Performance Measurement and Pay Dispersion

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ABSTRACT
We identify differences in performance measurement precision between jobs within the same firm as an important, yet previously unidentified, source of pay dispersion. Downes and Choi (2014) conclude in their review of prior research that pay dispersion will not cause employees to withhold effort when the dispersion reflects differences in performance. We extend their characterization of the effects of pay dispersion by examining whether, even though pay dispersion resulting from differences in performance measurement precision reflects differences in performance, employees nevertheless withhold effort because they perceive the process generating the pay dispersion as unfair. In a series of experiments we find that, consistent with Referent Cognition Theory, such performance measurement induced pay dispersion decreases lower-paid employees’ effort by decreasing their perception of pay fairness and that reducing such pay dispersion increases their effort by increasing their perception of pay fairness. We discuss the importance of these findings for practice and theory.

Keywords: effort; fairness; pay dispersion; performance measurement.
I. Introduction

Performance measurement and differences in pay between employees in the same firm (hereafter, “pay dispersion”) are two issues that have received considerable attention from researchers, regulators, and the popular press. Our study connects these two issues in a novel way by showing how differences between jobs in the ability to measure performance can lead to pay dispersion and examining whether this causes the lower-paid employees to withhold effort because they view such pay dispersion as unfair. In addition, we examine whether subsequently reducing such pay dispersion by increasing the lower-paid employee’s pay increases their effort, thereby offering one way that firms can potentially offset the negative effect on effort of such pay dispersion.

Performance measurement is a fundamental issue in accounting. Agency theory has shown that imprecision in measuring an individual employee’s performance results in a second-best (less than perfectly efficient) contract with that employee (Holmstrom 1979, Holmstrom and Milgrom 1991). Practicing managers also stress the limitations of various performance measures (Ittner and Larcker 2003, 1998), and archival research (e.g., Lazear 2000) documents cases of significant improvement in firm performance following the introduction of improved measurement and compensation systems.

Like performance measurement, pay dispersion has been studied extensively by researchers in a variety of areas, including economics (e.g., Mortensen 2003), management (e.g., Downes and Choi 2014), and accounting (e.g., Guo, Libby, and Liu 2017). Pay dispersion has also recently received considerable attention from regulators and the popular press (Pettypiece 2015; Picchi 2015; Economist 2016; Cohen 2015;
Seetharaman 2015; Gellman 2015; Ip 2015). One frequently discussed question is whether, and under what circumstances, the lower-paid employees react negatively to pay dispersion and how this affects their behavior, particularly their performance (Downes and Choi 2014; Shaw 2014).

From a conventional economics perspective, performance measurement precision relates to pay dispersion because when measures of individual job performance are less precise, employees receive less pay and respond by providing less effort. Likewise, when measures of individual job performance are more precise, employees receive more pay and respond by providing more effort. For example, revenue or customer satisfaction generated by a sales employee often provides a relatively precise measure of the employee’s performance. In contrast, operational measures, such as downtime percentages for a group of nuclear power plant technicians, provide relatively imprecise measures of the individual performance of one technician in the group. Consistent with such performance measurement differences, the Economic Research Institute [ERI] reports that the average total pay for sales managers is $142,541, with about 17% of that being paid in the form of incentives, whereas the average total pay for labor relations managers is $133,010, with essentially none of that being paid in the form of incentives.¹

¹ In addition to our model in Section 2, we use ERI’s 2017 compensation survey summary data to provide modest archival support for our conclusion that total pay is higher for jobs for which performance is more precisely measured. ERI surveys a majority of the Fortune 500 and thousands of other small and medium sized (public, private, and non-profit) organizations in the United States and Canada. Each participating organization provides salary and incentive information for each relevant job description, resulting in 120,000 observations across 218 separate job descriptions. Participating organizations also rate the necessary education level for each relevant job ranging from 1 (orally literate) to 11 (Ph.D degree or equivalent). We proxy for performance measurement precision with a dichotomous variable of 1 (n = 99) if any of the surveys indicated the job pays incentive pay and 0 (n = 119) otherwise. We also proxy for the level of skill required for a job with the average necessary education level. We regress the mean total compensation (salary plus incentive pay) for each job on our proxy for measurement precision while controlling for skill. We find a positive and statistically and economically significant coefficients for both
In addition, anecdotal evidence suggests that sales employees often receive higher pay both because of the importance of sales to the firm and also because the sales employees’ performance can be measured precisely.\(^2\)

We begin our study by showing analytically how differences in performance measurement precision between jobs can produce pay dispersion between those jobs. We then conduct a series of experiments to examine two main research questions regarding the consequences of this type of pay dispersion. First, we examine whether such pay dispersion causes the lower-paid employees to withhold effort. Second, we examine whether subsequently reducing such pay dispersion by raising the lower-paid employees’ pay increases employee effort, thereby offsetting the negative effect on effort of such pay dispersion.

In their review of prior research on pay dispersion, Downes and Choi (2014) conclude that the primary factor determining how lower-paid employees react to pay dispersion is whether they believe the differences in pay are due to differences in performance. If the lower-paid employees believe that pay dispersion arises from differences in performance, they will perceive their lower pay as fair and therefore provide the same level of effort as when there is no pay dispersion.\(^3\) However, if the

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\(^2\) Recent web posts (Tolan 2010; Goltz 2013) analyze why sales employees apparently earn more than other employees, attributing the higher pay to the importance of sales to the firm and to the firm’s ability to measure sales precisely. Tolan notes that, “In the end – in sales, what gets measured gets done.” One reply stresses the measurement precision issue, stating, “Not to mention the transparency associated with sales performance. There are few if any jobs in any company (CEO included) with such transparent metrics on performance.”
lower-paid employees believe that pay dispersion does not reflect differences in performance, they will perceive their lower pay as unfair and respond by withholding effort from the firm.

We agree with Downes and Choi (2014) that employees’ perceptions of the fairness of their pay are important, but view their characterization as incomplete because it implicitly assumes that firms measure performance with equal precision in all jobs. We extend their characterization of the effects of pay dispersion to reflect the more realistic assumption that performance measurement precision varies significantly across jobs.

Given this assumption, we draw on behavioral theory regarding the effects of perceived fairness and referent cognition theory (Cropanzano and Folger, 1989; Ambrose, Harland, and Kulik, 1991; Folger, 1986) to predict how lower-paid employees react to pay dispersion resulting from differences in the ability to measure performance precisely. Specifically, we predict that the lower-paid employees will view this type of pay dispersion as unfair and therefore withhold effort. We test this prediction in a series of experiments in a setting in which the firm uses employee performance measures optimally, but in which the performance measure for the lower-paid job is less precise than the performance measure for the higher-paid job.

The results of our experiments are consistent with our predictions. We find that lower-paid employees withhold effort from the firm when the pay dispersion results from differences in performance measurement precision in our first main experiment and also again in each of the two conditions of a related additional experiment. We collect a

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Downes and Choi use the word “legitimate” rather than “fair”, but we view these terms as capturing the same construct, which is that the dispersion is viewed as justified and therefore acceptable. We use the term “fair” from this point forward to describe this construct.
measure of the lower-paid employees’ fairness perceptions in our first main experiment and use mediation analysis to show that, consistent with our theoretical development, the lower-paid employees withhold effort because they view such pay dispersion as unfair. It appears that the lower-paid employees react negatively to their lack of control over whether they can earn as much in their job as the higher-paid employee for whom performance can be measured more precisely. Additional experiments further support our predictions by showing that lower-paid employees increase their effort when the firm subsequently reduces pay dispersion by raising the lower-paid employees’ pay. Further, consistent with the negative effort reaction to the pay dispersion, this positive effort reaction to reduced pay dispersion is mediated by a corresponding increase in perceived fairness.

Our findings contribute to the performance measurement and pay dispersion literatures and have important implications for practice. First, our model and attendant analyses demonstrate that differences in performance measurement precision across jobs can generate pay dispersion across such jobs. Performance measurement precision is a fundamental accounting issue and we connect it to pay levels to offer a novel explanation for why pay dispersion occurs.

Second, in combination with our experimental results showing that employees who are paid less because of differences in performance measurement precision withhold effort, our analytical result has important theoretical implications. Specifically, this combination of results extends the conclusion of Downes and Choi (2014) that lower-paid employees perceive pay dispersion that reflects differences in performance as fair. We show that lower-paid employees perceive pay dispersion that arises from differences
in performance measurement precision as unfair despite being based on measured performance differences. This finding suggests that expectations regarding the effects of pay dispersion should take into account the underlying reason for differences in measured performance. Specifically, it is important to distinguish between cases for which the lower-paid employees can control whether they earn more by working harder versus cases in which the lower-paid employees cannot control whether they earn more by working harder because their lower pay is the result of the firm’s inability to measure their performance more precisely. Consistent with Downes and Choi’s characterization, lower-paid employees in the first case are likely to view their pay as fair and not withhold effort. However, lower-paid employees in the latter case are likely to view their pay as unfair and thus withhold effort.

Our findings also have implications for practice by suggesting two ways that firms could potentially reduce the cost to the firm of lower-paid employees’ negative reactions to pay dispersion resulting from performance measurement differences. First, when cost effective, firms could reduce the pay dispersion by developing better performance measures for the jobs for which performance is currently less precisely measured. Second, when firms cannot develop better performance measures, they could reduce the pay dispersion by increasing the pay of the lower-paid employees. Of course, firms would only increase the pay of the lower-paid employees if the cost of doing this is less than the cost to the firm of the lower-paid employees’ negative reaction to pay dispersion. In summary, our results suggest that managers who set pay policies should consider a fuller range of potential costs and benefits.
Sections II and III describe our model of the relation between performance measurement and pay dispersion and develop our hypotheses concerning the consequences of pay dispersion resulting from performance measurement differences. Sections IV and V describe the method and results for our experiments. Section VI concludes with a discussion of our findings and the implications of our study.

II. Model of Performance Measurement and Pay Dispersion

In this section, we discuss our economic model of the relation between performance measurement and pay dispersion (See Appendix A). Owners select performance measures as part of their management control system to align employee incentives with firm objectives by basing employee pay on these measures (Brickley, Smith, and Zimmerman 1995). Our model analyzes how a profit-maximizing owner uses performance measures to compensate employees. The model shows how a difference in performance measurement precision between two jobs determines the extent of pay dispersion between the employees performing the jobs. Performance measure precision ultimately determines the inferences that the owner can draw concerning the action the employee took based on the performance measure. A more precise performance measure allows the owner to infer with more certainty whether the employee provided the effort the owner prefers.

In our model, a firm with a risk-neutral owner hires a risk-averse and effort-averse employee. The firm’s payoff depends on the employee’s effort and a random state outcome. Because firm value and employee effort are not contractible, the firm must base the employee’s pay on the best available measure of the employee’s performance. We
assume the available performance measures for some jobs are less precise measures of effort than the available performance measures for other jobs.

The firm’s choice of performance measure and a schedule specifying the employee’s pay for each level of the performance measure, together with a random state outcome, determine how much the employee will be paid in exchange for the effort the employee provides. The owner pays the employee the current market wage for a given job, meaning that the employee’s utility for pay less disutility for effort just equals the employee’s reservation utility. As a result, employees receive more (less) pay for supplying more (less) effort in jobs for which their performance can be measured more (less) precisely.\footnote{We make the simplifying assumption that employee productivity is equal in the two jobs.}

For example, the performance measure for some production jobs is relatively imprecise because it depends on both the employee’s individual effort and also on other employees’ effort, as well as on several random state outcomes for the production technology. In contrast, for many sales jobs, performance is measured based on customer satisfaction or total sales, which are relatively more precise measures because they depend largely on how much effort the employee expends in identifying and interacting with potential customers. The result is that differences in performance measurement precision between these jobs results in the sales employee being paid more than the production employee because the performance measure is more precise for the sales employee. Importantly, such pay dispersion is performance-based; i.e., the sales employee is paid more for performing at a higher level (providing more effort and
meeting a higher performance target) than the production employee. If the sales employee fails to achieve the performance target, s/he does not receive higher pay.

The following proposition summarizes how, given additional assumptions specified in the model, the level of an employee’s pay varies with measurement precision. Specifically, the proposition shows that as the precision of a performance measure increases, the owner will optimally adjust the employee’s contract to induce the employee to provide more effort in return for more pay. Therefore, if we compare one job with a less precise performance measure to a second job with a more precise performance measure and identical employees perform both jobs, the latter employee will receive more pay in exchange for more effort, i.e., there will be pay dispersion between the two employees (see appendix for proof).

Proposition: Assume a LEN (linear exponential normal) environment in which the employee’s contract is a linear function of the performance measure, the employee is risk-averse with a negative exponential utility function, and the firm’s payoff depends on employee effort plus a normally distributed random error term. Then as the variance of the noise term is reduced, making the performance measure more precise, the owner induces the employee to exert more effort and the employee’s expected pay increases.

Rather than “testing” this proposition regarding the relation between measurement precision and pay dispersion, we use our experiments to test our behavioral predictions regarding the consequences of the resulting performance measurement induced pay dispersion.

III. Hypotheses Development

Our hypotheses address how lower-paid employees respond to pay dispersion resulting from differences in the ability to measure performance. Our focus on
employees’ reaction to pay dispersion extends the conclusions of Downes and Choi (2014) described in their survey of the pay dispersion literature. They conclude that the mixed archival evidence on how employees react to pay dispersion reflects differences in lower-paid employees’ perceptions about whether the pay dispersion results from differences in performance. Specifically, Downes and Chow conclude that lower-paid employees who believe that pay differences reflect performance differences will accept the pay dispersion as fair and not withhold effort, while those who do not believe that the pay differences reflect performance differences will perceive the dispersion as unfair and withhold effort.

In our experimental setting, a firm hires two identical employees at the same time and randomly assigns one to a production job with an imprecise performance measure, and the other employee to a sales job with a more precise performance measure. The firm chooses an optimal level of effort and amount of pay for each employee. Consistent with the economic reasoning in the model described in the previous section, the production employee receives a fixed wage in both the initial period and the subsequent period as long as s/he meets the imprecise performance standard. The sales employee initially receives the same fixed wage but can receive an increase in pay in the subsequent period if her performance in the initial period meets a challenging specified target based on the more precise performance measures. The sales employee meets this target in the initial period.

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\(^4\)Prior experimental studies also find mixed results concerning how pay dispersion affects employee effort. Some studies find either a positive or no effect (Bartling and von Siemens 2011; Brown, Martin, Moser, and Weber 2015; Charness and Kuhn 2007; Kepes et al. 2009; Mueller, Ouimet, and Simintzi 2016). However, other studies find pay dispersion reduces lower-paid employee effort (e.g., Clark, Masclet and Villeval 2010; Cohn, Fehr, Hermann, and Scheider 2014; Cowherd and Levine 1992; Gachter and Thoeni 2010).
period and therefore receives the pay increase in the subsequent period, creating pay
dispersion between the lower-paid production employee and the higher-paid sales
employee.

Both employees are paid based on the performance measure available for their
job, but the performance measure for the production employee is relatively less precise.
Given this setting, we draw on referent cognition theory (RCT) to predict how the lower-
paid employee will react to the resulting pay dispersion. RCT proposes that individuals
assess fairness by comparing their outcomes (in our study, their pay) and the processes
that generated those outcomes to the corresponding experiences of other individuals
(Cropanzano and Folger, 1989). According to RCT, “people will feel unfairly treated
when they believe they would have obtained a more favorable outcome if another
procedure had been used” (Grienberger, Rutte and van Knippenberg, 1997, p. 913-914).

Based on RCT, we expect the lower-paid production employee in our setting to
perceive the pay dispersion as unfair because they have no control over the process, i.e.,
providing more effort cannot increase their pay as it can for the sales employee. In RCT,
the extent of control individuals have over the process determines how the resulting
outcomes influence their fairness perceptions. Studies find an interaction between control
over the process and the favorability of a referent outcome (i.e., the favorability of the
outcome for someone in a similar position relative to the participant’s outcome) on
perceptions of fairness (Cropanzano and Folger, 1989; Ambrose et al., 1991). Participants
in these studies felt unfairly treated only when they lacked control over the process by
which the outcomes were determined and faced a referent outcome that was more
favorable than their own. When participants had some control over the process that
determined the outcomes, they no longer felt unfairly treated, even when they faced a referent outcome that was more favorable than their own.

We hypothesize that the lower-paid production employee will compare their outcome (lower pay) and the process that generates that outcome against the outcome for the sales employee (higher pay) and the process that generated that outcome. In our setting, the lower-paid employee has no control over the measurability of his or her own effort, and therefore no opportunity to earn the higher pay earned by the sales employee. Therefore, despite the fact that the pay dispersion is based on performance differences, RCT predicts that the lower-paid employee will perceive the pay dispersion as unfair, which will cause them to withhold effort. This leads to our first hypothesis:

Hypothesis 1: When pay dispersion results from differences in performance measure precision, lower-paid employees will withhold effort because they perceive the pay dispersion as unfair.

The underlying logic for Hypothesis 1 extends Downes and Choi’s (2014) reasoning regarding the effect of pay dispersion by predicting that, even though the pay dispersion is based on differences in performance, it will be perceived as unfair by the lower-paid employee when the dispersion results from differences in the precision of performance measures. Downes and Choi do not address this issue because they classify pay as either performance-based or not performance-based, without regard to the

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6 An important feature of our setting is that the differential treatment of the two employees in terms of performance standards and compensation, rather than being treatment choices of the experimenter, are the firm’s optimal responses to the differential ability to measure performance between the two jobs. That is, firm profit is maximized by paying the production employee less for exerting lower effort and the sales employee more for exerting greater effort.
precision of the performance measures. However, from an accounting or economic perspective, the precision of performance measures is critically important.

Assuming support for Hypothesis 1, we next consider how a firm could potentially mitigate the negative effect of pay dispersion resulting from differences in performance measurement precision. Recently, firms such as Facebook, Gravity Payments, Wal-Mart, and McDonald’s have increased the pay of lower-paid employees in an attempt to mitigate the problems caused by pay dispersion (Cohen 2015, Isidore 2015, Seetharaman 2015, Whitehouse and Davidson 2015). Consistent with RCT, we expect that reducing pay dispersion resulting from differences in performance measurement precision will increase the lower-paid employees’ perceived pay fairness and thus their effort. That is, we expect lower-paid employees to view the reduced pay dispersion as the firm’s attempt to correct an unfair policy of paying employees differently because of differences in the precision of their performance measures. Thus, our second hypothesis is:

Hypothesis 2: When pay dispersion results from differences in performance measure precision, reducing pay dispersion by increasing lower-paid employees’ pay increases their effort, and this effect is mediated by an increase in their perceived pay fairness.

IV. Experiments

Overview of experiments

Experiment 1 tests Hypothesis 1, which predicts that when pay dispersion results from differences in the measurability of performance, lower-paid employees will withhold effort because they perceive the pay dispersion as unfair. Experiment 2 tests Hypothesis 2, which predicts that when pay dispersion results from differences in the
measurability of performance, reducing such pay dispersion by increasing the lower-paid employee’s pay increases their effort by increasing their perceived pay fairness. We conduct additional experiments related to our two main experiments to provide evidence that our results are not an artifact of our procedures. We use a pre-post two-period design in all our experiments, but the design of Experiment 2 and the related additional experiment is more elaborate in order to rule out alternative explanations for the results. All Experiments were approved by the University’s Institutional Review Board.

**Experiment 1**

**Participants**

We recruited 41 participants via Amazon’s Mechanical Turk (MTurk) online platform for our study. MTurk participants are similar to traditional laboratory-participants in terms of their willingness to provide effort (Farrell, Grenier, and Leiby 2017), but they are actual employees rather than only students and are more representative of the general population in terms of demographics (Buhrmester, Kwang and Gosling 2011). We required all participants to be located in the U.S. and to be “master” MTurkers with at least a 90% approval rating in prior MTurk participation. Our participants were 46% female, averaged 39.2 years old, and had an average of 16.5 years of work experience.

**Procedures**

Figure 1 provides a timeline of the procedures for Experiment 1. In step 1 participants read about the setting. All participants assumed the role of a recently hired
installer at an irrigation company, Sprinkle Inc. They were informed that the irrigation company also hired a sales associate at the same time that they were hired and at the same wage of 500 Lira per period. All monetary amounts in the study are stated in terms of Lira, an experimental currency that converts to U.S. dollars at a rate of 500 Lira per U.S. dollar. Because both the participants, i.e., installers, and the sales associates earned 500 Lira during period 1, there was no pay dispersion in period 1.

[Insert Figure 1 here]

Participants were informed that they (the installer) and the sales associate report directly to the general manager of the company. To give the scenario a realistic context, participants were further informed that installers dig water lines on customers’ property, remove tree roots, install irrigation nozzles, connect the irrigation system pieces, test the irrigation system, and efficiently finish each job. They also learned that the sales associate engages and recruits customers, provides installation quotes, answers customers’ questions, checks the finished irrigation system with customers, and coordinates the weekly schedule of installations.

There are two periods in the experiment. After reading the information described above, in step 2 the installers assessed the fairness of their 500 Lira Period 1 pay, which was the same as the sales associate’s pay for the period, by rating their agreement with the statement “My wage is fair given the work that I do for Sprinkle Inc.” on an 11-point scale with endpoints of -5 (strongly disagree) and +5 (strongly agree), and a midpoint of zero.
Next, in step 3 the installers chose an effort level for Period 1 from the following
menu.
As can be seen in the menu, the effort choices range from 0.1 to 1.0, with higher effort levels costing the installer more Lira. The instrument explained that although the general manager preferred that installers choose the highest effort level, the general manager could not determine which effort level an installer actually chose. Period 1 ended when the installer made an effort choice for the first period.

In step 4 participants were informed that because the sales associate’s Period 1 performance met a demanding customer satisfaction standard, Sprinkle Inc. increased the sales associate’s Period 2 wage to 1,000 Lira. Participants were further informed, however, that because the general manager could not measure whether the installer provided effort above the minimum standard of showing up for work, the installer’s pay remained at 500 Lira in Period 2. Thus, there is pay dispersion in Period 2, with the installer being paid 500 Lira and the Sales Associate being paid 1,000 Lira. The experimental materials for Experiment 1 provided a modest level of detail for why the sales associate’s pay was increased while their own pay was not. The intention was to provide the level of detail that employees would typically have in practice. However, as described in the results section, we conducted an additional experiment that included another condition that provided more extensive and explicit information about these issues to examine whether the level of detail matters.

After reading the additional information described above, in step 5 the installers assessed the fairness of their 500 Lira Period 2 pay, which was lower than the sales
associate’s pay of 1,000 Lira, using the same scale as in Period 1. Next, in step 6, installers chose their Period 2 effort level from the same menu as used in Period 1. Finally, in step 7 each installer completed a post experiment questionnaire, which included manipulation check questions and a variety of demographic and other questions. Installers took an average of five minutes and 25 seconds to complete the study and received their payment within 48 hours after finishing the task.

**Earnings**

Each installer’s earnings from the experiment equals the sum of Period 1 and Period 2 net wages. Net wage for each period equals the installer’s wage for the period minus the cost of the effort the installer chose that period. Installers earned a wage of 500 Lira in both Period 1 and in Period 2, and therefore participants could earn between 640 Lira ($1.28) and 980 Lira ($1.96) depending on their effort level choices. Participants’ average earnings were 867 Lira ($1.73).

**Dependent Variables**

Our primary dependent variables are *Effort*, measured as the cost of effort (in Lira), and *Fairness*, measured as the installer’s fairness assessment prior to making their effort choices. We measure *Effort* and *Fairness* both before (in Period 1) and after the sales associate received a wage increase (in Period 2). We also measure the effect of pay dispersion on the changes in installer effort and fairness perceptions between Period 1 and Period 2 and report these as descriptive statistics. That is, *Effort 1-2 Change*

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4 The minimum payment of 640 Lira equals a wage of 500 Lira in each of two periods and a cost of effort of 180 in each of two periods. The maximum payment of 980 Lira equals a wage of 500 Lira in each of two periods and a cost of effort of 10 in each of two periods.
(Fairness 1-2 Change) equals an installer’s Effort (Fairness) in Period 2 minus that installer’s Effort (Fairness) in Period 1.

Test of Hypothesis 1

Hypothesis 1 predicts that when pay dispersion results from differences in the measurability of performance, lower-paid employees will withhold effort because they perceive the pay dispersion as unfair. Mean Effort 1-2 Change is -25.12 Lira (Table 1, Panel A), which is a 31.8% decrease from Period 1 Effort to Period 2 Effort.9 We test the significance of this decrease in effort using multi-level model regression analysis, which controls for correlated error terms caused by our repeated measure research design (Luke 2004).10 In our regression, Effort is the dependent variable and Pay Dispersion (= 0 in Period 1; = 1 in Period 2) is the independent variable. For each installer, the regression includes two observations of Effort, one at each level of Pay Dispersion.11 Consistent with

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9 Thirty-eight of the 41 installers (93%) passed our manipulation check by correctly identifying that, in Period 2, Sprinkle Inc. did not pay its installers the same wage as it paid the Sales Associate (Table 1). Because the inferences about our results do not change if we exclude those installers who failed the manipulation check, we use the full sample of installers to test Hypothesis 1.

10 Other terms for a multi-level model include a hierarchical linear model, a nested model, a mixed model, and a random coefficient model. The term multi-level indicates that data are combined at the most disaggregated level, which in this case is the individual effort level. Further, a random effect coefficient is included to capture a second level of data aggregation at the individual participant level. OLS regression with clustered standard errors by participant (Petersen 2009) yields the same results.

11 Prior experimental economics and accounting research find that individuals generally do not conform strictly to assumptions of rationality and wealth maximization in two-party settings in which one party makes a decision that divides a given amount of wealth between the two parties (e.g., Evans, Hannan, Krishnan, and Moser 2001; Rankin, Schwartz, and Young 2008; Bohnet and Frey 1999). Thus, before considering the effect of pay dispersion, we expect that employees in the less precisely measured installer job to provide more than the minimum amount of effort, thereby sharing the total payoff with the firm. We tested this expectation based on whether installers’ Period 1 and Period 2 mean effort are greater than the minimum allowed of 10 Lira. In Periods 1 and 2 mean installer effort was 79.02 Lira and 53.90 Lira, both of which are significantly greater than the 10 Lira minimum (p < 0.01).
Hypothesis 1, Table 2, Panel A shows that Pay Dispersion has a significant negative effect on installers’ effort ($\beta_1 = -25.12, p < 0.01$).\textsuperscript{12}

[Insert Tables 1 and 2 here]

Hypothesis 1 predicts that the reason that lower-paid employee withhold effort is because they view the pay dispersion as unfair. Therefore, we use Baron and Kenny’s (1986) three-step approach to test whether their effort level is mediated by their perceived pay fairness. The steps are: 1) the predictor variable (Pay Dispersion) affects the dependent variable (Effort), 2) the predictor variable (Pay Dispersion) affects the mediator (Fairness), and 3) the mediator variable (Fairness) affects the dependent variable (Effort) after controlling for the predictor variable (Pay Dispersion). As reported above, Pay Dispersion has a significant negative effect on Effort. As shown in Panel B of Table 2, Pay Dispersion has a significant negative effect on Fairness ($\beta_1 = -2.44, p < 0.01$). Finally, as shown in Panel C of Table 2, Fairness has a significant positive effect on Effort ($\beta_2 = 4.16, p < 0.01$) after controlling for the effect of Pay Dispersion. Thus, our results support the Hypothesis 1 prediction that pay fairness partially mediates the negative effect of pay dispersion on installer effort.

To provide further evidence that Hypothesis 1 was supported for the reasons used to develop the hypothesis, we examine installer responses to two post-experiment questions (Unfair and Legitimate). Each question is measured on an 11-point scale (-5 strongly disagree to +5 strongly agree, with a midpoint of 0). Installers responded to the Unfair PEQ item, “It was unfair that Sprinkle Inc. could measure the sales associate’s performance, but could not measure my performance beyond whether I showed up for

\textsuperscript{12} All p-values reported in the paper are two-tailed.
work.” Installers’ mean response of 2.10 is significantly greater than the scale mid-point of 0 (not tabulated: t = 4.58, p < 0.01), indicating that, consistent with our theory, performance measurement differences are perceived to be an unfair rationale for pay dispersion.

Installers also responded to the Legitimate PEQ item “In period 2, the General Manager at Sprinkle Inc. had a legitimate reason to raise the Sales Associate’s pay to 1,000 Lira while keeping my pay at 500 Lira.” Because the mean response to this Legitimate question of -1.17 is significantly less than the scale mid-point of 0 (not tabulated: t = -2.45, p = 0.02), we conclude that participants did not consider an increase in only the sales associate’s pay to be legitimate. Consistent with our use of “Fair” to capture the construct that Downes and Choi (2014) call “legitimate,” Unfair and Legitimate and are highly negatively correlated (r = -0.67, p < 0.01) and both are correlated with Fairness 1-2 Change (Legitimate: r = 0.44, p < 0.01; Unfair: r = -0.29, p = 0.06). These results provide further support for the theory underlying Hypothesis 1 that lower-paid employees perceive performance measurement differences to be an unacceptable rationale for pay dispersion.

Additional Experiment

We next address two reasons why the effort results reported above could be misleading. First, assessing pay fairness before making their effort decisions could have increased the salience of fairness concerns, causing installers to decrease their effort in period 2 (Spencer, Zanna, and Fong 2005). Second, installers may not have fully understood two important facts about the pay dispersion they faced. They may not have understood 1) why the firm did not increase their pay in Period 2; and 2) that the Sales
Associate had to provide a high level of effort in Period 1 to reach the challenging performance target to receive the pay increase in Period 2.

To address these two concerns, we collected data from 93 additional MTurk participants in an additional experiment. We again required all MTurk participants to be located in the U.S. and to be “master” Mturkers with at least a 90% approval rating in prior MTurk participation. These participants were 49% female, averaged 37.1 years old, and had an average of 15.2 years of work experience. The additional experiment used the same design and procedures as Experiment 1 with two important modifications.

First, participants chose their effort level without first assessing pay fairness. Second, we manipulated the information provided to installers as Standard Information or Greater Information. The Standard Information condition used identical wording to that in Experiment 1. In the Greater Information condition, prior to the installers’ making their Period 1 effort choice, they received more explicit information about why the firm did not increase their pay for period 2 and also more explicit wording explaining that the sales associate needed to provide high effort in order to receive their pay increase in Period 2 (see appendix B for the wording used in each condition).

As shown in Panel A of Table 3, Mean Effort 1-2 Change in the Standard

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13 Eighty-one of the 93 (87%) installers passed our manipulation check by correctly identifying that, in Period 2, Sprinkle Inc. did not pay its installers the same wage as it paid the Sales Associate (Panel A of Table 3). Because none of our statistical inferences change if we exclude those installers who failed the manipulation check, we use the full sample of installers to test our hypothesis.

14 We report data from multiple experiments that were conducted at different times. MTurk workers who participated in any one experiment were not allowed to participate in any other experiment reported in the paper.

15 To ensure that participants in the Greater Information condition understood that the sales associate’s higher pay in period 2 was performance-based, they answered “true” or “false” to the following statement: “The Sales Associate received a pay increase in the most recent period (i.e., Period 2) by providing a high work level in Period 1 to achieve a challenging level of customer satisfaction.” Ninety-seven percent (47 out of 50) participants answered this question correctly.
Information condition was -12.79 Lira, which is a 17.1% decrease in Effort from period 1 to period 2 and Mean Effort 1-2 Change in the Greater Information condition was -8.40 Lira, which is a 12.5% decrease in Effort from period 1 to period 2. Importantly, as shown in Panel B of Table 3, consistent with our earlier test of Hypothesis 1, Pay Dispersion has a significant negative effect on installers’ Effort in both the Standard Information condition ($\beta_1 = -12.79, p < 0.01$) and in the Greater Information condition ($\beta_1 + \beta_3 = -8.40, p = 0.02$). Further, increased Information had neither a significant main effect on Effort ($\beta_2 = -7.68, p = 0.53$) nor did it interact with Pay Dispersion to affect Effort ($\beta_3 = 4.39, p = 0.48$). Thus, we provide three instances of support for Hypothesis 1, i.e., our test of Hypothesis 1 in Experiment 1, and now separate additional support in both the Standard Information condition and the Greater Information condition.

[Insert Table 3 here]

The fact that we replicate the original support for Hypothesis 1 from Experiment 1 in our additional modified experiment provides evidence that the original support cannot be attributed to two potential alternative explanations. First, our original support for Hypothesis 1 cannot be attributed to installers assessing pay fairness before making their effort choice. Second, our original support for Hypothesis 1 cannot be attributed to installers failing to understand why the firm could not increase their pay or that the sales associate needed to provide high effort in order to receive their pay increase.

**Experiment 2**

**Overview**

Experiment 2 tests Hypothesis 2, which predicts that when pay dispersion results from differences in performance measure precision, reducing pay dispersion by
increasing the lower-paid employees’ pay increases their effort because it increases their perceived pay fairness. Experiment 2 uses the same design and procedures as Experiment 1 except that we now introduce Period 3 and installers assess pay fairness and choose an effort level in Periods 2 and 3 rather than in Periods 1 and 2. That is, participants do not assess pay fairness or make an effort choice in Period 1, but they do in Period 2 as they did in Experiment 1, and then again in the new Period 3. In Period 3, participants are randomly assigned to one of three manipulations designed to examine the effect of reduced pay dispersion on lower-paid employees’ effort (details provided below). As in Experiment 1, the primary dependent variables are the installer’s effort level and perceived pay fairness in each of the two periods.

Participants

We recruited 148 participants via Amazon’s Mechanical Turk (MTurk) online platform to act as installers in Experiment 2. We again required all MTurk participants to be located in the U.S. and to be “master” Mturkers with at least a 90% approval rating in prior MTurk participation. Our participants were 55% female, averaged 36.4 years old, and had an average of 14.4 years of work experience. Participants took an average of eight minutes and 45 seconds to complete the experiment and received their pay within 48 hours after finishing the task.

Design

Experiment 2 includes three between-participant conditions manipulated in Period 3: Partial Reduction, Full Reduction, and No Dispersion Change. In the Partial Reduction and Full Reduction conditions pay dispersion between the installer and the sales associate is reduced in Period 3 by raising the installer’s Period 3 wage.
Specifically, in the *Partial Reduction* condition, the installer’s wage increases from 500 Lira in Period 2 to 750 Lira in Period 3, while the sales associate’s wage remains at 1,000 Lira in both periods. Therefore, the pay dispersion between the installer and the sales associate is reduced from 500 Lira in Period 2 (1,000 - 500) to 250 Lira in Period 3 (1,000 - 750). In the *Full Reduction* condition, the installer’s wage increases from 500 Lira in Period 2 to 1000 Lira in Period 3, while the sales associate’s wage remains at 1000 Lira in both periods. Therefore, the difference in pay dispersion between the installer and the sales associate is reduced from 500 Lira in Period 2 (1,000 - 500) to zero Lira in Period 3 (1,000 - 1,000).

Reducing the pay dispersion by raising the lower-paid installer’s wage from Period 2 to Period 3, as we do in the *Partial Reduction* and *Full Reduction* conditions, is consistent with recent actions by firms such as Facebook and Gravity Payments (Cohen 2015). However, if installers respond by increasing their effort from Period 2 to Period 3, this could simply be a response to receiving a higher wage in Period 3 rather than to the reduction in pay dispersion between Periods 2 and 3. An extensive gift-exchange literature (e.g., Akerlof 1982, Hannan et al. 2002, Kuang and Moser 2009, Choi 2014) shows that when employers offer employees a “gift” of a wage above the market-clearing wage, employees respond with a “gift” of costly effort above the minimum required amount. Thus, an alternative explanation for any increase in effort in the *Partial Reduction* and *Full Reduction* conditions in which pay dispersion is increased by increasing the installers’ wage could be that they simply responded positively to a perceived gift wage from the employer.
To test this alternative explanation for an increase in effort between Periods 2 and 3 in the *Partial Reduction* and *Full Reduction* conditions, we added a *No Dispersion Change* condition in which the wage increase that the installers receive is held constant at the same amount as in the *Partial Reduction* condition, while the sales associate’s wage is increased by the same amount as the increase for the installer. Consequently, the level of pay dispersion is held constant from Period 2 to Period 3 in the *No Dispersion Change* condition. Specifically, in the *No Dispersion Change* condition, we increase both the installer’s and sales associate’s wage by 250 Lira from Period 2 to Period 3 (from 500 Lira to 750 Lira for the installer and from 1,000 Lira to 1,250 Lira for the sales associate). This holds the increase in the installer’s wage constant across the *Partial Reduction* and *No Dispersion Change* conditions but varies the level of pay dispersion from 250 (1,000 – 750) in the *Partial Reduction* condition to 500 (1,250 – 750) in the *No Dispersion Change* condition. A finding of no increase in installers’ effort or their perceived pay fairness between Periods 2 and 3 in the *No Dispersion Change* condition where there is no change in pay dispersion would show that any increase in effort and perceived fairness between Periods 2 and 3 in the *Partial Reduction* and *Full Reduction* conditions was due to the reduction in pay dispersion rather than simply to the increase in installers’ pay.

**Earnings**

Each installer’s earnings in Experiment 2 equals the sum of Period 2 and Period 3 net wages. Net wage for each period equals the installer’s wage for the period minus the cost to the installer of the effort the installer chose that period. The Period 2 wage is always 500 Lira, but the Period 3 wage varies by experimental condition based on our pay dispersion manipulation as explained above. Participants in Experiment 2 could earn
between 890 Lira ($1.78) and 1,480 Lira ($2.96) depending on the wage level in their randomly assigned experimental condition and their effort level choices.\textsuperscript{16} Across our three experimental conditions participants average earnings were 1,173 Lira ($2.35).

**Dependent Variables**

Our primary dependent variables in Experiment 2 are the same as in Experiment 1. We measure \textit{Effort} and \textit{Fairness} both before (in Period 2) and after (in Period 3) our manipulations. We also report the change in perceived pay fairness between Periods 2 and 3 as a descriptive statistic. That is, \textit{Effort 2-3 Change (Fairness 2-3 Change)} equals an installer’s \textit{Effort (Fairness)} in Period 3 minus their \textit{Effort (Fairness)} in Period 2.

**Results**

**Test of Hypothesis 2**

Hypothesis 2 predicts that when pay dispersion results from differences in performance measure precision, reducing pay dispersion by increasing the lower-paid employees’ pay increases their effort because this increases their perceived pay fairness. As shown in Table 4, mean \textit{Effort 2-3 Change} in the Partial Reduction (PR) condition is 15.88 Lira, which is a 24.2\% increase in \textit{Effort} from Period 2 to Period 3, whereas mean \textit{Effort 2-3 Change} in the Full Reduction (FR) condition is 38.43 Lira, which is a 54.3\% increase from Period 2 to Period 3.\textsuperscript{17} As in Experiment 1, we test the significance of these

\textsuperscript{16} The minimum payment of 890 Lira equals a wage of 500 Lira in period 1 and a wage of 750 in the Partial Reduction condition and a cost of effort of 180 in each of two periods. The maximum payment of 1,480 Lira equals a wage of 500 Lira in the first period and a wage of 1,000 in the Full Reduction condition and a cost of effort of 10 in each of two periods.

\textsuperscript{17} One hundred thirty nine of 148 (94\%) participants passed our manipulation check by correctly identifying their Period 3 pay condition in the post experiment questionnaire (Table 4). Because none of our statistical
increases using multi-level model regression analysis, which controls for correlated error terms caused by our repeated measure research design (Luke 2004). Specifically, we conduct separate regressions for the \textit{Partial Reduction} and \textit{Full Reduction} conditions with \textit{Effort} as the dependent variable and \textit{Reduced Dispersion} (= 0 in Period 2; = 1 in Period 3) as the independent variable. For each installer, the regressions include two observations of \textit{Effort}, one at each level of \textit{Reduced Dispersion}. As shown in Panel A of Table 5, and consistent with Hypothesis 2, \textit{Reduced Dispersion} has a positive and significant effect on \textit{Effort} in both the \textit{Partial Reduction} ($\beta_1 = 15.88$, $p < 0.01$) and the \textit{Full Reduction} conditions ($\beta_1 = 38.43$, $p < 0.01$). Further, using an unpaired t-test to examine two independent populations, we find that, as expected, the positive effect of \textit{Reduced Dispersion} is greater in the \textit{Full Reduction} condition than in the \textit{Partial Reduction} condition (not tabulated; $p < 0.01$).\footnote{We also combined data from both reduction conditions and tested whether the effect of \textit{Reduced Dispersion} on \textit{Effort} differs by \textit{Condition} (0 = Partial Reduction; 1 = Full Reduction). While \textit{Reduced Dispersion} remained significant (untabulated: $\beta = 15.88$, $p < 0.01$) and \textit{Condition} was insignificant (untabulated: $\beta = 5.29$, $p = 0.66$), there was a significant positive \textit{Reduced Dispersion by Condition} interaction, indicating a greater increase in \textit{Effort} for participants in the \textit{Full Reduction} condition than those in the \textit{Partial Reduction} condition (untabulated: $\beta = 22.54$, $p < 0.01$).}

\footnotetext[18]{Pay dispersion can be measured by level or by ratio. The \textit{No Dispersion Change} condition measures pay dispersion as the difference between the two employees’ pay level and holds pay dispersion constant because the installer receives the same amount of pay increase as the sales associate, which means the difference between their pay is unchanged. Alternatively, pay dispersion could be held constant in terms of the ratio of the sales associate pay to the installer pay before and after the pay increase. We collected additional data with 48 MTurk participants for an additional condition in which the installer’s 250 Lira wage increase is matched by a corresponding 500 Lira increase in the sales associate’s wage, such that the ratio of their pay remained two-to-one before and after the increases. Mean of \textit{Effort Change} is -6.47 in this \textit{No Ratio Change} condition and \textit{Reduced Dispersion} is insignificant in multi-level analysis (untabulated; $p$}

We use the results from the \textit{No Dispersion Change} condition to rule out the alternative “gift exchange” explanation for the results for Hypothesis 2 reported above.\footnote{Inferences change if we exclude those participants who failed the manipulation check, we use the full sample of installers to test Hypothesis 2.}
As reported in Table 4, the mean *Effort Change* is -1.09 Lira in the *No Dispersion* condition. As shown in Panel A of Table 5, *Reduced Dispersion* has an insignificant effect on *Effort* ($\beta_1 = -1.09$, $p = 0.83$). This provides evidence that the support for Hypothesis 2 reported above is not due to installers reciprocating the firm’s gift of a higher wage in period 3, but rather due to the reduction in pay dispersion.

Hypothesis 2 also predicts that the positive effect of the reduced pay dispersion on the lower-paid employee’s effort reported above results from an increase in their perceived pay fairness. As we did for Experiment 1, we use Baron and Kenny’s (1986) three-step approach to test for mediation. First, as reported above, *Reduced Dispersion* has a significant positive effect on *Effort* in both the *Partial Reduction* and *Full Reduction* conditions. Second, as shown in Panel B of Table 5, *Reduced Dispersion* has a positive and significant effect on *Fairness* for both the *Partial Reduction* ($\beta_1 = 2.00$, $p < 0.01$) and *Full Reduction* ($\beta_1 = 5.11$, $p < 0.01$) conditions. Finally, as shown in Panel C of Table 5, *Reduced Dispersion* no longer affects *Effort* at conventional significance for either the *Partial Reduction* condition ($\beta_1 = 6.99$, $p = 0.63$) or the *Full Reduction* condition ($\beta_1 = 14.17$, $p = 0.59$) after controlling for the positive and significant effect of *Fairness* on *Effort* (*Partial Reduction*: $\beta_2 = 4.45$, $p < 0.01$; *Full Reduction*: $\beta_2 = 4.74$, $p < 0.01$). That is, *Fairness* fully mediates the effect of *Reduced Dispersion* on *Effort*, indicating that consistent with Hypothesis 2, the positive effect of reducing pay dispersion on the lower-paid employee’s effort results from increased perceived pay fairness.

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* = 0.23), which indicates there was no increase in *Effort* from period 2 to period 3. Thus, our conclusion that the installer responds to changes in pay dispersion rather than to a gift wage is robust to whether pay dispersion is measured as the difference in the two employees’ pay level or the ratio of their pay.
Additional Experiment

As in Experiment 1, a potential concern regarding Experiment 2 is that assessing pay fairness before choosing an effort level could drive the effects on effort (Spencer, Zanna, and Fong 2005). Therefore, we again conducted an additional experiment using the identical design as for Experiment 2, except that installers made their effort choices without first assessing pay fairness. We recruited 93 participants via Amazon’s Mechanical Turk (MTurk) to act as installers. We again required all MTurk participants to be located in the U.S. and to be “master” Mturkers with at least a 90% approval rating in prior MTurk participation. These participants were 55% female, averaged 37.4 years old and had an average of 14.8 years of work experience.  

As reported in Table 6, Panel A, mean Effort Change was 13.87 Lira for the Partial Reduction condition and 27.94 for the Full Reduction condition. Consistent with Experiment 2, as shown in Panel B of Table 6, Reduced Dispersion has a significant effect on Effort in both the Partial Reduction ($\beta_1 = 13.87, p < 0.01$) and Full Reduction ($\beta_1 = 27.94, p < 0.01$) conditions. Likewise, consistent with Experiment 2, as reported in Panel B of Table 6, Reduced Dispersion has an insignificant effect on Effort in the No Dispersion Change condition ($\beta_1 = -12.14, p = 0.15$). This replication of our Experiment 2 results provides additional support for Hypothesis 2 and is evidence that the results of Experiment 2 were not driven by installers’ assessing pay fairness before choosing their effort level.

[Insert Table 6 here]

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20 Eighty-nine of 93 (96%) participants passed our manipulation check by correctly identifying their Period 3 pay condition in the post experiment questionnaire (Table 6). Because the inferences about our results do not change if we exclude those participants who failed the manipulation check, we use the full sample of installers to test our hypothesis.
VI. Conclusion

We identify differences in performance measurement precision between jobs within the same firm as an important, but previously unidentified, source of pay dispersion. The results of Experiment 1 and the additional related experiment support our hypothesis that lower-paid employees will withhold effort in response to pay dispersion resulting from differences in performance measurement precision because they perceive the underlying rationale for such pay dispersion as unfair. The results of Experiment 2 and the additional related experiment show that reducing such pay dispersion by increasing the pay of lower-paid employees is one way firms can mitigate the negative effect on effort. The additional experiments rule out potential alternative explanations for the main results of Experiments 1 and 2 and provide evidence that the results are not artifacts due to our experimental procedures.

Our study makes several important contributions to the performance measurement and pay dispersion literatures. First, we identify and analyze how differences between jobs in the fundamental accounting process of measuring individual performance can generate pay dispersion across such jobs. This focus on how accounting can influence pay dispersion is important because prior research has identified pay basis, i.e., whether or not employees believe that differences in pay are due to differences in individual performance, as the most important moderator of the relation between pay dispersion and firm performance (Downes and Choi 2014, 56).

Second, our study is the first to find that pay dispersion resulting from differences in performance measurement precision cause the lower-paid employees to withhold effort
because they view such pay dispersion as unfair. We provide further support for our underlying theory by showing that reducing such pay dispersion by increasing the lower-paid employees’ pay increases their effort by increasing their perceived pay fairness. To our knowledge, we provide the first empirical evidence of the mediating effect of employees’ perceptions of pay fairness on the relation between increased and decreased pay dispersion on employee effort. That is, we provide empirical evidence regarding the theoretical mechanism by which pay dispersion affects employees’ effort. Most prior research on pay dispersion analyzes archival data. By emphasizing the role of fairness perceptions, we respond to the call by Downes and Choi (2014) to use experimental methods to “better understand the mechanisms of individuals’ responses to pay dispersion” (2014, 64).

Importantly, our results extend the conclusions of Downes and Choi (2014) that lower paid employees accept pay differences based on performance differences as fair and therefore do not respond negatively. We show that lower-paid employees perceive pay dispersion resulting from differences in performance measurement precision as unfair despite being based on performance differences. This suggests that management’s expectations regarding the effects of pay dispersion should take into account the underlying reasons for the differences in measured performance. For cases in which employees can control whether working hard leads to more pay, the lower-paid employees are likely to accept differences in pay as fair. However, for cases in which pay dispersion is due to differences in the ability to measure performance, lower paid employees are likely to perceive their pay as unfair and therefore withhold effort.

Our results suggest two ways that firms could reduce lower-paid employees’
negative reaction to pay dispersion resulting from differences in the ability to measure performance. First, if cost effective, firms could attempt to reduce pay dispersion by developing better performance measures for the lower-paid employees and therefore allow them to earn higher pay for better performance. Second, in cases where firms are unable to cost effectively develop better performance measures, they still might reduce the pay dispersion by increasing the lower-paid employees’ pay. Of course, firms would only do this if the increased effort they received in exchange for the increased pay exceeds the cost of the additional pay. In summary, our results suggest that managers establishing pay policies need to consider a wider range of potential costs and benefits than considered by Downes and Chow (2014).

Using experiments to test our hypotheses helps to clarify the role of “pay basis” on employee behavior. Archival pay dispersion studies that relate pay basis to firm performance face the problem that the firm’s choice of pay basis is endogenous, and therefore researchers try to control for this selection effect. Our experimental approach helps overcome such difficulties encountered in archival pay basis studies. Random assignment to our experimental conditions, overcomes selection problems due to employee characteristics such as experience, skill and risk preferences. Thus, we are able to draw stronger causal inferences about the effect of pay dispersion resulting from differences in performance measurement precision on lower-paid employee effort.

Two qualifications of our results offer opportunities for future research. Our design does not incorporate the increased compensation cost to the firm of increasing the lower-paid installer’s pay. Therefore, a possible extension would be to compare the benefit of increased lower-paid employees’ effort to the cost of increased pay to lower-
paid employees. Further, we only study the effect of pay dispersion resulting from differences in performance measurement precision and its subsequent reduction on the lower-paid employee’s effort. Therefore, a second possible extension would be to analyze the effect of such pay dispersion and its subsequent reduction on the higher-paid employee’s effort.
Appendix A

Part 1 of Appendix A demonstrates that performance measurement differences between two jobs can produce pay dispersion. Part 2 of Appendix A explains how we simplify the measurement of employee performance in our experimental task.

Part 1. Performance Measurement Settings that Generate Pay Dispersion

To study pay dispersion and how firms can manage it requires first establishing what causes the pay dispersion. This focus is consistent with Downes and Choi’s (2014, 58) conclusion that the effect of pay dispersion depends on whether employees perceive the dispersion as fair or not. In particular, employees’ perceptions of pay fairness are likely to depend on what causes the pay dispersion. We next show how pay dispersion can arise endogenously when firms choose optimal effort levels and payment schedule for employees in jobs that differ with respect to how precisely performance can be measured. In this way, Part 1 of Appendix A provides a performance measurement explanation for why pay dispersion occurs in our experimental setting.

Part 1 assumes a LEN (linear exponential normal) environment in which employee pay is a linear function of a performance measure, the employee is risk-averse with a negative exponential utility function and the firm’s payoff depends on employee effort plus a normally distributed random error term. The firm’s gross payoff depends on the employee’s effort and a random state outcome. We assume that the employee’s effort is private information but the gross payoff is contractible and serves as the performance measure that determines the employee’s pay. The precision of performance measurement in a given job is represented by the inverse of the variance of the random noise term in
the firm’s outcome, with reduced variance of the noise term reflecting more precise performance measurement.

Our model below shows that a profit-maximizing firm would pay two identical employees different amounts when they perform two jobs for which their marginal productivity is the same but performance is measured more precisely in the second job than in the first. Using the model, the proof below establishes conditions under which, starting with an initial performance measurement precision in one job, increasing the precision leads the owner to choose a higher level of desired effort from the employee and to increase the employee’s pay in order to induce the employee to supply that increased effort. The resulting two levels of pay for two levels of performance measurement precision produce pay dispersion between the employees performing the two jobs.

**Proposition:** Assume a LEN (linear exponential normal) environment in which the employee’s contract is a linear function of the performance measure, the employee is risk-averse with a negative exponential utility function, and the firm’s payoff depends on employee effort plus a normally distributed random error term. Then as the variance of the noise term is reduced, making the performance measure more precise, the owner induces the employee to exert more effort and the employee’s expected pay increases.

**Proof**

Let the firm’s gross payoff be a linear function of the employee’s effort (e) and , a randomly distributed error term, where \( \sim N(0, \sigma^2) \).

Firm gross payoff is \( (e) = fe + N(0, \sigma^2) \)

Employee compensation is \( S + \alpha \), where \( S \) is salary and \( \alpha \) is incentive compensation.

The employee has a negative exponential utility function with a coefficient of risk aversion of \( \beta \) and disutility of effort of \( e^2/2 \), so the employee’s expected utility (EU) is:

\[
EU = E(S + \alpha) - \text{var}(\alpha) - \frac{e^2}{2} = (S - e) = (1 - \alpha)fe - S
\]

The owner’s expected net payoff is:

\[
E() - E(S + \alpha) = fe - (S + \alpha e) = (1 - \alpha)fe - S
\]
The owner chooses $S$ and $\alpha$ to maximize the expected net payoff subject to the employee’s Individual Rationality (IR) and Incentive Compatibility (IC) constraints:

\[
\begin{align*}
\text{s.t.} \quad EU & \geq K \quad \text{(IR)} \\
& e \in \arg\max EU \quad \text{(IC)},
\end{align*}
\]

where $K$ is the employee’s reservation expected utility.

From the incentive compatibility (IC) constraint, the employee’s effort maximizes his expected utility:

\[
= 0 \Rightarrow \alpha f = e \Rightarrow \alpha^* = \quad \text{(1)}
\]

From the individual rationality (IR) constraint, the employee’s salary is such that his expected utility equals $K$, the reservation expected utility:

\[
S^* = K - \alpha f e^* + \alpha^2 \sigma^2 + e^2
\]

Substituting from (1) and (2) for $\alpha^*$ and $S^*$ into the owner’s profit maximization, the owner’s problem of becomes

which reduces to

The owner then optimizes over how much effort to induce the employee to choose, which yields:

\[
- = -(1 + ) = 0 \Rightarrow = < 0 \text{ because } > 0 \text{ and } r > 0.
\]

Therefore, as the signal becomes noisier, the employee exerts less equilibrium effort.

Next, substituting for $e^*$ in equation (1) gives:

\[
\alpha^* = , \quad < 0,
\]

which means that as the performance measured becomes more precise, the coefficient on the employee’s incentive compensation increases.

To analyze how the agent’s expected total pay varies with $\sigma^2$, we have

\[
\begin{align*}
E(S + \alpha) &= (K - \alpha f e + \alpha^2 \sigma^2 + e^2) + \alpha f e \\
&= K + \alpha^2 \sigma^2 + e^2
\end{align*}
\]
Substituting the equilibrium conditions for $\alpha^*$ and $e^*$ into the preceding equation gives:

\[
E(S + \alpha) \\
= K + + \\
= K + \\
= K + .
\]

Therefore, we have

\[
= < 0.
\]

This result establishes that as the signal becomes noisier, the employee’s expected compensation decreases, which is the desired result.

**Part 2. Performance Measurement in the Experimental Setting**

Our experimental setting simplifies measurement of employee performance to make the experimental task easier for participants to understand. In the experiment, a performance measure partitions or divides a set of signals about the employee’s performance into two or more subsets. For the Installer, the performance measure is attendance at work and the attendance signal takes on one of two values, indicating either that the Installer is present for work or not. The attendance signal is obviously a relatively imprecise measure of the Installer’s performance, but for simplicity, we assume that no more precise measure is available. The firm measures the Sales Associate’s performance based on the average response to a customer satisfaction survey, which is a much more precise performance measure than the attendance measure used for the Installer. The customer satisfaction signal enables the firm to set a relatively precise and demanding target for average customer satisfaction that the Sales Associate must achieve in order to receive a pay increase in the second period.
Appendix B

We used two information conditions in the additional experiment related to Experiment 1: Standard Information condition (used in all experiments) and Greater Information condition (used only as a second condition in the additional experiment related to Experiment 1). The additional information provided in the Greater Information condition is italicized below to highlight the difference between the two conditions, but this information was not italicized in the experimental instrument. There are no other differences between the Standard Information and Greater Information conditions.

Period 1 wording (differs by information condition)

Standard Information Condition

The General Manager hired you, the other two Installers, and the Sales Associate at the same time. Installers work an average of 40 hours a week, and their job is physically demanding and requires attention to details. Installers dig water lines in the ground, remove tree roots, install irrigation nozzles, connect the irrigation system pieces, test the irrigation system, and efficiently finish each job.

The Sales Associate also works an average of 40 hours a week with much of that time being spent talking to current and prospective customers or working at Sprinkle Inc.'s office. The Sales Associate engages customers and provides them with installation quotes, answers customers' questions, inspects the finished irrigation system with customers, and sets up the weekly schedule of installations.

Each Installer and the Sales Associate earns a wage of 500 Lira per period.

Greater Information Condition

The General Manager hired you, the other two Installers, and the Sales Associate at the same time. Installers work an average of 40 hours a week, and their job is physically demanding and requires attention to details. Installers dig water lines in the ground, remove tree roots, install irrigation nozzles, connect the irrigation system pieces, test the irrigation system, and efficiently finish each job.

The Sales Associate also works an average of 40 hours a week with much of that time being spent talking to current and prospective customers or working at Sprinkle Inc.'s office. The Sales Associate engages customers and provides them with installation quotes, answers customers' questions, inspects the finished irrigation system with customers, and sets up the weekly schedule of installations.

Each Installer and the Sales Associate earns a wage of 500 Lira per period.

*Sprinkle Inc.'s policy is to increase an employee’s wage after Period 1 if the General*
Manager can determine that an employee performed well in Period 1. This policy for increasing an employee’s wage means that for jobs such as the Sales Associate, for which the firm can measure the individual employee’s performance accurately, the employee is eligible for a wage increase in the second period depending on his or her first period performance. Specifically, customers complete a customer satisfaction survey to evaluate the Sales Associate’s performance for Period 1. The customer satisfaction survey results only reflect the effort and performance of the Sales Associate. The survey results provide no information regarding the Installers’ effort and performance. If the Period 1 customer satisfaction survey results reach a specified challenging target level, then the General Manager will increase the Sales Associate’s wage for Period 2. This policy gives the Sales Associate a strong financial incentive to work hard to reach the specified challenging level of customer satisfaction in Period 1.

However, the policy means that for jobs such as yours as an Installer, for which the firm cannot measure performance accurately, the employee is not eligible for a wage increase in Period 2. Specifically, the firm cannot measure your performance as an Installer in Period 1 or Period 2 because Installers’ work affects how long the system will last, which will not be known until sometime after Period 2. Therefore, the General Manager will not increase your wage in Period 2 regardless of your effort in Period 1.

**Period 2 wording (identical in both information conditions)**

A recent survey conducted by the General Manager showed a significant increase in customer satisfaction since you, the other Installers, and the Sales Associate were hired. This is great news for Sprinkle Inc. because customer satisfaction is a leading indicator of future profitability.

Based on the positive customer satisfaction survey results, the General Manager has increased the Sales Associate's wage from 500 to 1,000 Lira per period. Meanwhile, the General Manager has explained that Installers will continue to earn 500 Lira per period because the quality of their installation work will not be known until sometime in the future.
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Whitehouse, K., and P. Davidson. 2015. McDonald’s Raises Pay for 90,000 Employees.
Figure 1

Experiment 1 Timeline

Step 1
Explanation of setting and initial pay structure

Step 2
Participants assess the fairness of their pay in Period 1

Step 3
Participants choose their effort level for Period 1

Step 4
Sales Associate receives a pay increase creating pay dispersion

Step 5
Participants assess the fairness of their pay in Period 2

Step 6
Participants choose their effort level for Period 2

Step 7
Participants complete the PEQ

---

1 Participants assume the role of an Installer of irrigation systems and are informed that they were hired at the same time as a Sales Associate and that they and the Sales Associate receive the same pay for Period 1. Thus, there is no pay dispersion in Period 1. The explanation of the setting also included information about the nature of the work for both the Installers and Sales Associates and the organizational structure of the firm.

2 The PEQ contained a manipulation check and questions about factors that influenced participants’ choice of effort, their perceived legitimacy of the pay dispersion in Period 2, and their demographic characteristics.
Table 1: Experiment 1 Descriptive Results

<table>
<thead>
<tr>
<th></th>
<th>Period 1</th>
<th>Period 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Installer Pay</td>
<td>500 Lira</td>
<td>500 Lira</td>
</tr>
<tr>
<td>Sales Associate Pay</td>
<td>500 Lira</td>
<td>1000 Lira</td>
</tr>
<tr>
<td>Pay Dispersion</td>
<td>0 Lira</td>
<td>500 Lira</td>
</tr>
<tr>
<td>Participants</td>
<td>N = 41</td>
<td></td>
</tr>
<tr>
<td>Pass Manipulation Check (%)</td>
<td>38 (93%)</td>
<td></td>
</tr>
<tr>
<td>Mean (SD) Period 1 Effort</td>
<td>79.02 (58.90)</td>
<td></td>
</tr>
<tr>
<td>Mean (SD) Period 2 Effort</td>
<td>53.90 (54.40)</td>
<td></td>
</tr>
<tr>
<td>Mean (SD) Effort 1-2 Change</td>
<td>-25.12 (44.28)</td>
<td></td>
</tr>
<tr>
<td>Mean (SD) Period 1 Fairness</td>
<td>0.37 (2.66)</td>
<td></td>
</tr>
<tr>
<td>Mean (SD) Period 2 Fairness</td>
<td>-2.07 (3.25)</td>
<td></td>
</tr>
<tr>
<td>Mean (SD) Fairness 1-2 Change</td>
<td>-2.44 (3.18)</td>
<td></td>
</tr>
</tbody>
</table>

1 Forty-one participants took part in Experiment 1 and assumed the role of an installer who made decisions in two Periods. Effort reflects the cost of effort installers paid in Lira. Effort 1-2 Change is Period 2 Effort minus Period 1 Effort. Fairness is employees' rating of their agreement with the following statement on a -
5 (strongly disagree) to +5 (strongly agree) scale: “My wage is fair given the work that I do for Sprinkle Inc.” *Fairness 1-2 Change* is Period 2 Fairness minus Period 1 Fairness.

**Table 2: Experiment 1 Multi-level Analysis of Effort and Fairness**

### Panel A: The Effect of Pay Dispersion on Effort

Model: \( \text{Effort}_i = \beta_0 + \beta_1 \text{PayDispersion}_i + \varepsilon_i \)

<table>
<thead>
<tr>
<th>Model</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>104.15</td>
<td>(13.03, p &lt; 0.01)</td>
</tr>
<tr>
<td>Pay Dispersion</td>
<td>-25.12</td>
<td>(6.83, p &lt; 0.01)</td>
</tr>
<tr>
<td>Bryk-Raudenbush R²</td>
<td>0.248</td>
<td></td>
</tr>
<tr>
<td>Observations</td>
<td>n = 82</td>
<td></td>
</tr>
</tbody>
</table>

### Panel B: The Effect of Pay Dispersion on Fairness

Model: \( \text{Fairness}_i = \beta_0 + \beta_1 \text{PayDispersion}_i + \varepsilon_i \)

<table>
<thead>
<tr>
<th>Model</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>2.80</td>
<td>(0.83, p &lt; 0.01)</td>
</tr>
<tr>
<td>Pay Dispersion</td>
<td>-2.44</td>
<td>(0.49, p &lt; 0.01)</td>
</tr>
<tr>
<td>Bryk-Raudenbush R²</td>
<td>0.376</td>
<td></td>
</tr>
<tr>
<td>Observations</td>
<td>n = 82</td>
<td></td>
</tr>
</tbody>
</table>

### Panel C: The Effect of Pay Dispersion on Effort Controlling for Fairness

Model: \( \text{Effort}_i = \beta_0 + \beta_1 \text{PayDispersion}_i + \beta_2 \text{Fairness}_i + \varepsilon_i \)

<table>
<thead>
<tr>
<th>Model</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>92.47</td>
<td>(13.47, p &lt; 0.01)</td>
</tr>
<tr>
<td>Pay Dispersion</td>
<td>-14.97</td>
<td>(7.81, p = 0.06)</td>
</tr>
<tr>
<td>Fairness</td>
<td>4.16</td>
<td>(1.74, p &lt; 0.01)</td>
</tr>
<tr>
<td>Bryk-Raudenbush R²</td>
<td>0.316</td>
<td></td>
</tr>
<tr>
<td>Observations</td>
<td>n = 82</td>
<td></td>
</tr>
</tbody>
</table>
See Table 1 for variable definitions. In all three panels, model subscript $i$ refers to participant ($i = 1, 2,$ etc.) and model subscript $t$ refers to period ($t = 1$ or $2$). Each line of regression results reports the unstandardized regression coefficients (standard error, p-value). Our within-subject manipulation of *Pay Dispersion* was applied between period 1 and period 2. We code *Pay Dispersion* as 0 in period 1 and 1 in period 2. We use multi-level model regressions to correct standard errors for correlated error terms caused by two observations of effort and fairness for each participant. An individual level random effect parameter is included in each regression, but related results are not reported in the table. p-values are shown two-tailed.
Table 3: Experiment 1 Additional Data¹

Panel A: Descriptives

<table>
<thead>
<tr>
<th>Information</th>
<th>Standard</th>
<th>Greater</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Participants</td>
<td>n = 43</td>
<td>n = 50</td>
<td>N = 93</td>
</tr>
<tr>
<td>Pass Manipulation Check (%)</td>
<td>37 (86%)</td>
<td>44 (88%)</td>
<td>81 (87%)</td>
</tr>
<tr>
<td>Mean (SD) Period 1 Effort</td>
<td>74.88 (62.99)</td>
<td>67.20 (61.48)</td>
<td>70.75 (61.96)</td>
</tr>
<tr>
<td>Mean (SD) Period 2 Effort</td>
<td>62.09 (59.90)</td>
<td>58.80 (56.27)</td>
<td>60.32 (57.68)</td>
</tr>
<tr>
<td>Mean (SD) Effort 1-2 Change</td>
<td>-12.79 (25.75)</td>
<td>-8.40 (24.44)</td>
<td>-10.43 (30.10)</td>
</tr>
</tbody>
</table>

Panel B: Multi-level Regression of the Effect of Pay Dispersion and Information on Effort

Model: \( \text{Effort}_i = \beta_0 + \beta_1 \text{PayDispersion}_i + \beta_2 \text{Information}_i + \beta_3 \text{PayDispersion*Information}_i + \epsilon_i \)

<table>
<thead>
<tr>
<th>Model</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>74.88</td>
</tr>
<tr>
<td></td>
<td>(9.07, p &lt; 0.01)</td>
</tr>
<tr>
<td>Pay Dispersion</td>
<td>-12.79</td>
</tr>
<tr>
<td></td>
<td>(4.55, p &lt; 0.01)</td>
</tr>
<tr>
<td>Information</td>
<td>-7.68</td>
</tr>
<tr>
<td></td>
<td>(12.37, p = 0.53)</td>
</tr>
<tr>
<td>Pay Dispersion*Information</td>
<td>4.39</td>
</tr>
<tr>
<td></td>
<td>(6.21, p = 0.48)</td>
</tr>
</tbody>
</table>

\(^1\) Ninety-three participants participated and assumed the role of an installer the responded made decisions in two Periods. We manipulated two Information conditions (Standard = 0 vs. Greater = 1). The wording for each Information condition is presented in full in Appendix B. Data for the two conditions were collected.
at different times. See Table 1 for all other variable definitions. In panel B, model subscript i refers to participant (i = 1, 2, etc.) and model subscript t refers to period (t = 1 or 2). Each line of regression results in Panel B reports the unstandardized regression coefficients (standard error, p-value). Our Pay Dispersion manipulation was applied between period 1 and period 2. We code Pay Dispersion as 0 in period 1 and 1 in period 2. We use multi-level model regressions to correct standard errors for correlated error terms caused by our collecting two observations of effort for each participant. An individual level random effect parameter is included in each regression, but related results are not reported in the table. p-values are shown two-tailed.

Table 4: Experiment 2 Descriptive Results by Experimental Condition

<table>
<thead>
<tr>
<th>All Conditions</th>
<th>Period 2</th>
<th>Period 3 Experimental Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Installer Pay</td>
<td>500 Lira</td>
<td>750 Lira 1000 Lira 750 Lira</td>
</tr>
<tr>
<td>Sales Associate Pay</td>
<td>1000 Lira</td>
<td>1000 Lira 1000 Lira 1250 Lira</td>
</tr>
<tr>
<td>Pay Dispersion</td>
<td>500 Lira</td>
<td>250 Lira 0 Lira 500 Lira</td>
</tr>
<tr>
<td>PR</td>
<td>N = 51</td>
<td>N = 51</td>
</tr>
<tr>
<td>FR</td>
<td>48 (94%)</td>
<td>47 (92%)</td>
</tr>
<tr>
<td>NDC</td>
<td>44 (96%)</td>
<td></td>
</tr>
<tr>
<td>Mean (SD) Period 2 Effort</td>
<td>65.49 (58.42)</td>
<td>70.78 (56.03)</td>
</tr>
<tr>
<td>Mean (SD) Period 3 Effort</td>
<td>81.37 (60.89)</td>
<td>109.21 (65.87)</td>
</tr>
<tr>
<td>Mean (SD) Effort 2-3 Change</td>
<td>15.88 (29.33)</td>
<td>38.43 (49.25)</td>
</tr>
<tr>
<td>Mean (SD) Period 2 Fairness</td>
<td>-2.12 (2.41)</td>
<td>-2.17 (2.76)</td>
</tr>
<tr>
<td>Mean (SD) Period 3 Fairness</td>
<td>-0.12 (2.64)</td>
<td>2.94 (2.28)</td>
</tr>
<tr>
<td>Mean (SD) Fairness 2-3 Change</td>
<td>2.00 (2.16)</td>
<td>5.11 (3.30)</td>
</tr>
</tbody>
</table>

Legend:
PR = Partial Reduction condition
FR = Full Reduction condition
NDC = No Dispersion Change condition
One hundred forty-eight participants took part in Experiment 2 and assumed the role of an installer who made decisions in two Periods. Effort reflects the cost of effort installers paid in Lira. Effort 2-3 Change is Period 3 Effort minus Period 2 Effort. Fairness is employees’ rating of their agreement with the following statement on a -5 (strongly disagree) to +5 (strongly agree) scale: “My wage is fair given the work that I do for Sprinkle Inc.” Fairness 2-3 Change is Period 3 Fairness minus Period 2 Fairness. The three conditions are: 1) Partial Reduction (PR): Installer wage increases from 500 Lira in period 1 to 750 Lira in period 3, and Sales Associate wage is 1000 Lira in period 2 and period 3; 2) Full Reduction (FR): Installer wage increases from 500 Lira in period 2 to 1000 Lira in period 3, and Sales Associate’s wage is 1000 Lira in period 2 and period 3; 3) No Dispersion Change (NDC): Installer wage increases from 500 Lira in period 2 to 750 Lira in period 3, whereas sales associate wage is increased from 1000 Lira in period 2 to 1250 Lira in period 3.

Table 5: Experiment 2 Multi-level Analysis of Effort and Fairness

Panel A: The Effect of Reduced Pay Dispersion on Effort

Model: \( \text{Effort}_it = \beta_0 + \beta_1 \text{ReducedDispersion}_it + \epsilon_i \)

<table>
<thead>
<tr>
<th></th>
<th>PR</th>
<th>FR</th>
<th>NDC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>49.61 (10.08, p &lt; 0.01)</td>
<td>32.35 (12.85, p = 0.01)</td>
<td>81.74 (11.86, p &lt; 0.01)</td>
</tr>
<tr>
<td>Reduced Dispersion</td>
<td>15.88 (4.07, p &lt; 0.01)</td>
<td>38.43 (6.82, p &lt; 0.01)</td>
<td>-1.09 (5.11, p = 0.83)</td>
</tr>
<tr>
<td>Bryk-Raudenbush R²</td>
<td>0.230</td>
<td>0.383</td>
<td>0.001</td>
</tr>
<tr>
<td>Observations</td>
<td>n = 102</td>
<td>n = 102</td>
<td>n = 92</td>
</tr>
</tbody>
</table>

Panel B: The Effect on Fairness

Model: \( \text{Fairness}_it = \beta_0 + \beta_1 \text{ReducedDispersion}_it + \epsilon_i \)

<table>
<thead>
<tr>
<th></th>
<th>PR</th>
<th>FR</th>
<th>NDC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>-4.12 (0.55, p &lt; 0.01)</td>
<td>-7.29 (0.74, p &lt; 0.01)</td>
<td>-1.61 (0.57, p &lt; 0.01)</td>
</tr>
<tr>
<td>Reduced Dispersion</td>
<td>2.00 (0.30, p &lt; 0.01)</td>
<td>5.11 (0.46, p &lt; 0.01)</td>
<td>0.24 (0.26, p = 0.37)</td>
</tr>
<tr>
<td>Bryk-Raudenbush R²</td>
<td>0.466</td>
<td>0.585</td>
<td>0.017</td>
</tr>
<tr>
<td>Observations</td>
<td>n = 102</td>
<td>n = 102</td>
<td>n = 92</td>
</tr>
</tbody>
</table>

Panel C: The Effect on Effort Controlling for Fairness

Model: \( \text{Effort}_it = \beta_0 + \beta_1 \text{ReducedDispersion}_it + \beta_2 \text{Fairness}_it + \epsilon_i \)

<table>
<thead>
<tr>
<th></th>
<th>PR</th>
<th>FR</th>
<th>NDC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>67.91 (11.78, p &lt; 0.01)</td>
<td>66.93 (18.03, p &lt; 0.01)</td>
<td>90.29 (11.95, p &lt; 0.01)</td>
</tr>
<tr>
<td>Reduced Dispersion</td>
<td>6.99</td>
<td>14.17</td>
<td>-2.36</td>
</tr>
<tr>
<td>--------------------</td>
<td>-------</td>
<td>-------</td>
<td>-------</td>
</tr>
<tr>
<td></td>
<td>(5.01, p = 0.63)</td>
<td>(11.28, p = 0.59)</td>
<td>(4.95, p = 0.63)</td>
</tr>
<tr>
<td>Fairness</td>
<td>4.45</td>
<td>4.74</td>
<td>5.32</td>
</tr>
<tr>
<td></td>
<td>(1.60, p &lt; 0.01)</td>
<td>(1.79, p &lt; 0.01)</td>
<td>(2.08, p = 0.01)</td>
</tr>
<tr>
<td>Bryk-Raudenbush $R^2$</td>
<td>0.307</td>
<td>0.431</td>
<td>0.077</td>
</tr>
<tr>
<td>Observations</td>
<td>n = 102</td>
<td>n = 102</td>
<td>n = 92</td>
</tr>
</tbody>
</table>

**Table 5: Continued**

Legend:
- PR = Partial Reduction condition
- FR = Full Reduction condition
- NDC = No Dispersion Change condition

¹See Table 4 for variable definitions. In all three panels, model subscript $i$ refers to participant ($i = 1, \ldots, 51$ in “PR” and “FR”; $i = 1, \ldots, 46$ in “NDC”) and model subscript $t$ refers to period ($t = 1$ or $2$). Each line of regression results reports the unstandardized regression coefficients (standard error, p-value), one for each condition. Our manipulation was applied between period 2 and period 3. We use multi-level model regressions to correct standard errors for correlated error terms caused by two observations of effort and fairness for each participant. An individual level random effect parameter is included in each regression, but related results are not reported in the tables. p-values are shown two-tailed.
Table 6: Experiment 2 Additional Data

Panel A: Descriptives

<table>
<thead>
<tr>
<th></th>
<th>PR</th>
<th>FR</th>
<th>NDC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Participants</td>
<td>N = 31</td>
<td>N = 34</td>
<td>N = 28</td>
</tr>
<tr>
<td>Pass Manipulation Check (%)</td>
<td>30 (97%)</td>
<td>31 (92%)</td>
<td>28 (100%)</td>
</tr>
<tr>
<td>Mean (SD) Period 2 Effort</td>
<td>80.32 (67.95)</td>
<td>84.12 (63.87)</td>
<td>87.50 (58.29)</td>
</tr>
<tr>
<td>Mean (SD) Period 3 Effort</td>
<td>94.19 (68.84)</td>
<td>112.06 (64.37)</td>
<td>75.36 (58.15)</td>
</tr>
<tr>
<td>Mean (SD) Effort 2-3 Change</td>
<td>13.87 (25.78)</td>
<td>27.94 (47.78)</td>
<td>-12.14 (45.73)</td>
</tr>
</tbody>
</table>

Panel B: Multi-level Regression for The Effect on Effort

Model: $Effort_{it} = \beta_0 + \beta_\text{ReducedDispersion}_{it} + \varepsilon_{it}$

<table>
<thead>
<tr>
<th></th>
<th>PR</th>
<th>FR</th>
<th>NDC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>80.32</td>
<td>84.12</td>
<td>87.50</td>
</tr>
<tr>
<td></td>
<td>(12.08, p &lt; 0.01)</td>
<td>(10.83, p &lt; 0.01)</td>
<td>(10.80, p &lt; 0.01)</td>
</tr>
<tr>
<td>Reduced Dispersion</td>
<td>13.87</td>
<td>27.94</td>
<td>-12.14</td>
</tr>
<tr>
<td></td>
<td>(4.55, p &lt; 0.01)</td>
<td>(8.07, p &lt; 0.01)</td>
<td>(8.49, p = 0.15)</td>
</tr>
<tr>
<td>Bryk-Raudenbush $R^2$</td>
<td>0.230</td>
<td>0.261</td>
<td>0.068</td>
</tr>
<tr>
<td>Observations</td>
<td>n = 62</td>
<td>n = 68</td>
<td>n = 56</td>
</tr>
</tbody>
</table>

Legend:
PR = Partial Reduction condition
FR = Full Reduction condition
NDC = No Dispersion Change condition
Ninety-three participants participated in Experiment 2 additional data and assumed the role of an installer that made decisions in two Periods. See Table 4 for variable definitions. In panel B, model subscript $i$ refers to participant ($i = 1, \ldots, 51$ in “PR” and “FR”; $i = 1, \ldots, 46$ in “NDC”) and model subscript $t$ refers to period ($t = 1$ or $2$). Each line of regression results reports the unstandardized regression coefficients (standard error, $p$-value), one for each condition. Our manipulation was applied between period 2 and period 3. We use multi-level model regressions to correct standard errors for correlated error terms caused by two observations of effort and fairness for each participant. An individual level random effect parameter is included in each regression, but related results are not reported in the tables. $p$-values are shown two-tailed.