CAES Working Paper Series

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WP-2010-004

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

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Abstract

This paper shows that introducing a paid-vacation system tied to performance is effective for increasing motivation of laborers to make effort and exercise high productivity. This is similar to the effects of implementing a performance-based wage system, on which the reviewed literature has focused. The paid-vacation system can be more effective in companies where high-skilled laborers are required and the base salary is high compared to the performance-based wage system. Moreover, we find that the paid-vacation system affects the motivation level of each type of laborer differently. Therefore, laborers' motivation can be higher when laborers are able to choose their favorite incentive mechanism between the performance-based system and the paid-vacation system.

JEL classification: D61, J31, J41

Key words: paid vacation, performance-based wage, incentive, effort

*I am grateful to Shin Sato and Kenmei Tsubota for their helpful comments and encouragement.

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1 Introduction

Over the past thirty years, a lot of theoretical and empirical analysis has clarified that laborers increase their incentive to work and earn more money under the performance-based wage system compared to the situation under the salaried or hourly paid system (Pencavel, 1977; Seiler, 1984; Lazear, 1986; Ewing, 1996; Booth, 1999; and Parent, 1999). Lazear (2000) find that a performance-based wage system enhances motivation to work on average and clarify that output per laborer increase about 44 percents. Moreover, Dohmen and Falk (2006) show empirical results that output is much higher in several wage systems compared to the fixed payment scheme. On the other hand, there are few researches about mechanisms that increase laborers' incentive to work besides several wage systems.

This paper shows that introducing a paid-vacation system tied to performance also gives laborers motivation to make effort and exercise high productivity, such as that which is seen with a performance-based wage system. In addition, the paid-vacation system can be more effective in companies where high-skilled laborers are required and the base salary is high compared to the paid-vacation system. Moreover, we find that the paid-vacation system affects the motivation of each type of laborer differently. Therefore, laborers' motivation can be higher when laborers are able to choose the incentive mechanism between the performance-based system and the paid-vacation system.

2 The model

Under the salaried or the hourly paid system, laborers do not have the motivation to exercise high performance with any effort. On the other hand, laborers show high productivity when their performance is evaluated and high evaluation increase their utility.

Before considering the effects of such incentive mechanisms which succeed in increasing laborers' productivity, we examine the exercised productivity of each laborer under the salaried system, which determines labor hours and wages as 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 and l_i indicate exercised productivity and labor hours of individual i respectively, and functions h and f show costs of labor hours and costs of 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 people who attach weight to leisure, while it is small for hard workers. In addition, laborers with high skill can show high productivity with little effort since they have high ability. Therefore, w_2 for high-skilled laborers is less than that of low-skilled laborers.

2.1 Fixed labor hours and fixed wages

We assume that labor hours for each employee are determined as $\hat{l}$ and a base salary is set as y by employment contracts. y is determined as $a_L\hat{l}$, where a_L is a bare essentials of productivity per capita. Only laborers whose potential ability is higher than a_L are hired because laborers whose productivity is less than a_L are laid off by employers. When the utility of laborers under the contracts is higher than that of unemployed people, laborers show their productivity as being at least a_L. 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 some 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. Laborers make effort to show $a_i = a_L$ insofar as they are not laid off.

2.2 A performance-based wage system

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

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

In this case, profits of the employers brought by a laborer is $(1-\alpha)(a_i\hat{l} - y)$ and each laborer's utility function is formed as

$$U = (1-\alpha)y + \alpha a_i \hat{l} - w_1 h(\hat{l}) - w_2 f(a_i). \tag{3}$$

The first-order condition of (3) with respect to a_i is

$$\frac{\partial U}{\partial a_i} = \alpha \hat{l} - w_2 f'(a_i) = 0. \tag{4}$$

From (4), $a_i^* > 0$ is realized where a_i^* is the optimal productivity of individual i. If $a_L \geq a_i^*$ is satisfied, laborers show their productivity a_L to maximize their utility and it can be said that the performance-based wage system is not effective to increase laborers' productivity. On the other hand, if $a_L < a_i^*$ is satisfied, laborers increase their productivity as long as their maximum ability exceeds a_i^*.

Now, we focus attention on the affect of the parameters α, $\hat{l}$, and w_2 on the decision of the laborers' optimal 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 determined labor hour $\hat{l}$ is long and the percent of the restored production to laborers α is large. Moreover, a_i^* of high-skill laborers must be higher than that of low-skill laborers because the value of w_2 of high-skilled laborers is less than that of low-skill laborers.

2.3 A paid-vacation system

In this section, we consider an effect of a paid-vacation system which is the second incentive mechanism we try to examine in this paper. We assume that employers give paid vacations to a laborer who finishes a bare essential production per capita, $y = a_L \hat{l}$ more quickly than $\hat{l}$ by high productivity that is over a_L. The length of paid vacations is determined as

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

where β is the percentage of laborers' production that is more than a bare essential production. That is, the paid-vacation is defined as hours during

which a laborer makes the restored production that is more than y. In this case, profits of the employers brought by a laborer is $(1-\beta)(a_i\hat{l}-y)$.[1]

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

$$\begin{aligned} U &= y - w_1 h(\hat{l} - \frac{\beta(a_i\hat{l}-y)}{a_i}) - w_2 f(a_i) \\ &= y - w_1 h((1-\beta)\hat{l} + \frac{\beta y}{a_i})) - w_2 f(a_i). \end{aligned} \tag{5}$$

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

$$\frac{\partial U}{\partial a_i} = \frac{\beta y}{a_i^2} w_1 h'((1-\beta)\hat{l} + \frac{\beta y}{a_i})) - w_2 f'(a_i) = 0. \tag{6}$$

When $a_i \to 0$, the value of (6) comes close ∞ while it comes close $-\infty$ when $a_i \to \infty$. Therefore, $0 < a_i^{**} < \infty$ is satisfied where a_i^{**} is the optimal productivity of individual i. Hence, we can say that the paid-vacation system is effective to increase laborers' productivity if $a_L < a_i^{**}$ and the maximum ability of a labor 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 productivity under the paid-vacation system. Let us consider the effects of each parameter to laborers' productivity in detail. First, we define that $\partial U/\partial a_i = A$. Then, the deviation of A with respect to a_i is

$$\frac{\partial A}{\partial a_i} = -\frac{2\beta y w_1}{a_i^3} h'((1-\beta)\hat{l} + \frac{\beta y}{a_i}) - \frac{\beta^2 y^2 w_1}{a_i^4} h''((1-\beta)\hat{l} + \frac{\beta y}{a_i}) - w_2 f''(a_i) < 0. \tag{7}$$

That is, there is a negative correlation between A and a_i. From this result, we obtain some results as follows.

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

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

[1] When $\alpha = \beta$ is satisfied, the profits of employers from a laborer are 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 although a_i^{**} increases by introducing the paid-vacation system. Therefore, we focus on implications of the relationship between a_i^{**} and other four parameters.

First, it is clarified from (6) that increased w_1 and decreased w_2 raise the value of A. In order to decrease the value of A to realize (6), a_i^{**} increases. That is, laborers who attach the weight of leisure or laborers with high skill tend to show higher productivity under the mechanism.

Second, A increases by raising the value of $\hat{l}$ and y since the function h is convex. That is, the longer labor hours are and the higher the base salary is, the higher laborers show their productivity.

2.4 Effective incentive mechanisms

In this section, we examine effects of increasing laborers' incentive to work under the performance-based wage system and the paid-vacation system, thereby comparing them in several situations. First of all, we can obtain the following propositions.

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

Proof. From (4) and (6), it is found that the laborer's optimal productivity a_i^* and a_i^{**} are positive. Therefore employers can urge laborers to increase their productivity by introducing these systems when a_i^* and a_i^{**} become higher than a_L and laborers' ability exceeds them. ■

Proposition 2 *A performance-based wage system and a paid-vacation system are effective to laborers who have high skills.*

Proof. a_i^* and a_i^{**} have the negative correlation with w_2. Since high-skilled laborers have low-value of w_2, these systems affect high-skill laborers more than low-skilled laborers. ■

Next, let us consider the difference between two mechanisms. It clarifies that the decision of laborers' optimal productivity depends on the parameters α, $\hat{l}$, and w_2 under the performance-based wage system, while it depends on β, $\hat{l}$, y, w_1 and w_2 under the paid-vacation system. From this fact, we obtain the propositions as follows.

Proposition 3 *The increased based salary can introduce high productivity of high-skilled laborers' under the paid-vacation system.*

Proof. From (6), it is found that a_i^{**} rises by increasing y. That is, the paid-vacation system is effective to increase laborers' incentive to show high productivity where the base salary $y = a_L\hat{l}$ is high. ■

Moreover, we can find the type of laborers whom the paid-vacation system affects strongly.

Proposition 4 *A paid-vacation system is effective for laborers who attach the weight on leisure.*

Proof. *From (6), we find that there is positive correlation between w_1 and a_i^{**}. Since w_1 of laborers who attach weight on leisure is large, they tend to show higher productivity than low-skill laborers.* ■

The performance-based wage system is more effective to raise laborers' incentive to work when $a_i^* > a_i^{**}$ while the paid-vacation system is more effective when $a_i^* < a_i^{**}$. Proposition 2 and 3 show that the paid-vacation system is effective for the companies where high-skilled laborers are required and $a_i^* < a_i^{**}$ is realized easily. Moreover, since this system shows different effects to different types of laborers, it should be noted that laborers' increase their productivity more when they can choose one of the incentive mechanism, such as the performance-based wage system and the paid-vacation system.

3 Conclusion

In this paper, we consider the incentive mechanism such as the performance-based wage system and the paid-vacation system and clarify that introducing a paid-vacation system tied to performance is also effective to increase motivation of laborers to make effort and exercise high productivity, such as seen in a performance-based wage system. We find that the paid-vacation system is effective in companies where high-skilled laborers are required and their base salary is high. In addition, it is clarified that the paid-vacation system affects each laborer diffidently and is effective especially to the laborers who attach greater weight on leisure. Therefore, the laborers increase their productivity more when they can choose the more attractive incentive mechanism between the performance-based wage system and the paid-vacation system.

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