

Pay Harmony: Peer Comparison and Executive Compensation

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Abstract:

Do horizontal wage comparisons affect firm policies on executive pay? This paper explores that question using a 1992 SEC proxy disclosure rule that mandated increased disclosure of executive pay. We argue that this rule differentially increased wage comparisons within firms with geographically-dispersed managers—firms with the greatest information frictions prior to the rule change. We report three changes related to compensation after 1992 for division managers. First, within firms with dispersed managers, division manager pay is less sensitive to individual performance and co-moves more with peer pay. Second, pay disparity between managers located in different states decreases relative to that of co-located managers. Third, division productivity falls in dispersed firms, with the effect driven by managers at the low end of the wage distribution. Taken together, our findings suggest that principals account for horizontal peer comparison when designing executive wage contracts and that they face a tradeoff between the incentive effects of performance-based pay and effects of peer comparison.

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I. Introduction

Prior research has focused on whether peer comparison affects the utility that individuals derive from pay and, specifically, whether individuals care not only about their absolute income, but also about their income relative to others. (e.g., Frank, 1985; Akerlof and Yellen, 1990; Luttmer, 2005).¹ While recent empirical studies based on field experiments demonstrate the effect of relative income comparison on employee satisfaction (e.g., Card et al., 2011), there is limited research on how income comparison affects pay itself, particularly among top managers, a highly competitive group of individuals at the extreme of the pay distribution. One recent exception is Shue (2012), who shows that CEO pay responds to pay shocks of peers. To our knowledge, however, no research has considered the effect of horizontal comparisons on managerial wage contracts *within firms*. In this paper, we use rich panel data on division manager pay, in conjunction with a regulatory shock to pay disclosure, to explore this question. Our findings suggest that firms account for horizontal peer comparisons when designing executive wage contracts and face a tradeoff between the incentive effects of performance-based pay and the effects of peer comparison in designing executives' pay policy.

While firms regularly aim to match an executive's outside option to retain talent, internal comparisons can be equally, if not more, important (e.g., Baker, Gibbs, and Holmstrom, 1994; Lazear and Oyer, 2004). Whether managers care about relative income for behavioral reasons or whether they interpret pay differentials as an informative signal about future pay prospects or relative ranking, peer comparison can affect motivation and effort provision (Charness and Kuhn, 2007).² In practice, compensation consulting firms that specialize in designing executive pay emphasize the importance of "pay harmony" among managers within a firm.³ To ensure some semblance of internal equity and to minimize perceived inequities in pay and associated

¹ Peer comparison of pay can be illustrated by the following (non-executive) anecdote related in Baron and Kreps (1999): "We recall an eminent labor economist who, while doing his stint as chair of his economics department – one of the best in the world – remarked in somewhat mystified fashion that his best-paid colleagues seemed particularly concerned not with how their annual raises compared with inflation, but instead how they stacked up with the raises earned by their other highly paid colleagues." (pg. 256). Closer to our setting, Nickerson and Zenger (2008) relate how Harvard University was forced to reduce compensation of high-performing fund managers of the Harvard Management Company, the subsidiary managing the university's \$27 billion endowment. Harvard took these actions largely due to faculty and alumni uproar over fund manager pay that, while appropriate for the external finance market, was several orders of magnitude greater than typical faculty salaries.

² In this paper, we are agnostic about whether relative pay concerns arise for behavioral or informational reasons. Card et al. (2012) specifically focus on isolating these two mechanisms and find support for behavioral explanations. Other papers, such as Cohen, Frazzini and Malloy (2010) have focused on the information effects of peer groups.

³ The term *harmony* derives from the Greek *ἀρμονία* (*harmonía*), meaning "joint, agreement, concord."

effects on morale, firms' internal pay structures are commonly based on systems that specify pay ranges by job and level (e.g., Hay points) (Baron and Kreps, 1999). At the same time, there has been a significant increase in performance-based executive pay over the past several decades (e.g., Hall and Murphy, 2003; Cunat and Guadalupe, 2009; Frydman and Jenter, 2010), offsetting this effort to maintain harmony. As a result, compensation consultants cite a critical tradeoff in structuring executive pay between the incentive effects of a strong pay-for-performance compensation system and the effects of peer comparison within firms.⁴ This tradeoff is similar to the observation by Rebitzer and Taylor (2011) that inequality aversion results in lower optimal incentive pay within firms. One objective of our study is to explore whether this tradeoff does, in fact, affect pay of top managers in firms.

The primary empirical challenge that we face is to isolate the effects of peer comparison from unobserved factors that could explain our results,⁵ such as production interdependencies between managers or divisions (team production), selection effects (firm-manager matching) and common shocks or changes in the firm's environment (e.g., local labor-market conditions). Recent studies of peer influence, facing similar challenges, have exploited exogenous disclosures of information, such as peer pay and productivity rankings, that would increase peer comparison without simultaneously affecting other factors in the environment. For example, Card et al. (2012) find that pay disclosure reduces the job satisfaction of university employees who are paid below the median, and Charness and Kuhn (2005) find laboratory evidence that firms compress wages when wages are public information, relative to when they are private. Barankay (2012) analyzes the effects of disclosing employee productivity rank to salespeople at a furniture company and finds this knowledge reduces individual productivity.

Our paper follows in a tradition similar to that of the above research by using a 1992 SEC rule change that exogenously mandated additional disclosure of top executive pay in firms' annual proxy statements. We argue that this ruling led to greater comparison of pay differences at all levels of senior management in the organization. We also maintain that the new rule differentially impacted division managers based on the ease of which pay information was

⁴ Previous research suggests that vertical comparisons of pay across organizational levels are important. Using compensation survey data (1981-1985), Wade, O'Reilly and Pollock (2006) document higher exit rates when lower-level managers are underpaid relative to the CEO. However, they do not have the advantage of a change in regulation of pay disclosure for identification.

⁵ This challenge is a version of the reflection problem discussed by Manski (1993) which focuses on empirical issues arising from attributing similar observed behavior within groups to peer (or social) effects.

shared prior to the SEC ruling—specifically that: (i) the rule impacted geographically-dispersed firms more than concentrated firms because greater distance between divisions would have impeded managers from sharing pay information prior to 1992; and (ii) within a given firm, non-proximate managers (located in different states) were less likely than managers located in the same state to share pay information with each other prior to 1992.⁶ The notion that pay is more likely to be shared between managers that are geographically proximate was confirmed based on interviews with compensation consultants and senior executives, as well as consistent with psychological studies that show that social comparison is influenced by physical propinquity (Baron and Kreps, 2013).⁷

To explore the potential effects of peer comparison on pay and to evaluate evidence of a tradeoff between performance pay (disparity) and “pay harmony” (compression), we conduct three sets of differences-in-differences analyses at the division level. First, we look at changes in pay for performance and pay co-movement using a modified wage model that allows for peer comparison. Next, we calculate pay distances between pairs of division managers to evaluate changes in pay disparity within firms. Lastly, in our most exploratory analysis, we assess changes in division productivity as a potential effect of peer comparison.

We define *pay-referent* sensitivity (PRS) as the degree to which division manager pay changes with the average pay of all other division managers within the firm.⁸ Consistent with the executive compensation literature, we measure *pay-performance* sensitivity (PPS) as the degree to which division manager pay changes with changes in division performance. Our first differences-in-differences analysis measures the change in PRS and PPS before and after 1992 within dispersed firms relative to concentrated firms. After the new regulation, we find increases in PRS and decreases in PPS in dispersed firms and no change in concentrated firms. Note that these effects occur entirely within the two-year period immediately following the ruling. We also find these effects to be stronger within the subset of dispersed firms with the least pay disclosure prior to the rule—the firms most affected by the new regulation.

⁶ Ideally, we would like random assignment of pay disclosure across firms to identify the effect of peer comparison on pay. Since this treatment is infeasible in our context, we instead exploit the differential impact of the rule across firms.

⁷ See footnote 15 for a specific example from Morgan Stanley.

⁸ We incorporate a modified linear-in-means term into a standard wage equation framework. This approach involves several immediate challenges that we discuss later in the paper.

While pay co-movement is one measure of sensitivity to referent pay, it not necessarily informative about pay disparity within firms. To capture disparity, we conduct a second differences-in-differences analysis that examines the mean distance between the excess pay of pairs of division managers within a firm. We find that, while overall pay distance increases after the 1992 SEC ruling (consistent with the overall trend toward more performance pay and greater pay disparity during the period), distance increases less between managers of divisions located in different states than between managers located in the same state.

Finally, we conduct a more exploratory analysis of division productivity to look for a performance impact on dispersed firms after the rule change. We find that division productivity increases less after 1992 in dispersed firms than in concentrated firms and that this effect is most pronounced for managers at the low end of the wage distribution of division managers within the firm. While the productivity findings may have a number of alternative explanations, they are consistent with managers expending less productive effort upon discovering that their pay is low relative to peers, an interpretation that suggests a potential real cost of peer comparison.

We argue that these results, taken together, are consistent with firms accounting for horizontal peer comparison when designing executive wage contracts. The findings are also consistent with a tradeoff between the incentive effects of performance pay and effects of peer comparison that arise from unequal pay.

We also investigate several alternative explanations for our results. One concern is that unobserved, time-varying trends may affect dispersed firms differently than they affect concentrated firms. To address this, we observe the timing of the changes in pay co-movement and find a discrete, significant increase in PRS and decrease in PPS in the two-year period immediately following passage of the rule and no pre- or post-trends. We also conduct a set of placebo tests around the timing of the passage of the rule. The null findings of our placebo tests, together with the distinctive time signature of the observed changes in PRS and PPS, are inconsistent with long-run secular trends that do not have a specific break in 1992. We also consider several specific alternative explanations, including different trends in IT productivity, horizontal rotation of division managers, recovery following the 1990-91 recession, vertical (CEO) comparison, and whether our measures of geographic concentration coincide with industry or headquarter-state affiliation.

The unique contribution of the paper is to provide evidence of how firms' pay policies respond to concerns about horizontal peer comparison and internal equity, which, to our knowledge, has not been documented elsewhere. Our findings relate to several literatures, including the literature on peer effects and social comparison in behavioral economics (e.g., Camerer and Malmendier, 2007; Rebitzer and Taylor, 2011) and management/strategy (e.g., Nickerson and Zenger, 2008; Larkin, Pierce, and Gino, 2012), as well as the effect of disclosure and feedback of relative standing on employee motivation and productivity (e.g., Barankay, 2012; Marino and Ozbas, 2013). Our findings suggest that peer comparison is an important attribute of internal labor markets, with pay and potential productivity consequences.

This paper also contributes to the ongoing policy debate on the consequences of transparency and mandatory information disclosure to investors (e.g., Hall, and Murphy, 2003; Greenstone, Oyer and Vissing-Jorgensen, 2006; and Hertzberg, Liberti, and Paravisini, 2011), and contribute to the literature on pay secrecy (e.g., Lawler, 1965; Bewley, 1999) which suggests that employers may have an incentive to not disclose pay. More broadly, our findings suggest that pay disclosure can increase the importance of internal relative to external labor markets in determining firms' wage policies.

The remainder of the paper is organized as follows. Section II briefly discusses theory related to executive pay. Section III describes our empirical strategy and the data. Section IV outlines and discusses our results. Section V concludes.

II. Theoretical Background: Pay-for-Performance vs. Peer Comparison

The principal-agent model is a workhorse in economics that has implications for how firms set executive pay (c.f., Murphy, 2012; Jensen and Meckling, 1976). The main theoretical implication for firms is that, to elicit optimal effort from agents, principals should link pay to performance. Wage contracts are typically assumed to have the following linear form, in which pay-performance sensitivity is defined as b_1 and the optimal choice of b_1 depends on the underlying model:

$$(1) w = a + b_1 y$$

where w is the wage and y is the measurable output (or performance) of the agent. Generally, a is determined by time-invariant personal and market characteristics, as well as time-varying factors that affect the individual's participation constraint (and bargaining power) within a firm.

The magnitude of b_1 is chosen to elicit the optimal effort from the agent. Pay setting within a firm, therefore, is a function of both external and internal markets (e.g., Baker, Gibbs and Holmstrom, 1994; Lazear and Oyer, 2004) and the underlying utility of the agent.

However, while there is extensive research in economics on the determinants of executive pay, in practice, the process is more social than the existing research suggests.⁹ Social comparison has long been studied in the social psychology literature (e.g., Festinger, 1954), in which one of the key questions is: who is the salient referent? Festinger’s original proposition is that similar others would be frequently chosen as referents. In our setting, we maintain that division heads managing business units in a multibusiness firm represent each other’s salient referents—i.e., they are in roles of similar responsibility within the firm and compete for the same pools of resources and positions for promotion.

To provide a structure to guide our analysis, we offer the following highly-simplified utility function, in which an agent cares about both absolute and relative pay:¹⁰

$$(1a) U(w, \bar{w}_{-d}) = u(w - c) + Iv(w - \bar{w}_{-d})$$

where $u(\cdot)$ is the agent’s utility from absolute pay and $v(\cdot)$ is utility from relative pay. w represents wages and \bar{w}_{-d} is the reference point for peer wages. While \bar{w}_{-d} can be defined in many ways, here, we assume that the reference point is defined as the mean peer pay.¹¹ c is the cost of effort, and I is a measure ranging from 0 to 1 of the degree of information available on peer pay, similar to Card et al. (2012). We consider the simplest case, in which $u(\cdot)$ and $v(\cdot)$ are linear,¹² the wage contract continues to take the linear form $w = a + b_1y$ and the

⁹ This is despite an early mention of fairness in wages dating back to Hicks (1963) in *The Theory of Wages* (pg. 317). “The labor market is . . . a very special kind of market which is likely to develop ‘social’ as well as purely economic aspects. . . . For the purely economic correspondence between wages paid to a particular worker and his value to the employer is not a sufficient condition of efficiency: it is also necessary that there should not be strong feelings of injustice about the relative treatment of employees since these would diminish the efficiency of the team.”

¹⁰For an analysis and a review of the principal agent model from a behavioral perspective and the relationship to employee relationships and labor markets, refer to Rebitzer and Taylor (2011).

¹¹ In a typical linear-in-means model of social comparison, individuals gain utility if their actions match the mean action of their referent group, generally simplified as a linear function of the overall group choice. This model, if implemented literally, is likely to be significantly biased (Manski, 1993). In the empirical design section, we discuss how we address this challenge.

¹² For simplicity, and since it is not the focus of our paper, we generally assume that utility from information about relative pay is linear. This abstracts away from the literature on asymmetric preferences—e.g., Fehr-Schmidt preferences (Fehr and Schmidt, 1999) and loss aversion—which would imply that the disutility from being below mean pay is greater than the utility from being above mean pay. However, in our productivity analysis, we explore asymmetries and whether divisional productivity varies by position in the distribution of wages. See Rebitzer and Taylor (2011) for an illustration of how asymmetric inequality aversion in a principal agent model requires the

participation constraint binds. In this setup, $w - c + I(w - \bar{w}_{-d}) = 0$ and wages vary with peer wages as follows: $\frac{dw}{d\bar{w}_{-d}} = \frac{I}{1+I}$.

We can represent the linear contract, then, as

$$(2)w = a' + b_1y + b_2\bar{w}_{-d}$$

where $a = a' + b_2\bar{w}_{-d}$ and $b_2 = \frac{I}{1+I}$. b_2 is a positive, concave function of I , such that pay increasingly co-moves with peer pay as the available information on peer pay increases. There are two classes of practical explanations for this relationship. First, managers may care directly about relative income in addition to absolute income for strictly behavioral reasons (e.g, Frank, 1985; Camerer and Malmendier, 2007; Rebitzer and Taylor, 2011). Second, managers may use information about pay differences as a signal to: (i) update expectations of future pay and career prospects—for example, through a promotion (e.g., Card et. al. 2012); (ii) infer performance relative to peers; or (iii) generally become more informed about pay levels and the internal labor market.

From equation 2 and the associated discussion, we explore several possible implications for pay setting. First, consistent with peer comparison, executive pay should exhibit pay-referent sensitivity or PRS. Specifically, b_2 in equation 2 should be positive and significant, particularly when pay information about peers is more readily accessible or when peers are immediately salient (for example, geographically proximate).¹³ Second, the existence of both agency behavior and peer comparison within firms leads to a different optimal wage contract for firms, as discussed in Rebitzer and Taylor (2011) and observed empirically by Encinosa, Gaynor and

incentive pay parameter to “to do the ‘double duty’ of eliciting work effort and determining the extent of expected pay inequality in the firm. As a result, the firm must compromise along an important dimension by lowering incentive pay and reducing the effort level elicited from workers.” (pg. 730)

¹³ One implicit assumption of this discussion, consistent with the practitioner concept of “pay harmony,” is that the effect of increased pay disclosure is a net increase in disutility in the manager population that leads to increased pay co-movement and less disparity (although our empirical setup allows for the opposite result to be obtained). A positive finding here implies that any positive utility accrued to the top performers from learning about their above-mean pay is more than offset by the disutility incurred by the lower-paid managers. This assumption diverges from Lazear (1989, 1991), who points out that it may be “more important to keep the best workers happy than the worst ones” (However, if this were true, then why wouldn’t firms disclose pay, which in practice, is uncommon?). On the other hand, it is consistent with aggregate Fehr and Schmidt (1999) asymmetric preferences, where the disutility incurred by workers from being below the reference point is greater than the utility gained from being above the same point. While asymmetric responses are not the main focus on this paper, we do investigate them later when looking at productivity responses to pay disclosure.

Rebitzer (2007) in physician contracts. Finally, an increase in peer comparison, all else being equal, should compress intra-firm pay.

III. Empirical Strategy

III.A. Division Manager Pay in Multidivisional Firms

To investigate the effect of horizontal peer comparison on firm pay policies, we use a proprietary dataset based on a confidential compensation survey conducted by Hewitt Associates, a leading human resources consulting firm specializing in executive compensation and benefits (described in detail in section III D). We analyze pay for multiple division manager positions inside large U.S. firms over a 14-year period. A division manager in our data, also known as a business unit head, is the most senior manager in a division with overall P&L responsibility for that business unit.

Our data and setting are advantageous in evaluating the effects of peer comparison within firms for a number of reasons. First, our panel data include multiple “like” positions within firms—a well-defined reference group—that allow comparisons of similar, standard positions. It is important to note that division heads are senior positions with bargaining power over pay-setting. Second, we have detailed pay data for multiple division managers within a firm and performance data for their respective divisions. These data allow us to estimate pay-performance sensitivity (PPS) and pay-referent sensitivity (PRS), as well as pay distance between manager pairs. Third, we are able to observe and exploit variation in the geographic location of divisions in our sample, while, at the same time, focusing on divisions located within the U.S. (thus, roughly similar labor markets). Moreover, according to Hewitt, the market for division managers is generally a national, rather than local, labor market, and so local market effects should be less of a challenge in this setting than when studying less-senior employees. Finally, the types of firms in our sample and the period covered allow us to exploit the 1992 SEC proxy disclosure rule for a more compelling identification of peer comparison. Our sample includes large, publicly-traded U.S. firms (300+ of Fortune 500)—precisely the target of the 1992 disclosure rule, which, fortuitously, occurs in the middle of our sample period (1986-1999).

III.B. Empirical Design

III.B1. Identification and the SEC 1992 Proxy Disclosure Rule on Executive Pay

The most important empirical challenge that we face is to isolate peer influence from unobserved factors that cause co-movement of division manager pay. The most obvious unobserved factors in our setting are production interdependencies (or team production), selection effects (e.g., firm-manager matching), and common shocks to the firm or changes in the firm's environment. This challenge is similar to that raised by Manski (1993) in his discussion of the reflection problem endemic to research on social effects.¹⁴ Ideally, pay disclosure would be randomly assigned across firms to enable identification of the effects of peer comparison on pay. However, given that this treatment is infeasible given our context, we instead attempt to address the reflection problem by employing a differences-in-differences research design in which we argue that (i) the 1992 pay information shock differentially affected non-proximate managers more and (ii) these managers were not simultaneously affected by unrelated (unobserved) trends that would lead to similar changes in pay. We discuss these identifying assumptions in more depth below and relax them in a series of robustness analyses at the end of the paper.

We exploit exogenous variation in access to pay information resulting from the 1992 SEC regulation that required greater pay disclosure for five highest-paid executives (described in detail in Appendix A). The SEC 1992 proxy disclosure rules led to better disclosure of executive pay, particularly performance-based pay. The most important changes for our research are three-fold: The ruling (i) replaced narrative descriptions of compensation plans with five tables based on a standardized format that allows more-direct comparisons across firms (and across positions within firms); (ii) required salary and bonus to be reported separately, instead of aggregated cash compensation, which combined salary and bonus; and (iii) required all forms of long-term incentives (i.e., restricted stock, stock options, and other forms of long-term incentive pay (LTIP), such as performance units) to be reported separately in a set of detailed tables with dollar valuations.

We argue that this increased pay disclosure for top executives led to greater comparison of pay differences at *all* senior management levels in the organization and also that the new rule had a differential impact on managers based on their geographic proximity prior to the rule change. This differential impact arose because we expect that proximate managers would have been more likely to share pay information prior to 1992. As such, we argue that (i) geographically-dispersed firms were relatively more impacted by the rule than concentrated

¹⁴ See Blume et al. (2011) for a review of identification in social interactions.

firms were because greater distance between divisions would have impeded managers from sharing pay information prior to 1992¹⁵; and (ii) within a given firm, non-proximate managers (located in different states) were relatively more affected by the rule because they were less likely than those managers located in same state to have shared pay information with each other prior to 1992.

III.B2. Empirical Models

In this section, we describe our identifying assumptions and the models we use to implement the differences-in-differences analyses.

III. B2.1 Wage Equation

Equation 2, translated into a form that can be empirically tested, becomes a standard wage model augmented by a modified linear-in-means specification to capture peer influence:

$$(3) w_{dt} = \alpha + \beta_1 s_{dt} + \beta_2 \bar{w}_{-dt} + D'_{dt} \beta_{31} + F'_{dt} \beta_{32} + \eta_d + d_t + \epsilon_{dt}$$

Here, d indexes divisions within a firm at time t . A division manager's (log) wage in period t is a function of division performance, s_{dt} , and referent pay, defined as the average (log) wage of all *other* division managers within the firm, excluding own wage, \bar{w}_{-dt} .¹⁶ A vector of both division, D'_{dt} , and firm characteristics, F'_{dt} , are included as controls. We also include year fixed effects, d_t , and cluster standard errors at the firm level. Our basic specification includes division fixed

¹⁵ To illustrate the importance of geographic proximity in peer comparisons of pay, let us share a story about investment bankers as told to us by the Chief Development Officer (CDO) and Managing Director (MD) at a large U.S. investment bank from 1992 to 1997. Two MDs at NYC headquarters had similar jobs (e.g., number of accounts, number of travel days) and similar performance. On the same day, near the end of 1993, the MDs were individually informed by the CDO about their own annual compensation (bonuses and proposed salary increases). The following day, the lower-paid MD was in the office of the CDO to ask: "Why am I paid less? Is this a signal about my odds of promotion?" This dynamic was much less common with MDs working in the firm's international offices. For example, the MD in Hong Kong was not only less informed about pay differences (due to delays in information sharing about pay), but also had less access to the CDO since they didn't bump into each other in the hallways of headquarters.

¹⁶ Linear-in-means specifications typically use the average of the whole group, with the underlying assumption that any one participant has a small marginal impact on the whole group. Because that assumption is not valid in our context, we use the average of all other division managers to calculate our mean pay variables. This definition complicates the interpretation of the standard errors because of the potential for correlated errors between observations within a given firm-year. In addition to clustering by firm and using division fixed effects for our primary specifications, we also run simulations to test whether this calculation can introduce spurious correlations and significance levels into the data. We found no such biases or efficiency distortions.

effects, η_d , which control for unobserved, time-invariant, division or firm heterogeneity and allow us to interpret coefficients as the change in manager pay with changes in the independent variables. This division fixed effects specification analyzes similarities in pay *changes*.¹⁷ However, to explore peer comparison in pay *levels*, we also estimate regressions without division fixed effects.

The two coefficients of interest in this specification are β_1 , which represents pay-performance sensitivity (PPS), and β_2 , which captures pay-referent sensitivity (PRS). As mentioned above, the main empirical challenge in estimating β_2 is to separate peer influence—which we refer to hereafter as ψ —from unobservable factors—hereafter θ , —that also cause pay co-movement.

We make the following identifying assumption: The 1992 SEC ruling did not differentially increase θ in dispersed versus concentrated firms. So, for example, we assume that the ruling did not cause dispersed firms to hire more similarly-productive managers than did concentrated firms. More generally, we assume that there were no other concurrent secular changes around the time of the ruling that caused differential increases in θ in dispersed versus concentration firms. We discuss potential scenarios in which these assumptions may be violated in a later section on alternative explanations. We also present a more formal discussion of our identification strategy in Appendix C.

Turning to our empirical models, we compare estimates of β_1 and β_2 for firms operating in different information environments. We assume full information about pay in concentrated firms ($I=1$) and, specifically, that proximate managers are informed about each other's pay and engage in peer comparison. We likewise assume no information in dispersed firms ($I=0$). We then employ a differences-in-differences approach (described above) that compares the changes in β_1 and β_2 as responses to the SEC ruling in dispersed and concentrated firms. To isolate the effect of ψ , we assume that increases in information from the new ruling are greater in dispersed firms than in concentrated firms ($\Delta I_{disp} > \Delta I_{conc} \sim 0$) and, consistent with the identifying

¹⁷ While we know the state in which a division is located, the inclusion of division fixed effects subsumes fixed effects for the state of location and, as such, controls for time-invariant local labor-market conditions. Also, while we have rich information about division manager positions, we know little about the individual manager filling the position. We do know the tenure of the manager in the position and, hence, can estimate our regressions with manager fixed effects instead of division fixed effects. The results are qualitatively similar.

assumptions discussed above, that any changes in θ at the time of the ruling are no different in concentrated and dispersed firms ($\Delta\theta_{disp} = \Delta\theta_{conc}$).¹⁸

III. B2.2. Pairs Distance Analysis and Pay Disparity

While our wage regressions aim to identify the effect of peer comparison on pay co-movement, they are not informative about intra-firm pay compression or disparity. To address this, building on Shue (2012), we conduct a second analysis that measures distances between pay of pairs of division managers within firms.¹⁹ While it does not allow us to estimate PPS and the tradeoff between pay-for-performance and pay harmony, the main advantage of this measure is that it is a simple statistic that conveys the degree of pay disparity between managers.

The analysis compares the mean absolute difference in pay residuals between two division managers operating in the same state within a firm with the difference between two managers operating in different states. We again exploit the SEC 1992 rule change and measure changes in pay distance of same- and different-state managers concurrent with increased pay disclosure. As a general response to the rule, overall pay distance between managers may have increased after 1992 as firms increased overall performance-based pay. However, as with concentrated firms in our earlier analysis, we assume that managers operating in the same state shared more pay information before the SEC ruling than did managers in different states and, therefore, that the SEC ruling had less impact. Estimation follows a two-stage procedure similar to that in Shue (2012).

$$(4) \text{ 1}^{\text{st}} \text{ Stage: } w_{dt} = \gamma_0 + \gamma_1 X_{dt} + \hat{w}_{dt}$$

$$(5) \text{ 2}^{\text{nd}} \text{ Stage: } |\hat{w}_{dt} - \hat{w}_{et}| = \delta_0 + \delta_1 * post92 + \delta_2 diff_{state} + \delta_3 diff_{state} * post92$$

As earlier, d indexes division managers within a firm and t indexes firm years in the panel data. Observations in the first stage are unique at the manager-position, firm-year level. The first-stage

¹⁸ Our differences-in-differences wage methodology classifies concentrated firms for the entire period and dispersed firms after 1992 as full information environments. Note, then, that this approach should lead to a conservative analysis of peer effects since it is likely that, because sharing pay information increased in concentrated firms post 1992, because there was some sharing of pay information within dispersed firms prior to 1992, or because of incomplete sharing of pay information in dispersed firms after 1992.

¹⁹ This method is analogous to that in Shue (2012). She compares section vs. class cohorts of randomly-assigned HBS MBA students. We compare pay for division managers within a firm, who are located in the same state vs. different states, before and after disclosure of information about pay.

regression (equation 4) is similar to the wage regressions in the earlier analysis (equation 3), with one important difference—it does not include the referent pay measure. Division manager wages w_{dt} are regressed on X_{dt} , which includes manager, division, firm, industry, and time controls. The objective of the first stage is to estimate “abnormal” wages beyond those explained by observable determinants of division manager pay (e.g., division size and tenure in position). As such, the residuals \widehat{w}_{dt} from the first-stage regression measure this unexplained component of w_{dt} and are used in the second stage.

In the second stage, we create all possible pairs of division managers within the firm in a given year. Note that division manager positions in different firms are never paired; nor are division managers across years. The unit of observation in the second stage is a pair of division manager positions within a firm in a given year. The pair absolute difference is then regressed on several dummy variables and associated interactions: $diff_{state}$ for whether d and e are located in different states and $post92$ to designate years after increased pay disclosure from the 1992 SEC ruling.²⁰

Referring to equation 5, δ_0 represents the mean distance in pre-1992 pay residuals between two managers in a firm that are located in the same state, while $\delta_0 + \delta_1$ are post-1992 distances for same-state managers. Similarly, $\delta_0 + \delta_2$ is the pre-1992 mean distance between two different-state managers, while $\delta_0 + \delta_1 + \delta_2 + \delta_3$ is post-1992 distance for different-state managers. Evidence in support of peer influence is a negative and statistically significant estimate of δ_3 , which indicates that the change in mean distances for different-state managers *within the same firm* before and after 1992 is smaller than the change for same-state managers within the same firm. We summarize the empirical implications from the above discussion in Table A1 (Appendix).

III. C. Data

²⁰ Calculation of significance levels is complicated by each manager appearing in multiple pair-wise observations in a given year. To address this correlation issue, we follow methods in Shue (2012) and estimate standard errors and significance levels using Monte Carlo simulations that employ non-parametric permutation tests. For each permutation, managers are shuffled into random states and manager-pairs are shuffled into random post92 designations. Both the state and post92 assignments match the underlying distributions for each firm. State and firm assignments persist for the entire placebo test to account for autocorrelation and firm-specific factors. We generate 10,000 placebo estimates and calculate 2-sided standard errors and p-values.

The primary dataset used in this study includes a panel of more than 300 publicly-traded U.S. firms over the years 1986-1999, spanning a number of industries. The data are collected from a confidential compensation survey conducted by Hewitt Associates, a leading human resources consulting firm specializing in executive compensation and benefits.²¹ The survey is exceptionally broad in that it collects data on many senior and middle management positions, including both operational (e.g., Chief Operations Officer and Division CEO) and staff (e.g., Chief Financial Officer and Head of Human Resources) positions. The survey typically covers all the positions at the top of the hierarchy and a sample of positions lower down. In this paper, we focus on the most-senior position in a division, which is defined in the survey as “the lowest level of profit center responsibility for a business unit that engineers, manufactures and sells its own products.” We focus on the division manager position because we have multiple observations per firm and it is a managerial position that is consistently defined across firms. The dataset is rather unique because it allows us to identify changes in pay within division manager positions over a 14-year period that is characterized by significant change in pay practices.

The data for each position include all components of compensation, including salary, bonuses, restricted stock, stock options, and other forms of long-term incentives (e.g., performance units).²² An observation in the dataset is a division managerial position within a firm in a year. To ensure consistency in matching these positions across firms, the survey provides benchmark position descriptions and collects additional data for each position, leading to a dataset rich in position characteristics. As a result, in addition to data on all aspects of compensation for multiple division manager positions, the dataset includes division-specific characteristics, such as: job title; the title of the position to whom the position reports (i.e., the position’s boss); division sales; number of employees under the position’s jurisdiction; industry of operation; geographic state of location; number of positions between the division manager position and the CEO in the organizational hierarchy (division depth); an indicator of the incumbent’s status as a corporate officer; and the manager’s tenure in the position.

²¹ For a detailed description of the survey, please refer to Appendix B. Based on several analyses, we conclude that the survey sample is most representative of Fortune 500 firms.

²² The value of long-term incentive pay is computed by Hewitt. Stock options are valued using a modified version of Black-Scholes that takes into account vesting and termination provisions in addition to the standard variables of interest rates, stock price volatility, and dividends. As is standard practice among compensation consulting firms, the other components of long-term incentives are valued using an economic valuation similar to Black-Scholes that takes into account vesting, term provisions, and the probability of achieving performance goals.

The above data are supplemented with financial and headquarters location information from Compustat and firm-level information technology investments from Harte-Hanks. Finally, we construct a number of variables that are used as controls and that we will describe in the results section.

In Table 1 (Panel A), we present descriptive statistics for the firms and divisions in the sample. While the dataset includes more than 300 firms, the exact number varies over the period, as firms enter and exit as survey participants. The firms in the sample are large, well-established and profitable, with average size of sales of \$8.5 billion, market capitalization of \$9.4 billion, 44,000 employees and return on assets of five percent. The average number of divisions reported in the survey for the sample firms is 4.6. Next, turning to divisional statistics, the mean size of divisions is \$752 million in sales and approximately 3000 employees. The average tenure in position is 42 months; approximately 23 percent of the division managers are corporate officers; and there are 1.4 positions between the CEO and division managers, on average. Average annual division manager pay is \$209K (salary), \$300K (salary plus bonus), and \$460K (total compensation). Finally, the sample firms span many industrial sectors of the economy, with some concentration in the food, paper, chemical, machinery, electrical, transportation equipment, instrumentation, communications and utilities industries.

Using the information on division state of location from the Hewitt dataset and headquarters' state and county of location from Compustat, we attempt to characterize divisional proximity to headquarters. We construct a firm-level measure of geographic dispersion by computing the proportion of divisions in the same state as headquarters (mean of 0.48 for the sample). We then construct quintiles of geographic concentration using this firm measure and assign values ranging from 1 (least concentrated) to 5 (most concentrated). In Table 1 (Panel B), we split the sample into concentrated firms (4th and 5th quintiles) and dispersed firms (1st and 2nd quintiles) and report key statistics for these two subsamples. As can be seen from this table, firms in these two categories are roughly similar in several characteristics. The biggest difference is that concentrated firms have fewer and bigger divisions than dispersed firms, based on means. However, in comparing median sales and employees, division size is generally comparable across firm geography.

Finally, Figure 1 depicts aggregate changes in pay disparity within firms over time. It plots the median coefficients of variation (std dev/mean) for the three main pay measures across

both concentrated and dispersed firms.²³ Consistent with a general trend towards higher performance sensitivity, pay variance across all firms increases over time, particularly during the later years of the sample. The figure also shows that, for dispersed firms, pay variance declines in the years just after the 1992 SEC ruling for all three pay measures. In contrast, there is no comparable decline in concentrated firms. These patterns are broadly consistent with our claim that dispersed firms were differentially affected by the rule change and are consistent with more peer comparison leading to less pay disparity. We now turn to the results of our multivariate analysis.

IV. Results

We begin by documenting both pay-performance sensitivity (PPS) and pay-referent sensitivity (PRS) in our sample of firms in standard, position-level, wage regressions (Table 2). We then present our first differences-in-differences analysis of how pay co-movement within concentrated and dispersed firms changes before and after the 1992 rule change (Tables 3 and 4). Our second differences-in-differences analysis looks at how pay distance changes in proximate (same state) and non-proximate (different state) manager pairs within firms (Table 5). We then present our exploratory analysis of the effect of pay disclosure on division productivity (Table 6). Finally, we conduct placebo tests (Table 7) and consider several alternative explanations of our results (Tables in Appendix). We use three pay measures—salary, salary plus bonus, and total compensation—throughout our analysis.

IV.A. Pay-Performance Sensitivity (PPS) vs. Pay-Referent Sensitivity (PRS)

We begin by estimating a standard wage equation for division manager positions (equation 3). In Table 2, columns 1-3, we regress the logarithm of the three pay measures on division and firm performance, while controlling for a set of covariates common to wage regressions. All regressions include division manager fixed effects (and cluster standard errors by firm); thus, the coefficients can be interpreted as correlations between the changes in pay and changes in the independent variables. Division performance is measured as log division sales,

²³ Since this figure is not a multivariate analysis that accounts for compositional changes in our sample over time, we use a subsample of firms that are present in the panel for more than 75 percent of the possible years (have at least 11 years of data) and for which the mean divisional coverage (number of years a division appears in the panel relative to the number of years a firm is in the panel) is more than 50 percent.

which can be interpreted as sales growth in our fixed effects specifications. We use two measures of firm performance: return on assets (%) and log firm sales, also interpreted as changes in those measures in our fixed effect specifications.²⁴

Consistent with pay-for-performance contracts, we find evidence that firms link pay to both division (local) and firm (global) performance. The coefficient on division sales represents the pay-*division* performance sensitivity, which is positive and significant for all three pay measures. The coefficients on firm performance measures represent the pay-*firm* performance sensitivity and are positive and significant for salary plus bonus and total compensation measures, but not for salary. While annual bonuses and long-term incentives are related to firm performance measures, salary increases (i.e., raises) appear to be driven primarily by division performance. The correlations with the additional controls are as expected. Pay is higher for managers with longer tenure in the job, managers that are officers, and managers closer to the top of the organizational hierarchy (lower depth). We find no relation with the number of other divisions in the firm.

In Table 2, columns 4 through 6, we add both referent pay (the log of the firm-wide average pay of other division managers) and an external benchmark (log of industry average pay for all division managers in the division's industry, but external to the firm). The most notable result is that division manager pay increases as the firm-wide average pay of *other* division managers increases. The coefficients on referent pay are positive and significant for all pay measures. So, in addition to pay-performance sensitivity (PPS), we find evidence for pay-referent sensitivity (PRS). Our PRS measure (the coefficient on referent pay in a log-log specification) can be interpreted as the elasticity of a manager's pay with respect to referent pay. In column 4, the elasticity of base salary is 0.28 (column 4)—which means that a doubling of the average salary of other division managers inside the firm is associated with a 28 percent increase in the salary of an individual division manager. The corresponding PRS measures for the other two pay measures are 0.44 (column 5) and 0.55 (column 6), respectively.

Positive PRS is consistent with peer influence (ψ in our discussion above), as well as with omitted factors that also can drive pay co-movement (θ in our discussion above). As discussed earlier, one factor is division managers sharing a common performance shock or a

²⁴As a robustness test, we also include growth in market capitalization (change in logarithm of market capitalization). Our results are qualitatively similar. We exclude this variable from the basic specifications for ease of exposition.

common change in their environment that is not captured by existing controls. Indeed, coefficients on all measures of firm performance drop dramatically with the addition of referent pay in columns 5 and 6 (less so in column 4 because salary is sticky), while those on division performance are stable, evidence that pay co-movement reflects broader firm-level performance.²⁵ Note that other covariates are relatively stable.

IV.B. Pay, Geography, and the 1992 SEC Proxy Disclosure Rules

In Table 3, we show results of our first differences-in-differences analysis, which measures changes in PRS and PPS within firms across the 1992 period by geographic dispersion:

$$(6) w_{dt} = \alpha + \beta_1 s_{dt} \cdot disp_{dt} \cdot Post92 + \beta_2 \bar{w}_{-dt} \cdot disp_{dt} \cdot Post92 + D_d' \beta_{31} + F_d' \beta_{32} + \eta_d + d_t + \epsilon_{dt}$$

In Table 3 Panel A, we implement the above specification by splitting the sample by firm geography. We report results for concentrated firms (highest two quintiles of geographic concentration) and dispersed firms (lowest two quintiles of geographic concentration).²⁶ We include the same set of controls as in Table 2 and report two sets of regressions for each pay measure: without division fixed effects (columns 1, 3 and 5) and with division fixed effects (columns 2, 4, and 6).²⁷ Across both types of firms, we see that all three measures of division manager pay are sensitive to referent pay (PRS) and division performance (PPS). We also see that PRS before 1992 is substantially higher for concentrated firms relative to dispersed firms (e.g., in column 4, 0.57 vs. 0.28), while PPS is lower in concentrated firms relative to dispersed firms (e.g., in column 4, 0.066 vs. 0.109).

Next, we examine how pay sensitivity changes after the SEC rule. In concentrated firms, there are no differences in any measure of PRS or PPS after 1992 (all interaction terms with

²⁵One other notable point is that the standard principal-agent model also predicts that external benchmarks are important in setting wages, as firms may match outside options for executives to retain talent. Consistent with this, we find some (weak) evidence that salaries are matched to the external market (positive and weakly significant coefficient in column 4). While firms use compensation surveys to set executive pay (in fact, the main purpose of the Hewitt survey), the criteria used to set pay can vary substantially: division industry (the measure we use), firms used as peers, wages in local labor markets, firm or division size, or a combination of these criteria. As mentioned earlier, and as claimed by Hewitt consultants, the labor market for executives at the division manager level is more of a national market than a local market.

²⁶ We split the groups for ease of interpreting results and report triple interactions in Table A2 in the Appendix.

²⁷ In this specification, *disp* is a dummy variable for whether the firm is dispersed (bottom two quintiles of concentration) or concentrated (top two quintiles). For this and all subsequent analyses, all direct and pair-wise interactions are included in our specifications. Additionally, any variable that is interacted with division performance is also interacted with our firm-wide performance measures.

Post92 are statistically insignificant, and the point estimates have the opposite signs from our predictions). As such, concentrated firms do not appear to respond to changes in the SEC's pay disclosure rule. In contrast, pay practices in dispersed firms are significantly different after 1992. Most importantly, the coefficient on the interaction between referent pay and the *Post92* indicator is positive and significant (and economically meaningful) for all three pay measures.²⁸ Panel B shows the results of the triple interaction using the combined sample. All triple interactions with PRS are positive and statistically significant, indicating that the changes in PRS around 1992 are statistically different between the concentrated and dispersed samples. The coefficients on the triple interactions with division sales are all negative and statistically significant in the cross-section.

Perhaps our most convincing evidence is presented in Table 4, in which we explore the dynamics of pay changes over time to see if the changes are consistent with the timing of the 1992 rule change. We would expect to see no pre-existing trend before 1992, a discrete jump after 1992 and little change thereafter. We focus on the dispersed firms and include a set of dummy variables representing different time periods.²⁹ In Table 4, we see that PRS increased in the two years immediately following the rule (1993-1994) and generally stayed at the same level throughout the remaining time periods. Notably, there is no change in PRS in the period preceding the rule change (1990-1991), and the interactions in the 1995-1996 and 1997-1999 periods are not statistically different from the 1993-1994 period. Note that we find minimal changes in PRS over time in concentrated firms (unreported) and, in particular, no corresponding discrete change between the 1990-1991 and 1993-1994 periods.³⁰

We expect differential effects of the 1992 rule on dispersed firms with relatively less disclosure prior to 1992. Specifically, among dispersed firms, those with relatively more performance pay before 1992 should be more affected by the rule change since the rule required

²⁸ In Table A2 (Appendix), we confirm that the differences between firm types across time periods are, indeed, statistically significant by combining our sub-samples of concentrated and dispersed firms as defined above, and estimating three-way interactions—e.g., *PRS*post92*dispersed*, to confirm that PRS (and PPS) for dispersed firms is larger (and smaller) after the rule change. We find statistically significant differences in the specification for PRS in all specifications and for PPS without division fixed effects (and the correct signs in the fixed effects specifications).

²⁹ For this analysis, we exclude 1992, the shoulder year, since the distribution of fiscal year ends around the effective date of the SEC rule implies a mix of pre- and post-disclosure firms within that year. Because we divide observations into narrow two-year time buckets around the time of the ruling, the analysis is more sensitive to the addition of this shoulder year than are the analyses represented in Tables 2 and 3.

³⁰ We evaluated whether geographic dispersion was simply a proxy for industry to evaluate whether our results varied by industry instead of geography and found no evidence to this effect (unreported).

detailed disclosure of performance-based pay (bonuses, restricted stock, stock options, and LTIP). To capture this difference, we further split the sub-sample of dispersed firms by the ratio of performance-based pay (i.e., annual bonus plus the value of all long-term incentives divided by total compensation) and report the results in Table A3 (Appendix).³¹ The results are consistent with pay disclosure affecting these firms relatively more. First, pay-referent sensitivity is generally greater after 1992 in firms with less pre-1992 disclosure and no different for firms with more pre-1992 disclosure. Also, pay-performance sensitivity is generally lower after 1992 for the less-disclosure sample.³²

Taken together, this evidence is consistent with greater pay disclosure from the SEC rule intensifying peer comparison and facilitating sharing of pay across non-proximate division managers. More generally, the wage regression results suggest a role for peer influence in wage setting within firms, and our finding that PPS is lower in dispersed firms after 1992 suggests a tradeoff between PPS and PRS in dispersed firms.

IV.C. Pairs Distance Analysis and Pay Disparity

We now turn to the pairs distance analysis, which measures whether the mean absolute distance in pay between proximate (same-state) managers differs from that of non-proximate (different-state) managers. We estimate the second-stage equation 5 and report the results in Table 5. We use two different first-stage regressions to calculate pay residuals. For the “minimum” specification, we regress pay on division performance (sales) and a minimum set of controls (tenure, officer corp, and division depth) and year fixed effects. Results for this specification are reported in columns 1, 3, and 5 of Table 5. For the “maximum” specification, we add firm performance (return on assets and revenue), as well as firm fixed effects and division state fixed effects, and report the results in columns 2, 4 and 6. Together, these analyses aim to capture two measures for peer influence—i.e., peer similarities in pay beyond what can be explained by observable similarities in division manager positions and in time-invariant firm characteristics and division location. We are agnostic about which first-stage specification is more appropriate, although one can argue that the residuals calculated from a first stage that

³¹ We calculate the ratio of performance-based pay using the three-year average ratio of bonus and long-term incentive compensation to total compensation for division managers (1990-1992).

³²When we estimate triple interactions, we find the expected signs on the coefficients, but weak support for statistically significant differences between sub-samples. This may be due to smaller sample sizes reducing the power of the tests.

excludes firm and local geographic fixed effects may include pay that is not rightly considered “excess” by managers who are aware of firm and local pay practices.

A similar pattern holds for all pay measures but is most pronounced for total compensation. Several general findings are notable. First, we find that mean distance in pay residuals between same-state divisions is lower than that of different-state divisions in each time period and across all pay measures, although only significant in columns 4 through 6. That is, there is generally less pay disparity in proximate divisions, consistent with stronger peer comparison between division managers who are geographically close. Second, we find that mean distance increases after 1992 for both pair types and for all pay measures, which we interpret as more pay disparity, consistent with greater performance-based pay after the rule change.

Finally, and most importantly for our analysis, the increase in distance after 1992 is *less* in different-state divisions than in same-state divisions. We find a negative coefficient on the interaction term, *diff_state*post92*, suggesting a lower increase in pay disparity for non-proximate division managers, particularly in the pay measures that include performance pay. This finding is consistent with more-pronounced peer comparison in non-proximate than in proximate divisions after the new SEC rule. The magnitude of this coefficient is also economically meaningful. Looking at total compensation in column 6, we see that the increase in distance for same-state divisions is 6.74 percent between periods, while the comparable increase for different-state divisions is 2.94 percent. That is, the increase in distance after 1992 for non-proximate divisions is approximately half of that for proximate divisions.

Our finding of increasing pay disparity after 1992 is consistent with more performance-based pay after the disclosure law. However, despite the general trend toward more performance pay, we find relatively lower increases in pay disparity between non-proximate managers after 1992. Analogous to the findings of the wage regression analyses, these findings are consistent with firms facing a tradeoff between higher-powered incentive contracts and less pay disparity in the face of peer comparison.

IV. D. Pay Disclosure and Division Productivity

In the prior analyses, we argue that peer comparison affects pay setting in firms. Here, we explore whether peer comparison has any productivity impact within firms. If we assume that firms optimize wage contracts and that pay disclosure affects this equilibrium, then we

might expect dispersed firms to experience some form of performance impact after the 1992 rule. Identifying this effect is extremely difficult, particularly in an equilibrium context in which principals simultaneously choose wage contracts and absorb any performance impact of the disclosure. As such, this section is purely exploratory and simply asks: Do we see any effect of pay disclosure on performance? For our performance variable, we use division productivity (defined as sales/employee), which has the advantage of being at the division manager level and, therefore, has fewer firm-level factors to confound the measure.

While there is a growing body of evidence suggesting that relative pay affects utility, the theoretical prediction about a manager's effort response to information about relative pay is ambiguous. On the one hand, when a manager discovers that she is paid less than her peers, one potential response is to become disgruntled because of unfair pay practices and, thus, to reduce effort. However, low relative pay could have the opposite effect: A manager might expend more effort because of greater opportunity for pay raises or because she is fearful of being fired and is generally more complacent. For the manager paid more than her peers, again, the response could go either way. Top-paid managers might slack off because of limited opportunities for raises or become more motivated when they discover that they are "stars" and work harder. Finally, pay disclosure may not affect manager effort at all (see Charness and Kuhn (2007) for some evidence of this from a lab experiment). Peer pay may simply be used to negotiate better pay with senior management, but it may have no effect on effort provided for productive purposes, particularly if wages are adjusted appropriately in response.

In this section, we explore the productivity response of divisions within dispersed and concentrated firms across the 1992 period. These results are intended to be suggestive only since there could be many alternative explanations for our findings that are independent of peer comparison or reduced effort by managers.

The productivity regression that we estimate takes the following form:

$$(7) \text{Log div Sales/empl}_{dt} = \alpha + \beta_1 \text{disp}_{ft-1} + \beta_2 \text{Post92} + \beta_1 \text{disp}_{ft-1} * \text{Post92} + \eta_f + d_t + \epsilon_{dt}$$

We regress the log of division productivity in period t on prior-period indicator variables for whether the firm is dispersed, whether the year is after 1992, and an interaction term between

the two, as well as firm and year fixed effects.³³ Results are shown in Table 6, Panel A. We find a negative and statistically significant coefficient on the interaction term—evidence that is consistent with divisions in dispersed firms exhibiting reduced productivity after 1992 relative to divisions in concentrated firms. The coefficient is larger with a higher level of significance when we restrict the sample to 1990-1997, a smaller window that excludes outlying years.

Next, in Table 6, Panel B, we use the restricted sample to evaluate whether divisional productivity differs by whether the manager is below or above the mean salary in the prior year. We find that the division managers at the bottom end of the wage distribution largely drive the lower productivity in the dispersed firms (Column 1). In fact, when we split the sample into above- and below-mean division managers, we find no productivity differences between dispersed and concentrated firms among division managers paid above-mean wages, while we see large differences within the below-mean sample (Columns 2 and 3). Thus result indicates that the relative change in productivity between dispersed and concentrated firms after 1992 is driven by a relative drop in productivity among the low-wage earners in dispersed firms.

These results suggest that division productivity declined after 1992 within the firms most affected by the rule change, particularly for managers at the low end of the pay scale. While there may be many alternative explanations, the evidence is consistent with managers reducing productive effort when they discover they are paid less than their peers.

IV.E. Alternative Explanations

In this section, we explore alternative explanations for our results. We describe the tests and report select findings in Table 7 (with remaining results in the Appendix).

The most significant concern in interpreting our wage regression and productivity results is that dispersed firms may differ from concentrated firms in time-varying, unobservable firm characteristics, and we are simply picking up differential trends in dispersed firms. A number of our previously reported findings counter this concern. First, we found in Table 4 that the changes in pay in dispersed firms occur primarily in the two-year period after rule change. Any alternative explanation that appeals to trends differentially affecting dispersed firms would also have to exhibit this distinctive time pattern. We also reported results in Table A3 that show that

³³ We use prior-period indicator variables in this analysis because we assume that the effort response lags realized pay by one period. Note that the sample size is reduced by approximately 50 percent because of this restriction.

PRS and PPS changes are more pronounced within the subsample of dispersed firms that disclose less pay before 1992, again a distinctive finding that an alternative story would have to explain. Furthermore, the pairs distance analysis in Table 4 does not use the geographic dispersion of firms but, rather, the proximity of manager pairs within firms, regardless of firm dispersion. Again, an alternative explanation would have to account for this second treatment approach. Finally, our asymmetric productivity results in Table 6 Panel, B find that the productivity drop in dispersed firms was entirely driven by low-wage workers, a result that may be difficult to explain by macroeconomic, industry or IT trends during this period.

We also run several additional tests to specifically address this concern. Since differential trends should not exhibit a specific break in 1992, one general test for these trends is to conduct tests of placebo breaks. We split the sample by the 1992 break and pick a placebo break year in the middle of each smaller panel. For the 1986-1992 subpanel, we create a dummy indicator to represent a 1989 placebo break year, while for the 1993-1999 subpanel, we create a dummy indicator to represent a 1995 placebo break. We then recreate the differences-in-differences analysis of Table 3, Panel B with the placebo years and the two subpanels. Table 7, Panel A reports the results as triple interactions for space purposes. Columns 1 through 3 and 4 through 6 report the results for the 1989 and 1995 breaks, respectively. The coefficients on PRS are negative and generally insignificant, and the PPS estimates are also insignificant. These results are not consistent with alternative secular trends that differentially affect dispersed firms unless they, too, affect firms only in the years immediately following 1992. Panel B reports a similar result for the productivity analysis, with no significant interactions with the placebo breaks.

We also consider several alternative explanations not related to peer comparison that could explain the increase in PRS in dispersed firms in the post-1992 period. In the first alternative explanation, IT productivity improved over the same period as the SEC rule implementation, facilitating greater team production (increase in θ), especially in dispersed firms.³⁴ Adoption, for example, of networking and telecommunications infrastructure, fax

³⁴ IT may also improve communication about pay, which is another related explanation for our results. This falls under the category of a technological change that affects the difference in information between geographically-dispersed and concentrated firms.

machines, email and common operating systems and software enabled division managers to coordinate their activities during the 1990s to a greater degree than during earlier periods.³⁵

Again, the results in Table 4 show that the pay changes occur primarily in the period just after 1992, which is at odds with this explanation. We also look for evidence of this explanation directly, using IT productivity (measured by number of PCs per employee in the firm). If IT intensity drives increased pay co-movement, we would expect to see greater pay co-movement post-1992 in more IT-intensive firms. In the subsample of dispersed firms, we interact the referent pay*1992 interaction with IT intensity and predict a positive coefficient if IT drives co-movement. In all specifications, the coefficients are negative and generally insignificant, particularly in the models with division fixed effects (reported in Table A3 in the Appendix).

The second alternative is that the practice of rotating division managers through multiple divisions, particularly in dispersed firms, increased during the 1990s as a method of grooming future leaders for roles as top managers. This increased rotation, in turn, may have led to increased co-movement in division manager pay, due not to peer comparison, but simply to convergence in job characteristics between division managers and to the stickiness of compensation plans that are challenging to change as individuals rotate through roles. To explore this, we investigate whether tenure decreased relatively more in dispersed firms after 1992, reflecting increased job rotation. We do not find evidence of this (reported in Table A4 in the Appendix). Moreover, based on our interviews with Hewitt Associates, the practice of horizontal rotations for division managers was uncommon during this time frame. Also, it is not clear how horizontal rotation would explain stronger effects in the years just following the rule change.

The third alternative story is that the end of the 1990-91 recession coincided with the 1992 ruling, and dispersed firms responded differently to the recovery than concentrated firms did. This alternative is compelling because it shares similar timing characteristics with the main explanation. We argue, however, that this story is unlikely to drive our findings for three reasons:

³⁵ Theoretically, increased IT productivity may have the opposite impact—namely, greater monitoring of agents. Under this argument, IT enables principals (CEOs, group managers, directors) to monitor the activities of division managers more closely and, therefore, understand their individual contributions with greater accuracy, negating the free-riding aspects of team production (Holmstrom 1979) or the distortions from multitasking (Holmstrom 1982) that occur with less-accurate monitoring. However, we do not consider this scenario, as it would bias the results away from our findings.

First, it does not appear that the recession differentially affected our two groups of firms.³⁶ Second, if the recession differentially affected dispersed firms, we should also see effects during the actual recession years of 1990-91. The 1990-1991 indicators in Table 4 and the 1989 placebo break test in Table 6 should produce significant estimates, but they do not. Finally, it is hard to articulate recession-based explanations for i) the pairs distance results in Table 5 that use an alternative treatment that does not rely on overall geographic dispersion of the firm; ii) the result that the PRS increases even more in the subsample of dispersed firms with less pre-1992 pay disclosure (Table A2 in the Appendix); and iii) the asymmetric productivity result in Table 6 Panel B that shows that the productivity drop in dispersed firms was driven by managers at the low end of the wage spectrum. We argue that these three points, taken together, make a recession-based alternative story unlikely.

The last alternative story is that our measures of dispersed and concentrated firms are inadvertent proxies for underlying time-varying industry or geographic effects. For example, if most concentrated firms are technology firms based in California, and most dispersed firms are manufacturing firms based in the Midwest, then, perhaps, we are capturing relative California-Midwest trends or technology-manufacturing trends. Figure A1 plots the distribution of concentrated and dispersed firms by industry. While there are some differences visible at the two-digit SIC level, on aggregate, the industry composition broadly matches between the two groups. As an additional check, we rerun the main specifications, excluding industries that are highly skewed to either concentrated or dispersed firms, and find that the results remain.³⁷ Figure A2 shows the distribution by headquarters location. As with industry, there is no broad regional skew between the two types of firms, although there are state-level differences. Similar to the industry analysis, when we rerun our analysis excluding skewed states, we obtain economically similar and statistically significant results.³⁸

Aside from differential trends driving these results, we also consider two other potential effects of the 1992 rule that could lead to similar results. The first effect is that we are observing

³⁶ In an unreported figure, we plot five firm performance metrics over time by geographic concentration. Dispersed and concentrated firms exhibit similar patterns during the recession and early recovery period across all five measures.

³⁷ We did this in two ways. First, we excluded the highly-skewed industries (high levels of concentrated or dispersed firms) 2-digit SIC codes 28, 36, 37. We also ran the analyses including all industries that were between 15- and 85-percent concentrated, excluding the tails on both ends.

³⁸ In this analysis, we exclude California, Massachusetts, Michigan, Minnesota and Virginia, states that were highly skewed toward either concentrated or dispersed firms.

vertical comparison to CEO pay and that pay co-movement is simply due to comparison by all division managers to CEO pay, and not to each other (horizontal comparison). To address this, we include CEO pay measures in the wage models and find, if anything, that pay co-moved *less* with CEO pay after 1992 (reported in Table A5 in the Appendix). The second effect is that CEOs are merely substituting tournament incentives for pay incentives in dispersed firms after 1992. That is, increased promise of vertical rewards from promotions offsets less pay disparity within firms. This alternative does not dispute the introduction of PRS within firms; rather, it counters the existence of a tradeoff between PRS and PPS. We test whether increased vertical incentives—in the form of increased pay jumps between division and group manager levels to motivate and maintain high productivity of their agents—after 1992 are implemented more in dispersed firms.³⁹ When we examine the relation between the steepness of the pay changes and horizontal co-movement of pay within firms, we find no evidence of this tradeoff (reported in Table A6 in the Appendix). Furthermore, the positive coefficient on the PPS triple interaction is evidence that performance pay and tournament pay become closer complements after 1992, consistent with a general increase in higher-powered pay during this period.

Altogether, we do not find compelling evidence that differential trends, alternative explanations, or secondary mechanisms of the 1992 ruling are driving our results.

V. Conclusion

In this study, we find evidence consistent with the presence of peer comparison influencing pay policies for executives inside firms. Our underlying approach is to measure changes in pay co-movement, disparity and productivity using a 1992 SEC ruling that mandated greater disclosure of top executive pay. We argue that this ruling led to greater awareness of pay and, hence, greater peer comparison throughout all managerial ranks, particularly in non-proximate managers who had natural information barriers prior to the ruling.

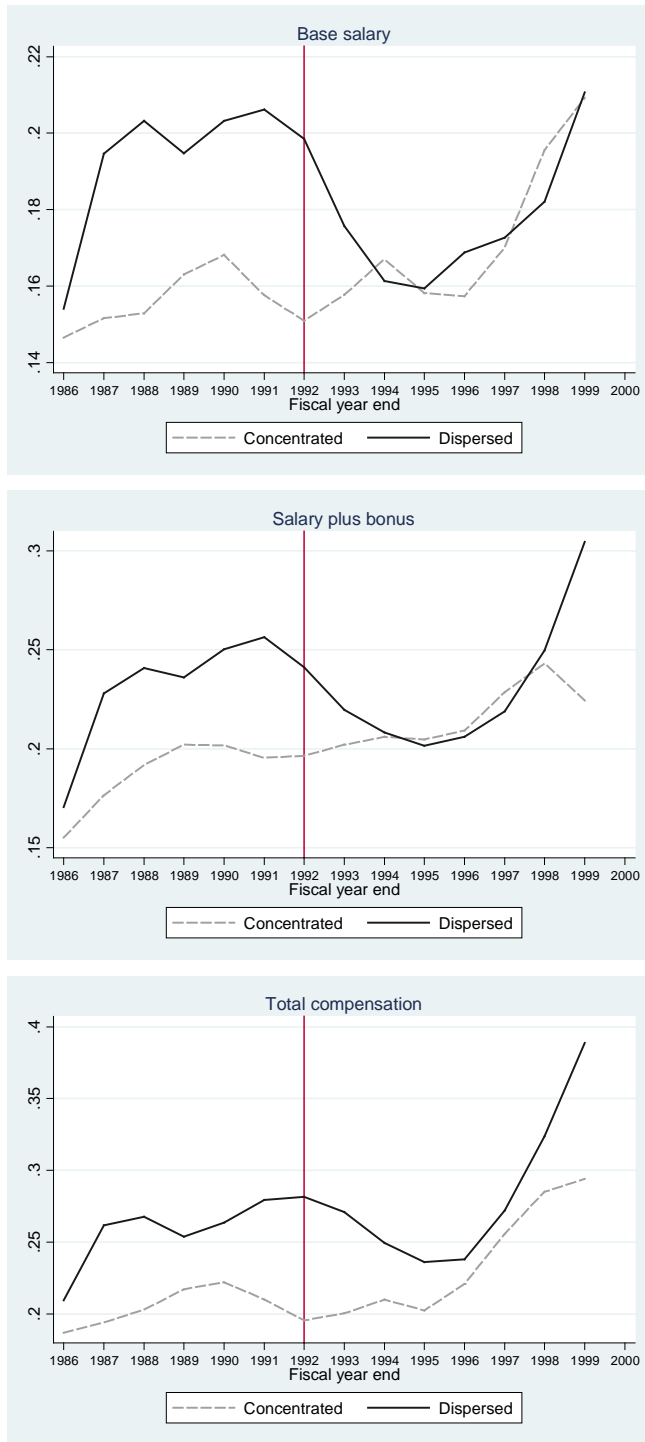
We present the results of three analyses that, taken together, support the argument that firms' pay policies respond to peer comparison and concerns about internal equity. In general, we find evidence that pay variance within firms, pay distance between managers and division productivity all increased during this period. However, we find that these measures increased

³⁹ Clearly, this, too, must come at a cost; otherwise, these CEOs would have instituted higher tournament incentives prior to the change in compensation. However, delineating this alternative tradeoff is beyond the scope of this study.

less among firms and managers that were more affected by the 1992 SEC disclosure rule. Specifically, after the new regulation, we find increases in PRS (pay-referent sensitivity)—or greater co-movement of division manager pay—and decreases in PPS (pay-performance sensitivity) in geographically-dispersed firms, but not in concentrated firms. Notably, these changes occur in the two-year period following the rule change, with no observed pre or post trends. We also find these results to be stronger among firms with less pay disclosure prior to the rule. We find that residual pay distance between pay of managers within firms increases after the 1992 SEC ruling, consistent with an overall trend toward greater pay disparity within firms. But we also find that distance increases less between managers of divisions located in different states relative to managers located in the same state, who were likelier to have been sharing pay information prior to the rule change. Finally, in our most exploratory analysis, we find that division productivity in dispersed firms increases less after 1992 relative to divisions in concentrated firms and that this effect is driven by managers at the low end of the wage distribution for division managers. Altogether, our findings suggest that horizontal wage comparisons within firms and concerns for “pay harmony” affect firms’ policies on setting pay for executives and that firms face a tradeoff between the incentive effects of performance pay and the effects of peer comparison that arise from unequal pay.

The unique contribution of the paper is that it demonstrates how firms’ pay policies respond to concerns about internal equity, which, to our knowledge, has not been documented elsewhere. This research also raises questions for future research on the costs of pay disclosure and on labor markets more generally. What are the equilibrium consequences of the changes in wage contracts resulting from increased pay disclosure? From the firm’s perspective, these consequences may range from pay ratcheting to aggregate shifts in worker effort or firm-specific investments and turnover. Each of these changes, in turn, may have performance consequences for firms. From the employee’s perspective, increased pay disclosure may influence decisions to join firms and shift the relative importance of internal and external benchmarks, thereby having larger labor-market consequences. Aside from the contributions in this paper, these areas represent potentially fruitful avenues for further research as we broaden our understanding of peer influence within firms.

Figure 1: Intra-firm Variance in Pay (coefficient of variation) over time: Dispersed vs. Concentrated Firms



Notes: Median coefficient of variation (sd/mean) of Base salary, Salary + bonus and Total compensation. The figure has been locally smoothed using a bandwidth of 0.4. The sample is all firms with more than ten years of observations and for which divisions appear, on average, in at least 50 percent of the years. The x-axis represents fiscal-year ends (not calendar-year time) so that, for example, the data at 1992 represent compensation granted at year end for work completed during 1992.

Table 1 Panel A: Summary Statistics: Firm and Division

Variable	Obs	Mean	Std. Dev.
Firm			
Sales (\$millions)	2,315	8,508	13,548
Market capitalization	2,248	9,366	16,502
Employees (000s)	2,307	44.12	69.46
Assets (\$millions)	2,319	8,868	17,933
Return on assets	2,315	0.0512	0.0674
Average no. div / firm	2,362	4.55	4
Proportion div in HQ state	2,362	0.48	0.39
Division			
Sales (\$millions)	9,871	752	1,448
Employees (000s)	9,790	3.02	10.14
Productivity (sales/emp)	9,373	590	1435
Division manager			
Tenure (months)	8,899	42.23	42
Officer corp	10,731	0.23	0.42
Division depth	10,706	1.42	0.81
Base salary (\$)	10,731	208,849	82,439
Base plus bonus (\$)	10,731	300,088	151,459
Total compensation (\$)	10,731	459,640	357,865

Table 1 Panel B: Concentrated v Dispersed firms (Means)

Variable	Concentrated	Dispersed
Firm		
Obs	1,003	865
Firm sales (\$millions)	8992.64	7607.12
Market capitalization	9349.69	7757.12
Firm employees (000s)	44.91	44.39
Firm assets	9764.51	7507.56
Return on assets	0.0554	0.0443
Average no. div / firm	3.83	5.1
Proportion div in HQ state	0.89	0.05
Division		
Obs	3,837	4,346
Sales (mean) (\$millions)	919	562
Sales (median)	379	258
Employees (mean) (\$000s)	3.3	2.6
Employees (median)	0.9	1.1
Productivity (mean) (\$000s)	881	399
Productivity (median)	319	190
Division manager		
Tenure (months)	40.33	43.66
Base salary (\$)	216,397	197,225
Base plus bonus (\$)	312,907	280,139
Total compensation (\$)	498,911	415,225

Firm statistics are obtained from Compustat and Hewitt Associates for 296 firms and 2572 divisions between 1986 and 1999. Division and division manager statistics are from Hewitt. Concentrated firms are defined as firms in the top two quintiles of firms with the highest proportion of divisions in the same state as HQ, and dispersed firms are those firms in the bottom two quintiles. *Tenure* refers to the number of months a division manager has been in the position. *Officer corp* is equal to one if the division manager is also an officer of the firm. *Division depth* is the number of levels between the division and the CEO. *Base salary* refers to annual salary, *Base plus bonus* refers to salary plus annual bonus and *Total compensation* refers to salary plus bonus plus (ex ante valuation of) restricted stock grants, stock option grants, and other forms of long-term incentive pay (LTIP: performance units). Reported in 1996 dollars.

Table 2: Division Manager Pay-Performance Sensitivity (PPS) and Pay-Referent Sensitivity (PRS)

Log pay type:	Base salary (1)	Base + bonus (2)	Total compensation (3)	Base salary (4)	Base + bonus (5)	Total compensation (6)
PRS and PPS						
Log referent pay (PRS)				0.2838*** (0.0351)	0.4413*** (0.0388)	0.5511*** (0.0276)
Log division sales (PPS)	0.0751*** (0.0071)	0.0935*** (0.0102)	0.1106*** (0.0121)	0.0715*** (0.0068)	0.0873*** (0.0091)	0.1022*** (0.0106)
Firm Performance						
Return on assets	-0.0211 (0.0607)	0.5472*** (0.1285)	0.6307*** (0.1513)	-0.0065 (0.0479)	0.3059*** (0.0766)	0.2853*** (0.0746)
Log firm revenues	0.0377** (0.0150)	0.0820*** (0.0250)	0.1446*** (0.0351)	0.0236** (0.0116)	0.0391*** (0.0150)	0.0564*** (0.0181)
Other Controls						
Tenure	0.0009*** (0.0001)	0.0011*** (0.0001)	0.0011*** (0.0001)	0.0009*** (0.0001)	0.0011*** (0.0001)	0.0010*** (0.0001)
Officer corp	0.0879*** (0.0134)	0.1052*** (0.0204)	0.1525*** (0.0250)	0.0792*** (0.0118)	0.0937*** (0.0155)	0.1253*** (0.0178)
Division depth	-0.0501*** (0.0065)	-0.0597*** (0.0091)	-0.0895*** (0.0117)	-0.0436*** (0.0057)	-0.0474*** (0.0072)	-0.0639*** (0.0085)
Number of non-focal divisions in firm	-0.0014 (0.0011)	-0.0006 (0.0015)	-0.0006 (0.0021)	0.0010 (0.0009)	0.0035*** (0.0012)	0.0056*** (0.0016)
Log industry pay				0.0384* (0.0196)	0.0045 (0.0201)	-0.0083 (0.0195)
Constant	12.0891*** (0.1059)	12.3131*** (0.1433)	12.6738*** (0.3616)	8.6564*** (0.4310)	6.8895*** (0.4995)	5.6629*** (0.4111)
Division and year FE	Y	Y	Y	Y	Y	Y
Observations	10312	10312	10312	10312	10312	10312
R-squared	0.274	0.252	0.364	0.315	0.352	0.511

Standard errors clustered by firm. *** = $p < 0.01$, ** = $p < 0.05$, * = $p < 0.1$. *Log referent pay* refers to the log mean pay of division managers, excluding the focal division, within a given firm and year. Referent pay is calculated using base salary in column (4), base+bonus in (5) and total compensation in (6). *Number of non-focal divisions* refers to the number of divisions in a firm-year, excluding the focal division. *Log industry pay* refers to the log mean pay of all division managers outside the firm in the focal manager's Fama-French industry. Refer to footnote in Table 1 for additional definitions.

Table 3 Panel A: Effect of 1992 SEC Proxy Rule on PRS and PPS in Concentrated and Dispersed Firms

Log pay type:	Base salary		Base + bonus		Total compensation	
	(1)	(2)	(3)	(4)	(5)	(6)
Concentrated firms (N=3620)						
Log referent pay (PRS)	0.5416*** (0.0447)	0.4142*** (0.0601)	0.6294*** (0.0430)	0.5683*** (0.0602)	0.6939*** (0.0305)	0.6426*** (0.0374)
Log division sales (PPS)	0.0643*** (0.0087)	0.0545*** (0.0100)	0.0759*** (0.0108)	0.0659*** (0.0129)	0.0836*** (0.0121)	0.0671*** (0.0150)
<i>Post 1992 Interactions</i>						
Log referent pay (PRS)*Post 1992	-0.0260 (0.0421)	-0.0397 (0.0419)	-0.0393 (0.0415)	-0.0441 (0.0429)	-0.0145 (0.0332)	-0.0255 (0.0328)
Log division sales (PPS)* Post 1992	0.0055 (0.0100)	0.0023 (0.0103)	0.0106 (0.0123)	0.0068 (0.0130)	0.0194 (0.0133)	0.0186 (0.0138)
R-squared	0.6489	0.331	0.676	0.423	0.753	0.521
Dispersed firms (N=4225)						
Log referent pay (PRS)	0.4292*** (0.0525)	0.1096* (0.0600)	0.4889*** (0.0410)	0.2814*** (0.0591)	0.5609*** (0.0339)	0.4332*** (0.0360)
Log division sales (PPS)	0.0982*** (0.0089)	0.0911*** (0.0104)	0.1250*** (0.0106)	0.1090*** (0.0131)	0.1396*** (0.0112)	0.1224*** (0.0140)
<i>Post 1992 Interactions</i>						
Log referent pay (PRS)* Post 1992	0.1534*** (0.0406)	0.1251** (0.0561)	0.1386*** (0.0404)	0.1008* (0.0541)	0.1147*** (0.0361)	0.0997** (0.0417)
Log division sales (PPS)* Post 1992	-0.0236*** (0.0078)	-0.0181** (0.0075)	-0.0323*** (0.0108)	-0.0192* (0.0110)	-0.0256** (0.0122)	-0.0123 (0.0133)
R-squared	0.695	0.295	0.69	0.296	0.757	0.503
Firm and division controls, year FE	Y	Y	Y	Y	Y	Y
Firm performance * Post 1992	Y	Y	Y	Y	Y	Y
Division FE	N	Y	N	Y	N	Y

Standard errors clustered by firm. *** = $p < 0.01$, ** = $p < 0.05$, * = $p < 0.1$. *Log referent pay* refers to the log mean pay of division managers, excluding the focal division, within a given firm and year. Referent pay is calculated using base salary in column (1, 2), base+bonus in (3, 4) and total compensation in (5, 6). Concentrated (dispersed) firms are those in the highest (lowest) two quintiles of the proportion of divisions in the same state as headquarters. All pair-wise interactions and direct effects included in specification. Firm and division controls are the same as those in Table 2. Refer to footnote in Table 1 for additional definitions.

Table 3 Panel B: PRS and PPS After 1992 by Geography: Triple Interactions

Log pay type: <i>N</i> = 7845	Base salary		Base + bonus		Total compensation	
	(1)	(2)	(3)	(4)	(5)	(6)
Log referent pay (PRS)* Post 1992*Dispersed	0.1716*** (0.0589)	0.1547** (0.0680)	0.1674*** (0.0591)	0.1394** (0.0683)	0.1224** (0.0492)	0.1255** (0.0518)
Log division sales (PPS)* Post 1992*Dispersed	-0.0271** (0.0126)	-0.0172 (0.0128)	-0.0403** (0.0165)	-0.0210 (0.0169)	-0.0427** (0.0181)	-0.0253 (0.0189)
Firm and other controls, Year FE	Y	Y	Y	Y	Y	Y
Firm performance* Post 1992*Dispersed	Y	Y	Y	Y	Y	Y
Division FE	N	Y	N	Y	N	Y
R-squared	0.68	0.316	0.686	0.359	0.759	0.516

Standard errors clustered by firm. *** = $p < 0.01$, ** = $p < 0.05$, * = $p < 0.1$. *Log referent pay* refers to the log mean pay of division managers, excluding the focal division, within a given firm and year. Referent pay is calculated using base salary in column (1, 2), base+bonus in (3,4) and total compensation in (5, 6). Concentrated (dispersed) firms are those in the highest (lowest) two quintiles of the proportion of divisions in the same state as headquarters. All pair-wise interactions and direct effects included in specification. Firm and division controls are the same as those in Table 2. Refer to footnote in Table 1 for additional definitions.

Table 4: Timing of Effect of 1992 SEC Proxy Rules on PRS and PPS in Dispersed Firms

Log pay type: <i>N</i> = 3,913	Base salary		Base + bonus		Total compensation	
	(1)	(2)	(3)	(4)	(5)	(6)
PRS						
Log referent pay (PRS)	0.3724*** (0.0586)	0.0928 (0.0755)	0.4175*** (0.0449)	0.2643*** (0.0688)	0.4687*** (0.0432)	0.3880*** (0.0548)
Log referent pay (PRS)*(1988-89)	0.0467 (0.0489)	-0.0242 (0.0511)	0.0467 (0.0489)	0.0250 (0.0444)	0.0942** (0.0470)	0.0264 (0.0484)
Log referent pay (PRS)*(1990-91)	0.0752 (0.0583)	0.0073 (0.0610)	0.0752 (0.0583)	0.0466 (0.0525)	0.1146** (0.0498)	0.0479 (0.0523)
Log referent pay (PRS)*(1993-94)	0.2308*** (0.0672)	0.1468* (0.0766)	0.2308*** (0.0672)	0.1323* (0.0691)	0.2302*** (0.0595)	0.1374** (0.0658)
Log referent pay (PRS)*(1995-96)	0.2068*** (0.0685)	0.1275 (0.0843)	0.2068*** (0.0685)	0.1501** (0.0744)	0.2004*** (0.0649)	0.1428** (0.0711)
Log referent pay (PRS)*(1997-99)	0.2365*** (0.0789)	0.1802** (0.0856)	0.2365*** (0.0789)	0.1625** (0.0788)	0.2145*** (0.0659)	0.1873*** (0.0711)
PPS						
Log division sales (PPS)	0.1123*** (0.0129)	0.0996*** (0.0125)	0.1484*** (0.0159)	0.1222*** (0.0162)	0.1618*** (0.0166)	0.1332*** (0.0169)
Log division sales (PPS)*(1988-89)	-0.0195* (0.0114)	-0.0173 (0.0108)	-0.0266* (0.0136)	-0.0212* (0.0125)	-0.0208 (0.0162)	-0.0128 (0.0153)
Log division sales (PPS)*(1990-91)	-0.0132 (0.0151)	-0.0092 (0.0147)	-0.0270 (0.0178)	-0.0215 (0.0169)	-0.0197 (0.0203)	-0.0112 (0.0197)
Log division sales (PPS)*(1993-94)	-0.0387*** (0.0136)	-0.0239* (0.0129)	-0.0577*** (0.0177)	-0.0372** (0.0187)	-0.0551*** (0.0188)	-0.0330* (0.0192)
Log division sales (PPS)*(1995-96)	-0.0348*** (0.0134)	-0.0325** (0.0127)	-0.0434** (0.0185)	-0.0263 (0.0183)	-0.0284 (0.0209)	-0.0067 (0.0221)
Log division sales (PPS)*(1997-99)	-0.0379** (0.0162)	-0.0286* (0.0166)	-0.0593*** (0.0220)	-0.0362 (0.0240)	-0.0514* (0.0267)	-0.0226 (0.0305)
Firm and other controls, Year FE	Y	Y	Y	Y	Y	Y
Firm performance* year groups	Y	Y	Y	Y	Y	Y
Division FE	N	Y	N	Y	N	Y
R-squared	0.704	0.306	0.698	0.304	0.764	0.514

Standard errors clustered by firm. *** = $p < 0.01$, ** = $p < 0.05$, * = $p < 0.1$. 1992 is omitted. *Log referent pay* refers to the log mean pay of division managers, excluding the focal division, within a given firm and year. Referent pay is calculated using base salary in columns (1, 2), base+bonus in (3, 4) and total compensation in (5, 6). Sample includes only geographically-dispersed firms defined as those in the lowest two quintiles of the proportion of divisions in the same state as headquarters. All pair-wise interactions and direct effects included in specification. Firm and division controls are the same as those in Table 2. Refer to footnote in Table 1 for additional definitions.

Table 5: Pay Disparity (Pairs Distance) between Managers in Same State versus Different States within Firms

Pairs distance between pay residuals by log pay type:	Base salary		Base + bonus		Total compensation	
	Min	Max	Min	Max	Min	Max
	(1)	(2)	(3)	(4)	(5)	(6)
Different State	0.0106 (0.0147)	0.0109 (0.0130)	0.0128 (0.0070)	0.0172** (0.0079)	0.0109*** (0.0034)	0.0162*** (0.0000)
Post 1992	0.0287*** (0.0000)	0.0263*** (0.0000)	0.0470*** (0.0000)	0.0449*** (0.0000)	0.0674*** (0.0000)	0.0674*** (0.0000)
Different State* Post 1992	-0.0050 (0.0038)	-0.0059 (0.0039)	-0.0075 (0.0061)	-0.0132** (0.0065)	-0.0300*** (0.0081)	-0.0380*** (0.0102)
Cons	0.1760*** (0.0473)	0.1780*** (0.0576)	0.2107*** (0.0567)	0.2111*** (0.0568)	0.2352*** (0.0632)	0.2337*** (0.0628)
First stage controls & year FE	Y	Y	Y	Y	Y	Y
First stage firm FE	N	Y	N	Y	N	Y
First stage division state FE	N	Y	N	Y	N	Y
Observations (DM-DM pair within firm)	29,007	29,007	29,007	29,007	29,007	29,007
R-squared	0.0114	0.0107	0.0127	0.0111	0.0141	0.0128

Each observation represents manager-manager pairs within a given firm and year. Significance is represented by: *** = $p < 0.01$, ** = $p < 0.05$, * = $p < 0.1$. Standard errors calculated by non-parametric permutation tests implemented by Monte Carlo simulation (10,000 runs per model). Details about the permutation tests are described in more detail in Footnote 18. *Different state* represents whether the division managers in the same firm are located in different states from each other. The dependent variable, *Pairs distance between pay residuals* is calculated according to equation 5 as the absolute value difference between pay residuals calculated from a first stage model described in equation 4. Columns (1), (3), (5) show results for residuals calculated using the minimum specification in the first stage (without firm and division state FE) and Columns (2), (4), and (6) show results for residuals calculated with the full first stage specification.

Table 6 Panel A: Divisional Productivity differences

Log (Sales/employee)	All years		1990-1997	
	(1)	(2)	(3)	(4)
Dispersed* Post 1992	-0.1483*	-0.1524**	-0.1776**	-0.1940**
	(0.0793)	(0.0774)	(0.0863)	(0.0834)
Dispersed	-0.0006	-0.1441**	0.1244	-0.1236
	(0.0681)	(0.0590)	(0.1307)	(0.0925)
Post 1992	0.3322***	0.3288***	0.3635***	0.3253***
	(0.0811)	(0.0811)	(0.1042)	(0.1026)
Year FE	Y	Y	Y	Y
Firm FE	Y	N	Y	N
Observations	4723	4723	3139	3139
R-squared	0.017	0.050	0.013	0.057

Table 6 Panel B: Divisional Productivity differences – asymmetric effects

Log (Sales/employee)	1990-1997		
	All firms	At or above mean pay	Below mean pay
	(1)	(2)	(3)
Dispersed*Post 1992*Below mean pay	-0.2706**		
	(0.1156)		
Dispersed*Post 1992		-0.0757	-0.2554**
		(0.0908)	(0.1103)
Year FE	Y	Y	Y
Firm FE	Y	Y	Y
Observations	3139	1667	1472
R-squared	0.019	0.015	0.011

Standard errors clustered by firm. *** = $p < 0.01$, ** = $p < 0.05$, * = $p < 0.1$. Dependent variable, \log Sales/employee, is calculated as division sales divided by the number of division employees. Mean pay is defined as mean base salary of division managers in a given firm-year. Firm and division controls are the same as those in Table 2. Refer to footnote in Table 1 for additional definitions. All dependent variables lagged by one year and, therefore, sample only includes division observations with adjacent one-year lagged observation.

Table 7 Panel A: Alternative Explanations: PRS and PPS and Placebo breaks

Log pay type:	1989 break (1986-1992)			1995 break (1993-1999)		
	Base salary	Base + bonus	Total compensation	Base salary	Base + bonus	Total compensation
	(1)	(2)	(3)	(4)	(5)	(6)
Log referent pay (PRS)*Post break*Dispersed	-0.0449 (0.0836)	-0.0166 (0.0814)	-0.0420 (0.0750)	-0.2002** (0.0829)	-0.0120 (0.0991)	0.0189 (0.1017)
Log division sales (PPS)*Post break*Dispersed	0.0142 (0.0161)	-0.0020 (0.0201)	0.0030 (0.0235)	-0.0144 (0.0193)	-0.0197 (0.0257)	-0.0414 (0.0311)
Year FE	Y	Y	Y	Y	Y	Y
Division FE	Y	Y	Y	Y	Y	Y
Observations	4024	4024	4024	3821	3821	3821
Adjusted R-squared	0.419	0.389	0.434	0.279	0.269	0.360

Table 7 Panel B: Alternative Explanations: Divisional Productivity and Placebo breaks

Sales/employee	1989 break (1986-1992)		1995 break (1993-1999)	
	(1)	(2)	(3)	(4)
Dispersed*Post break	0.0645 (0.0767)	0.0128 (0.1024)	-0.1141 (0.1077)	-0.0927 (0.1126)
Dispersed*Post break*Below mean		0.0948 (0.1188)		-0.0543 (0.1618)
Year FE	Y	Y	Y	Y
Division FE	Y	Y	Y	Y
Observations	2625	2625	2098	2098
Adjusted R-squared	0.001	0.010	0.005	0.006

Standard errors clustered by firm. *** = $p < 0.01$, ** = $p < 0.05$, * = $p < 0.1$. *Post break* is a dummy equal to 1 for all years after the designated break year (1989 or 1995). In Panel A *Log referent pay* refers to the log mean pay of division managers, excluding the focal division, within a given firm and year. Referent pay is calculated using base salary in columns (1, 4), base+bonus in (2, 5) and total compensation in (3, 6). In Panel B, the dependent variable, *Sales/employee*, is calculated as division sales divided by the number of division employees. *Below mean* is a dummy equal to 1 if division manager pay is below mean pay, where mean pay is defined as mean base salary of division managers in a given firm-year. All pair-wise interactions and direct effects included in specification. Firm and division controls are the same as those in Table 2. Refer to footnote in Table 1 for additional definitions.

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Appendix A: SEC 1992 Proxy Disclosure Rules on Executive Pay

In October 1992, the Securities and Exchange Commission (SEC) “announced sweeping new rules affecting the disclosure of top executive compensation in the annual proxy statement” of publicly-traded firms (Murphy, 1999, pg. 50). The regulation was partially in response to heightened visibility of CEO pay via a variety of media outlets just prior to the 1992 presidential election.⁴⁰ One primary objective of the new rules was to improve disclosure of pay information to enable shareholders to evaluate the link between executive pay and performance. However, the new rules were expected to have many potential, far-reaching effects. As Murphy (1999, pg. 49) noted: “The public disclosure of executive pay required by the Securities and Exchange Commission (SEC) virtually guarantees that third parties such as rank-and-file employees, labor unions, consumer groups, Congress, and the media affect the type of contracts written between management and shareholders.”⁴¹

The new rules led to better disclosure of pay, especially performance-based pay. The most important changes for this paper are three-fold:⁴²

- Replace narrative descriptions of compensation plans with five tables based on a standardized format that allows more-direct comparisons across firms (and across positions within firms). For example, the required Summary Compensation Table discloses annual salary, bonus and all other compensation of the CEO and the four other most-highly-paid senior executive officers over a three-year period. Much of the prior narrative was “short on numbers but long on legalistic descriptions of complicated benefit plans” (Stone, 1992; Lissy, 1993).⁴³

⁴⁰ From Murphy (1999, p. 50): “Although the business press had followed CEO pay for decades, CEO pay did not really become a public “issue” until 1991. Feature stories on CEO pay aired on the nightly news broadcasts of the three major networks in the Spring of 1991, and CNN, *60 Minutes* and *Nightline* devoted segments to CEO pay. The controversy heightened with the November 1991 introduction of Graef Crystal’s (1991) expose on CEO pay, *In Search of Excess*, and exploded following President George Bush’s ill-timed pilgrimage to Japan in January 1992, accompanied by an entourage of highly paid US executives. What was meant to be a plea for Japanese trade concessions dissolved into accusations that US competitiveness was hindered by its excessive executive compensation practices as attention focused on the “huge pay disparities between top executives in the two countries.”

⁴¹ Hall and Murphy (2003) refer to a ratchet effect of 1992 on stock options as stated in Camerer and Malmendier (2007).

⁴² From Murphy (2011, p. 5): “The new rules required a Summary Compensation Table summarizing the major components of compensation received by the CEO and other highly paid executives over the past three years, and additional tables describing option grants, option holdings, and option exercises in much greater detail than under previous rules.”

⁴³ Edward Stone, “New Executive Compensation Disclosures Proposed by the SEC,” *Journal of Corporate Accounting and Finance* (Autumn, 1992). William Lissy, “Currents in Compensation and Benefits,” *Compensation*

- Report salary and bonus separately, instead of reporting cash compensation, which combined salary and bonus.
- Report all forms of long-term incentives separately in a set of detailed tables (i.e., restricted stock, stock options, other forms of LTIP—e.g., performance units).

Around the time of the new SEC disclosure rule, there was extensive media and political attention on the disparity between CEO pay and average worker pay.⁴⁴ We argue that the importance of vertical comparisons (Wade, O’Reilly and Pollock, 2006), combined with attention to pay disparities, led to more horizontal pay comparisons between division managers.⁴⁵

Appendix B: Data Description and Sample Representativeness

The primary dataset used in this study includes a panel of more than 300 publicly-traded U.S. firms over the years 1986-1999, spanning a number of industries. The data are collected from a confidential compensation survey conducted by Hewitt Associates, a leading human resources consulting firm specializing in executive compensation and benefits. The survey is the largest private compensation survey (as measured by the number of participating firms), and the participants are typically leaders in their sectors. More than 75 percent of the firms in the dataset are listed as Fortune 500 firms in at least one year, and more than 85 percent are listed as Fortune 1000 firms. In general, Hewitt survey participants also participate in other compensation consulting firm surveys (e.g., Hay Associates, Mercer, Towers Perrin, to name a few) and do so primarily to receive information about pay practices to use as a competitive benchmark in evaluating their own compensation programs. It is important to note that the sample includes many more firms than Hewitt’s consulting client base, with at least 50 percent of the firms as survey participants with no other relationship to Hewitt.

and Benefits Review, May/June 1993. “[O]ld disclosure requirements were short on numbers but long on legalistic descriptions of complicated benefit plans.” (p. 91)

⁴⁴ From Murphy 1999, p. 50: “Legislation had been introduced in the House of Representatives disallowing deductions for compensation exceeding 25 times the lowest-paid worker.” In 1997, the AFL-CIO launched a website focusing exclusively on “exorbitant pay schemes that have created unprecedented inequities in the American workplace” and described as a “working families’ guide to monitoring and curtailing the excessive salaries, bonuses and perks in CEO compensation packages.” (pp. 51/76).

⁴⁵ Another regulation affecting CEO pay around this time period was the 162m ruling that imposed a cap on CEO cash compensation that was tax-deductible for corporations. The cap was \$1 million. It is not obvious how this regulation affected division manager pay.

We believe the survey data are accurate for several reasons. First, Hewitt personnel are knowledgeable about survey participants because they are assigned to specific participants for several years. Furthermore, while the participating firms initially match their positions to the benchmark positions in the survey, Hewitt personnel follow up to verify accuracy and spend an additional eight to ten hours on each questionnaire evaluating the consistency of responses with public data (e.g., proxy statements) and across years. Finally, participants have an incentive to match positions correctly and provide accurate data because they use the survey results to set pay levels and design management compensation programs.

Clearly, an important issue in datasets such as this one is the question of sample selection and whether the firms in the dataset are distinct from, or representative of, employers of similar size in their industry. The survey participants are typically the leaders in their sectors and, in fact, more than 75 percent of the firms in the dataset are listed as Fortune 500 firms in at least one year. We evaluate the representativeness of the broader sample by comparing key financial measures of our survey participants to a matched sample from Compustat. We begin by matching each firm in the Hewitt dataset to the Compustat firm that is closest in sales within its two-digit SIC industry in the year the firm joins the sample. We then perform Wilcoxon signed rank tests to compare the Hewitt firms with the matched firms. While the firms in the Hewitt dataset are, on average, have slightly larger sales than the matched sample, we find no statistically significant difference in employment and profitability (return on sales). We also find no statistically significant difference in sales growth, employment growth, or annual changes in profitability for all sample years. We also calculate financial measures for the sample of Compustat firms with 10,000 employees or greater over the period from 1986 to 1999 (excluding firms operating in financial services). On average, survey participants are more profitable, but growing at a slower rate than those in the sample of large Compustat firms. This is consistent with our observation that the firms in our sample are likely to be industry leaders (hence, slightly more profitable) and also large (hence, the slightly slower growth). In sum, the survey sample is most representative of Fortune 500 firms (for more details, see Rajan and Wulf, 2006).

Appendix C: Identification strategy

To be more precise and to illustrate our identification strategy, we introduce the following two (unobservable) variables: ψ and θ . $\psi(I) \in [0,1]$ represents the strength of peer influence on pay as a function of I , the degree of pay information available in the environment, where $\frac{\partial \psi}{\partial I} > 0$. As such, the elasticity of pay with respect to referent pay can be represented as $\beta_2 \psi(I)$. $I=1$ is an environment with full information about peer pay; $I=0$ is an environment with no information.

The variable θ represents all unobservable factors that simultaneously affect pay across division managers that are not captured through existing controls (i.e., team production, selection, common shocks). Critically, $\rho_{w\theta} = \text{corr}(\bar{w}_{-dt}, \theta) > 0$; that is, an increase in θ is correlated with an increase in peer pay. This correlation creates our challenge in separately identifying the effect of ψ and θ on pay and will bias upward the estimate of β_2 in equation 3 such that $\hat{\beta}_2 = \beta_2 + \rho_{w\theta} \frac{\sigma_\theta}{\sigma_w}$.

In an attempt to address this problem, we estimate β_2 for firms operating in different information environments. More specifically, consider the following equation that includes θ and an unbiased β_2 :

$$(4) w_{dt} = \alpha + \beta_1 s_{dt} + \beta_2 \psi(I) \bar{w}_{-dt} + \beta_\theta \theta + \dots,$$

where β_θ measures the association between wages and unobservable factors unrelated to peer influence. We assume $\psi(1)$ is full information sharing and $\psi(0)$ is no information sharing and that $\psi(1) > \psi(0)$, leading to the following two equations:

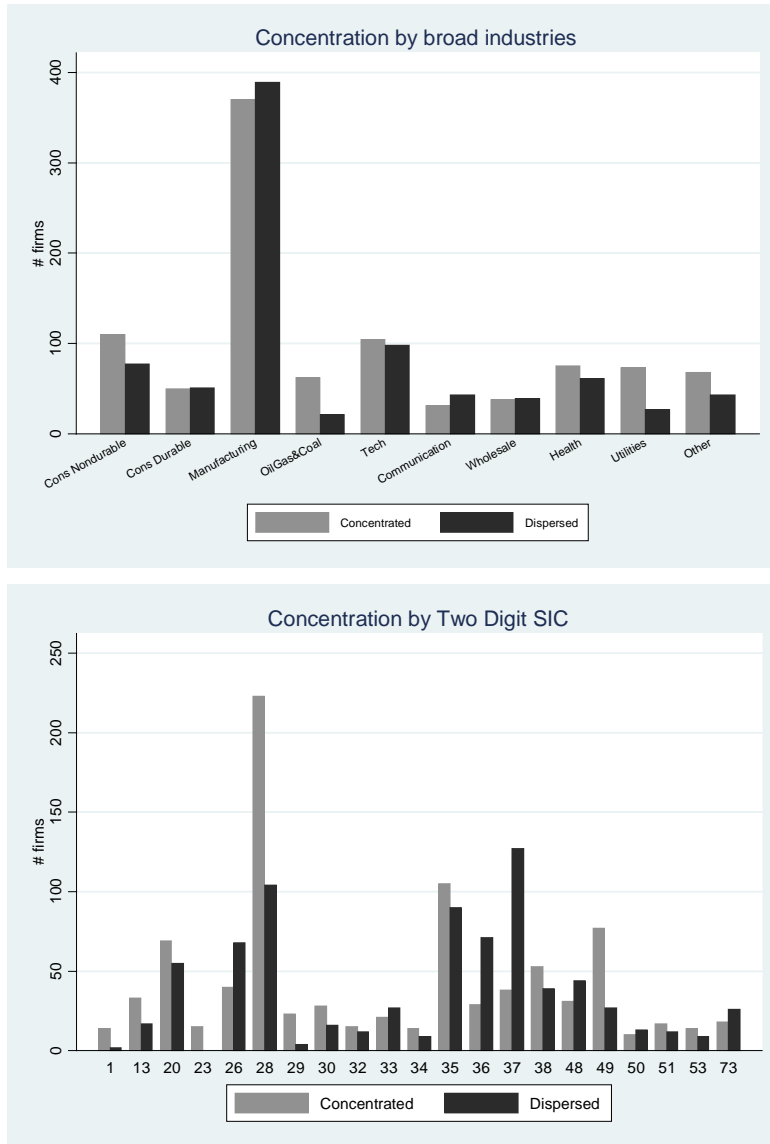
$$w_{dt} = \dots \beta_2 \psi(1) \bar{w}_{-dt} + \beta_\theta \theta + \dots$$

$$w_{dt} = \dots \beta_2 \psi(0) \bar{w}_{-dt} + \beta_\theta \theta + \dots$$

In our differences-in-differences models, we subtract the two equations and eliminate $\beta_\theta \theta$, giving us an unbiased estimate of $\beta_2 \psi$. To simplify and without loss of generality, if we define $\psi(0)=0$ and $\psi(1)=1$, then subtracting these two equations will yield an unbiased estimate of β_2 . Similar logic applies for estimates of β_1 (PPS).

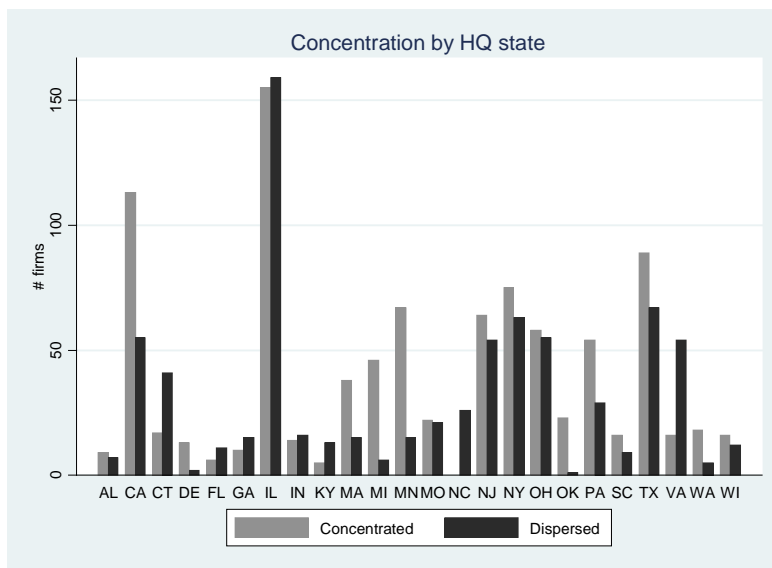
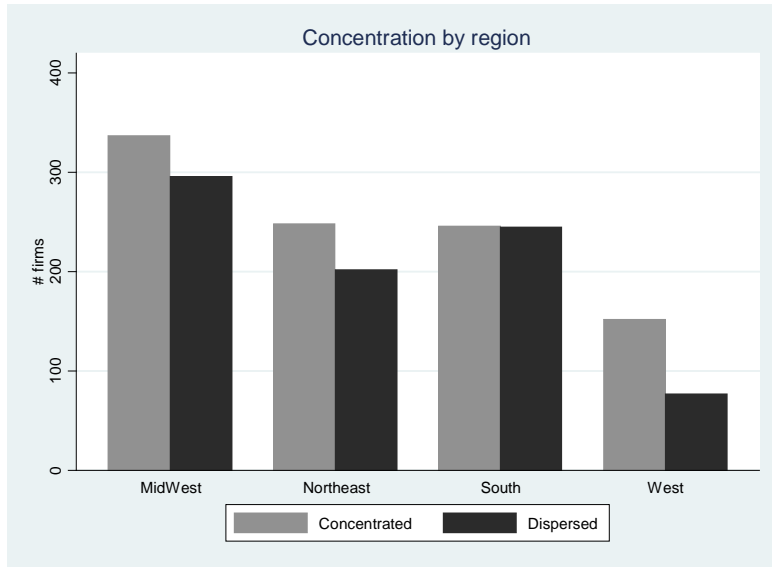
APPENDIX – Additional Figures

Figure A1: Distribution of Geographic Concentration by Industry



Notes: Bottom panel includes categories with 15 or more total firm-year observations. Two-digit SIC codes are as follows: 1- Agriculture Production-Crops; 13 – Oil and gas extraction; 20 – Food and kindred product; 23 – Apparel & other finished product; 26 – Paper and allied products; 28 – Chemicals and allied products; 29 – Petroleum refining and related industries; 30 – Rubber and misc plastics; 32 – Stone clay glass and concrete products; 33 – Primary metal industries; 34 – Fabricated metal products; 35 – Industrial and commercial machinery; 36 – Electronic and other electrical equipment; 37 – Transportation equipment; 38 – Measuring and analyzing instruments; 48 – Communications; 49 – Electric gas and sanitary services; 50 – Wholesale trade – durable goods; 51 – Wholesale trade – nondurable goods; 53 – General merchandise stores; 73 – Business services

Figure A2: Distribution of Geographic Concentration by HQ State



Notes: Top panel regions classified according to U.S. Census Bureau. Bottom panel includes categories with 15 or more total firm-year observations.

APPENDIX – Additional Tables

Table A1: Empirical Implications for Peer Comparison

Panel 1: Wage Regressions: PRS and PPS

<u>Pay Measures</u>	<u>Sample Split</u>	<u>Hypotheses</u>		<u>Mechanism & Interpretation</u>
	<u>Geography</u>	<u>PRS*Post 92</u>	<u>PPS*Post 92</u>	
All Measures	Dispersed	$\beta_2 > 0$	$\beta_1 < 0$	<ul style="list-style-type: none"> • Greater access to information facilitates peer comparison • Trade-off between PRS & PPS • No Difference post-92
	Concentrated	$\beta_2 = 0$	$\beta_1 = 0$	<ul style="list-style-type: none"> • No Difference post-92
	<u>Pre-1992 Disclosure</u>			
All Measures	Less Disclosure	$\beta_2 > 0$	$\beta_1 < 0$	<ul style="list-style-type: none"> • Greater access to information facilitates peer comparison • Tradeoff between PRS & PPS • No Difference post-92
	More Disclosure	$\beta_2 = 0$	$\beta_1 = 0$	<ul style="list-style-type: none"> • No Difference post-92

Panel 2: Pairs Distance Analysis: Pay Disparity

	<u>Same State</u>	<u>Different State</u>	<u>Peer comparison</u>	<u>Mechanism & Interpretation</u>
Pre 92	δ_0	$\delta_0 + \delta_2$	$\delta_2 > 0$	<ul style="list-style-type: none"> • Greater access to information facilitates peer comparison <ul style="list-style-type: none"> ○ Less distance btw same-state divisions pre 92
Post 92	$\delta_0 + \delta_1$	$\delta_0 + \delta_1 + \delta_2 + \delta_3$	n/a	<ul style="list-style-type: none"> • Performance-based pay increasing across all firms <ul style="list-style-type: none"> ○ More distance for all pairs post 92
Difference-in-Difference (post 92 – pre 92)	δ_1	$\delta_1 + \delta_3$	$\delta_3 < 0$	<ul style="list-style-type: none"> • Difference between before and after 92 less for different-state divisions

Table A2: Effect of 1992 SEC Proxy Rule on PRS and PPS in Geographically-Dispersed Firms: Less vs. More Disclosed Pay Pre-1992

Log pay type:	Base salary		Base + bonus		Total compensation	
	(1)	(2)	(3)	(4)	(5)	(6)
Less disclosed pay pre-1992 (N=2085)						
Log referent pay (PRS)	0.3672*** (0.0575)	0.1345** (0.0634)	0.4222*** (0.0498)	0.2455*** (0.0719)	0.5732*** (0.0378)	0.4996*** (0.0396)
Log division sales (PPS)	0.0897*** (0.0080)	0.0815*** (0.0100)	0.1148*** (0.0099)	0.1009*** (0.0126)	0.1330*** (0.0122)	0.1204*** (0.0162)
<i>Post 1992 Interactions</i>						
Log referent pay (PRS)* Post 1992	0.0494 (0.0451)	0.0997* (0.0517)	0.0918** (0.0463)	0.1422*** (0.0512)	0.1190** (0.0481)	0.1593*** (0.0470)
Log division sales (PPS)* Post 1992	-0.0231** (0.0090)	-0.0192* (0.0102)	-0.0261* (0.0148)	-0.0197 (0.0164)	-0.0304* (0.0180)	-0.0271 (0.0192)
R-squared	0.572	0.262	0.564	0.261	0.667	0.523
More disclosed pay pre-1992 (N=1527)						
Log referent pay (PRS)	0.4236*** (0.1112)	0.0715 (0.0996)	0.4878*** (0.0889)	0.3017*** (0.0947)	0.4632*** (0.0871)	0.3345*** (0.0722)
Log division sales (PPS)	0.1017*** (0.0151)	0.0942*** (0.0188)	0.1241*** (0.0203)	0.1088*** (0.0261)	0.1365*** (0.0192)	0.1167*** (0.0236)
<i>Post 1992 Interactions</i>						
Log referent pay (PRS)* Post 1992	-0.0045 (0.0700)	-0.0208 (0.0749)	0.0208 (0.0773)	-0.0157 (0.0893)	0.0802 (0.0727)	0.0255 (0.0931)
Log division sales (PPS)*Post 1992	-0.0057 (0.0128)	0.0020 (0.0122)	-0.0062 (0.0213)	0.0086 (0.0187)	0.0097 (0.0208)	0.0361** (0.0171)
R-squared	0.718	0.370	0.696	0.374	0.734	0.535
Firm and division controls, year FE	Y	Y	Y	Y	Y	Y
Firm performance* Post 1992	Y	Y	Y	Y	Y	Y
Division FE	N	Y	N	Y	N	Y

Standard errors clustered by firm. *** = $p < 0.01$, ** = $p < 0.05$, * = $p < 0.1$. *Less (more) disclosed pay pre-1992* defined as the set of firms in the top three (bottom two) quintiles as defined by the ratio of bonus plus lti to total compensation during the years 1990-1992. *Log referent pay* refers to the log mean pay of division managers, excluding the focal division, within a given firm and year. Referent pay is calculated using base salary in columns (1, 2), base+bonus in (3, 4) and total compensation in (5, 6). Concentrated (dispersed) firms are those in the highest (lowest) two quintiles of the proportion of divisions in the same state as headquarters. All pair-wise interactions and direct effects included in specification. Firm and division controls are the same as those in Table 2. Refer to footnote in Table 1 for additional definitions.

Table A3: Alternative Explanation: IT Intensity Changes

Log pay type: <i>N=3190</i>	Base salary		Base + bonus		Total compensation	
	(1)	(2)	(3)	(4)	(5)	(6)
Log referent pay (PRS)* Post 1992*IT Intensity	-0.0771** (0.0308)	-0.0548 (0.0402)	-0.0589* (0.0326)	-0.0681 (0.0456)	-0.0514 (0.0340)	-0.0389 (0.0362)
Log division sales (PPS)* Post 1992*IT Intensity	0.0056 (0.0065)	0.0046 (0.0071)	0.0085 (0.0086)	0.0082 (0.0092)	0.0114 (0.0098)	0.0082 (0.0110)
Firm and other controls, Year FE	Y	Y	Y	Y	Y	Y
Division FE	N	Y	N	Y	N	Y
Observations	3190	3190	3190	3190	3190	3190
R-squared	0.693	0.286	0.668	0.260	0.737	0.487

Standard errors clustered by firm. *** = $p < 0.01$, ** = $p < 0.05$, * = $p < 0.1$. *IT Intensity* is defined as the quintile for each firm in a given year of ratio of PCs/employee. *Log referent pay* refers to the log mean pay of division managers, excluding the focal division, within a given firm and year. Referent pay is calculated using base salary in columns (1, 2), base+bonus in (3, 4) and total compensation in (5, 6). Concentrated (dispersed) firms are those in the highest (lowest) two quintiles of the proportion of divisions in the same state as headquarters. All pair-wise interactions and direct effects included in specification. Firm and division controls are the same as those in Table 2. Refer to footnote in Table 1 for additional definitions.

Table A4: Alternative Explanation: Horizontal Job Rotation

	Tenure in position (in months)	
	(1)	(2)
Dispersed* Post 1992	-4.4047 (3.7573)	-3.9053 (3.4322)
Dispersed	7.4430 (4.5768)	4.1094 (2.5755)
Post 1992	11.8911*** (4.0926)	4.7726 (3.4361)
Year FE	Y	Y
Division FE	Y	N
Observations	6424	6424
R-squared	0.007	0.003

Standard errors clustered by firm. *** = $p < 0.01$, ** = $p < 0.05$, * = $p < 0.1$. Dependent variable is *Tenure in position*, Refer to footnote in Table 1 for additional definitions. *Dispersed* is defined as those firms in the lowest two quintiles of the proportion of divisions in the same state as headquarters.

Table A5: Alternative Explanation: Vertical Comparison to CEO Salary in Dispersed Firms

Log pay type: <i>N=4225</i>	Base salary		Base + bonus		Total compensation	
	(1)	(2)	(3)	(4)	(5)	(6)
Log CEO pay	0.1196*** (0.0296)	0.0310 (0.0418)	0.1345*** (0.0231)	0.1320*** (0.0296)	0.1593*** (0.0249)	0.1459*** (0.0307)
Log referent pay (PRS)	0.3957*** (0.0544)	0.1069* (0.0607)	0.4494*** (0.0410)	0.2230*** (0.0581)	0.4769*** (0.0383)	0.3548*** (0.0433)
Log division sales (PPS)	0.1016*** (0.0088)	0.0916*** (0.0108)	0.1254*** (0.0108)	0.1031*** (0.0147)	0.1407*** (0.0111)	0.1208*** (0.0142)
<i>Post 1992 Interactions</i>						
Log CEO pay* Post 1992	-0.1025*** (0.0316)	-0.0064 (0.0404)	-0.0536 (0.0349)	0.0140 (0.0303)	-0.0586* (0.0346)	-0.0270 (0.0325)
Log referent pay (PRS)* Post 1992	0.1893*** (0.0504)	0.1238** (0.0584)	0.1473*** (0.0450)	0.0862 (0.0579)	0.1445*** (0.0478)	0.1134** (0.0527)
Log division sales (PPS)* Post 1992	-0.0272*** (0.0079)	-0.0182** (0.0076)	-0.0320*** (0.0111)	-0.0140 (0.0109)	-0.0283** (0.0130)	-0.0131 (0.0137)
R-squared	0.703	0.296	0.695	0.292	0.763	0.514
Firm and division controls, year FE	Y	Y	Y	Y	Y	Y
Firm performance * Post 1992	Y	Y	Y	Y	Y	Y
Division FE	N	Y	N	Y	N	Y

Standard errors clustered by firm. *** = $p < 0.01$, ** = $p < 0.05$, * = $p < 0.1$. *Log CEO pay* refers to CEO base salary in Columns (1) and (2), CEO salary+bonus in Columns (3) and (4) and CEO total compensation in Columns (5) and (6). All pair-wise interactions and direct effects included in specification. Firm and division controls are the same as those in Table 2. Refer to footnote in Table 1 for additional definitions.

Table A6: Alternative Explanation: Tournament Pay Substitution in Dispersed Firms

Log pay type: Pay ratio type:	Base salary		Base + bonus		Total compensation	
	CEO/Div (1)	Group/Div (2)	CEO/Div (3)	Group/Div (4)	CEO/Div (5)	Group/Div (6)
Log referent pay (PRS)* Vertical pay* Post 1992	-0.0386 (0.0295)	-0.0599 (0.0471)	-0.0004 (0.0256)	-0.0390 (0.0536)	0.0001 (0.0259)	-0.0404 (0.0362)
Log division sales (PPS)* Vertical pay* Post 1992	0.0061** (0.0025)	0.0030 (0.0040)	0.0054* (0.0029)	0.0087* (0.0046)	0.0035 (0.0035)	0.0029 (0.0057)
Year FE	Y	Y	Y	Y	Y	Y
Division FE	Y	Y	Y	Y	Y	Y
Observations	4225	3595	4225	3595	4225	3595
R-squared	0.310	0.298	0.301	0.285	0.506	0.481

Standard errors clustered by firm. *** = $p < 0.01$, ** = $p < 0.05$, * = $p < 0.1$. *Vertical pay* is defined as the ratio of CEO pay to average division manager pay in a given firm year in Columns (1), (3) and (5) and average group manager to average division manager pay in Columns (2), (4), and (6). *Log referent pay* refers to the log mean pay of division managers, excluding the focal division, within a given firm and year. Referent pay and CEO and group manager pay refers to base salary in column (1, 2), base + bonus in (3, 4) and total compensation in (5, 6). All pair-wise interactions and direct effects included in specification. Firm and division controls are the same as those in Table 2. Refer to footnote in Table 1 for additional definitions.