

# **An Empirical Analysis of Employee Responses to Bonuses and Penalties**

**Wim A. Van der Stede**☆

Department of Accounting  
London School of Economics and Political Science  
w.van-der-stede@lse.ac.uk

**Anne Wu**

Department of Accounting  
College of Commerce  
National Chengchi University  
anwu@nccu.edu.tw

**Steve Yuching Wu**

School of Business  
Faculty of Business and Economics  
University of Hong Kong  
sycwu@hku.hk

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☆ Corresponding author: Wim A. Van der Stede, Department of Accounting, London School of Economics, Houghton Street, London WC2A 2AE, UK, tel. +44 (0)20 7955 6695, w.van-der-stede@lse.ac.uk.

## **An Empirical Analysis of Employee Responses to Bonuses and Penalties**

**ABSTRACT:** We examine how employees respond to bonuses and penalties using a proprietary data set from an electronic chip manufacturer in China. First, we examine the relative effects of bonuses and penalties and observe a stronger effect on subsequent effort and performance for penalties than for bonuses. Second, we find that the marginal sensitivity of penalties diminishes faster than that of bonuses, indicating that the marginal effect of a bonus may eventually exceed that of a penalty when their values are sufficiently large. Third, we find that penalties increase employee turnover especially for skillful and high-quality workers. Finally, we extend our analyses to implicit gains/losses and find a negative impact of both implicit gains/losses, where the effects of implicit losses are stronger. These results help inform our understanding of the observed limited use of penalties in practice, their effectiveness and possible unintended consequences, and also how these effects may extend into implicit incentives.

**Keywords:** *employee compensation, incentives, bonus, penalty, prospect theory*

**Data Availability:** *The confidentiality agreement with the company that provided data for this study precludes the dissemination of detailed data without the company's consent.*

## I. INTRODUCTION

Humans respond to the prospect of reward as well as the fear of punishment. Incentive contracts in use in most organizations, however, are generally predicated on the motivation derived from the prospect of rewards. Other than practical considerations (e.g., the inability of firms to ask employees to “pay the company back” beyond the use of clawbacks in cases of fraudulently earned bonuses), the reasons why bonus contracts have been more prevalent than penalty contracts are not well understood. This is surprising given that almost everyone has been exposed to at least a mix of rewards and punishments when growing up. Of course, in organizations, a penalty perhaps suffices to be “implicit” by way of “not earning” a reward (such as missing out on an “expected” bonus or a “hoped-for” promotion). And there is also the ultimate threat of dismissal.

A small number of prior studies have shed light on this issue by examining the framing effect of incentive contracts in experimental settings. Luft (1994) finds that employees prefer incentive contracts described in bonus terms to identical contracts described in penalty terms. Hannan, Hoffman, and Moser (2005) extend Luft’s finding by showing that employees generally expend more effort under penalty contracts than they do under equivalent bonus contracts to avoid “paying” penalties (which as a feature can be more feasibly incorporated in a lab experiment than in practice). In a field experiment, Hossain and List (2012) also find that penalty-framed contracts enhance team productivity compared with bonus-framed contracts. That said, in an incomplete contract setting, Christ, Sedatole, and Towry (2012) find that negatively-framed penalty contracts reduce trust in the principal, leading to lower effort on tasks not governed by the contracts as a potential way to settle up.

While these studies rely on prospect theory to develop their hypotheses, the empirical investigation rarely goes beyond the loss aversion nature of the theory, leaving the other predictions of prospect theory unexplored. In addition to loss aversion, an important feature of the value function of prospect theory is that it is concave in the gain position but convex in the loss position, suggesting that people become less sensitive to gains/losses as their value increases. The diminishing sensitivity to gains/losses has profound implications for our understanding of the relative effectiveness of bonuses versus penalties. For example, although prior studies find that people on average respond positively (i.e., by increasing their effort) to a penalty, the marginal effect may eventually become curtailed (i.e., people reduce their effort in response to an increase in the penalty) when a penalty reaches a larger value. Furthermore, if people's sensitivity to penalties diminishes faster than their sensitivity to bonuses, the marginal effect of bonuses may dominate that of penalties beyond a certain threshold. If that is the case, penalties will not always be more effective in motivating employee effort. Therefore, to design an effective incentive system, we should not only focus on the average effect of a bonus or penalty, as has typically been the case in prior studies, but also the marginal effect that varies with the amount of bonuses/penalties.

The purpose of this study is to investigate the marginal effect of bonuses and penalties in a field setting. We empirically analyze production output and compensation data of 543 production line workers in an electronic chip manufacturing plant in China. Unusually, but pertinent to our investigation, the workers' compensation scheme is a bonus-malus contract, which includes both bonus and penalty components. A worker receives a bonus when s/he outperforms the performance standard, but a penalty when the performance falls below the standard. Given this, we examine how the bonuses and penalties received during the prior month are associated with

the worker's current deviation in performance from his or her own average, controlling for workers' fixed effects and the impact of other factors.

First, we examine the relative effects of bonuses and penalties; that is, how employees respond directly to bonuses or penalties by changing their level of effort in the immediate subsequent period. Prospect theory suggests that penalties provide stronger stimuli to employees compared with bonuses due to loss aversion. That is, employees are expected to respond more strongly to penalties compared to bonuses to avoid incurring subsequent additional penalties. Consistent with our prediction, we observe a stronger link between penalties and subsequent effort (measured by production quantity and time) and performance (measured by production quality and efficiency), suggesting that a per-dollar penalty motivates higher levels of effort and performance than a per-dollar bonus which, as we will see, is consistent with the lab finding by Hannan et al. (2005) and the field evidence by Hossain and List (2012).

Second, we examine whether employees' subsequent efforts and performance exhibit a diminishing sensitivity to bonuses/penalties. Prospect theory maintains that the value function is concave at gain positions but convex at loss positions. Therefore, the marginal utility/disutility decreases with the value of the gain/loss. The diminishing sensitivity implies that the magnitude of an employee's response to a per-dollar increase in a bonus/penalty also decreases. This hypothesis is supported by our data, indicating a curvilinear relationship between bonuses/penalties and subsequent performance. Our findings thus imply that diminishing sensitivity presents a limit on using monetary bonuses and penalties to motivate employee efforts. Furthermore, we find that the curvature of a penalty is significantly greater than that of a bonus, and therefore that the marginal effect of a bonus eventually exceeds that of a penalty when the values of the bonus and penalty are sufficiently large. This finding may be one of the reasons why penalty schemes do not dominate bonus schemes in practice. This important feature of

diminishing sensitivity has not yet been examined by prior studies that compare rewards versus penalties.

Third, we investigate how bonuses and penalties are associated with voluntary employee turnover. Although penalties stimulate a higher level of effort, studies have found them to lower employee morale, trigger employee distrust of managers, and result in other dysfunctional behaviors (Hannan et al. 2005; Christ et al. 2012). Consistent with this line of research, we find penalties to be associated with a greater probability of voluntary employee turnover. Furthermore, the link between penalties and voluntary turnover is especially significant for workers who are capable/skillful to handle complex tasks, and those who obtain high production quality. This finding suggests that managers should be especially careful about human capital losses in their organizations when they use penalty schemes.

Finally, we investigate how employees respond to implicit bonuses/penalties that in our context arise due to factors outside the employees' control, namely due to changes in performance standards. Specifically, we first estimate employees' perceived implicit gain or loss, measured as the gap between the actual pay received and what it would have been had the performance standards remained unchanged. Then we examine how employees' perceived implicit gain/loss is associated with subsequent effort and performance. Unlike bonuses and penalties that are clearly tied to the workers' efforts, implicit gains and losses come from changes in performance standards (either favorable or unfavorable) and therefore can be expected to have muted effects owing to uncontrollable factors. Consistent with our expectation, we find implicit gains and losses to be negatively associated with workers' subsequent efforts and performance. Furthermore, in line with prospect theory, the negative impact of implicit losses is significantly greater than that of implicit gains. This finding reveals the additional costs that management should consider when adjusting performance standards.

This study makes several contributions to the literature. First, we extend the application of prospect theory in compensation research. Prior studies have relied on the loss aversion feature of prospect theory to develop hypotheses for the framing effect of gains versus losses. The other predictions, however, have been left mostly unexplored in this line of research. In this study, we not only use loss aversion to develop our prediction of the relative effect of bonuses and penalties, but also examine whether employees exhibit diminishing sensitivity to bonuses/penalties as suggested by the concavity/convexity of the value function in the gain/loss positions. Moreover, we investigate whether the diminishing rate differs significantly between the gain and loss positions. Diminishing sensitivity is a critical feature of the value function and suggests that, in addition to the average effect, we should also be attentive to the marginal effect of rewards and punishments and where they become differentially attenuated.

Second, while most of the findings in prior studies come from lab experiments (Hossain and List 2012 as an exception), our study adds further and incremental evidence from the field. An advantage of field research, compared with lab experiments, is the ability to shed light on the effect sizes of bonuses and penalties. For example, our field setting allows us to examine how the marginal effect of bonuses/penalties varies with the monetary value of the incentive. It also allows examining how the probability of employee voluntary turnover changes following the receipt of bonuses and penalties, which is a result that provides additional evidence on the impact of bonus/penalty in this area.

Our study also provides insights for practice. First, although negatively-framed incentives are less widely used, our study shows that employees who receive a penalty perform significantly better than their own average in the subsequent period and such performance improvement exceeds that of those who receive an equivalent bonus or a base salary. This is consistent with the theoretical argument that penalties usually have a stronger effect on human behavior than

rewards. Thus, in line with insights from Hossain and List (2012), we suggest that careful use of penalty schemes may effectively contribute to productivity and performance. Second, we find that the marginal effects of bonuses and penalties, however, decrease with their value and that this is more pronounced for penalties than for bonuses. Therefore, management should consider moderating its use of bonuses, and especially penalties, and rely on other forms of motivation when the values of bonuses and especially penalties become larger. Third, management should also be careful about the potential loss of human capital when using penalty schemes, as especially valuable employees appear to show a greater propensity to leave the organization after having received penalties. Fourth, we find that implicit gains and losses, which stem from changes in performance standards, are negatively associated with subsequent effort and performance. This can occur when performance standards are adjusted, where during such periods the incentive plans may not work as effectively as expected due to perceived implicit gains or losses.

The following section reviews the relevant literature and develops the hypotheses. The third section explains the research design and variable measurements. The fourth section presents the core empirical results as well as various robustness checks. The final section concludes and discusses the study's limitations and opportunities for future research.

## **II. LITERATURE AND HYPOTHESES**

### **Effects of Bonuses and Penalties**

Economists and psychologists maintain that behavior is shaped by its consequences (Thorndike 1911; Skinner 1953; Bandura 1977). In a business context, organizations often use various monetary and non-monetary forms of reward/punishment to influence employee decisions and behavior (Merchant and Van der Stede 2017). Bonuses, a form of monetary



rewards, are positive reinforcement mechanisms that give employees additional utility and in turn motivate a greater level of effort. In contrast, monetary penalties are punishment mechanisms that decrease employee utility and, thus, should curb undesirable behavior such as sloppiness, inattention, or shirking. Although they come about through different stimuli, both bonuses and penalties motivate employees to exert a higher level of effort to either increase utility or decrease disutility, and thus, achieve better performance in the subsequent period.

We follow prospect theory to determine the relative strength of the response associated with a bonus or penalty. Prospect theory indicates that the same amount of bonus and penalty provides different levels of stimulus to people because individuals value gains differently than they value losses (Kahneman and Tversky 1979). As shown in Figure 1, the slope of the well-known prospect theory value function is steeper in the loss position than in the gain position. The asymmetric slope implies loss aversion.

– Insert Figure 1 –

Loss aversion has profound implications in many domains. In particular, researchers have used the theory to investigate the framing effect of compensation plan design. Luft (1994) finds that employees prefer incentive contracts described in bonus terms to identical contracts described in penalty terms. Hannan et al. (2005) extend Luft's finding by showing that employees generally expend more effort under penalty contracts than they do under equivalent bonus contracts to avoid paying penalties. Similarly, Hossain and List (2012) find that penalty-framed contracts enhance team productivity compared with bonus-framed contracts.

The asymmetric slope of the value function suggests that \$1 of loss creates greater disutility than the utility created by \$1 of gain. If we consider an employee's base salary as the reference point, a penalty would provide the employee greater disutility than the utility provided by an equivalent bonus. Therefore, we expect an employee's response to be stronger for a penalty

than for a bonus, thus trying harder to avoid a penalty than to gain a bonus, resulting in a higher level of performance. This suggests the following hypotheses:

**H1a:** Bonuses/penalties have a positive effect on subsequent performance.

**H1b:** Ceteris paribus, penalties have a greater positive effect than bonuses on an employee's subsequent performance.

### **Diminishing Sensitivity**

In addition to loss aversion, prospect theory suggests that the value function is concave in a gain position and convex in a loss position (see Figure 1). The curvature of the value function implies diminishing sensitivities to gains and losses. Any incremental gain or pay above the reference point results in a progressively smaller improvement in utility, and any incremental reduction of pay below the reference point results in a progressively smaller reduction in utility. The diminishing sensitivity to gains and losses has profound implications for practice. One important implication is that people tend to be risk-averse in a gain position but risk-seeking in a loss position. In addition to lab evidence (e.g., Kahneman and Tversky 1979; Tversky and Kahneman 1992; Fennema and Wakker 1997), diminishing sensitivity has also been inferred from the field. For example, Pope and Schweitzer (2011) find that professional golfers are more likely to make risk-averse putts when they are in the domain of gains (golfers attempting eagle or bogey putts) rather than the domain of losses (those attempting par, bogey, or double bogey putts).

In compensation scheme design, diminishing sensitivity suggests that employees perceive a smaller amount of marginal change in utility when the value of a bonus/penalty increases, which implies that the marginal effect of a bonus/penalty on employee performance also decreases. As such, \$1 of an incremental bonus/penalty induces employees to exert less effort when the value

of the bonus/penalty increases. Our second hypothesis tests the diminishing sensitivity of a bonus/penalty:

**H2a:** The marginal effect of a bonus/penalty on an employee's subsequent performance decreases with the value of the bonus/penalty.

Furthermore, Heath, Larrick, and Wu (1999) propose that diminishing sensitivity across the value function is demonstrated by how an individual frames the “starting problem”—that is, when people do not feel as though they are making much progress toward their goals, they find it difficult to gather the motivation necessary to accomplish the goal. Heath et al.'s (1999) argument thus suggests that the diminishing sensitivity might be more significant in loss positions, due to this starting problem, compared to gain positions. In the context of compensation plan design, employees usually face the starting problem when they receive large penalties. Large penalties may make employees feel they are too far away from the goals or the performance standards, and therefore find it difficult to motivate themselves to start the task. This implies that the decreasing sensitivity in the penalty range may be greater than in the bonus range, and therefore that the marginal effect of a bonus will eventually exceed that of a penalty when the values of the bonus and penalty, respectively, are sufficiently large. This leads us to propose the following further hypothesis related to diminishing sensitivities:

**H2b:** The marginal effect of a penalty on an employee's subsequent performance diminishes faster than the marginal effect of a bonus on an employee's subsequent performance.

### **Employee Turnover**

Although we focus on the relationship between bonuses/penalties and subsequent performance, bonuses and penalties may also influence performance by affecting the internal cognitive processes of employees and, therefore, their subsequent attitudes and behavior (Podsakoff, Bommer, Podsakoff, and MacKenzie 2006). In particular, attribution theory indicates

that people are more likely to attribute events to external factors when the events are negative and to internal factors when they are positive (Morewedge 2009). Therefore, employees who receive bonuses attribute their good performance to their own ability and/or efforts and thus perceive the compensation as fair and warranted. In contrast, those who receive penalties are more likely to attribute their poor performance to external factors and perceive the penalties as unfair. Consistent with this logic, Hannan et al. (2005) find that people under bonus contracts perceive a higher level of fairness than those under penalty contracts. Moreover, Christ et al. (2012) show that penalty contracts engender a greater level of distrust, which in turn leads to lower efforts expended on tasks that inevitably incomplete contracts omit as a potential way for the employee to settle up. The perceived unfairness and distrust under the penalty condition is likely to decrease employee job satisfaction and increase turnover. In contrast, employees who receive bonuses are likely to be more satisfied and less likely to quit. Formally, we test the following two hypotheses:

**H3a:** Employees who receive penalties are more likely to quit their jobs.

**H3b:** Employees who receive bonuses are less likely to quit their jobs.

### **Implicit Gains and Losses due to Uncontrollable Factors**

For effective incentive system design, bonuses and penalties should be closely tied to performance to motivate desirable or to discourage undesirable behaviors in employees. When the link between bonuses/penalties and outcomes is unclear, the incentive system becomes less effective. Many studies of subjective performance evaluation have documented such a mismatch between rewards and outcomes. For example, Marchegiani, Reggiani, and Rizzolli (2016) find that leniency and severity biases, both of which represent mismatches between compensation and outcomes, lead to deterioration in subsequent performance.

Perceived mismatches between compensation and outcomes, however, can occur even with objective performance evaluations. This can arise when a change in performance standards (or another aspect of the incentive scheme) occurs and employees do not fully and/or immediately incorporate these changes into their outcome expectations. Therefore, an employee who puts an equal amount of effort into his or her work and believes s/he has done equally well may receive different amounts of pay during these two periods. Such differences could affect people's coding of gains and losses. Indeed, Koszegi and Rabin (2006) show that people's reference points could be endogenously determined according to the recently held rational expectation of the outcomes, and that deviations from this rational expectation are perceived as gains or losses.<sup>1</sup> As such, employees who receive more than they expect will tend to experience an implicit gain, whereas those who receive less will tend to experience an implicit loss.

However, because implicit gains and losses stem from external factors (changes in performance standards in our setting), they can be expected to have muted effects due to their uncontrollability. Moreover, such uncontrollable implicit gains/losses could be harmful to an organization because they 'misfire'. Workers who experience implicit losses may perceive the appraisal system as too harsh (Marchegiani et al. 2016) and condemn it for failing to reward the committed levels of effort (Blanchard, Chow, and Noreen 1986). For example, in a tournament-based incentive setting, Cai and Gallani (2018) find that implicit penalties induced by management's *ex post* subjective adjustment to objective performance (and thus uncontrollable by the evaluatees) are associated with subsequent performance declines. In contrast, those who

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<sup>1</sup> Several empirical studies have provided evidence that supports the reference-dependent decision in Koszegi and Rabin's (2006) model. For example, Crawford and Meng (2011) find that using rational expectation as the reference point explains the labor supply decisions of New York City cab drivers more precisely than prior models examining labor supply. Pope and Schweitzer (2011) similarly use the performance data of professional golfers to test several predictions of prospect theory. Although par is a salient reference point for professional golfers, the authors find some evidence that golfers may develop expectations of their performance according to the difficulty of each hole and use these expectations as alternative reference points.

experience implicit gains may perceive (although perhaps not condemn) the appraisal system as too lenient, and experience having been undeservingly rewarded. Regardless, economics-based incentive theory predicts that either of these will distort the incentives.

Marchegiani et al. (2016) further show that the severity bias (that fails to reward a deserving level of effort or that earns less than what was expected), however, is more detrimental than the leniency bias (that rewards an undeserving level of effort or that earns more than what was expected) due to the nature of loss aversion as suggested by prospect theory. In other words, the distorted, negative effects of implicit losses on subsequent performance are expected to be greater than those of implicit gains. Taken together, this leads us to suggest the following hypotheses:

**H4a:** Implicit gains/losses have a negative effect on subsequent performance.

**H4b:** Ceteris paribus, implicit losses have a greater negative effect than implicit gains on an employee's subsequent performance.

### **III. METHOD**

#### **Research Site**

The research site is a leading manufacturer of electromagnetic interference components, including several types of electronic filters and inductors. The main products are widely used in various types of laptop/desktop computers and consumer electronic products, such as mobile phones, digital cameras, GPS navigation devices, and LCD TVs. Primary customers include Siemens, Samsung, HTC, and Foxconn.

The company currently operates three manufacturing plants in China. We base our study on compensation and performance data collected from production line workers in one of these plants from February 2008 to April 2010. The sample consists of 543 individual workers. Because the workers perform discrete tasks of the production process on an individual basis, their

productivity and the quality of their outputs can be directly related to their effort and ability. The direct link between effort and performance allows us to investigate how the workers respond to the bonuses or penalties they receive. Each day, supervisors assign tasks to the workers. The task assignments depend on the daily production schedules, which are primarily determined based on customer orders, and the supervisors' consideration of the workers' past experience and skills. According to our data, each worker was assigned an average of 3.56 different tasks per month. Roughly 10% of the workers were assigned to work on more than 10 different tasks per month. According to our interviews with management, the workers normally did not have the flexibility to choose their task assignments. Yet, the company does not have specific requirements for how many units each worker should produce. Therefore, for any group of workers assigned to the same tasks, hard workers produce more. Moreover, workers do have some discretion to choose how many hours to work each day, and how many days to work each month.

Each worker's monthly compensation is the sum of base salary, overtime pay, monthly bonus or penalty if any, and other allowances. The starting base salary for a production line worker is RMB900. However, the actual amount of salary received depends on the worker's attendance rate (days attended/total working days) in each month. The worker's overtime pay is RMB7.76 (RMB10.34) per hour during weekdays (weekend days).

A worker's bonus and penalty is determined by his or her production efficiency and quality each month. To note, a worker can receive a bonus and a penalty in the same period if they come from different aspects of performance (e.g., a bonus for good efficiency and a penalty for poor quality), but as we will discuss further below (see also fn. 2), we are able to keep bonuses and penalties separate in our data, thus retaining the most information and allowing more detailed analyses and investigations.

Efficiency is measured as the difference between the standard and actual amount of hours worked during production. The company sets a standard time for each product or procedure. The standard production time for a worker is then calculated by multiplying the actual quantity of output by the standard time per unit of output. If a worker is efficient, s/he will obtain a favorable production efficiency variance because the actual time used during production is less than the standard time. The company pays RMB2.2 for 1 hour of favorable variance and deducts RMB7.76 (RMB10.34) for 1 hour of unfavorable variance during weekdays (weekend days). For example, a worker works for 3 hours to produce 20 units of chips. The company expects an average worker to produce one unit of chips in 12 minutes. The standard production time for the worker to produce 20 units is 4 hours (20 units  $\times$  12 minutes). Thus, the worker has 1 hour of favorable variance and receives RMB2.2 (RMB2.2  $\times$  1 hour) as a bonus for high efficiency. In contrast, if the worker spends 5 hours on the task during a weekday (weekend day), RMB7.76 (RMB10.34) is removed from his or her pay as a penalty for poor efficiency.

In addition to the penalty for inefficiency, a worker can also be penalized for poor quality of output. The quality control department inspects all of the production outputs. A worker is penalized if the quality of output does not meet the standard. The company tracks each worker's production defects and applies a standard rework time to each type of defects. Depending on the severity of the problem, the standard rework time ranges from a few minutes to 3 hours. The company then charges RMB4.5 per hour to the worker responsible for the manufacturing defect.

### **Empirical Models and Variable Measurement**

We use the following model (1) to examine the relationship between bonuses/penalties and subsequent performance.

$$\begin{aligned}
 \text{Performance}_{i,t} = & \alpha + \beta_1 \text{Bonus}_{i,t-1} + \beta_2 \text{Penalty}_{i,t-1} + \beta_3 \text{Bonus}_{i,t-1}^2 + \beta_4 \text{Penalty}_{i,t-1}^2 \\
 & + \Sigma \beta \text{Controls}_{i,t} + \varepsilon_{i,t}
 \end{aligned}
 \tag{1}$$



We use four proxies to measure an individual worker's effort and performance.  $Quantity_{i,t}$  and  $Time_{i,t}$  are two direct measures of a worker's level of effort after receiving bonuses or penalties.  $Quantity_{i,t}$  is the total amount of products produced and/or tasks performed by worker  $i$  in month  $t$ . We expect workers who were motivated by bonuses or penalties received during the last month to expend more effort at work and thereby produce more units. However,  $Quantity_{i,t}$  may be biased when different tasks are not exactly comparable due to their differing levels of complexity. Therefore, we use another measure,  $Time_{i,t}$ , to capture the total standard production time required for a worker's production output.  $Time_{i,t}$  is estimated as  $\Sigma(Q_{i,j,t} \times T_{j,t})$ , in which  $Q_{i,j,t}$  is the amount of task  $j$  completed by worker  $i$  in month  $t$ , and  $T_{j,t}$  is the standard time set by the company to complete one unit of task  $j$ . Converting production quantity into time allows us to compare the productivity of the workers even when they were assigned to work on different tasks. The two performance variables we study in this paper are  $Efficiency_{i,t}$  and  $Quality_{i,t}$ .  $Efficiency_{i,t}$  is measured as the difference between the standard production time (i.e.,  $Time_{i,t}$ ) and the actual amount of hours used during production. A favorable variance indicates that a worker completed his or her tasks more efficiently than the standards set by the company. While the three performance measures discussed above ( $Quantity_{i,t}$ ,  $Time_{i,t}$ , and  $Efficiency_{i,t}$ ) capture employees' effort and productivity, we also include each individual employee's production quality as the fourth dependent variable.  $Quality_{i,t}$  is measured as the number of production outputs processed by worker  $i$  in month  $t$  that successfully pass the quality inspection (i.e., free of defects) per thousand units of his/her production.

The major independent variables in this study are  $Bonus_{i,t-1}$ ,  $Penalty_{i,t-1}$ , and their quadratic terms. We use the bonuses and penalties received in the previous month ( $t-1$ ) to determine how

the workers responded to the positive and negative outcomes.<sup>2</sup> We include the quadratic terms to capture the curvilinear relationship as suggested by the diminishing sensitivity of the value function in H2a and b. We include several control variables in our model. First, we control for work experience by including a worker's tenure at the company, *Tenure*<sub>*i,t-1*</sub>, measured in months. Another control variable for worker experience, *Task Experience*<sub>*i,t-1*</sub>, is the weighted average cumulative hours of experience for the tasks assigned. Second, the difficulty of tasks assigned to workers may vary significantly. We therefore include *Task Complexity*<sub>*i,t-1*</sub>, measured as the weighted average number of hours needed to complete a task, in our models. Third, we include worker's age as it may be a proxy for a worker's job horizon. In addition, we include the worker fixed effect to control for the potential effect of unobservable, worker-specific, time-invariant factors.<sup>3</sup> In doing so, we examine how the bonuses and penalties received during the prior month are associated with the worker's current deviation in performance from his or her own average. A fixed-effects model is appropriate because it takes away each worker's average productivity from the model. Therefore, the coefficients of *Bonus*<sub>*i,t-1*</sub>/*Penalty*<sub>*i,t-1*</sub> can be interpreted as the extent to which RMB1 of bonus or penalty motivated the worker to outperform or underperform his or her own average performance. We also include the year fixed effect to control for the effects of environmental factors such as changes in economic conditions. All of the continuous variables are winsorized at the top and bottom 1%.<sup>4</sup> We cluster all standard errors at the worker level.

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<sup>2</sup> We treat bonuses and penalties separately, instead of aggregating them together and presenting the net number, for the following reasons. First, theory does not provide clear guidance on whether people respond to the components of their payoff or the net total pay. As suggested by prospect theory, the impact depends on how people frame their gain/loss position and the reference point they use. A feature of our setting, however, is that workers' framing of gains and losses is unlikely to be contaminated because bonuses and penalties are presented as different items on their pay checks. Second, our empirical analyses (untabulated) show that a penalty's impact does not differ significantly when it is provided with a bonus, and vice versa. This finding suggests that, at least in our setting, people do respond to the bonus and penalty components separately, instead of to the net number only.

<sup>3</sup> Therefore, we do not include worker-specific characteristics that do not vary over time (e.g., gender, education, ability) in the model.

<sup>4</sup> Our findings are robust without winsorization.

To test H3, we use a discrete-time survival model to examine how bonuses and penalties are associated with the probability of employee turnover.<sup>5</sup> In model (2), *Turnover*<sub>*i,t*</sub> is a dummy variable that equals one if worker *i* voluntarily left the company in month *t* and zero otherwise:<sup>6</sup>

$$P(\text{Turnover}_{i,t}) = \alpha + \beta_1 \text{Bonus}_{i,t-1} + \beta_2 \text{Penalty}_{i,t-1} + \beta_3 \text{Bonus}_{i,t-1}^2 + \beta_4 \text{Penalty}_{i,t-1}^2 + \sum \beta \text{Controls}_{i,t} + \varepsilon_{i,t} \quad (2)$$

Lastly, our research site provides a good setting to examine how workers respond to perceived implicit gains and losses. The management of our research site periodically reviews and updates the standard production time for each product/task. As such we can calculate the implicit gains/losses part of the total bonuses/penalties. As described earlier, each worker usually performs several different tasks each month, necessitating some way or some heuristic to track their production efficiency on the various tasks. When faced with performance standard changes, workers can only rely on past experience as an “anchor” to form expectations of their performance outcomes, and then make adjustments to the standard changes. With the expected outcome as the reference point, the difference between the expected and actual outcome would be framed as an implicit gain (if favorable) or implicit loss (if unfavorable).

To estimate proxies for implicit gains and losses, we use each worker’s prior outcome as the anchoring point. However, the difference between a worker’s anchoring point and the actual outcome could be attributable to either internal, controllable factors (such as changes in his/her effort level) or external, uncontrollable factors (such as changes in performance standards). Therefore, one critical step in the process is to estimate the change in worker’s effort level from one period to another. The company keeps track of workers’ monthly performance based on two

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<sup>5</sup> Compared to a regular logistic model, a discrete-time survival model reduces potential bias due to censored data, as we have in our setting.

<sup>6</sup> The case company records the reasons why employees quit their jobs. We use this information to differentiate between voluntary and forced turnover.

different sets of standards: current-period and base-period. Current-period standards are used to calculate workers' production efficiency and thus their bonus/penalty in each month. Base-period standards, on the other hand, allow managers to compare workers' performance across different periods because the performance standards are held constant. Using these data, we estimate each worker's base-period adjusted production efficiency in the months  $t-2$  and  $t-1$ , and then calculate the difference between the two periods, which reflects the worker's change in effort level from  $t-2$  to  $t-1$ . We add this change in effort level to the production efficiency in  $t-2$  (i.e., the initial anchoring point) to get our proxy for worker's adjusted expectation on production outcome in  $t-1$ . The difference between the expected and actual outcome, which is attributable to changes in performance standards, then serves as our proxy for *Implicit Gain*  $_{i,t-1}$  if the variance is favorable, and *Implicit Loss*  $_{i,t-1}$  if the variance is unfavorable.<sup>7</sup> We include *Implicit Gain*  $_{i,t-1}$  and *Implicit Loss*  $_{i,t-1}$  into model (1) to test H4a and b.

To be clear, consider the following example to illustrate the calculation of implicit gains and losses. Assume that a worker's current-period production efficiency in period  $t-2$  and  $t-1$  was 10 (*Efficiency* $_{t-2}$ ) and 15 (*Efficiency* $_{t-1}$ ), respectively. Also assume that the company reduced the performance standard in  $t-1$ , and therefore at least part of this worker's improvement in production efficiency could be reasonably expected to be attributable to the lower standard (in this example resulting in a favorable effect). To tease out the portion of the total difference or variance reasonably attributable to the change in standard, we first calculate what the worker's performance would have been had the performance standard not been changed. In this example, the worker's "base period" or "re-based" production efficiency in  $t-1$  was 12 (*Efficiency* $_{base, t-1}$ ).<sup>8</sup> The 2 units of efficiency improvement (*Efficiency* $_{base, t-1}$  - *Efficiency* $_{t-2}$ ) should be reasonably

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<sup>7</sup> We take the absolute values of the differences, and thus both implicit gain and loss have non-negative values.

<sup>8</sup> For simplicity, we use  $t-2$  as the base period in this example.

attributable to the change in worker's effort. That is, if the worker used  $t-2$  as the anchoring point, the worker's adjusted expectation on production outcome in  $t-1$  would be the anchoring point ( $Efficiency_{t-2}$ ) plus the expected change in production due to effort (i.e.,  $Efficiency_{base, t-1} - Efficiency_{t-2} = 2$  units). The other 3 units account for the difference between the actual ( $Efficiency_{t-1}$ ) and the expected ( $Efficiency_{base, t-1}$ ) outcomes, attributable to the change in the performance standard from  $t-2$  to  $t-1$ . We use this variance as the proxy of implicit gain (if favorable) or implicit loss (if unfavorable).

#### IV. EMPIRICAL RESULTS

Table 1 reports the descriptive statistics. Our final sample consists of 3,328 worker-month observations.<sup>9</sup> On average, each worker received a bonus of RMB148.202 and a penalty of RMB50.085 per month. Some workers received a bonus of up to RMB655 or a penalty of up to RMB474, which is quite significant compared with the average base salary of RMB900. The distributions of both bonuses and penalties are right-skewed, indicating that not all workers did receive either a bonus or penalty in a month. The average worker tenure is 6.697 months, which is low compared with the full sample period (27 months). This is consistent with the prevalent situation in mainland China that low-skilled factory workers tend to switch jobs frequently by jumping to other companies.

– Insert Table 1 –

Table 2 shows Pearson and Spearman correlations. The four performance measures are positively correlated with each other, especially production efficiency, quantity and time, which are all related to workers' productivity in that month. The measures of workers' experience, *Task*

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<sup>9</sup> The effective sample is reduced to 2,713 for *Quality*<sub>*i,t*</sub>. The effective sample for *Implicit Gain*<sub>*i,t-1*</sub> and *Implicit Loss*<sub>*i,t-1*</sub> is reduced to 2,676 because of the requirement of two consecutive periods of data ( $t-2$  and  $t-1$ ) to estimate the implicit gain and loss.

*Experience*<sub>*i,t*</sub> and *Tenure*<sub>*i,t*</sub>, are also positively correlated with performance. This is consistent with the intuition that more experienced workers achieve better production outcomes.

– Insert Table 2 –

### **Effects of Bonuses and Penalties**

Table 3 shows the regression results for model (1). The first hypothesis predicts that both bonuses and penalties are positively associated with subsequent performance and that penalties have a stronger effect than the equivalent amount of bonuses. Table 3 shows the regression results for several aspects of subsequent performance, including production efficiency, quantity, time, and quality. For each dependent variable, we present the base model that includes only the control variables with the employee and year fixed effects, followed by the full model. Columns (1) and (2) show the results of the base and full regression models for each individual worker's production efficiency. We find positive and significant coefficients for *Bonus*<sub>*i,t-1*</sub> and *Penalty*<sub>*i,t-1*</sub>, suggesting that both bonuses and penalties motivated workers to achieve better production efficiency in the subsequent period. Moreover, in line with the predictions of prospect theory, the coefficient of *Penalty*<sub>*i,t-1*</sub> (0.493, *t* = 8.292) is significantly larger (*F* = 5.126, *p* < 0.05) than that of *Bonus* (0.345, *t* = 9.762). This is consistent with our theoretical prediction that penalties stimulate more effort and thus better performance than the equivalent amount of bonuses. This result is consistent with the findings of Hossain and List (2012) and Hannan et al. (2005).<sup>10</sup> Our findings are also economically significant. Column (2) shows that a RMB1 bonus motivates a worker to work more efficiently and save 0.345 hours in the next month, and that a RMB1 penalty motivates a worker to save 0.493 hours, thus having nearly half again as much the effect of the bonus. The case company paid its employees RMB7.76 per hour of overtime work. As

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<sup>10</sup> It should be noted though that Hossain and List (2012) find a significant result for team-based workers but not for individual workers.

such, 0.345 (0.493) of an hour amounts to RMB2.677 (RMB3.826) of savings in overtime pay to workers.

– Insert Table 3 –

We also examine how bonuses and penalties are associated with an individual worker's subsequent production quantity and time, which are more direct proxies of the worker's effort level. Columns (3) and (4) show the results for individual worker's production  $Quantity_{i,t}$ . We find that both bonuses and penalties are positively associated with workers' production quantity in the next month. The coefficient of  $Penalty_{i,t-1}$  (0.567,  $t = 6.980$ ) is significantly larger ( $F = 3.876$ ,  $p < 0.05$ ) than that of  $Bonus_{i,t-1}$  (0.382,  $t = 8.064$ ), suggesting that penalties provide a stronger incentive than equivalent bonuses in motivating a greater level of effort from the workers. Using each worker's standard production  $Time_{i,t}$  as the alternative dependent variable in columns (5) and (6) yields similar results: an RMB1 bonus motivates an average employee to work an additional 0.362 hour ( $t = 9.785$ ), and an RMB1 penalty motivates an additional 0.538 hour ( $t = 8.418$ ) of effort. The magnitude of the effects differs significantly ( $F = 5.740$ ,  $p < 0.05$ ).

In addition to productivity, we also examine how bonuses/penalties influence workers' subsequent production quality. Columns (7) and (8) show the results for individual worker's production  $Quality_{i,t}$ . We find a positive and significant coefficient on  $Penalty_{i,t-1}$  (0.130,  $t = 2.083$ ). Monetary penalty incentives thus appear to motivate the workers to improve production quality: an RMB1 penalty reduces 0.130 unit defects per thousand of production units. However, we do not obtain a significant coefficient for  $Bonus_{i,t-1}$ .

### **Diminishing Sensitivity**

H2a predicts bonuses and penalties to exhibit diminishing sensitivities; that is, workers become less sensitive to per dollar bonuses/penalties when the value of the bonuses/penalties increases. This implies that we should observe a curvilinear relationship between bonuses/

penalties and subsequent performance. Because the coefficients of  $Bonus_{i,t-1}$  and  $Penalty_{i,t-1}$  are both positive, we expect the quadratic terms of  $Bonus_{i,t-1}$  and  $Penalty_{i,t-1}$  to have negative coefficients. Our findings support the diminishing-sensitivity hypothesis (H2a). According to Table 3, the quadratic terms of  $Bonus_{i,t-1}$  and  $Penalty_{i,t-1}$  have negative and significant coefficients. This finding is consistently robust across the four models using the different performance measures as dependent variables. The implication of this finding is intuitive: because the marginal value of money decreases, the marginal effect of bonuses and penalties also decreases. An RMB1 increase in bonus from RMB10 to RMB11 motivates an employee to exert more effort than an RMB1 increase from RMB100 to RMB101. Therefore, employers must consider the cost and benefit of giving out additional bonuses when the value is large.

Our results also indicate that the marginal sensitivity of  $Penalty_{i,t-1}$  diminishes faster than that of  $Bonus_{i,t-1}$  in the models with the various performance measures as dependent variables except for  $Quality_{i,t}$ . Specifically, using the efficiency model as an example, in column (2) we find that the magnitude of the coefficient on  $Penalty_{i,t-1}^2$  ( $-1.024 \text{ E}^{-3}$ ,  $t = -7.713$ ) is significantly larger ( $F = 22.541$ ,  $p < 0.01$ ) than that of  $Bonus_{i,t-1}^2$  ( $-3.430 \text{ E}^{-4}$ ,  $t = -5.211$ ), thus supporting H2b. The difference in bonus and penalty's quadratic terms is also statistically significant in the quantity model ( $F = 9.698$ ,  $p < 0.01$ ) and time model ( $F = 15.191$ ,  $p < 0.01$ ). Based on the coefficients from column (2) in Table 3, we find that when the value of the bonus/penalty goes beyond RMB217, the marginal sensitivity of the penalty falls below that of a bonus. In this company, therefore, an RMB1 bonus may motivate more effort than an RMB1 penalty when the monetary value of the bonus/penalty exceeds RMB217. At a more extreme level, specifically around RMB481 in our setting, we find a tipping point in which the marginal effect of penalties on production efficiency becomes negative. This finding may provide an explanation for why penalty schemes are not as widespread as bonus schemes in practice.



We also find that task experience is positively associated with production efficiency, production quantity, and quality. This finding is consistent with the intuition that workers can be more productive and have better production quality when they are more familiar with the tasks they perform.

### **Employee Turnover**

Our third hypothesis (H3) tests whether the use of penalties (bonuses) is associated with a higher (lower) probability of employee turnover. Table 4, Panel A, presents the results from a discrete-time survival model. As our study involves the estimation of curvilinear relationships in a logistic model, we follow Osborne's (2015) suggestion to remove observations that bring significant noise to the estimation.<sup>11</sup> The coefficient of  $Bonus_{i,t-1}$  is negative and significant ( $-0.011 E^{-3}$ ,  $Wald\ Chi-square = 31.128$ ), which is consistent with our hypothesis that workers are less likely to quit their jobs after receiving a bonus. The quadratic term of  $Bonus_{i,t-1}$  is positive and significant ( $1.503E^{-5}$ ,  $Wald\ Chi-square = 24.384$ ), suggesting that the marginal impact of bonus on voluntary turnover probability decreases with its value. Regarding penalties, we find that the coefficient of  $Penalty_{i,t-1}$  is positive and significant ( $5.736 E^{-3}$ ,  $Wald\ Chi-square = 4.307$ ), suggesting that workers are more likely to quit when they have received a penalty. However, the quadratic term of  $Penalty_{i,t-1}$  is insignificant. In economic terms, one standard deviation of bonuses reduces the turnover probability for an average worker by 2.828%, while one standard deviation of penalties increases the turnover probability by 1.660%.<sup>12</sup>

– Insert Table 4 –

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<sup>11</sup> Specifically, following Osborne's (2015) procedure, we excluded observations that change the model's Pearson chi-square by 15, which resulted in removing 59 observations.

<sup>12</sup> We calculate the economic significance using the results (untabulated) from a model in which we center all the other independent variables by their means, except for bonus and penalty.

Taken together, our findings indicate that although penalties have a stronger effect on workers' subsequent performance, penalties may also prompt higher employee turnover, which could be costly, although that may depend on who the company loses. Thus, we further explore the type of workers who are more likely to quit after receiving penalties. The labor economics literature maintains that a person's reservation wage and job opportunities are important factors that determine his or her choice of job and employment contract. Workers with better abilities usually have higher reservation wages and more outside job opportunities. In contrast, those with lesser abilities have fewer opportunities and lower reservation wages. When being penalized, a worker with better ability is more likely to receive a paycheck lower than his or her reservation wage, since his or her reservation wage is higher than those with poorer abilities. As such, good workers, when being penalized, are more likely to seek outside job opportunities that can offer higher pay than the current job.

We empirically examine this question with our data. In Table 4, Panel B, we median-split the sample into "strong type" and "weak type" workers by two indicators: task complexity and production quality.<sup>13</sup> The assembly line tasks are similar across plants. Skillful workers can easily transfer their work experience and knowledge to a similar job in another company, and therefore have more outside opportunities compared to inexperienced workers. As shown in columns (1) and (2) in Table 4, Panel B, we find that  $Penalty_{i,t-1}$  is significantly associated with higher probability of voluntary turnover only for workers who are capable to handle complex tasks ( $8.351E^{-3}$ ,  $Wald\ Chi-square = 4.217$ ), but is insignificant for workers who can only process simple tasks. This finding is consistent with the logic that more capable workers are more likely to quit after being penalized due to higher reservation wages and more outside job opportunities.

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<sup>13</sup> We use the average production quality in the prior three months and task complexity in the previous month to median-split our sample into strong type and weak type workers.

Similarly, in columns (3) and (4), we find that  $Penalty_{i,t-1}$  is significantly associated with a higher probability of voluntary turnover for workers who consistently produce high quality products ( $7.679E^{-3}$ ,  $Wald\ Chi-square = 3.945$ ). The coefficient on  $Penalty_{i,t-1}$  is also positive but less significant at conventional levels ( $6.224E^{-3}$ ,  $Wald\ Chi-square = 2.917$ ) for workers with poor production quality. This finding supports our conjecture that “strong type” workers are more likely to quit when being penalized. In addition, we do not find significant curvilinearity for the relationship between  $Penalty_{i,t-1}$  and turnover probability, suggesting that the marginal effect of penalty on turnover does not decrease with value. On the other hand, we find a negative and significant association between  $Bonus_{i,t-1}$  and employee voluntary turnover, for both strong and weak type workers. The coefficient on  $Bonus_{i,t-1}^2$  is positive and significant, suggesting the retention effect decreases with bonus value.

Taken together, our findings suggest an undesirable selection effect for penalties: penalties appear to have the propensity to drive employees away, and such effect is stronger for strong type employees. In contrast, we find that bonuses appear to help retain employees regardless of their type (i.e., no selection effect for bonuses). These findings may provide additional evidence in support of the greater use of bonuses observed in practice.

### **Implicit Gains and Losses**

We also empirically test the effects of implicit gains/losses on subsequent performance. Consistent with our prediction, in Table 5 we find that implicit losses are negatively associated with all the performance and effort variables in the subsequent period. This finding suggests that when the performance standards were adjusted upward, workers might have experienced implicit losses, perceived the incentive system as too harsh and/or unfair, and thus decreased their efforts by reducing not only their productivity but also production quality. Similarly, we find that

implicit gains are also negatively associated with workers' effort and performance, except quality, in the subsequent period, but the magnitude of effect is significantly smaller than that of implicit losses in all the models, except for the quality model. Our finding is in line with the economic-based incentive theory's prediction that workers respond negatively to both implicit bonuses and penalties due to distortions in the performance evaluation (for any of a number of possible reasons ranging from imprecision to perceived unfairness).<sup>14</sup> The negative response to implicit losses is significantly stronger than that to implicit gains. These findings support H4a and b.

– Insert Table 5 –

### **Robustness Tests**

We examine the robustness of our findings using the following tests. The first concern is the confounding effect of past performance. Our major independent variables, the bonus and penalty in the prior period, may confound with workers' past performance. Therefore, our results may capture the serial correlation between current and past performance, instead of the incentive effect of compensation. To mitigate this possibility, we replace our independent compensation variables in the model with workers' production efficiency in the prior period. In these alternative models, the corresponding relationships for the replacement independent variable disappear. Nevertheless, past performance may still be an omitted correlated variable as it is correlated with both past compensation and current performance. An AR(1) model that includes workers' past performance in month  $t-1$  as an alternative test of our hypotheses leaves our results unchanged.

Second, we address the possible concern that our findings may be affected by the asymmetric bonus/penalty rate; that is, the effect of losses is greater than that of gains because

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<sup>14</sup> To repeat, the intuition behind this is clear from Blanchard et al. (1986) indicating that an implicit gain mutes employees' incentives by reducing effort because the reward was '(too) easy' to earn. Conversely, for an implicit loss, the reason could be perceived unfairness, but the effect of the incentives being muted is the same.

the penalty rate is greater than the bonus rate. We reckon that this is not the case, however, because we examine the response on a per-dollar of bonus or penalty basis, instead of on the basis of the prior period's performance. That said, we conduct the following robustness test to further address this issue. Although the penalty rate is higher than the bonus rate, the actual amount of penalty is bounded by an individual employee's overtime pay in each month. Labor law of the People's Republic of China requires that pay cannot fall below base salary. Therefore the penalty, if any, can only be deducted from overtime pay and other bonuses. Thus, if employees do not work much overtime, the imputed penalty rate would be lower than the stated rate in the contract. For example, if a worker had an unfavorable efficiency variance of 10 hours but only had RMB20 overtime pay, the penalty for poor efficiency would be RMB20 and thus the imputed penalty rate was RMB2 per hour. In a robustness test, we exclude observations with a calculated imputed penalty rate greater than the bonus rate, so that the imputed penalty rate is equal or even lower than the bonus rate in this reduced sample. Our results still hold in this reduced sample, suggesting the asymmetric bonus/penalty rate is not a threat to our findings.

Third, an alternative explanation for our findings is that workers may simply respond to the previous net payment amount, instead of the bonuses and penalties. That is, workers who received less payment in the previous period would put more effort into work simply to make up for the lower salaries received earlier. We note, however, that this potential alternative explanation may accord with the positive association between penalties and performance, but it does not explain why the marginal sensitivity of performance diminishes with the value of penalties. More importantly, the alternative explanation contradicts the theoretical prediction based on prospect theory, as well as our empirical findings, that subsequent effort/performance also increases with bonuses. If the alternative explanation drove our findings, we should find a negative association between prior bonuses and current performance because, according to the

alternative, workers who received more money should have less incentive to work hard in the current period. Instead, we find that bonuses also motivate higher levels of performance in the subsequent period; just the magnitude of the incentive is weaker compared to penalties as suggested by prospect theory. Therefore, we believe that this alternative explanation does not drive our findings.

Fourth, an alternative explanation to our findings about workers turnover is that the penalty may be a signal that identifies poor performers. This signal may not be significant during the first few months of employees' tenure but become more pronounced when workers gain more experience. We take a closer look at the "strong type" workers and compare the difference between the turnover vs. non-turnover groups. First, the average production efficiency in the past three months does not differ significantly between the two groups, suggesting that workers who left the company after being penalized are not weaker performers compared to those who stayed. Second, we find the workers who left the company used to work on more complicated products or tasks, suggesting that they are possibly more capable to perform complex jobs compared to others. This additional piece of evidence supports our finding that strong type workers are more likely to leave after being penalized. Relatedly, one may argue that workers would exert less effort before they quit, thereby leading to our finding of higher turnover probability following penalties. To rule out this alternative explanation, we examine the change in performance and effort in the month prior to voluntary employee turnover to see if there is significant reduction in effort levels. Using the non-turnover sample as the control group, we do not find significant reduction in effort or performance in the month before voluntary turnover. Therefore, our findings are unlikely to be driven by the alternative explanation.

## V. SUMMARY AND CONCLUSIONS

The use of incentive compensation schemes has attracted a great deal of research attention recently, although mostly focused on bonuses with less research being devoted to penalties. Using production-line employee compensation and production output data from an electronic component manufacturing company in China, we find that an RMB1 penalty motivates a higher level of effort and performance than an RMB1 bonus. This is consistent with the theoretical argument that penalties have a stronger effect than bonuses due to humans' loss aversion tendency. Second, we examine whether the effect exhibits a diminishing sensitivity to the value of bonuses/penalties. This hypothesis is supported by our data, showing a curvilinear relationship between bonuses/penalties and subsequent performance. We also find that the sensitivity of penalties diminishes faster than that of bonuses. Therefore, the marginal sensitivity of bonuses eventually becomes greater than that of penalties when their value is large, suggesting that a penalty scheme does not always dominate a bonus scheme in motivating employees. Third, we find penalties (bonuses) to be associated with a higher (lower) probability of voluntary employee turnover, where the effect of penalties on employee turnover is especially significant for skillful and high quality workers. These findings suggest that managers should be careful about the loss of especially valuable human capital that results from the use of penalty schemes. Finally, we find implicit gains and losses to be negatively associated with workers' subsequent efforts and performance. This finding reveals the additional costs that management should consider when adjusting performance standards (or when changing the incentive contract terms).

Our paper not only contributes to the theoretical literature but also offers useful insights for practitioners. Each of our findings has specific and meaningful implications for incentive compensation plan design. For example, we show that the effects of bonuses/penalties diminish

with their value, and thus employers should carefully evaluate the tipping point and consider other types of incentives beyond that point. Moreover, we find employee-perceived implicit gains and losses to be negatively associated with employees' subsequent effort and performance. This often occurs when management updates incentive plans or performance standards and employees fail to fully adjust to the new plans. Employers should therefore carefully consider the implications of changing incentive plans, communicate any changes clearly, and try to mitigate unproductive effects during a transition period.

Our research design is not without limitations, however. First, similar to other field-based studies, the focus of the current study on one firm may limit the generalizability of its findings. Our findings may also be affected by differences in the cultures, industries, education levels, and the skill levels of employees (assembly workers in this instance). It is undoubtedly worthwhile in future work to examine whether incentive plans that include penalties, explicit or implicit, follow the same patterns as we find in this study in different contexts or for different types or ranks of employees. That said, we believe that our findings help inform our understanding of the observed (limited) use of penalties in practice, their effectiveness (up to a point), and their possible unintended consequences (such as on undesired turnover or when affected by uncontrollables), and how these effects may even extend into implicit incentives, such as when employees miss out on their (expected) bonuses.



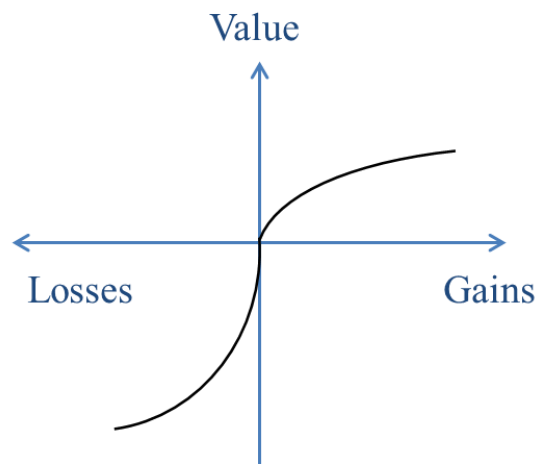
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**FIGURE 1**

**Value Function of Prospect Theory**  
(Kahneman and Tversky 1979)



**TABLE 1**  
**Descriptive Statistics**

	N	Mean	Std. Dev.	Min	Median	Max
<i>Efficiency</i> $_{i,t}$	3,328	1.595	102.793	-285.291	10.680	229.044
<i>Quantity</i> $_{i,t}$	3,328	265.520	173.857	0.1	220.670	687.087
<i>Time</i> $_{i,t}$	3,328	238.881	104.710	0.05	242.717	428.143
<i>Quality</i> $_{i,t}$	2,713	992.978	57.763	186.667	998.396	999.979
<i>Bonus</i> $_{i,t-1}$	3,328	148.202	171.069	0	90	655
<i>Penalty</i> $_{i,t-1}$	3,328	50.085	72.034	0	29	474
<i>Implicit Gain</i> $_{i,t-1}$	2,676	26.316	59.456	0	0	319.939
<i>Implicit Loss</i> $_{i,t-1}$	2,676	19.925	38.466	0	0	222.985
<i>Task Experience</i> $_{i,t}$	3,328	515.947	460.415	0	358.329	1673.28
<i>Tenure</i> $_{i,t}$	3,328	6.697	4.598	2	5	20
<i>Task Complexity</i> $_{i,t}$	3,328	1.069	0.414	0.236	1.102	2.633
<i>Age</i> $_{i,t}$	3,528	24.081	6.383	16	22	49

This table reports the distributions of the variables in the final sample of our main tests.

Variable definitions:

*Efficiency*  $_{i,t}$ : standard – actual amount of hours used in production

*Quantity*  $_{i,t}$ : the total amount of products/tasks completed (in thousands)

*Time*  $_{i,t}$ : the standard time for the amount of products produced or tasks performed

*Quality*  $_{i,t}$ : the number of products/tasked completed that are free of defects per thousand of productions

*Bonus*  $_{i,t-1}$ : total bonus received in the previous month  $t-1$

*Penalty*  $_{i,t-1}$ : total penalty deducted in the previous month  $t-1$

*Implicit Gain*  $_{i,t-1}$ : the favorable difference between expected and actual production efficiency in month  $t-1$

*Implicit Loss*  $_{i,t-1}$ : the unfavorable difference between expected and actual production efficiency in month  $t-1$

*Task Experience*  $_{i,t}$ : the weighted average cumulative hours of experience for the tasks assigned

*Tenure*  $_{i,t}$ : the number of months the employee has been working in this company

*Task Complexity*  $_{i,t}$ : the weighted-average number of standard hours needed to finish a task assigned in month  $t$

*Age*  $_{i,t}$ : the age of the employee in period  $t$

**TABLE 2**  
**Correlations**

	1	2	3	4	5	6	7	8	9	10	11	12
1. <i>Efficiency</i> $_{1,t}$		0.694 ***	0.834 ***	0.220 ***	0.591 ***	0.115 ***	-0.053 ***	-0.081 ***	0.482 ***	0.200 ***	-0.136 ***	0.165 ***
2. <i>Quantity</i> $_{1,t}$	0.674 ***		0.764 ***	0.197 ***	0.453 ***	0.225 ***	0.038 **	-0.085 ***	0.334 ***	0.043 **	-0.627 ***	0.043 ***
3. <i>Time</i> $_{1,t}$	0.856 ***	0.716 ***		0.124 ***	0.457 ***	0.151 ***	0.051 ***	-0.157 ***	0.383 ***	0.185 ***	-0.075 ***	0.156 ***
4. <i>Quality</i> $_{i,t}$	0.255 ***	0.140 ***	0.212 ***		0.210 ***	-0.145 ***	0.010	-0.032	0.262 ***	0.133 ***	-0.101 ***	0.079 ***
5. <i>Bonus</i> $_{i,t-1}$	0.449 ***	0.478 ***	0.390 ***	-0.049 **		0.072 ***	0.139 ***	-0.082 ***	0.555 ***	0.321 ***	-0.216 ***	0.236 ***
6. <i>Penalty</i> $_{i,t-1}$	0.005	0.115 ***	0.037 **	0.015	-0.026		0.135 ***	-0.110 ***	0.036 **	-0.027	-0.179 ***	-0.071 ***
7. <i>Implicit Gain</i> $_{i,t-1}$	-0.289 ***	-0.097 ***	-0.193 ***	-0.007	0.173 ***	0.068 ***		-0.835 ***	-0.009	0.060 ***	-0.033 *	0.017
8. <i>Implicit Loss</i> $_{i,t-1}$	-0.112 ***	-0.033 *	-0.140 ***	-0.060 ***	0.026	-0.056 ***	-0.229 ***		-0.025	-0.078 ***	-0.042 **	0.021
9. <i>Task Experience</i> $_{i,t}$	0.246 ***	0.276 ***	0.241 ***	0.054 ***	0.477 ***	-0.052 ***	0.119 ***	-0.011		0.567 ***	-0.120 ***	0.184 ***
10. <i>Tenure</i> $_{i,t}$	0.023	0.007	0.084 ***	0.054 ***	0.207 ***	-0.056 ***	0.183 ***	-0.038 **	0.458 ***		0.115 ***	0.217 ***
11. <i>Task Complexity</i> $_{i,t}$	-0.146 ***	-0.644 ***	-0.078 ***	0.038 **	-0.279 ***	-0.109 ***	-0.021	-0.059 ***	-0.115 ***	0.108 ***		0.092 ***
12. <i>Age</i> $_{i,t}$	0.090 ***	0.001	0.126 ***	-0.003	0.189 ***	-0.084 ***	0.081 ***	0.045 **	0.214 ***	0.284 ***	0.113 ***	

This table presents the Pearson and Spearman (below and above the diagonal, respectively) correlation matrix of the main variables.

\*\*\*, \*\*, and \* indicate significance at the 1%, 5%, and 10% level, respectively. Please refer to Table 1 for variable definitions.

**TABLE 3**  
**The Effect of Bonuses and Penalties on Subsequent Performance**

		Predicted signs	<i>Efficiency</i> $i_t$		<i>Quantity</i> $i_t$		<i>Time</i> $i_t$		<i>Quality</i> $i_t$	
			Base Model (1)	Full Model (2)	Base Model (3)	Full Model (4)	Base Model (5)	Full Model (6)	Base Model (7)	Full Model (8)
<i>Bonus</i> $i_{t-1}$	$\beta_1$	+		0.345*** (9.762)		0.382*** (8.064)		0.362*** (9.785)		0.062 (1.585)
<i>Penalty</i> $i_{t-1}$	$\beta_2$	+		0.493*** (8.292)		0.567*** (6.980)		0.538*** (8.418)		0.130** (2.083)
<i>Bonus</i> $i_{t-1}^2$	$\beta_3$	-		-3.430E <sup>-4</sup> *** (-5.211)		-3.749E <sup>-4</sup> *** (-4.469)		-3.643E <sup>-4</sup> *** (-6.025)		-1.379 E <sup>-4</sup> ** (-2.143)
<i>Penalty</i> $i_{t-1}^2$	$\beta_4$	-		-1.024E <sup>-3</sup> *** (-7.713)		-1.036E <sup>-3</sup> *** (-5.360)		-1.006E <sup>-3</sup> *** (-6.602)		-2.540E <sup>-4</sup> ** (-1.984)
<i>Task Experience</i> $i_t$	$\beta_5$		0.017*** (3.569)	0.015*** (3.254)	0.020*** (3.293)	0.019*** (2.872)	0.0106*** (3.030)	0.015*** (2.810)	0.024*** (3.266)	0.026*** (3.485)
<i>Tenure</i> $i_t$	$\beta_6$		0.289 (0.344)	-0.893 (-1.109)	-1.122 (-1.025)	-2.469** (-2.452)	-0.390 (-0.439)	-1.637** (-2.028)	1.924** (2.466)	1.857** (2.367)
<i>Task Complexity</i> $i_t$	$\beta_7$		18.035* (1.695)	10.435 (1.135)	-138.820*** (-8.714)	-147.419*** (-10.114)	20.521* (1.908)	12.350 (1.334)	-3.936 (-0.690)	-5.264 (-0.893)
<i>Age</i> $i_t$	$\beta_8$		-0.106 (-0.790)	-0.711*** (-8.096)	-0.587 (-0.742)	-1.325* (-1.926)	-0.425 (-0.780)	-1.120** (-2.491)	1.370E <sup>-5</sup> (0.000)	-0.177* (-1.676)
Employee Fixed Effect			Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effect			Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
$\beta_2 - \beta_1$ ( <i>F stat.</i> )				0.148** (5.126)		0.185** (3.876)		0.176** (5.740)		0.068 (0.936)
$\beta_4 - \beta_3$ ( <i>F stat.</i> )				-6.811E <sup>-4</sup> *** (22.541)		-6.610E <sup>-4</sup> *** (9.698)		-6.412E <sup>-4</sup> *** (15.191)		-1.161E <sup>-4</sup> (0.686)
R <sup>2</sup>			0.515	0.559	0.687	0.708	0.392	0.442	0.157	0.164
N			3,328	3,328	3,328	3,328	3,328	3,328	2,713	2,713

This table presents how bonus and penalty affect workers' subsequent effort and performance. Column (1) and (2) report the regression results of bonus and penalty on workers' subsequent production efficiency. Column (3) and (4) report the regression results of bonus and penalty on workers' subsequent production quantity. Column (5) and (6) report the regression results of bonus and penalty on workers' subsequent production time. Column (7) and (8) report the regression results of bonus and penalty on workers' subsequent production quality. Please refer to Table 1 for variable definitions. All continuous variables are winsorized at the top and bottom 1%. We report *t*-values in parentheses. Standard errors are clustered at the worker level. \*\*\*, \*\*, \* indicates significance at the 1%, 5%, and 10% level, respectively (two-tailed).

**TABLE 4**  
**The Effect of Bonuses and Penalties on Employee Turnover**

**Panel A: Discrete-Time Survival Analysis with All Samples**

		Predicted signs	<i>Voluntary Employee Turnover</i> <i><math>T_{i,t}</math></i>
<i>Bonus</i> <sub><i>i,t-1</i></sub>	$\beta_1$	-	-0.011*** (31.128)
<i>Penalty</i> <sub><i>i,t-1</i></sub>	$\beta_2$	+	5.736E <sup>-3</sup> ** (4.307)
<i>Bonus</i> <sub><i>i,t-1</i></sub> <sup>2</sup>	$\beta_3$		1.503E <sup>-5</sup> *** (24.384)
<i>Penalty</i> <sub><i>i,t-1</i></sub> <sup>2</sup>	$\beta_4$		-5.440E <sup>-6</sup> (0.714)
<i>Task Experience</i> <sub><i>i,t</i></sub>	$\beta_5$		1.871E <sup>-3</sup> *** (55.910)
<i>Tenure</i> <sub><i>i,t</i></sub>	$\beta_6$		-0.137*** (13.364)
<i>Task Complexity</i> <sub><i>i,t</i></sub>	$\beta_7$		0.325 (1.758)
<i>Age</i> <sub><i>i,t</i></sub>	$\beta_8$		-0.151*** (33.941)
Employee Fixed Effect			Yes
Year Fixed Effect			Yes
Max-rescaled Cox-Snell R <sup>2</sup>			0.147
N			3,269

**TABLE 4 (continued)**

**Panel B: Discrete-Time Survival Analysis with Sub-samples Median-split by Task Complexity and Production Quality**

		<i>Voluntary Employee Turnover</i> $i, t$			
		Complexity		Production Quality	
	Pred. signs	Complex Task Workers (1)	Simple Tasks Workers (2)	High Quality Workers (3)	Low Quality Workers (4)
<i>Bonus</i> $i, t-1$	$\beta_1$ -	-0.014*** (15.953)	-9.172E <sup>-3</sup> *** (15.356)	-0.010*** (18.788)	-0.014*** (21.525)
<i>Penalty</i> $i, t-1$	$\beta_2$ +	8.351E <sup>-3</sup> ** (4.217)	3.758E <sup>-3</sup> (0.911)	7.679E <sup>-3</sup> ** (3.945)	6.224E <sup>-3</sup> * (2.917)
<i>Bonus</i> $i, t-1$ <sup>2</sup>	$\beta_3$	2.143E <sup>-5</sup> *** (11.332)	1.329E <sup>-5</sup> *** (13.463)	1.398E <sup>-5</sup> *** (14.934)	2.178E <sup>-5</sup> *** (19.784)
<i>Penalty</i> $i, t-1$ <sup>2</sup>	$\beta_4$	-8.502E <sup>-6</sup> (0.956)	-5.487E <sup>-6</sup> (0.235)	-6.973E <sup>-6</sup> (0.579)	-7.899E <sup>-6</sup> (0.798)
<i>Task Experience</i> $i, t$	$\beta_5$	2.251E <sup>-3</sup> *** (30.163)	1.715E <sup>-3</sup> *** (22.665)	1.906E <sup>-3</sup> *** (28.668)	1.603E <sup>-3</sup> *** (16.180)
<i>Tenure</i> $i, t$	$\beta_6$	-0.141*** (7.364)	-0.140** (5.062)	-0.123** (4.639)	-0.136*** (9.913)
<i>Task Complexity</i> $i, t$	$\beta_7$	0.182 (0.124)	0.594 (0.751)	0.336 (0.698)	0.201 (0.372)
<i>Age</i> $i, t$	$\beta_8$	-0.147*** (16.561)	-0.162*** (15.637)	-0.219*** (34.854)	-0.089*** (6.858)
Employee Fixed Effect		Yes	Yes	Yes	Yes
Year Fixed Effect		Yes	Yes	Yes	Yes
Max-rescaled Cox-Snell R <sup>2</sup>		0.183	0.130	0.217	0.111
N		1,635	1,634	1,608	1,609

This table presents how bonus and penalty are associated with the probability of employee voluntary turnover in the subsequent period. Panel A shows the discrete-time survival model results with the full final sample. Panel B shows the discrete-time survival model results for various sub-samples. Specifically, Panel B Column (1) and (2) show the results for workers who are capable to handle complex or simple tasks, respectively. We use individual worker's weighted average task complexity in the previous month to median-split the sample. Panel B Column (3) and (4) show the results for workers with high and low production quality, respectively. We use individual worker's average production quality in the prior three months to median-split the sample. Please refer to Table 1 for variable definitions. All continuous variables are winsorized at the top and bottom 1%. We report *Wald Chi-square* values in parentheses. Standard errors are clustered at the worker level. \*\*\*, \*\*, \* indicates significance at the 1%, 5%, and 10% level, respectively (two-tailed).



**TABLE 5**  
**The Effect of Implicit Gains and Losses on Subsequent Performance**

		Predicted signs	<i>Efficiency</i> $_{i,t}$ (1)	<i>Quantity</i> $_{i,t}$ (2)	<i>Time</i> $_{i,t}$ (3)	<i>Quality</i> $_{i,t}$ (4)
<i>Implicit Gain</i> $_{i,t-1}$	$\beta_1$	-	-0.509*** (-20.921)	-0.428*** (-12.666)	-0.464*** (-17.339)	-1.796E <sup>-3</sup> (-0.130)
<i>Implicit Loss</i> $_{i,t-1}$	$\beta_2$	-	-0.634*** (-11.617)	-0.702*** (-9.845)	-0.721*** (-12.620)	-0.066** (-2.078)
<i>Bonus</i> $_{i,t-1}$	$\beta_3$	+	0.306*** (8.860)	0.323*** (6.878)	0.322*** (8.629)	3.792E <sup>-3</sup> (0.160)
<i>Penalty</i> $_{i,t-1}$	$\beta_4$	+	0.478*** (8.071)	0.515*** (6.556)	0.512*** (7.833)	0.080* (1.917)
<i>Bonus</i> $_{i,t-1}^2$	$\beta_5$	-	-2.522E <sup>-4</sup> *** (-4.204)	-2.713E <sup>-4</sup> *** (-3.258)	-2.811E <sup>-4</sup> *** (-4.769)	-3.046E <sup>-5</sup> (-0.689)
<i>Penalty</i> $_{i,t-1}^2$	$\beta_6$	-	-9.843E <sup>-4</sup> *** (-7.236)	-9.203E <sup>-4</sup> *** (-4.717)	-9.463E <sup>-4</sup> *** (-5.923)	-1.754E <sup>-4</sup> * (-1.948)
<i>Task Experience</i> $_{i,t}$	$\beta_7$		-1.952E <sup>-3</sup> (-0.399)	-0.011 (-1.509)	-9.701E <sup>-3</sup> (-1.621)	3.522E <sup>-3</sup> (1.270)
<i>Tenure</i> $_{i,t}$	$\beta_8$		-2.491*** (-3.328)	-5.031*** (-4.625)	-4.247*** (-5.060)	0.071 (0.194)
<i>Task Complexity</i> $_{i,t}$	$\beta_9$		13.780 (1.562)	-141.990*** (-8.940)	18.039* (1.726)	-2.053 (-0.791)
<i>Age</i> $_{i,t}$	$\beta_{10}$		0.304 (0.744)	0.386 (0.835)	0.370 (0.802)	5.280E <sup>-3</sup> (0.227)
Employee Fixed Effect			Yes	Yes	Yes	Yes
Year Fixed Effect			Yes	Yes	Yes	Yes
$\beta_2 - \beta_1$ ( <i>F stat.</i> )			-0.125** (6.565)	-0.274*** (21.659)	-0.257*** (32.155)	-0.064 (2.699)
R <sup>2</sup>			0.647	0.749	0.523	0.251
N			2,676	2,676	2,676	2,224

This table presents how implicit gains and losses affect workers' subsequent effort and performance. Column (1) reports the regression result on production efficiency. Column (2) reports the regression result on production quantity. Column (3) reports the regression result on standard production time. Column (4) reports the regression result on production quality. Please refer to Table 1 for all other variable definitions. All continuous variables are winsorized at the top and bottom 1%. We report *t*-values in parentheses. Standard errors are clustered at the worker level. \*\*\*, \*\*, \* indicates significance at the 1%, 5%, and 10% level, respectively (two-tailed).