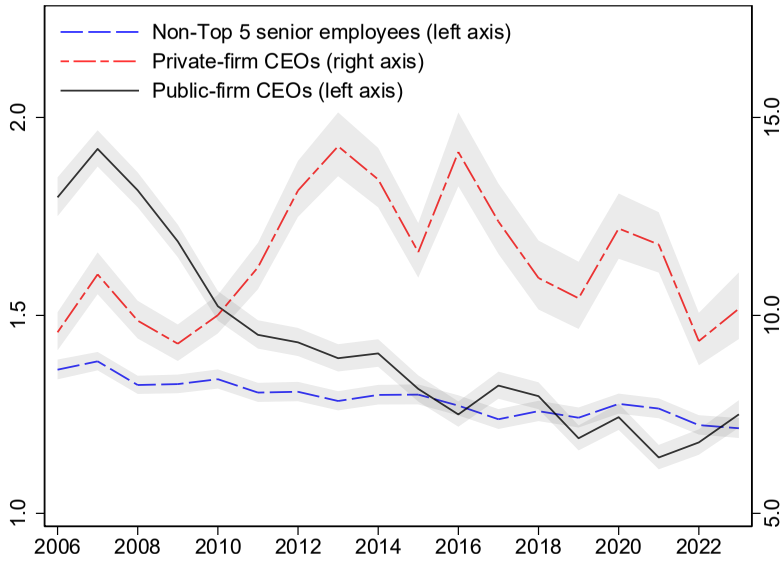


Figure 3B: Private-firm CEOs and other senior executives

Figure 4: Simulation

This figure shows the simulated and observed CEO pay dispersion in the economy. *Observed pay dispersion* is defined as in Figure 1A. *Simulated pay dispersion* is the economy-wide pay distribution when CEO pay is simulated under the assumption that all firms select compensation peers based on ISS's compensation peer selection methodology (see Appendix B for details). We target pay at a randomized target percentile of their peers' pay. That is, each year, each firm selects its compensation peers by following the industry- and size-based methodology developed by ISS and then sets its CEO pay level to a target percentile of this peer group pay distribution. Size and industry data for each year is obtained from Compustat. Target percentiles are randomly drawn from a normal distribution with mean 0.6 and standard deviation 0.1.

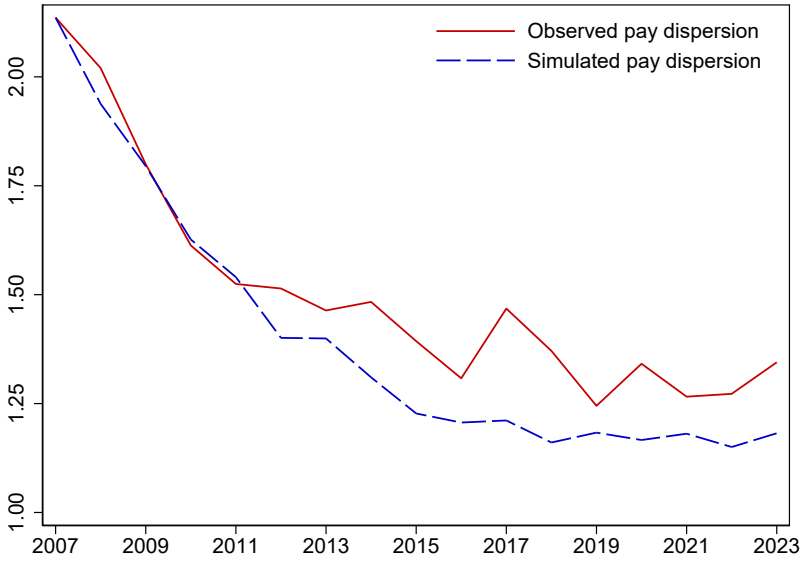
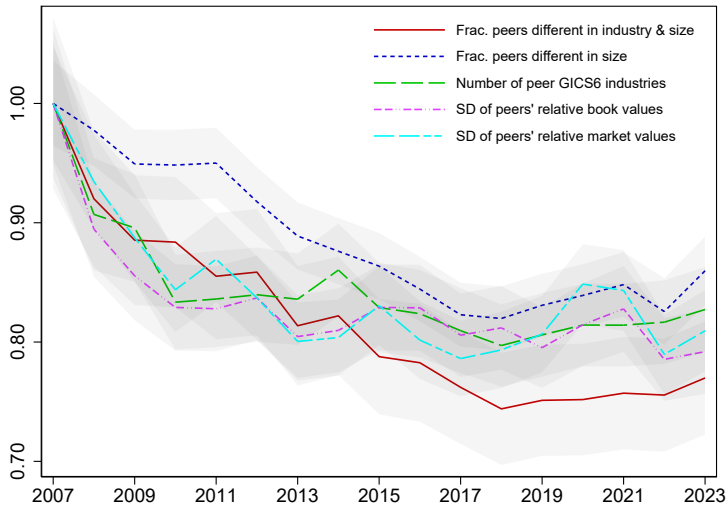
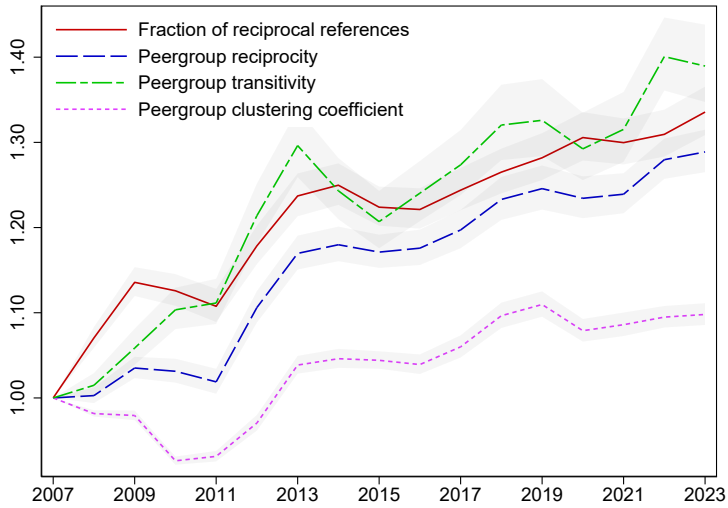


Figure 5: Compensation peer choices

This figure shows the composition of firms' compensation peer groups across time. In Panel A, *Frac. peers different in industry and size* is defined as the fraction of compensation peers that are in a different GICS1 industry and outside of 50-200% of relative asset size and market values. *Frac. peers different in size* is defined as the fraction of compensation peers that are outside of 50-200% of relative asset size and market values. *Number of peer GICS6 industries* is defined as the number of distinct GICS6 industries from which firms' compensation peers are drawn. *SD of peers' relative book value* (*market value*) is measured as the standard deviation of the ratio of peers' sizes to that of the subject firm, where size is measured using the book value of assets (total market value of assets). In Panel B, *Fraction of reciprocal references* is the fraction of compensation peers that reference back the subject firm in their respective peer groups. *Peergroup reciprocity*, *Peergroup transitivity* and *Peergroup clustering coefficient* further consider the connections among the peers: reciprocity is the fraction of connections in the network that are reciprocal; transitivity (clustering coefficient) is the fraction of triangles divided by the number of existing triad (divided by the number of possible triads) in the peer group network.



5A. Relative size and industry affiliation



5B. Peer group network measures

Figure 6: The influence of ISS on peer selection

This figure shows the probability that a potential peer is chosen by a subject firm as its compensation peer as a function of the potential peer's rank as per ISS's ranking methodology. In its methodology, ISS creates for each subject firm a ranking of appropriate compensation peers based on industry affiliation and relative-size criteria, and then chooses the highest-ranked 14-24 peers (see Appendix B for details). A lower ISS rank implies a more suitable peer. The x-axis shows a potential peer's relative rank per ISS methodology; the relative rank is defined as a potential peer's ISS rank minus the size of the ISS recommended peer group for the subject firm. For example, for a subject firm with an ISS recommended peer group of 14 (24) peers, relative rank 1 indicates a 15th (25th) ranked potential peer and which is hence just outside of ISS's peer group per ISS methodology.

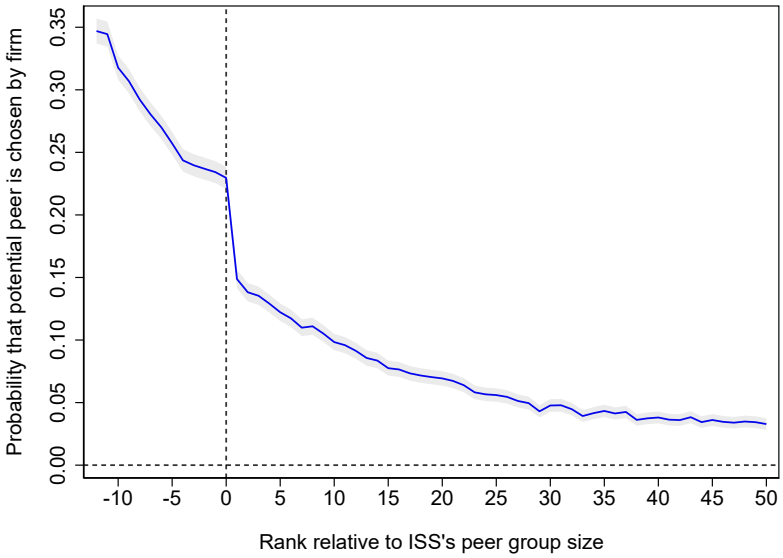


Figure 7: The influence of SOP on peer selection

This figure shows the univariate dispersion of peers' relative book values, dispersion of peers' relative market values, deviation from industry-size benchmarking, and conformity with ISS's peer selection policy in year [-3,+3] around firms' first SOP frequency vote event. The measures, normalized as of year 0 (i.e., the year of the first SOP frequency vote), are shown separately for the firms whose shareholders voted for a 1-year (3-year) SOP vote frequency in close shareholder votes. Close votes are defined as those with less than a 5 percentage point difference in support for the 1-year versus 3-year SOP vote frequency in a firm. The vertical lines around the point estimate show 95% confidence intervals.

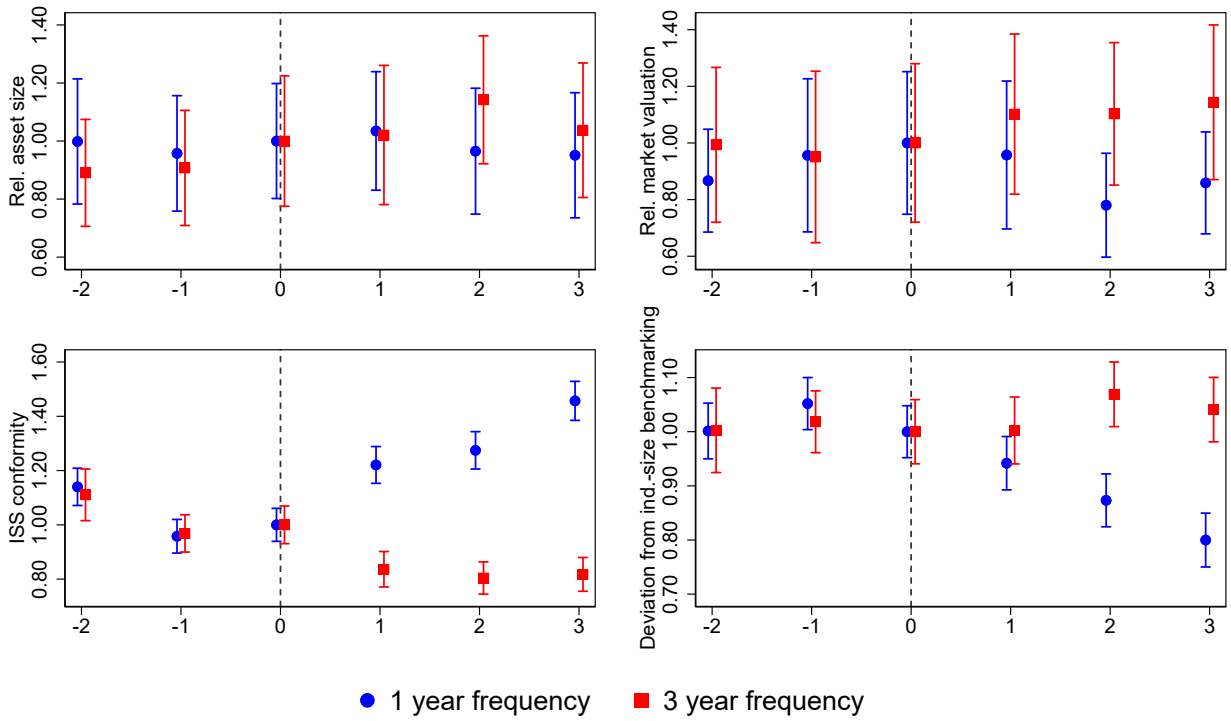


Table 1: Descriptive statistics

Panel A shows descriptive statistics for industry-size groups between 1996 and 2023 with data from Execucomp. Panel B shows descriptive statistics for the firm-level sample, consisting of S&P 1500 firms with sufficient pay data on their (S&P 1500 and non-S&P 1500) compensation peers. *CEO nominal pay* (with or without options) is a focal firm's own pay from Execucomp. *Pay* is defined as nominal CEO pay scaled by its median value in the year. *Pay dispersion / Pay dispersion (ex-options) / Pay dispersion (abnormal)* is the standard deviation of *Pay / Pay (ex-options) / Pay (abnormal)* in the economy (Panel A) or within compensation peer groups (Panel B) in the year. All variables defined in the variable appendix.

Panel A: Industry-size group sample (1996-2023)

	Mean	**Median**	**Std Dev**	**p5**	**p95**
Number of distinct firms per year	1,975	1,907	230	1,671	2,304
Number of GICS6 industries per year	67	67	1.39	65	69
Number of GICS4 industries per year	24	24	0.43	24	25
Number of GICS2 industries per year	10	10	0.49	10	11
Number of GICS6-size groups per year	322	328	12.05	296	335
CEO nominal pay (thousands of USD)	5,649	3,599	6,185	484	18,107
CEO nominal pay ex-options (thousands of USD)	4,274	2,504	4,818	387	14,300
Pay	1.584	1.000	1.840	0.153	5.016
Pay (ex-options)	1.552	1.000	1.735	0.181	4.796
Pay (abnormal)	-0.014	-0.098	1.158	-1.611	1.840
Pay dispersion	1.796	1.706	0.450	1.266	2.591
Pay dispersion (ex-options)	1.707	1.720	0.330	1.252	2.153
Pay dispersion (abnormal)	1.166	1.110	0.342	0.724	1.705
Total assets (millions of real 2023 USD)	17,329	3,127	48,623	222	73,305
Market valuation (millions of real 2023 USD)	26,102	5,787	68,678	412	116,862

Panel B: Firm-level sample (2007-2023)

	Mean	**p50**	**SD**	**p5**	**p95**
Number of distinct firms per year	1,240	1,277	119	838	1,329
Number of distinct peer firms per year	2,982	3,057	235	2,174	3,162
Size of compensation peer group per year	18	16	7	9	31
Nominal CEO pay (in thousands USD)	7,576	5,746	6,358	1,161	20,116
Nominal CEO pay excl. options (in thousands USD)	6,442	4,786	5,513	953	17,798
Pay	4.385	3.318	3.628	0.730	11.930
Pay (ex-options)	1.721	1.271	1.518	0.285	4.700
Pay (abnormal)	0.289	-0.048	2.330	-2.863	4.752
Pay dispersion	2.510	2.239	1.409	0.734	5.235
Pay dispersion (ex-options)	1.140	0.911	0.756	0.294	2.762
Pay dispersion (abnormal)	2.104	1.892	1.114	0.637	4.259
Total assets (millions of real 2023 USD)	24,526	5,477	61,442	529	106,969
Market valuation (millions of real 2023 USD)	37,668	8,759	87,978	880	180,264
Tobin's Q	1.899	1.483	1.248	0.936	4.441
Sales growth	0.069	0.053	0.193	-0.211	0.401
Return on assets	0.059	0.059	0.078	-0.066	0.175
Stock performance	0.112	0.091	0.375	-0.467	0.762
Idiosyncratic volatility	0.286	0.249	0.147	0.126	0.579

Table 2: CEO pay dispersion

This table shows the trend in CEO pay dispersion within industry-size groups (Panel A) and within compensation peer groups (Panel B). In models 1-3 of Panel A, industry-size groups are based on GICS6-industry affiliation and size quintiles are based on market value of assets; the level of observation is hence industry-size-year. In models 4-6 of Panel A, we match to each firm its 18 closest-sized GICS6-peers in that year (since 18 is the average peer group size in the data) before computing the pay dispersion measures among the matched peers; the level of observation is hence firm-year. In Panel B, we compute pay dispersion measures among the firm's disclosed compensation peers in a given year; the level of observation is hence firm-year. *Annual trend* is a linear time trend variable defined as the fiscal year minus the first year of the respective sample period. *Pay dispersion* is the standard deviation of *Pay*. *Pay dispersion (abnormal)* is the standard deviation of *Pay (abnormal)*, computed as explained in Appendix A. *Pay dispersion (ex-options)* is the standard deviation of *Pay (ex-options)*. Firm controls include lagged *Total assets (logged)*, *Tobin's Q*, *Sales growth*, *Stock return*, and *Idiosyncratic volatility*. In Panel A (Panel B) we also control for *Cumulative pay growth* between 2007 and the year of observation at the economy level (at the firm level). All variable definitions are described in the variable appendix. All models include a constant term. t-statistics in parentheses are based on standard errors clustered at the industry-size level (Panel A, models 1-3) or firm-level (Panel A, models 4-6 and Panel B). *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

Panel A: Pay dispersion in industry-size groups

Dependent variable:	*Pay dispersion*	*Pay dispersion (abnormal)*	*Pay dispersion (ex-options)*	*Pay dispersion*	*Pay dispersion (abnormal)*	*Pay dispersion (ex-options)*
Level:	Industry-size-year level			Firm-year level		
Method:	Groups based on ind.-size quintiles			Groups based on firm-specific ind.-size matched peers		
Sample period:	1996-2023			1996-2023		
Model:	(1)	(2)	(3)	(4)	(5)	(6)
Annual trend	-0.041***	-0.051***	-0.015***	-0.027***	-0.035***	-0.031***
	(-8.090)	(-8.919)	(-3.145)	(-10.33)	(-13.96)	(-6.239)
Observations	7,499	7,052	7,499	23,508	23,360	21,958
R-squared	0.417	0.407	0.392	0.627	0.607	0.267
Industry × Size FE	Yes	Yes	Yes	n/a	n/a	n/a
Firm FE	n/a	n/a	n/a	Yes	Yes	Yes

Panel B: Pay dispersion in firms' compensation peer groups

Dependent variable:	*Pay dispersion*			*Pay dispersion (abnormal)*			*Pay dispersion (ex-options)*		
Level:	Firm-year level			Firm-year level			Firm-year level		
Sample period:	2007-2023			2007-2023			2007-2023		
Model:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Annual trend	-0.119***	-0.105***	-0.113***	-0.093***	-0.085***	-0.092***	-0.096***	-0.091***	-0.094***
	(-20.93)	(-20.01)	(-21.25)	(-20.20)	(-20.94)	(-21.20)	(-28.48)	(-28.14)	(-27.65)
Lag log total assets		0.421***	0.434***		0.362***	0.376***		0.236***	0.233***
		(21.39)	(11.86)		(27.99)	(14.27)		(24.19)	(11.21)
Lag of Tobin's		0.108***	0.086***		0.085***	0.060***		0.059***	0.045***
		(9.307)	(6.486)		(11.63)	(6.897)		(9.853)	(6.474)
Lag of sales growth		0.032	0.027		0.014	0.015		0.019	-0.003
		(1.446)	(1.103)		(0.752)	(0.711)		(1.461)	(-0.193)
Log of stock return		-0.055***	-0.048***		-0.043***	-0.035***		-0.039***	-0.037***
		(-3.290)	(-2.907)		(-3.529)	(-2.872)		(-4.218)	(-3.839)
Lag of idio. volatility		0.192***	0.046		0.137***	0.025		-0.004	-0.088**
		(2.621)	(0.624)		(2.638)	(0.462)		(-0.105)	(-2.224)
Observations	21,082	20,807	20,662	21,082	20,807	20,662	21,036	20,761	20,614
R-squared	0.114	0.541	0.695	0.171	0.604	0.718	0.108	0.497	0.641
Firm controls	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Industry × Size FE	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Firm FE	No	No	Yes	No	No	Yes	No	No	Yes

Table 3: Peer groups

Panel A shows the time trend in the characteristics of firms' chosen compensation peer groups since the introduction of the SEC pay disclosure rule (2007-2023). *Dispersion in relative book values* and *Dispersion in relative market values* are the standard deviations of peers' relative book value of asset (BVA) and market value of assets (MVA), respectively. *Deviation from industry-size benchmarking* is the fraction of peers with a different GICS1 code or that are much larger (>200%) or much smaller (<50%) than the focal firm (in terms of BVA or MVA). *ISS conformity* refers to the fraction of peers included in a synthetic compensation peer group based on ISS's peer selection methodology (see Appendix B for details). Panel B shows network measures that describe the connections between firms and their compensation peers (including among the peers) as defined via firms' compensation peer groups. *Annual trend* is defined as the fiscal year minus 2007. Industry is defined as GICS6 affiliation. Firm controls are identical to those in Table 2B. All variable definitions are described in the variable appendix. All models include a constant term. t-statistics in parentheses are based on standard errors that are clustered at the firm level. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

Panel A: Peer characteristics

Dependent variable:	*Dispersion in rel. book values*		*Dispersion in rel. market values*		*Deviation from ind.-size benchmarking*		*ISS conformity*	
Sample period:	2007-2023		2007-2023		2007-2023		2007-2023	
Model:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Annual trend	-0.008***	-0.020***	-0.010***	-0.015***	-0.004***	-0.003***	0.002***	0.002***
	(-4.194)	(-7.665)	(-4.698)	(-5.451)	(-7.058)	(-5.611)	(4.942)	(4.703)
Observations	21,080	20,661	21,066	20,655	21,066	20,655	21,051	20,632
R-squared	0.002	0.664	0.003	0.583	0.006	0.745	0.003	0.691
Firm controls	No	Yes	No	Yes	No	Yes	No	Yes
Industry × Size FE	No	Yes	No	Yes	No	Yes	No	Yes
Firm FE	No	Yes	No	Yes	No	Yes	No	Yes

Panel B: Clusterization of peergroups

Dependent variable:	*Fraction of reciprocal peers*		*Peer group reciprocity*		*Peer group transitivity*		*Peer group clustering coeff.*	
Sample period:	2007-2023		2007-2023		2007-2023		2007-2023	
Model:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Annual trend	0.005***	0.009***	0.003***	0.004***	0.002***	0.002***	0.003***	0.003***
	(10.35)	(14.30)	(14.05)	(16.06)	(12.42)	(13.24)	(11.48)	(12.37)
Observations	21,082	20,662	21,082	20,662	21,082	20,662	21,052	20,632
R-squared	0.013	0.753	0.021	0.807	0.016	0.779	0.014	0.718
Firm controls	No	Yes	No	Yes	No	Yes	No	Yes
Industry × Size FE	No	Yes	No	Yes	No	Yes	No	Yes
Firm FE	No	Yes	No	Yes	No	Yes	No	Yes

Table 4: Peer pay dispersion and peer group composition

This table shows the correlation between *Pay dispersion* within compensation peer groups and peer group composition as measured by dispersion of compensation peers' relative size (measured either in book value of assets or in market value of assets), *Deviation from industry-size benchmarking*, *ISS conformity* and the *Fraction of reciprocal peers*. Firm controls are identical to those in Table 2B. All variable definitions are described in the variable appendix. All models include a constant term. t-statistics in parentheses are based on standard errors that are clustered at the firm level. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

	Pay dispersion				
Sample period:	2007-2023				
Model:	(1)	(2)	(3)	(4)	(5)
Dispersion in rel. book values	8.019***				
	(4.943)				
Dispersion in rel. market values		6.657***			
		(4.678)			
Deviation from ind.-size benchmarking			91.64***		
			(12.91)		
ISS conformity				-71.83***	
				(-9.074)	
Fraction of reciprocal peers					-49.36***
					(-6.611)
Observations	20,652	20,643	20,643	20,620	20,653
R-squared	0.750	0.750	0.755	0.753	0.751
Firm controls	Yes	Yes	Yes	Yes	Yes
Industry × Year FE	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes

Table 5: SEC disclosure rule

This table shows the trend in *Pay dispersion* within industry-size groups (Panel A) and within compensation peer groups (Panel B) around the introduction of the SEC disclosure rule for compensation peers. *Annual trend* is a linear time trend variable defined as the fiscal year minus the first year of the respective sample period. Panel B shows results for *Pay dispersion* and several metrics characterizing compensation peer choices (see Table 3 or variable appendix for definitions). *Low initial conformity* is an indicator variable that is one for firms with below-median conformity with the industry-size peer benchmark in 2007, else 0. Conformity with the industry-size benchmark is measured as the fraction of compensation peers that are from the same GICS2 industry and that are within 50-200% of a firm's relative market value of assets. Firm controls are identical to those in Table 2B. All variable definitions are described in the variable appendix. All models include a constant term. t-statistics in parentheses are based on standard errors that are clustered at the industry-size level in Panel A and at the firm-level in Panel B. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

Panel A: Pay dispersion in industry-size groups

Dependent variable:	*Pay dispersion*					
Sample period:	2003-2006		2007-2010		2003-2010	
Model:	(1)	(2)	(3)	(4)	(5)	(6)
Annual trend	0.038	0.052	-0.100***	-0.098***		
	(0.750)	(1.059)	(-4.391)	(-4.327)		
Post					-0.163***	-0.141***
					(-3.607)	(-3.217)
Observations	1,023	1,011	1,166	1,158	2,189	2,183
R-squared	0.003	0.664	0.014	0.659	0.008	0.555
Industry × Size FE	No	Yes	No	Yes	No	Yes

Panel B: Compensation peer choices and pay dispersion at the firm-level

Dependent variable:	*Pay dispersion*		*Dispersion in rel. book values*		*Dispersion in rel. market values*		*Deviation from ind.-size benchmarking*		*ISS conformity*	
Sample period:	2007-2010		2007-2010		2007-2010		2007-2010		2007-2010	
Model:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Annual trend	-0.145***	-	-0.007	-	-0.015	-	-0.000	-	0.004	-
	(-6.442)		(-0.457)		(-0.946)		(0.039)		(1.272)	
Low initial conformity	0.473***	-	0.326***	-	0.314***	-	0.237***	-	-0.179***	-
	(5.106)		(4.694)		(4.578)		(17.08)		(-15.99)	
Low initial conformity	-0.017	-0.066**	-0.058**	-0.100***	-0.052**	-0.087***	-0.010**	-0.020***	0.012***	0.017***
× *Annual trend*	(-0.531)	(-2.081)	(-2.459)	(-3.653)	(-2.135)	(-3.040)	(-2.306)	(-3.801)	(2.960)	(3.937)
Observations	2,977	2,882	2,977	2,882	2,973	2,878	2,973	2,878	2,965	2,867
R-squared	0.039	0.781	0.018	0.811	0.018	0.776	0.231	0.896	0.183	0.850
Firm controls	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Industry × Year FE	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Firm FE	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes

Table 6: ISS rankings

This table examines firms' decisions to include potential peers into their compensation peer groups. In Panel A, Models 1-3 include the top 100 potential peers ranked by ISS methodology (described in Appendix B). Models 4-6 limit the number of potential peers to 18, which is the average number of compensation peers (see Table IA.2). Panel B compares the likelihood of inclusion of potential peers that were ranked just at ISS's firm-specific peer group size threshold relative to those potential peers that were ranked just above it. *At threshold* is coded 1 for the peer with the highest rank per ISS methodology and that is still included in the ISS recommended peer group for the firm (i.e. relative rank 0 in Figure 6), else 0. *Above threshold* is coded 1 for the peer with relative rank +1 (i.e., ranked just outside ISS's recommended peer group), else 0. The omitted category are potential peers at relative rank -1. Panel A uses data after 2012 when ISS published its peer selection methodology. Panel B restricts data to year(s) either prior to 2012 (models 1-5 as placebo tests) or to years after 2012 (models 6-10) when ISS had published its peer selection methodology. A lower ISS rank implies a more suitable peer. Both panels include controls about the relative size and industry differences between the subject firm and the potential peer: *Relative assets*, *Relative market value*, *Relative Tobin's Q*, *Relative sales* as well as an indicator variable (*Different industry*) that is one if the potential peer is from a different GICS4-industry. All models include a constant term. *t*-statistics (in parentheses) are based on standard errors clustered at the firm level. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

Panel A: Importance of ISS rankings

Dependent variable:	*Included in peer group*					
Level:	Firm - Compensation peer - year level					
Window of analysis:	2012-2023					
Sample:	S&P 1500 firms with potential peers					
Sub-sample:	all potential peers within same GICS2			peers limited to top-ranked 18 peers		
Model:	(1)	(2)	(3)	(4)	(5)	(6)
ISS rank	-0.000***	0.000	-0.000	-0.010***	-0.009***	-0.010***
	(-6.826)	(0.232)	(-0.804)	(-11.87)	(-9.908)	(-9.260)
Trend	0.433***	-	-	0.347***	-	-
	(9.704)			(3.684)		
ISS rank × Trend	-0.006***	-0.006***	-0.005***	-0.018**	-0.016**	-0.015*
	(-11.17)	(-12.61)	(-8.833)	(-2.525)	(-2.292)	(-1.806)
Relative assets		-0.013***	-0.025***		-0.046***	-0.081***
		(-7.126)	(-11.36)		(-7.686)	(-9.615)
Relative market value		-0.017***	-0.051***		-0.049***	-0.149***
		(-10.38)	(-22.63)		(-9.132)	(-19.43)
Relative Tobin's Q		-0.006***	-0.055***		-0.016**	-0.130***
		(-3.118)	(-13.14)		(-2.283)	(-9.862)
Relative sales		0.049***	0.003		0.155***	0.367***
		(18.81)	(0.393)		(19.42)	(10.10)
Different industry		-0.139***	-0.137***		-0.250***	-0.225***
		(-28.62)	(-27.26)		(-16.69)	(-12.48)
Observations	1,599,969	1,278,865	1,277,692	270,823	219,889	216,579
R-squared	0.062	0.254	0.289	0.021	0.365	0.482
Year FE	No	Yes	n/a	No	Yes	n/a
Firm FE	No	Yes	n/a	No	Yes	n/a
Peer FE	No	Yes	n/a	No	Yes	n/a
Firm × Year	No	No	Yes	No	No	Yes
Peer × Year	No	No	Yes	No	No	Yes

Panel B: Analysis around ISS' threshold pre and post policy implementation

Dependent variable	*Included in peer group*									
Level:	Firm - Compensation peer - year level									
Sample:	S&P 1500 firms with potential peers									
Window of analysis:	2007-2011	2008-2011	2009-2011	2010-2011	2011	2012	2012-2013	2012-2014	2012-2015	2012-2023
Model:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
At threshold	-0.002	-0.001	-0.004	0.013	0.023	-0.066**	-0.046**	-0.020	-0.026	-0.025**
	(-0.151)	(-0.046)	(-0.184)	(0.608)	(0.694)	(-2.013)	(-2.052)	(-1.070)	(-1.555)	(-2.538)
Above threshold	-0.010	-0.014	-0.008	0.019	0.012	-0.108***	-0.075***	-0.063***	-0.068***	-0.071***
	(-0.491)	(-0.672)	(-0.318)	(0.710)	(0.306)	(-2.949)	(-2.774)	(-2.745)	-(3.493)	(-6.262)
Observations	7,200	6,260	4,907	3,439	1,749	1,793	3,577	5,333	7,127	21,172
R-squared	0.829	0.825	0.818	0.820	0.828	0.825	0.821	0.821	0.824	0.822
Relative peer differences (scaled)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm × Year	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Peer × Year	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Difference in coefficient	0.007	0.014	0.004	-0.006	0.011	0.042**	0.029***	0.043**	0.042***	0.046***
p-value of difference in coefficient	0.877	0.733	0.951	0.750	0.784	0.012	0.015	0.021	0.002	<0.001

Table 7: ISS and peer group changes

This table examines firms' decisions to drop peers from (add peers to) their compensation peer groups in $t+1$ in response to changes in ISS recommended peers for the firm in year t. The dependent variable *Dropped peer in t+1* (*Added peer in t+1*) in models 1-4 (models 5-8) is an indicator variable equal to 1 if a peer is dropped by a firm from (is newly added by a firm to) its compensation peer group in year $t+1$, else 0. *Just dropped below ISS cutoff* is an indicator variable that is equal to one if a firm's potential peer was just included in its ISS recommended peer group (i.e. relative rank between -4 and 0) in year $t-1$ but was just excluded from its ISS recommended peer group in year t (i.e., relative rank between 1 and 5). *Just rose above ISS cutoff* is an indicator variable that is equal to 1 if a firm's potential peer was just excluded in its ISS recommended peer group (i.e. relative rank between 1 and 5) in year $t-1$ but was just included from its ISS recommended peer group in year t (i.e., relative rank between -4 and 0). Control firms in models 4 and 8 are potential peers with relative ranks between -4 and 20 in years t and $t+1$ and that did not switch into or out of ISS's recommended peer group in year t. Further, *Delisted* is and indicator variable which is equal to 1 if the peer firm was delisted from the stock exchange in year t as a result of merger, bankruptcy or liquidation. *Change in relative market value* is the change in the relative market value of assets of the peer from year $t-1$ to year t. *Change in relative sales* is the change in the relative sales of the peer from year $t-1$ to year t. Firm controls are identical to those in Table 2B. All variable definitions are described in the variable appendix. All models include a constant term. t-statistics in parentheses are based on standard errors clustered at the firm-level. *, **, and *** denote significance at the 10%, 5%, and 1% levels respectively.

Dependent variable:	*Dropped peer (t+1)*				*Added peer (t+1)*			
Level:	Firm - Compensation peer - year level							
Window of analysis:	2012-2023				2012-2023			
Sample:	S&P 1500 firms with all their peers				S&P 1500 firms and all their potential peers			
Model:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dropped by ISS at t	0.078***	0.061***	0.047***					
	(11.42)	(9.384)	(9.339)					
Just dropped below ISS cutoff				0.023***				
				(3.564)				
Added by ISS at t					0.025***	0.022***	0.022***	
					(19.65)	(17.41)	(17.54)	
Just rose above ISS cutoff								0.008***
								(4.155)
In ISS peer group at t-1	-0.056***	-0.061***	-0.053***	-	0.016***	0.014***	0.014***	-
	(-19.27)	(-26.63)	(-29.58)		(45.39)	(42.79)	(42.79)	
Peer delisted at t	0.692***	-	-	-				
	(119.9)							
Change in rel. market value (t-1 to t)		0.000***	0.000***	0.011		0.000***	0.000	0.000**
		(11.50)	(2.628)	(1.197)		(2.631)	(1.206)	(2.360)
Change in rel. sales (t-1 to t)		0.005***	0.007***	0.028***		0.000***	0.000*	-0.005***
		(3.556)	(3.691)	(3.536)		(2.631)	(1.744)	(-4.053)
Observations	245,238	220,421	216,173	56,185	12,967,656	9,537,999	9,537,999	167,426
R-squared	0.247	0.172	0.584	0.778	0.006	0.014	0.030	0.286
Additional firm controls	No	Yes	n/a	n/a	No	Yes	n/a	n/a
Year FE	No	Yes	n/a	n/a	No	Yes	n/a	n/a
Firm FE	No	Yes	n/a	n/a	No	Yes	n/a	n/a
Peer FE	No	Yes	n/a	n/a	No	Yes	n/a	n/a
Firm × Year	No	No	Yes	Yes	No	No	Yes	Yes
Peer × Year	No	No	Yes	Yes	No	No	Yes	Yes

Table 8: Passive investing

This table shows cross-sectional associations between measures of industry-size benchmarking and measures of passive investing. *Fraction shares owned by institutional investors* is the fraction of shares owned by institutional investors in a given firm-year. *Fraction shares owned by quasi-indexers* is the fraction of shares in a firm-year owned by quasi-indexers (as classified by Bushee and Noe, 2000 and Bushee, 2001). *Fraction shares owned by index mutual funds* is the fraction of shares owned by mutual funds that follow index investing (as defined in Appel, Gormley and Keim, 2016). *Propensity to vote with ISS* is the fraction of shares owned by mutual funds that in prior years voted with ISS's advice when ISS and the firm's management gave conflicting voting advice. The latter measure is only available until 2017 as ISS has stopped selling vote recommendation data to academics. Firm controls are identical to those in Table 2B. Industry-by-year fixed effects are based on GICS4 industries. All variable definitions are described in the variable appendix. All models include a constant term. t-statistics in parentheses are based on clustered standard errors at the firm level. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

Dependent variable:	*Dispersion in relative book values*	*Dispersion in relative market values*	*Deviation from industry-size benchmarking*	*ISS conformity*	*Dispersion in relative book values*	*Dispersion in relative market values*	*Deviation from industry-size benchmarking*	*ISS conformity*
Passive investing proxy:	***Fraction shares owned by inst. investors***				***Fraction shares owned by quasi-indexers***			
Sample period:	2007-2023				2007-2023			
Model:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Passive investing	-0.240**	-0.361***	-0.184***	0.102***	-0.269	-0.644***	-0.184***	0.114***
	(-2.253)	(-3.232)	(-5.310)	(3.624)	(-1.638)	(-3.872)	(-3.825)	(2.913)
Observations	18,343	18,338	18,338	18,329	17,024	17,019	17,019	17,006
R-squared	0.290	0.192	0.216	0.098	0.283	0.190	0.217	0.098
Firm controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry × Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Dependent variable:	*Dispersion in relative book values*	*Dispersion in relative market values*	*Deviation from industry-size benchmarking*	*ISS conformity*	*Dispersion in relative book values*	*Dispersion in relative market values*	*Deviation from industry-size benchmarking*	*ISS conformity*
Passive investing proxy:	***Fraction shares owned by index mutual funds***				***Propensity to vote with ISS***			
Sample period:	2007-2023				2007-2017			
Model:	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
Passive investing	-0.675	-0.985**	-0.410***	0.197**	-2.445***	-2.104**	-0.538**	0.334
	(-1.543)	(-2.157)	(-3.228)	(1.963)	(-2.820)	(-2.309)	(-1.962)	(1.536)
Observations	19,370	19,362	19,362	19,353	10,202	10,196	10,196	10,189
R-squared	0.285	0.190	0.215	0.099	0.276	0.193	0.211	0.093
Firm controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry × Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Table 9: Say on pay

This table shows the impact of weak say on pay votes on the composition of compensation peer groups. The dependent variables in models 1-4 are *Dispersion in relative book values* and *Dispersion in relative market values*, which are the standard deviations of peers' relative book value of asset (BVA) and market value of assets (MVA) respectively. *Deviation from industry-size benchmarking* in models 5-6 is the fraction of peers with a different GICS1 code or that are much larger (>200%) or much smaller (<50%) than the focal firm (in terms of BVA or MVA). *ISS conformity* in models 7-8 refers to the fraction of peers included in a synthetic compensation peer group based on ISS's peer selection methodology (see Appendix B for details). *Weak SOP support* is an indicator for firms that receive voting support in their say on pay votes in the bottom decile of the SOP vote distribution. The analysis uses only the first instance of say on pay votes at firms relating to their pay in fiscal years 2010 or 2011 and keeps a window of [-3,+3] years around the say on pay votes. Control firms are those that have above-median SOP vote support and are matched by GICS2-industry and stock performance to weak-vote firms. Firm controls are identical to those in Table 2B. All variable definitions are described in the variable appendix. All models include a constant term. t-statistics in parentheses are based on standard errors clustered at the firm level. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

Dependent variable:	*Dispersion in rel. book values*		*Dispersion in rel. market values*		*Deviation from industry-size benchmarking*		*ISS conformity*	
Sample period:	2007-2014		2007-2014		2007-2014		2007-2014	
Window of analysis:	[-3, +3] around event		[-3, +3] around event		[-3, +3] around event		[-3, +3] around event	
Model:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Weak SOP support	0.092		0.006		0.021		-0.016	
	(1.041)		(-0.068)		(0.927)		(-0.911)	
Weak SOP support × Post year 1	-0.061	-0.111**	-0.087	-0.092	-0.004	-0.008	0.019**	0.014
	(-1.204)	(-2.001)	(-1.451)	(-1.499)	(-0.375)	(-0.581)	(1.992)	(1.130)
Weak SOP support × Post year 2	-0.221***	-0.223***	-0.281***	-0.200**	-0.036**	-0.037*	0.056***	0.038**
	(-3.446)	(-2.783)	(-3.445)	(-2.125)	(-2.283)	(-1.877)	(3.913)	(2.096)
Weak SOP support × Post year 3	-0.196***	-0.250***	-0.236***	-0.218**	-0.048***	-0.043***	0.067***	0.035*
	(-2.728)	(-2.640)	(-2.934)	(-2.049)	(-3.223)	(-2.052)	(4.732)	(1.800)
Observations	2,117	1,991	2,115	1,990	2,115	1,990	2,115	1,989
R-squared	0.004	0.774	0.008	0.753	0.003	0.837	0.009	0.807
Firm controls	No	Yes	No	Yes	No	Yes	No	Yes
Firm FE	No	Yes	No	Yes	No	Yes	No	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Table 10: Close say on pay frequency votes

This table compares the changes in peer group composition among Russell 3000 firms whose shareholders voted for an annual say on pay vote frequency over a 3-year say on pay vote frequency by a narrow margin (±5%). The analysis uses a narrow window [-3, +3] years around the first occurrence of a SOP frequency vote in firms (which happened in calendar years 2011 to 2013). We require firms to have at least 2 years data in the post period. The dependent variables in models 1-4 are *Dispersion in relative book values* and *Dispersion in relative market values*, which are the standard deviations of peers' relative book value of asset (BVA) and market value of assets (MVA) respectively. *Deviation from industry-size benchmarking* in models 5-6 is the fraction of peers with a different GICS2 code or that are much larger (>200%) or much smaller (<50%) than the focal firm (in terms of BVA or MVA). *ISS conformity* in models 7-8 refers to the fraction of peers included in a synthetic compensation peer group based on ISS peer selection methodology (see Appendix B for details). *Post* is an indicator variable equal to 1 in fiscal years that begin after the year of the first SOP frequency vote, else 0. *Annual SOP vote frequency* is an indicator variable that is equal to 1 if a firm's shareholders voted for annual SOP votes. Firm controls are identical to those in Table 2B. Industry-by-year fixed effects are based on GICS1 industry codes. All variable definitions are described in the variable appendix. t-statistics in parentheses are based on standard errors clustered at the firm level. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

Dependent variable:	*Dispersion in rel. book values*		*Dispersion in rel. market values*		*Deviation from industry-size benchmarking*		*ISS conformity*	
Sample period:	+/− 3 years around close SOP freq. vote		+/− 3 years around close SOP freq. vote		+/− 3 years around close SOP freq. vote		+/− 3 years around close SOP freq. vote	
Model:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Post	0.177**	0.362	0.184	0.158	0.018	0.025	-0.052	-0.099*
	(2.184)	(1.562)	(1.454)	(0.495)	(0.621)	(0.161)	(-1.637)	(-1.735)
Annual SOP vote frequency	-0.016	0.107	-0.181	-0.011	0.042	0.063	-0.078	-0.075
	(-0.135)	(0.876)	(-1.073)	(-0.064)	(0.704)	(0.902)	(-1.557)	(-1.478)
Annual SOP vote frequency × Post	-0.191*	-0.261**	-0.249	-0.368**	-0.084*	-0.111**	0.098**	0.114**
	(-1.747)	(-2.128)	(-1.580)	(-2.214)	(-1.953)	(-2.058)	(2.362)	(2.519)
Observations	355	340	355	340	355	340	344	329
R-squared	0.021	0.180	0.054	0.272	0.011	0.132	0.025	0.219
Firm controls	No	Yes	No	Yes	No	Yes	No	Yes
Industry × Year FE	No	Yes	No	Yes	No	Yes	No	Yes

INTERNET APPENDIX FOR

Why Have CEO Pay Levels Become Less Diverse?[*]

Internet Appendix I: Anecdotal Evidence

- Anecdotal evidence of peer group revisions and say on pay voting

Internet Appendix II: Figures and Tables

- Figure IA.1: Pay dispersion in high- versus low- option-use industries
- Figure IA.2: Pay dispersion and mega grants
- Figure IA.3: Variation in firm characteristics
- Figure IA.4: Pay dispersion within industries
- Figure IA.5: Dispersion in realized pay
- Figure IA.6: Alternative dispersion measures
- Figure IA.7: Extended simulation results
- Figure IA.8: Changes in above- vs. below-relative sized peers
- Figure IA.9: Clustering of compensation peer group networks

- Table IA.1: Effect of compensation consultants
- Table IA.2: Compensation peer group sizes
- Table IA.3: Size of industries and pay dispersion
- Table IA.4: Balance table of firms at the ISS peer group size cutoff
- Table IA.5: Say on pay and pay dispersion
- Table IA.6: Balance table of firms with close say on pay frequency votes

[*] Citation format: Jochem, Torsten, Gaizka Ormazabal and Anjana Rajamani, Internet Appendix to "Why Have CEO Pay Levels Become Less Diverse?", The Journal of Finance.

Internet 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 (i.e., peers that were not in ISS's recommended peer group as per ISS's methodology) 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.

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 had consulted with major shareholders and with ISS and had implemented 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.

Figure IA.1: Pay dispersion in high- versus low option-use industries

This figure shows CEO pay dispersion separately for industries that make above- versus below-median use of stock options in a given year. For a given firm, stock option usage is defined as the fraction of total CEO pay that is due to option-based pay. We then average stock option usage for all firms in a given industry-year group. Industry definitions are based on GICS6 classifications. We require at least 10 firms in a GICS6-year group.

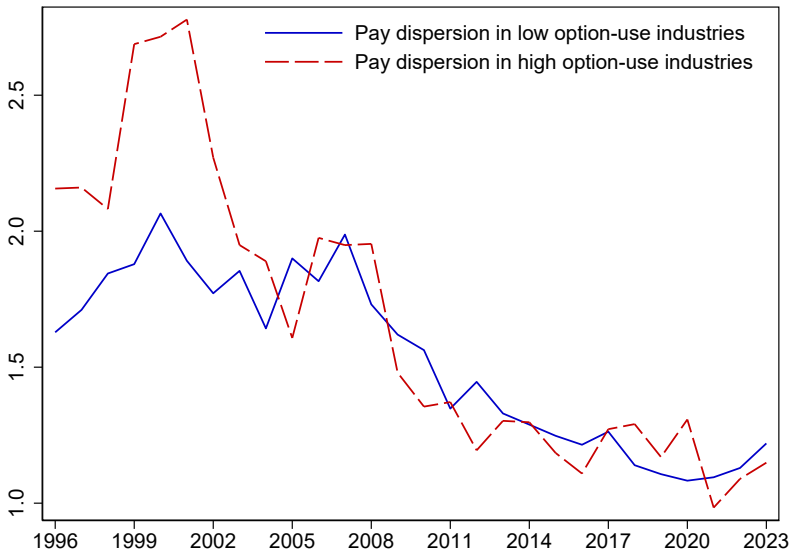
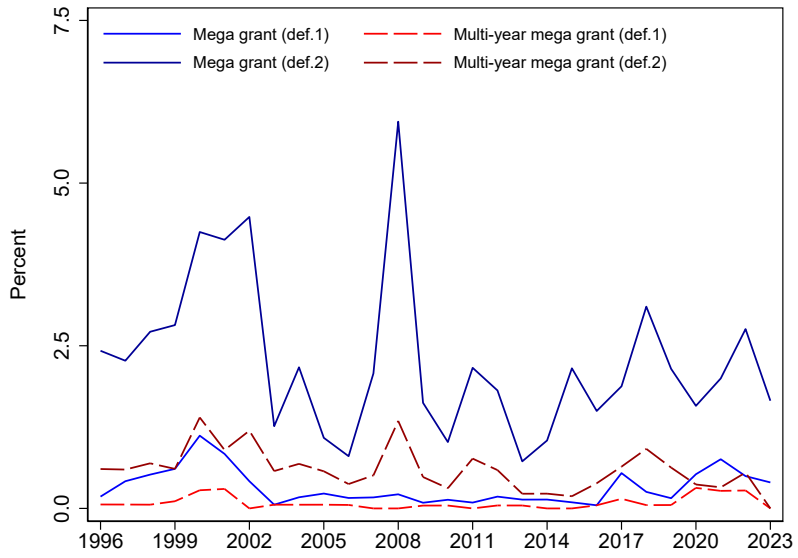
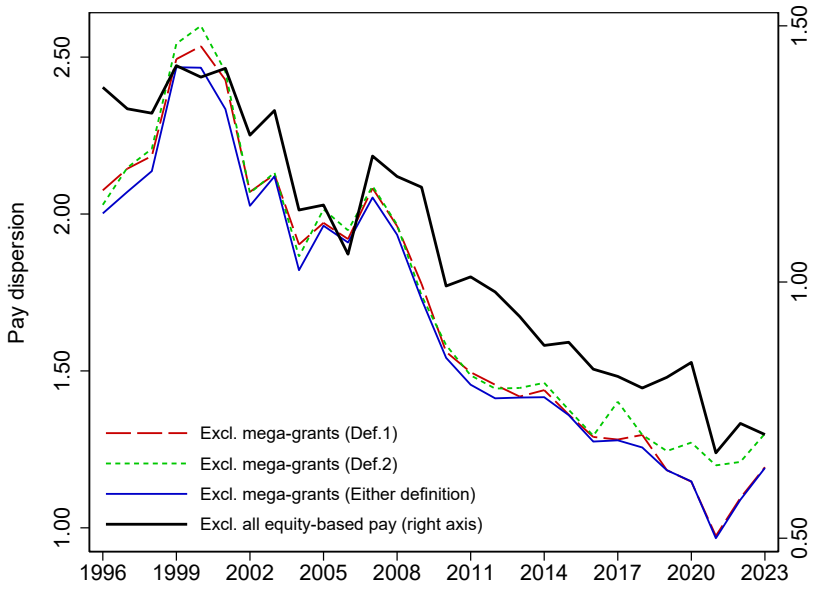


Figure IA.2: Pay dispersion and mega grants

Panel A plots the frequency of equity-based mega grants for CEOs between 1996 and 2023. Panel B plots (i) pay dispersion when excluding all stock- and option-based pay (thick solid line) and (ii) pay dispersion after excluding firm-years with mega grants. We define mega grants as equity grants (i.e., stock plus option grants) that are either larger than 50 million USD in nominal terms (definition 1) or that are larger than 1% of the firm's market value of equity (definition 2). Multi-year mega grants further require no additional equity-based pay in at least the year immediately following the initial mega grant.



Panel A: Frequency of mega grants



Panel B: Pay dispersion excluding mega grants or equity pay

Figure IA.3: Variation in firm characteristics

This figure shows the variation in firm characteristics and the dispersion of CEO pay for S&P 1500 firms. Variables that are measured as ratios or that are percentages (e.g., *Stock return*) are stationary; hence dispersion is measured via their standard deviation in a given year. For non-stationary variables (e.g., *CEO pay*, *Log assets* and *Log market value of equity*) that increase over time – we first divide the values by the median value in a given year before we compute the standard deviation to obtain their dispersion. All variables (except Log values) are winsorized at the 1st and 99th percentiles.

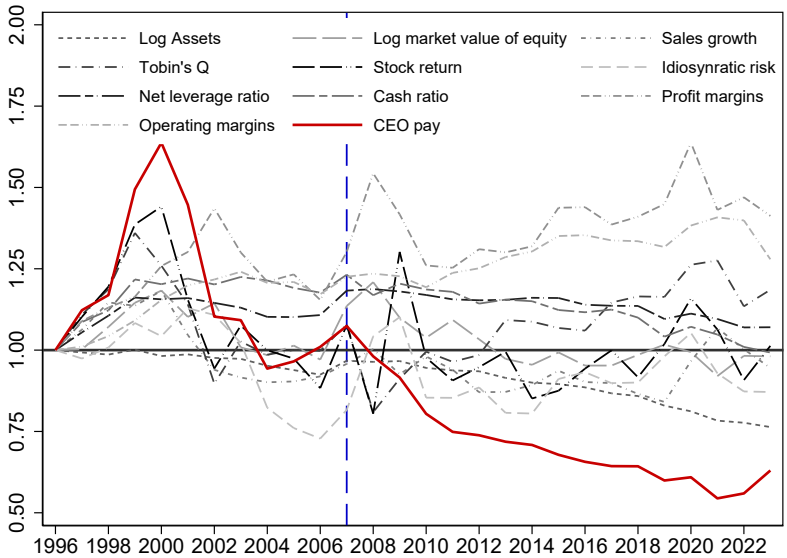


Figure IA.4: Pay dispersion within industries

Panel A plots CEO pay dispersion separately for all GICS2 industries excluding utilities. Panel B plots the average of within-industry pay dispersions for different industry definitions. CEO pay dispersion is measured as the standard deviation of firms' *Pay*, which is calculated as CEO pay (`TDC1`) divided by its median value in a given year and winsorized at the 1st and 99th percentiles. We remove utilities and require at least 10 firms in an industry in a given year to be included in the sample .

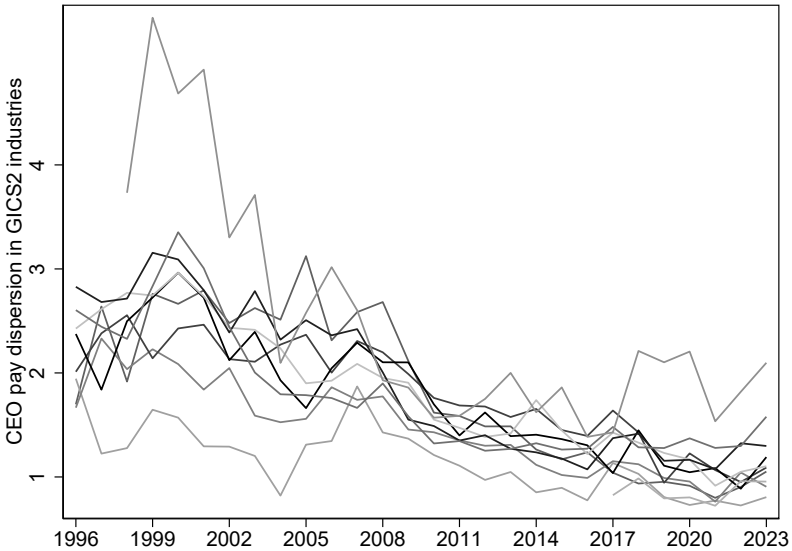


Figure A: Pay dispersion within GICS2 industries

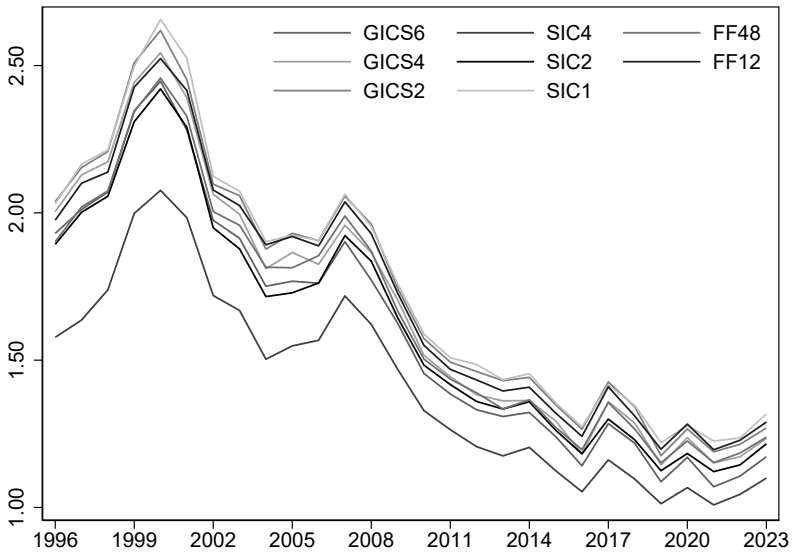


Figure B: Pay dispersion using alternative industry specifications

Figure IA.5: Realized pay dispersion

This figure shows dispersion in realized CEO pay between 2006 and 2023 for Execucomp firms (a lack of detailed pay data prevents its computation pre-2006). *Realized pay v1* is defined as total CEO pay reported in the DEF14 filing to the SEC, except that grant date fair values of stock and option awards are replaced with the value of stocks vested during the year and the value realized from options exercised during the year (=Execucomp item `TOTAL_ALT2`), winsored at the 5th and 95th percentiles. *Realized pay v2* follows the definition of the CAP2 measure (CAP="Compensation Actually Paid") by Carter and Pawliczek (2023). This measure makes the following changes to the reported pay (i) recalculates the value of stock and option grants made at the start of the year by multiplying their value with the percent of stock price appreciation that occurred during the year, (ii) adds the change in the value of outstanding unvested stock and options by multiplying the number of units times the stock price appreciation during the year, and (iii) adds the change in the value of shares vested during the year (i.e., value of vested shares minus number of shares vested times price at the beginning of the year). The measure is winsorized at the 5th and 95th percentiles. Finally, to compute the dispersion of both measures, we scale each measure by its median value in a given year and take the standard deviation the scaled measure. For further details, please see the Variable appendix.

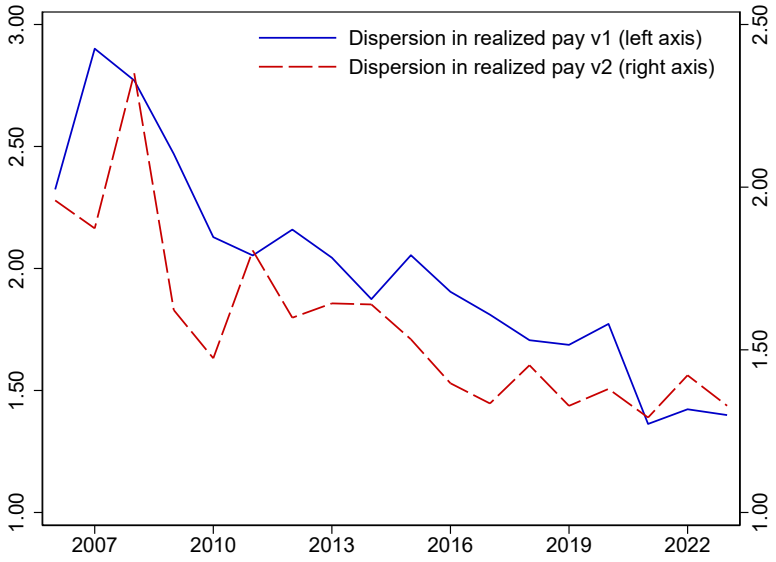


Figure IA.6: Alternative dispersion measures

This figure shows the skewness of total CEO compensation (defined as `TDC1`) and the interquartile range of CEO pay (defined as `TDC1` scaled by median `TDC1` in a given year). The skewness measure is unscaled as skewness is a dimensionless measure of dispersion. The interquartile range (IQR) is the distance in a given year between the 75th and the 25th percentile of median-scaled CEO pay.

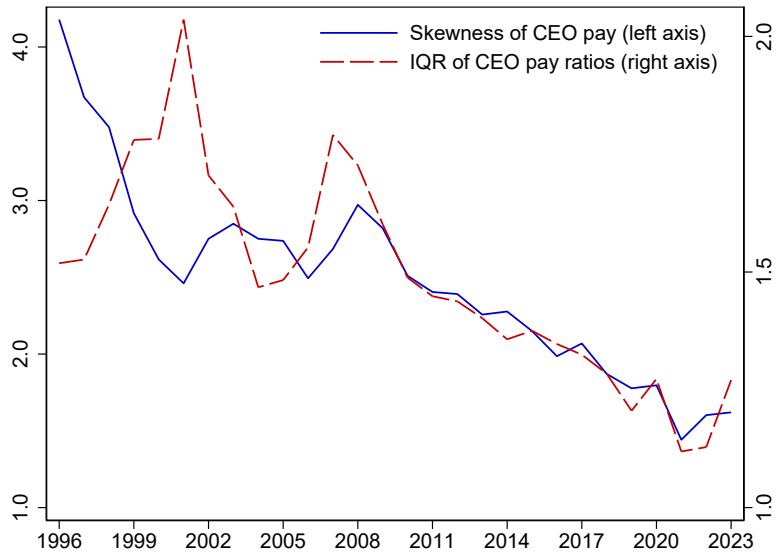


Figure IA.7: Extended simulation results

This figure shows simulated CEO pay dispersion in the economy if firms were to follow ISS's industry- and size-based compensation peer selection methodology and firms set their CEO pay to a given pay target percentile of such selected peers. Panel A show the trajectory of pay dispersion for various pay target percentiles. Panel B shows the trajectory of median pay in the simulation for various target percentiles. The figures shows that higher target percentiles lead to an escalation of average CEO pay (also known as the "pay ratcheting" effect) while pay dispersion declines in all scenarios.

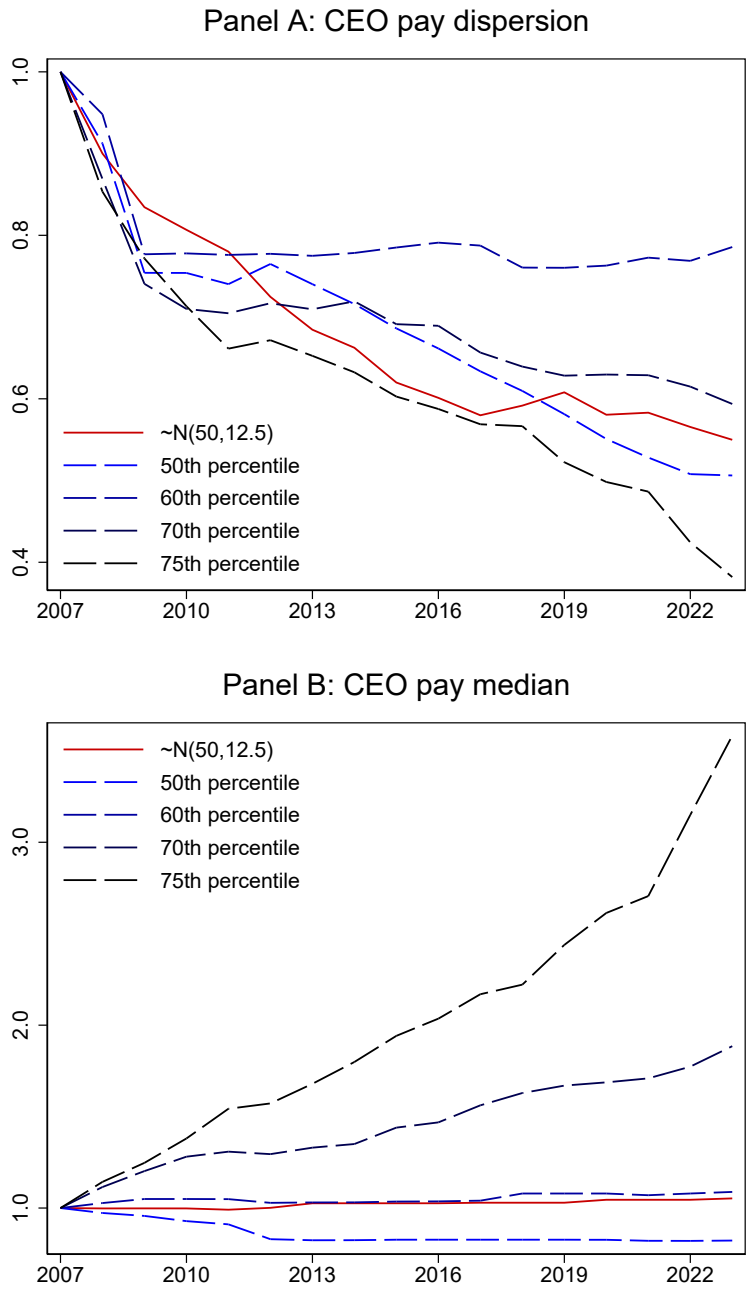


Figure IA.8: Changes in above- vs. below-relative sized peers

This figure shows the semi-variances of compensation peers' relative sizes in firms' compensation peer groups. Semi-variance is the variance computed only for observations that are either above or below the average and illustrates how variation changed on either side of the average. Red (blue) lines show the semi-variance in the relative sizes for compensation peers that are larger (smaller) than the subject firm. Relative size of a peer with respect to a focal firm is its size divided by the size of the subject firm, where size is measured as book value of assets, market value of equity or sales. All semi-variances are rescaled as of 2007.

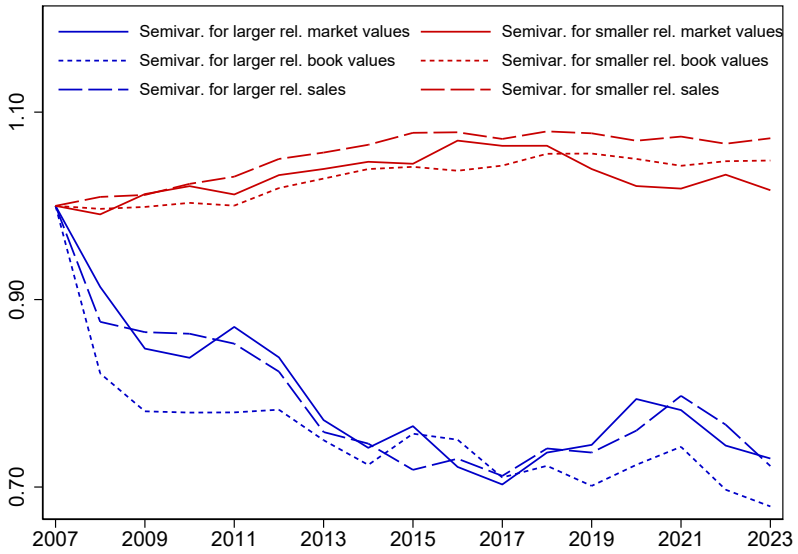


Figure IA.9: Clustering of compensation peer group networks

This figure shows different clustering measures of compensation peer networks at various aggregation levels. The network of compensation peer connections for the economy (Panel A) and – averaged across industries – for various GICS industry networks (Panels B, C and D). *Reciprocity* is the fraction of existing network linkages that are bilateral (i.e., point in both directions). *Triangles* are groups of three nodes that are completely connected. *Transitivity* is the number of triangles divided by the number of triads that exist in a graph (triads are groups of three nodes that are connected in some way while triangles are triads that are completely connected). *Clustering coefficient* is the number of triangles divided by the number of possible triads (intuitively, it measures how close a network is to a complete graph).

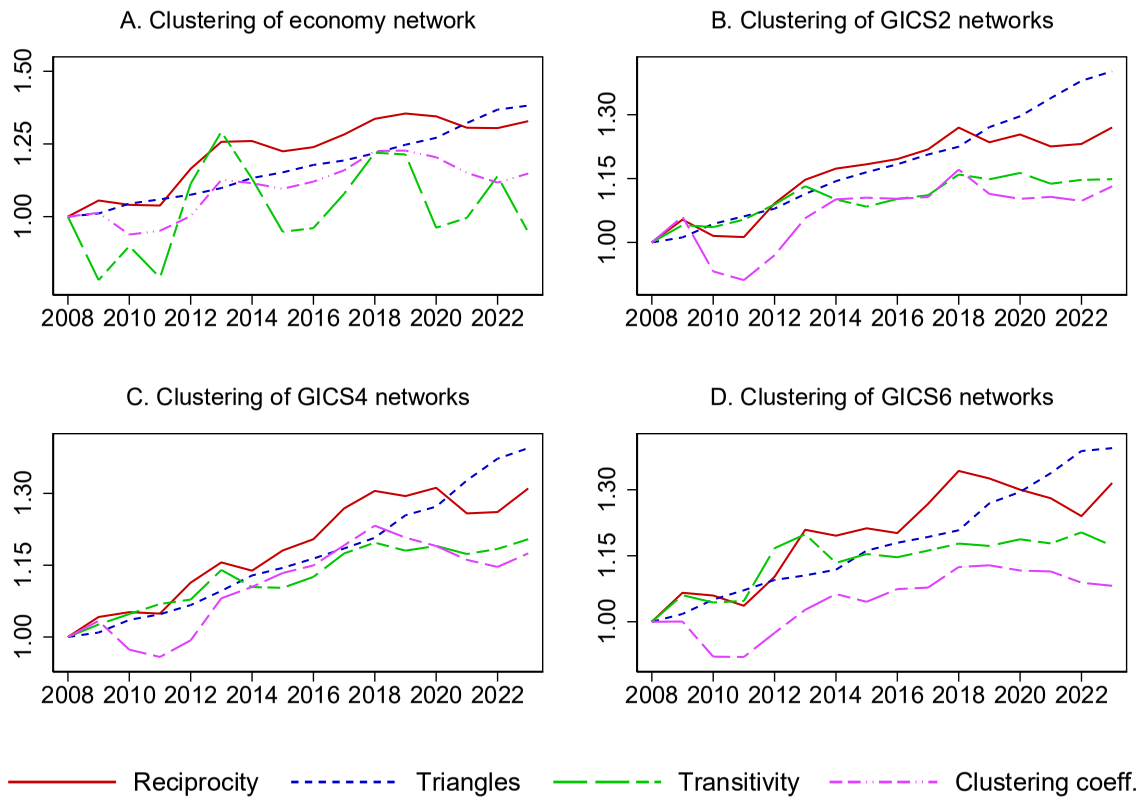


Table IA.1: Effect of compensation consultants

This table repeats the analysis in Panel B of Table 2 while including compensation consultant fixed effects (Panel A) or adding a control variable that controls for the fraction of subject firms' compensation peers that use the same compensation consultant(s) as the subject firm (Panel B). Regression specifications are identical to those used in Table 2B. All variable definitions are described in the variable appendix. All models include a constant term. t-statistics in parentheses are based on standard errors clustered at the firm level. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

Panel A: Compensation consultant fixed effects

Dependent variable:	*Pay dispersion*			*Pay dispersio (abnormal)*			*Pay dispersion (ex-options)*		
Sample period:	2007-2023			2007-2023			2007-2023		
Model:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Annual trend	-0.106***	-0.105***	-0.100***	-0.111***	-0.085***	-0.081***	-0.056***	-0.052***	-0.048***
	(-22.21)	(-14.76)	(-14.63)	(-31.01)	(-15.28)	(-14.40)	(-21.26)	(-10.66)	(-9.830)
Observations	12,522	12,399	12,333	12,522	12,399	12,333	12,511	12,388	12,322
R-squared	0.180	0.508	0.667	0.261	0.594	0.705	0.164	0.476	0.620
Firm controls	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Industry × Size FE	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Firm FE	No	No	Yes	No	No	Yes	No	No	Yes
Comp. consultant FE	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**

Panel B: Controlling for fraction of shared compensation consultants

Dependent variable:	*Pay dispersion*			*Pay dispersio (abnormal)*			*Pay dispersion (ex-options)*		
Sample period:	2007-2023			2007-2023			2007-2023		
Model:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Annual trend	-0.105***	-0.118***	-0.119***	-0.108***	-0.095***	-0.097***	-0.055***	-0.061***	-0.058***
	(-28.02)	(-17.68)	(-17.68)	(-39.10)	(-18.08)	(-18.08)	(-26.71)	(-12.69)	(-12.22)
Fraction of shared comp. consultants	0.288*	0.130	0.087	0.339***	0.122*	0.057	0.139*	0.039	-0.016
	(1.948)	(1.311)	(0.833)	(2.877)	(1.795)	(0.767)	(1.753)	(0.699)	(-0.233)
Observations	12,485	12,363	12,300	12,485	12,363	12,300	12,484	12,361	12,298
R-squared	0.140	0.498	0.660	0.228	0.586	0.699	0.123	0.459	0.607
Firm controls	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Industry × Size FE	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Firm FE	No	No	Yes	No	No	Yes	No	No	Yes

Table IA.2: Compensation peer group sizes

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

	P5	P25	P50	P75	P95	Mean	Std Dev	N
2007	7	11	15	21	38	17.6	9.7	838
2008	7	12	16	21	37	18.4	9.4	1,140
2009	8	13	16	21	36	18.1	8.7	1,189
2010	8	12	16	20	29	16.8	7.5	1,255
2011	8	12	16	19	29	16.8	7.4	1,289
2012	8	13	16	19	29	17.0	7.1	1,312
2013	9	14	16	19	27	17.0	6.3	1,329
2014	10	14	17	20	31	17.9	7.0	1,297
2015	10	14	17	20	30	17.8	7.0	1,277
2016	10	14	17	20	30	17.8	7.1	1,271
2017	10	14	16	19	30	17.7	7.2	1,291
2018	10	14	17	20	31	17.9	7.2	1,314
2019	10	14	17	20	32	18.0	7.3	1,322
2020	10	14	17	20	30	17.8	6.8	1,279
2021	10	14	17	19	28	17.6	6.8	1,252
2022	10	14	16	19	25	17.1	6.2	1,230
2023	10	14	17	19	26	17.3	5.8	1,196
Total	9	14	16	20	30	17.6	7.3	21,081

Table IA.3: Size of industries and pay dispersion

This table relates trends in CEO pay dispersion to the number of firms in a given industry. *Time trend* is defined in Panel A (in Panel B) as the fiscal year minus 1996 (minus 2007). In Panel A, *Pay dispersion* and *Pay dispersion (abnormal)* is computed at the industry level with industry fixed effects defined accordingly (i.e., GICS6, GICS4 and GICS2). The variable *Number of firms in industry* is the number of Compustat firms in a given firm's industry (i.e., its GICS6, GIC4 or GICS2 industry, respectively), winsorized at the 1st and 99th percentiles. In Panel B, *Pay dispersion* and *Pay dispersion (abnormal)* is computed at the firm level (i.e., within firms' compensation peer groups). *Number of firms in industry-size group* is the number of Compustat firms in the same GICS6-industry and within 50% and 200% of the market value of assets of the subject firm, winsorized at the 1st and 99th percentiles. For convenience in interpreting the coefficients, the variables *Number of firms in industry* and *Number of firms in industry-size group* are divided by 100. All models include a constant term. t-statistics in parentheses are based on standard errors that are clustered at the industry level in Panel A and at the firm level in Panel B. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

Panel A: Industry-level analysis

Dependent variable:	*Pay Dispersion*			*Pay Dispersion (abnormal)*		
	1996-2023			1996-2023		
	(1)	(2)	(3)	(4)	(5)	(6)
	GICS6	GICS4	GICS2	GICS6	GICS4	GICS2
Time trend	-0.006	-0.003	-0.001	-0.008**	-0.009*	-0.006
	(-0.887)	(-0.420)	(-0.104)	(-2.183)	(-1.998)	(-0.964)
Number of firms in industry	0.642***	0.315***	0.109*	0.622***	0.308***	0.128**
	(3.776)	(3.066)	(2.192)	(4.239)	(3.375)	(3.129)
Number of firms in industry × Time trend	-0.025***	-0.015***	-0.006***	-0.025***	-0.013***	-0.006***
	(-3.220)	(-3.455)	(-4.146)	(-4.029)	(-3.808)	(-4.424)
Observations	1,897	681	290	1,866	668	287
R-squared	0.519	0.531	0.515	0.485	0.555	0.570
Industry FE	Yes (GICS6)	Yes (GICS4)	Yes (GICS2)	Yes (GICS6)	Yes (GICS4)	Yes (GICS2)

Panel B: Firm-level analysis

Dependent variable:	*Pay dispersion*			*Pay dispersion (abnormal)*		
Sample period:	2007-2023			2007-2023		
Model:	(1)	(2)	(3)	(4)	(5)	(6)
Time trend	-0.112***	-0.099***	-0.105***	-0.085***	-0.076***	-0.081***
	(-16.82)	(-16.58)	(-17.07)	(-15.86)	(-16.55)	(-16.07)
Number of firms in industry-size group	0.037	0.047	-0.031	0.055**	0.011	-0.038
	(1.462)	(1.546)	(-0.925)	(2.519)	(0.461)	(-1.353)
Number of firms in industry-size group × Time Trend	-0.004	-0.004*	-0.006***	-0.005***	-0.006***	-0.008***
	(-1.620)	(-1.882)	(-3.110)	(-2.803)	(-3.938)	(-4.834)
Observations	20,963	20,799	20,654	20,963	20,799	20,654
R-squared	0.114	0.541	0.695	0.172	0.605	0.719
Firm controls	No	Yes	Yes	No	Yes	Yes
Industry × Size FE	No	Yes	Yes	No	Yes	Yes
Firm FE	No	No	Yes	No	No	Yes

Table IA.4: Balance table of firms at the ISS peer group size cutoff

This table shows differences in characteristics between peers that just met the peer group size cutoff for the ISS recommended peer group for a firm (i.e., relative rank 0) versus those that just fell outside ISS's peer group size cutoff for the firm (i.e., relative rank 1). *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

	Relative Rank 0		Relative Rank 1		Difference in mean		Difference in median	
	Mean	Median	Mean	Median	level	p-value	level	p-value
Log assets	8.602	8.498	8.381	8.322	0.221***	<0.001	0.176***	<0.001
Log sales	7.866	7.753	7.637	7.571	0.229***	<0.001	0.182***	<0.001
Log market valuation	9.054	8.944	8.839	8.781	0.215***	<0.001	0.163***	<0.001
Tobin's Q	1.888	1.410	1.918	1.416	-0.030	0.169	-0.006	0.563
Net book leverage	0.178	0.182	0.176	0.187	0.002	0.773	-0.005	0.271
Market leverage	0.215	0.172	0.217	0.174	-0.002	0.338	-0.002	0.541
Cash holdings	0.127	0.075	0.131	0.076	-0.004**	0.025	-0.001	0.630
Investments	0.037	0.024	0.037	0.024	0.000	0.256	0.000	0.992
PP&E	0.248	0.155	0.247	0.151	0.001	0.679	0.004	0.265
Profitability	0.103	0.102	0.102	0.101	0.001	0.208	0.001	0.487
Earnings	0.114	0.108	0.112	0.108	0.002	0.229	0.000	0.616
Profit margin	0.047	0.052	0.045	0.052	0.002*	0.058	0.000	0.767
Operating margin	0.124	0.119	0.134	0.119	-0.010	0.212	0.000	0.754
Stock performance	0.141	0.092	0.138	0.086	0.003	0.705	0.006	0.202
Idiosyncratic return volatility	0.305	0.256	0.314	0.266	-0.009***	<0.001	-0.010***	<0.001
Fraction independent directors	0.817	0.857	0.814	0.857	0.003*	0.065	0.000	1.000
CEO-chairman duality	0.451	0.000	0.446	0.000	0.005	0.525	0.000	1.000
Staggered board	0.306	0.000	0.308	0.000	-0.002	0.817	0.000	1.000
Board tenure	8.853	8.417	8.849	8.444	0.004	0.955	-0.027	0.715
Board age	62.80	62.86	62.73	62.73	0.075	0.261	0.130*	0.081

Table IA.5: Say on pay and pay dispersion

This table shows the impact of weak say on pay votes on CEO pay dispersion. Like in Table 9, the analysis uses only the first instance of weak say on pay votes at firms for their pay relating to fiscal years 2010 or 2011 and keeps a window of [-3,+3] years around the weak say on pay votes. Control firms are those that have above-median SOP vote support and are matched by GICS2-industry and stock performance to weak-vote firms. Firm controls are identical to those in Tables 9. All variable definitions are described in the variable appendix. All models include a constant term. *t*-statistics in parentheses are based on clustered standard errors at the firm level. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

Setting:	Weak say on pay votes			
Dependent variable:	*Pay dispersion*		*Pay dispersion (abnormal)*	
Sample period:	2007-2014			
Window of analysis:	[-3, +3] weak-vote event			
Model:	(1)	(2)	(3)	(4)
Weak vote	0.571***		0.514***	
	(3.619)		(3.961)	
Weak vote × Post year 1	-0.615***	-0.278***	-0.586***	-0.272***
	(-6.710)	(-2.668)	(-8.404)	(-3.572)
Weak vote × Post year 2	-0.700***	-0.395***	-0.588***	-0.305***
	(-7.182)	(-3.608)	(-7.713)	(-3.666)
Weak vote × Post year 3	-0.795***	-0.290**	-0.673***	-0.164*
	(-8.335)	(-2.272)	(-8.523)	(-1.672)
Observations	2,117	1,991	2,117	1,991
R-squared	0.027	0.834	0.032	0.852
Firm controls	No	Yes	No	Yes
Firm FE	No	Yes	No	Yes
Year FE	Yes	Yes	Yes	Yes

Table IA.6: Balance table of firms with close say on pay frequency votes

This table presents the differences in characteristics between firms that opted for a 1-year SOP vote frequency versus those that opted for a 3-year SOP vote frequency by a narrow margin (i.e., difference in support within firm for 1-year versus 3-year SOP vote frequency $\leq \pm 5$ percentage points). *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

	1-year say on pay frequency		3-year say on pay frequency		Difference in mean		Difference in median	
	Mean	Median	Mean	Median	level	p-value	level	p-value
Log assets	7.018	7.447	6.789	6.649	0.229	0.619	0.798	0.154
Log sales	6.462	6.640	5.685	6.236	0.777	0.153	0.404	0.498
Log market valuation	7.514	7.812	7.120	6.931	0.394	0.311	0.881	0.115
Tobin's Q	1.835	1.728	1.655	1.405	0.180	0.539	0.323	0.238
Net book leverage	0.021	0.053	0.031	0.095	-0.010	0.923	-0.042	0.741
Market leverage	0.175	0.116	0.170	0.123	0.005	0.929	-0.007	0.903
Cash holdings	0.209	0.158	0.175	0.103	0.034	0.564	0.055	0.285
Investments	0.056	0.038	0.048	0.040	0.008	0.637	-0.002	0.857
PP&E	0.239	0.155	0.281	0.187	-0.042	0.568	-0.032	0.671
R&D	0.097	0.069	0.135	0.074	-0.038	0.603	-0.005	0.937
Profitability	0.122	0.123	0.053	0.096	0.069	0.107	0.027	0.473
Sales growth	0.023	0.142	0.099	0.077	-0.076	0.201	0.065	0.489
Earnings	0.150	0.142	0.064	0.100	0.086*	0.071	0.042	0.303
ROA	0.078	0.068	0.027	0.060	0.051	0.310	0.008	0.763
Profit margin	0.061	0.071	-0.002	0.046	0.063	0.478	0.025	0.451
Operating margin	0.138	0.112	0.093	0.100	0.045	0.404	0.012	0.800
Stock performance	-0.029	-0.019	-0.071	-0.033	0.042	0.594	0.014	0.892
Idiosyncratic stock return volatility	0.304	0.303	0.300	0.266	0.004	0.895	0.037	0.366
Fraction independent directors	0.737	0.750	0.755	0.750	-0.018	0.730	0.000	1.000
CEO-chairman duality	0.385	0.000	0.364	0.000	0.021	0.920	0.000	1.000
Staggered board	0.615	1.000	0.818	1.000	-0.203	0.296	0.000	1.000
Board tenure	9.075	8.667	10.98	10.33	-1.905	0.249	-1.663	0.479
Board age	60.94	60.46	62.35	63.00	-1.410	0.437	-2.540	0.400

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ECGI is an international non-profit membership organisation that provides a platform for debate and dialogue among academics, policymakers, and business leaders, with a focus on major corporate governance, ESG, and stewardship issues.

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