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An incentive to increase laborers' productivity with adopting performance-based wages and paid vacations

Yui Nakamura
Faculty of Economics, Fukuoka University

Abstract

This paper shows that introducing a paid-vacation system tied to performance is effective in increasing the motivation of laborers to make effort and exercise high productivity. This effect is similar to the effects of implementing a performance-based wage system, on which many earlier papers have focused. We also found that the paid-vacation system can be particularly effective in companies where high-skilled laborers are required and labor hours are long. In addition, laborers' motivation can be greater when a company offers different performance-based compensation schemes, such as the performance-based system and the paid-vacation system, because each laborer has heterogeneous preference for leisure.

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1 Introduction

Over the past thirty years, much theoretical and empirical analysis has clarified that laborers' incentive to work and earn more money is greater under the performance-based wage system than under the salaried or hourly paid system (Pencavel, 1977; Seiler, 1984; Lazear, 1986; Ewing, 1996; Booth, 1999; and Parent, 1999). Lazear (2000) finds that a performance-based wage system enhances the average motivation to work, and output per laborer increases about 44 percent. Moreover, Dohmen and Falk (2006) show empirical results that output is much higher under several performance-based wage systems than under a salaried compensation scheme. However, few studies have addressed the mechanisms other than performance-based wage systems that increase laborers' incentive to work.

This paper shows that introducing a paid-vacation system tied to performance also gives laborers motivation to make an effort and exercise high productivity, similar to that which is seen with a performance-based wage system. Moreover, when laborers have heterogeneous preferences for leisure, the paid-vacation system can be more effective than the performance-based wage system for laborers who have high-skill and have long work hours. Therefore, we find that companies can improve their output by offering both systems to laborers and urge them to choose one of their schemes.

2 The model

Under the salaried or the hourly paid system, even if laborers make an effort to increase their productivity, doing so does not have an effect on their income. On the other hand, when laborers' productivity is evaluated under the performance-based wage system, making an effort to increase their productivity raises their income and may also increase their utility.

Before considering the effects of such incentive mechanisms on increasing laborers' productivity, we examine the exercised productivity of each laborer under the salaried compensation system, where labor hours and wages are determined in order to establish a benchmark.

The individuals' utility function is formed as follows:

$$U = a_i l_i - w_1 h(l_i) - w_2 f(a_i), \tag{1}$$

where a_i indicates exercised productivity that is less than or equal to the potential ability of individual i. l_i means labor hours of individual i, and functions h and f are the cost of labor hours and the cost of the effort to show productivity a_i respectively. We assume that both the h and f functions are increasing and convex. Moreover, w_1 and w_2 indicate the weight of costs from labor hours and making effort, when the weight of benefit from income is set as 1. Then, w_1 and w_2 are positive.

It is clear that the weight of w_1 is large for workers who attach weight to leisure, while it is small for workers who receive relatively less utility from leisure. In addition, laborers who have high skill can show high productivity with less effort. Therefore, we assume that the w_2 for highly-skilled laborers is less than that for low-skilled laborers.

2.1 Fixed labor hours and fixed wages

We assume that labor hours for each employee are set at $\hat{l}$ and a base salary is set at y by employment contracts. y is determined as $a_L\hat{l}$, where a_L is the minimum productivity per capita required from a company. Only laborers whose exercised productivity is higher than

a_L are hired, while laborers whose exercised productivity is less than a_L are laid off. Then the laborers face the utility function as follows:

$$U = y - w_1 h(\hat{l}) - w_2 f(a_i). \tag{2}$$

From (2), it is found that laborers do not have the incentive to show high productivity at all as long as labor hours and incomes are determined by the employment contracts. As long as the inequality

$$U = y - w_1 h(\hat{l}) - w_2 f(a_L) > 0 \tag{3}$$

is realized, exercised productivity of each laborer becomes $a_i = a_L$, insofar as they are not laid off.

2.2 A performance-based wage system

Next, we consider laborers' exercised productivity under a performance-based wage system. We assume that employers restore laborers some percentage of their production that is more than the minimum amount of production required from the company, y as a bonus under the determined labor hours $\hat{l}$. Bonus is determined as

$$B = \alpha(a_i \hat{l} - y). \tag{4}$$

$(1-\alpha)(a_i \hat{l} - y)$ brought by a laborer is surplus production of employers which is in excess of what it would have been under a salaried compensation scheme. In this case, each laborer's utility function is formed as

$$U = (1-\alpha)y + \alpha a_i \hat{l} - w_1 h(\hat{l}) - w_2 f(a_i). \tag{5}$$

The first-order condition of (5) with respect to a_i is

$$\frac{\partial U}{\partial a_i} = \alpha \hat{l} - w_2 f'(a_i) = 0. \tag{6}$$

From (6), $a_i^* > 0$ is realized, where a_i^* is the optimal exercised productivity of individual i. If $a_L \geq a_i^*$ is satisfied, laborers show their productivity a_L to maximize their utility and, so the performance-based wage system is not effective in increasing laborers' productivity. On the other hand, if $a_L < a_i^*$ is satisfied, laborers' exercised productivity increases as long as their potential ability is equal to or more than a_i^*.

Now, we focus attention on the effect of parameters α, $\hat{l}$, and w_2 on the laborers' optimal exercised productivity and obtain the following results.

1. There is a positive correlation between a_i^* and α, and between a_i^* and $\hat{l}$.
2. There is a negative correlation between a_i^* and w_2.

a_i^* tends to be high when a labor hour $\hat{l}$ is long and the percent of the restored production to laborers α is large. Moreover, the a_i^* of high-skill laborers must be higher than that of low-skill laborers because the value of w_2 for high-skilled laborers is less than that for low-skill laborers.

2.3 A paid-vacation system

In this section, we consider the effects of a paid-vacation system, which is another incentive mechanism with which to raise laborers' exercised productivity. We assume that employers give paid vacations to a laborer who shows the minimum amount of production required to keep from getting fired, $y = a_L\hat{l}$, more quickly than $\hat{l}$. That is, a laborer can achieve his or her aim of output y by achieving greater exercised productivity than a_L. In this case, the length of paid vacations is determined as

$$P = \frac{\beta(a_i\hat{l} - y)}{a_i}, \tag{7}$$

where β is the percentage of surplus production that is more than y. Surplus production of employers brought by a laborer, which is production in excess of what it would have been under a salaried compensation scheme, is $(1-\beta)(a_i\hat{l} - y)$.[1]

Laborers control their exercised productivity level and maximize their utility function, which is formed as follows:

$$\begin{aligned} U &= y - w_1 h(\hat{l} - \frac{\beta(a_i\hat{l} - y)}{a_i}) - w_2 f(a_i) \\ &= y - w_1 h((1-\beta)\hat{l} + \frac{\beta y}{a_i})) - w_2 f(a_i). \end{aligned} \tag{8}$$

The first-order condition of (8) with respect to a_i is

$$\frac{\partial U}{\partial a_i} = \frac{\beta y}{a_i^2} w_1 h'((1-\beta)\hat{l} + \frac{\beta y}{a_i})) - w_2 f'(a_i) = 0. \tag{9}$$

When $a_i \to 0$, the value of (9) comes close to ∞ and it comes close to $-\infty$ when $a_i \to \infty$ because functions h and f are increasing and convex. Therefore, $0 < a_i^{**} < \infty$ is satisfied when a_i^{**} is the optimal exercised productivity of individual i. Hence, the paid-vacation system is effective in increasing laborers' exercised productivity if $a_L < a_i^{**}$ and the potential ability of a laborer i exceeds a_i^{**}.

We focus attention on the facts that some parameters, such as β, w_1, w_2, y, and $\hat{l}$, affect the decision of the optimal exercised productivity under the paid-vacation system. Let us consider the effects of each parameter on laborers' productivity. Given that $\partial U/\partial a_i = A$, the deviation of A with respect to a_i is shown as

$$\frac{\partial A}{\partial a_i} = -\frac{2\beta y w_1}{a_i^3} h'((1-\beta)\hat{l} + \frac{\beta y}{a_i}) - \frac{\beta^2 y^2 w_1}{a_i^4} h''((1-\beta)\hat{l} + \frac{\beta y}{a_i}) - w_2 f''(a_i) < 0. \tag{10}$$

That is, there is a negative correlation between A and a_i. From this result, we obtain several correlations:

1. There are positive correlations between a_i^{**} and w_1, between a_i^{**} and $\hat{l}$, and between a_i^{**} and a_L because $y = a_L\hat{l}$.

2. There is a negative correlation between a_i^{**} and w_2.

[1] When $\alpha = \beta$ is satisfied, the surplus production of employers from a laborer is the same under the performance-based wage system and the paid-vacation system.

The correlation between a_i^{**} and β is not clear because it depends on the function h. Therefore, we focus on implications of the relationship between a_i^{**} and four parameters: w_1, w_2, $\hat{l}$ and a_L.

First, (9) shows that increased w_1 and decreased w_2 raise the value of A. In order to decrease the value of A to realize (9), a_i^{**} increases. That is, laborers who attach a high weight to leisure and highly skilled laborers tend to show greater exercised productivity under the paid-vacation system.

Second, A increases when the value of $\hat{l}$ and a_L rise since function h is convex; that is, the longer labor hours and the higher the minimum required productivity per capita urge laborers to show their greater exercised productivity.

2.4 Effective incentive mechanisms

In this section, we compare the effects of increasing laborers' incentive to work under the performance-based wage system and the paid-vacation system using several different situations. First, we make three propositions.

Proposition 1 *A performance-based wage system and a paid-vacation system give laborers the incentive to increase their exercised productivity.*

Proof. From (6) and (9), we find that laborers' optimal exercised productivity a_i^* and a_i^{**} are positive. Therefore, employers can motivate laborers to increase their exercised productivity by introducing these systems when a_i^* and a_i^{**} are higher than a_L, and when laborers' potential ability exceeds a_i^* under the performance-based wage system and a_i^{**} under the paid-vacation system. ■

Proposition 2 *A performance-based wage system and a paid-vacation system are particularly effective for laborers who have high skills to increase their exercised productivity.*

Proof. a_i^* and a_i^{**} are negatively correlated with w_2. From the assumption that high-skilled laborers have a low w_2 value, these systems affect highly skilled laborers more than low-skilled laborers. ■

Proposition 3 *A company in which employees work for long hours benefits from both performance-based wage systems and paid-vacation systems.*

Proof. From (6), (9) and (10), we find that a_i^* and a_i^{**} rise by increasing $\hat{l}$. That is, a performance-based wage system and a paid-vacation system are effective in increasing laborers' incentive to show high exercised productivity, especially where labor hours are long. ■

Considering the difference between the two mechanisms shows that laborers' optimal exercised productivity depends on parameters α, $\hat{l}$, and w_2 under the performance-based wage system, while it depends on β, $\hat{l}$, a_L, w_1 and w_2 under the paid-vacation system. From this fact, we obtain the following proposition.

Proposition 4 *A company that requires a high minimum productivity per capita benefits more from a paid vacation scheme.*

Proof. The level of the minimum productivity required by a company, a_L, does not affect the optimal exercised productivity under the performance-based wage system, but it does affect the laborers' optimal exercised productivity, a_i^{**}, and the minimum productivity and the optimal exercised productivity are positively correlated under the paid vacation system. Therefore, a_i^{**} increases by requiring a high level of a_L. ■

The performance-based wage system is more effective in raising laborers' incentive to work when $a_i^* > a_i^{**}$, while the paid-vacation system is more effective when $a_i^* < a_i^{**}$. Since laborers have heterogeneous preference for leisure, a company can exploit this heterogeneity by offering them two incentive mechanisms from which to choose.

3 Conclusion

In this paper, we consider two compensation schemes, the performance-based wage system and the paid-vacation system, and clarify that a paid-vacation system tied to performance is effective in increasing laborers' exercised productivity, similar to that which is seen in a performance-based wage system. The paid-vacation system is effective in companies where high-skilled laborers are required and labor hours are long. Moreover, we find that a company benefits relatively more from offering both systems because laborers have heterogeneous preferences for leisure and they will increase their exercised productivity more when they can choose between the performance-based wage system and the paid-vacation system.

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