Incentive system of skill-oriented dispatched employees based double moral hazard

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Abstract

As market competition gets increasingly fierce, the elastic way of employment arouses great concern among more and more enterprises, which results in rapid development of labour dispatch. Labour dispatch is different from the traditional way of employment and it involves the three parties of the employer, the accepting entity and the dispatched employee with the striking feature of asymmetric information. From the perspective of the employer, this paper analyses the incentives of the three parties in labour dispatch while taking the employer as the first principal and the accepting entity as the second principal in consideration of the factors that the intermediary agent's training will influence the quality of the employee. It verifies through models the sharing ratio paid by the accepting entity to the employer, the sharing ratio paid by the employer to the dispatched employee and the fixed wage paid by the accepting entity to the dispatched employee in expectation of offering concrete suggestions to the practice of enterprises.

Keywords: Labour Dispatch, Agent's Effort, Double Programming, Sharing Ratio

Introduction

With the development of global economy and the intensity of market competition, many enterprises endeavour to save business costs and enhance profit margins in order to keep and improve the core competitiveness. Different from the focus on the strict division of labour and centralization of functional authority under the background of industrialized production, the rapidly changing market requires that there should be more flexibility of the function and communication of the enterprise's various systems. Under such circumstances, flexible way of employment is widely adopted. On a global scale, although the elastic way of employment is of a small scale, it develops very rapidly.

Labour dispatch is that the dispatching unit signs the dispatching agreement with the accepting entity in accordance with the demands of the accepting entity and dispatch the employee with labour contract relations to the accepting entity so as to establish a special labour relation that the dispatched employee provides labour under the management of the accepting entity while the dispatching unit gets the dispatching payment from the accepting entity and pay the dispatched employees labour remuneration. Through the research on the situation of labour dispatch in Chicago, Peck and Theodore [1] find that this business is becoming divided, from which it derives the short-termed, low skilled and low-waged low-end service and the high-end service with a long-term cooperation and a close relation to the inner flow of the client's organization.

Labour dispatch is different from the traditional dual employment relationship, and it involves the three parties of the dispatching unit, the accepting entity and the dispatched employee. In general, the accepting entity does not know enough about the dispatching unit and the credit level and ability of the dispatched employee, which leads to the obvious asymmetric information. In the operation of labour dispatch, the training effort of the dispatching unit will influence the ability of the dispatched employee, and the ability and effort of the dispatched employee will directly influence the actual output of the accepting entity. Therefore, the double effort of the dispatching unit and the dispatched employee will influence the revenue of the accepting entity. This paper makes an analysis of the incentives of skill-oriented dispatched employees based on the bi-level program (i.e. when the work ability is stronger than the work effort) while taking the dispatching unit as the first principal and the accepting entity as the second principal under the circumstances of double moral hazard. The sharing revenues of the three parties are manifested through the models. The author wishes it a valuable reference to the practice of the enterprises.

Related literature

Labour dispatch involves the three parties of the dispatching unit, the accepting entity and the dispatched employee. The dispatching agreement is signed between the dispatching unit and the accepting entity and the employment contract is signed between the dispatching unit and the dispatched employee. Thus, the dispatching unit serves as the bridge in the business of labour dispatch. Literature from the perspective of the accepting entity mainly focuses on the motivation of choice of the accepting entity, such as literature [2] to [6] explaining the enterprise's motivation of the employment from the economic and social function. Literature from the perspective of the dispatched employee mainly focuses on the psychological contract and organization involvement, such as

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literature [7] to [9] discussing the relationship between psychological contract and attitude and action of the casual workers. Based on a study on 1091 dispatched workers and regular workers from 12 automobile factories in 6 provinces, Xie Yuhua et al. [10] analyses the difference of employee – organization relationship between the dispatched workers and regular workers. Based on a field survey of telecommunications in Jilin Province, Wang Hongyu [11] analyses the features of organizational justice of the dispatched employees in order to probe into the idea and effective ways to solve the organizational injustice. Most of the existing literature focuses on the practical experience of the labour dispatch unit instead of the theoretical research.

Moral hazard is a case of information asymmetry between the principal and the agent. Cooper [12] at first studies the problem of double moral hazard, proposing to encourage the two parties to reveal their actions by means of paying insurance money. Romano [13] makes a study on the double moral hazard model of linear contract. Al-Najjarz [14] expands the theory of linear contract in two-sided moral hazard to the situation of multiple agents. Under the background of the enterprise's incentives to the workers, considering that both the principal and the agent are risk averse, Agrawal [15] thinks that revenue-sharing contracts can make both parties' effort level reach the optimality. Tsoulouhas [16] applies the model of multiple agents' double moral hazard into the field of pricing the labour. De Janvry [17] makes a study on the sharing contract of labour revenue with moral hazard, manifesting those two-sided incentives of the employer and the employee can be obtained through making the sharing contract of labour revenue.

The existing research on double moral in the labour market focuses on the traditional dual relationship between the employer and the employee, while few focus on the study of the three parties of labour dispatch. Moreover, in the relationship of multiple agents, there is mainly paralleled competition or cooperation among the agents. However, there is no paralleled relationship among the multiple agents in labour dispatch. The effort of the dispatching unit will influence the working ability of the dispatched employees, and then the output level of the accepting entity. Therefore, the relationship among the multiple agents is the new principal-agent relationship.

3 Description of the models

This paper mainly discusses the incentives among the dispatching unit, the accepting entity and the dispatched employee in labour dispatch. The operation process in reality is that the accepting entity signs the agreement with the dispatching unit, and the dispatching unit signs the contract with the dispatched employee. The dispatching unit undertakes the training of the employees in expectation of improving their working ability, and then dispatches qualified employees to the accepting entity. The accepting entity pays some money to the employees and the dispatching unit according to the achievement of the dispatched employees. This paper mainly makes a study on the incentives of skill-oriented dispatched employees on the basis of double moral hazard (i.e. when the work ability is larger than the elastic coefficient work effort). For the convenience of research, following assumptions are made about the models:

1. Suppose that $f(\mathrm{e})$ is the output function of effort e, according to the actual situation, it should meet the requirement $f'(\mathrm{e}) \succ 0$, signifying that the more effort the dispatched employee and the dispatching unit make, the larger the output of the accepting entity. If the equation is $f''(\mathrm{e}) \le 0$, it signifies that the effort's marginal output is digressive (The equal sign signifies the marginal output is invariant). To simplify the assumption, here let the equation be $f_1(\mathrm{e}_1)=f_2(\mathrm{e}_2)=\mathrm{e}$.

2. Let $f_2(\mathrm{e}_2)$ be the function of the improvement of the dispatched employee's quality influenced by the effort e_2 of the dispatching unit. Let the coefficient of the dispatching unit's training ability be A_2, and its effort degree is e_2, both of which will directly influence the coefficient of the dispatched employee's working ability A_1. Moreover, A_1 will be influenced by the employee's original working ability d, that is, $A_1 = df_2(A_2, \mathrm{e}_2)$, thus $A_1 = dA_2 e_2$. The cost function of the dispatching unit's effort is $\mathrm{C}_2(\mathrm{e}_2) = \frac{b_2 \mathrm{e}_2^{\,2}}{2}$, and here b_2 is the cost coefficient of the dispatching unit's effort.

3. Suppose that the output function of the dispatched employee's effort for the accepting entity is $f_1(\mathrm{e}_1)$, and the cost function of the dispatched employee's effort is $\mathrm{C}_1(\mathrm{e}_1) = \frac{b_1 \mathrm{e}_1^{\,2}}{2}$, and here b_1 is the cost coefficient of the employee's effort.

4. The dispatching unit's training effort will influence the dispatched employee's working ability, and the working ability and working effort of the dispatched employee will directly influence the output level of the accepting entity. That is to say, the dispatching unit's training effort and the dispatched employee's working effort will directly influence the employee's output level. In this paper, let the output be based on the simplified Cobb-Douglas function, and the working ability and the working effort of the dispatched employee will exert different degrees of influence on the output. Let the dispatched employee's output be

$$Q = kA_1 e_1^{\alpha} + \varepsilon = kdA_2 \mathrm{e}_2 e_1^{\alpha} + \varepsilon . \quad (1)$$

Here, let the elastic coefficient of the dispatched employee's working ability be 1, and α is the elastic coefficient of the dispatched employee's effort for output, and also $0 < \alpha < 1$ (for details see the reduction of the

value range of α attached to this paper); ε is a random variable, and let it be accordant to the normal distribution $(0,\sigma^2)$, and suppose that the average revenue of the accepting entity's product is m, that is, the total revenue of the accepting entity is Qm;

5. In order to obtain the job opportunity provided by the dispatching unit, the dispatched employee needs to pay the fee v to the accepting entity while signing the employment contract with the dispatching unit.
6. The dispatching unit's revenue is directly connected with the dispatched employee's output level. The accepting entity pays the dispatching unit according to the proportion of the dispatched employee's output and income μ_1, therefore the dispatching unit's revenue is $\mu_1 Qm$. The income of the dispatched employee consists of regular wage and performance bonus. The accepting entity pays regular wage ω to the dispatched employee. The dispatching unit pays performance bonus to the dispatched employee according to its proportion of revenue μ_2. Thus the dispatched employee's income is $\omega+\mu_1\mu_2 Qm$.
7. Suppose that the accepting entity, the dispatching unit and the dispatched employee are all risk neutral.
8. This paper analyses the dispatching unit's function as the intermediary agent from the perspective of the dispatching unit, consequently taking the dispatching unit as the first principal and the accepting entity as the second principal.

Based on the above assumptions, the utility functions of the accepting entity, the dispatching unit and the dispatched employee can be concluded respectively as follows:

$$\pi_{the\ emplyer} = (1-\mu_1)kdA_2e_2e_1^{\alpha}m-\omega, \tag{2}$$

$$\pi_{the\ accepting} = \mu_1(1-\mu_2)\ kdA_2e_2e_1^{\alpha}m-\frac{1}{2}b_2e_2^{\ 2}+v, \tag{3}$$

$$\pi_{the\ dispatched} = \mu_1\mu_2 kdA_2e_2e_1^{\alpha}m+\omega-\frac{1}{2}b_1e_1^{\ 2}-v. \tag{4}$$

In the relationship of the three parties in labour dispatch, the accepting entity is the principal, the dispatching unit's training effort will influence the dispatched employee's working ability, and the working ability and effort of the dispatched employee will directly influence the accepting entity's actual output. Therefore, attention should be paid to the accepting entity's pursuit of maximizing its self-interest, the dispatched employee's incentive compatibility constraint and participation constraint, and also the maximizing interest of the dispatching unit. This paper carries on the research from the perspective of the dispatching unit, consequently taking the dispatching unit as the first principal and the accepting entity as the second principal. Thus, the following bi-level programming model is concluded:

$$\max_{\{\mu_2,e_2\}}\ \pi_{the\ employer}=\mu_1(1-\mu_2)kdA_2e_2e_1^{\alpha}m-\frac{1}{2}b_2e_2^{\ 2}+v, \tag{5}$$

$$s.t.\ \max_{\{\mu_1\}}\ \pi_{the\ accepting}=(1-\mu_1)kdA_2e_2e_1^{\alpha}m-\omega, \tag{6}$$

$$s.t.\ \ e_1\in \arg\max\ \mu_1\mu_2 kdA_2e_2e_1^{\alpha}m+\omega-\frac{1}{2}b_1e_1^{\ 2}-v, \tag{7}$$

$$\mu_1\mu_2 kdA_2e_2e_1^{\alpha}m+\omega-\frac{1}{2}b_1e_1^{\ 2}-v\geq s_1. \tag{8}$$

Let $R=kdA_2m$.

From equation (3) we get:

$$e_1^{o}=\left(\frac{\alpha\mu_1\mu_2\,\mathrm{Re}_2}{b_1}\right)^{\frac{1}{2-\alpha}}. \tag{9}$$

Substitute Eq. (9) and Eq. (8) into Eq. (6), we obtain:

$$\pi_{the\ accepting}=\frac{\mathrm{R}^{\frac{2}{2-\alpha}}e_2^{\frac{2}{2-\alpha}}\alpha^{\frac{\alpha}{2-\alpha}}\mu_1^{\frac{\alpha}{2-\alpha}}\mu_2^{\frac{\alpha}{2-\alpha}}}{2b_1^{\frac{\alpha}{2-\alpha}}}(2-2\mu_1+2\mu_1\mu_2-\alpha\mu_1\mu_2)-s_1-v. \tag{10}$$

From (10) we get

$$\frac{\partial\pi_{the\ accepting}}{\partial\mu_1}=\frac{\mathrm{R}^{\frac{2}{2-\alpha}}e_2^{\frac{2}{2-\alpha}}\alpha^{\frac{\alpha}{2-\alpha}}\mu_2^{\frac{\alpha}{2-\alpha}}}{2b_1^{\frac{\alpha}{2-\alpha}}}\cdot$$

$$\left[\frac{\alpha}{2-\alpha}\mu_1^{\frac{2\alpha-2}{2-\alpha}}(2-2\mu_1+2\mu_1\mu_2-\alpha\mu_1\mu_2)+\mu_1^{\frac{\alpha}{2-\alpha}}(2\mu_2-2-\alpha\mu_2)\right]$$

Let $\frac{\partial\pi_{the\ accepting}}{\partial\mu_1}=0$, then:

$$\mu_1^{o}=\frac{\alpha}{2+\alpha\mu_2-2\mu_2}. \tag{11}$$

Substitute Eq. (9) and Eq. (11) into Eq. (5), we obtain:

$$\pi_{the\ employer}=\frac{\alpha^{\frac{2+\alpha}{2-\alpha}}\mathrm{R}^{\frac{2}{2-\alpha}}e_2^{\frac{2}{2-\alpha}}(\mu_2^{\frac{\alpha}{2-\alpha}}-\mu_2^{\frac{2}{2-\alpha}})}{\mathrm{b}_1^{\frac{\alpha}{2-\alpha}}(2+\alpha\mu_2-2\mu_2)^{\frac{2}{2-\alpha}}}-\frac{1}{2}b_2e_2^2+v. \tag{12}$$

From (12) we get

$$\frac{\partial\pi_{the\ employer}}{\partial\mu_2}=\frac{\alpha^{\frac{4}{2-\alpha}}\mathrm{R}^{\frac{2}{2-\alpha}}e_2^{\frac{2}{2-\alpha}}\mu_2^{\frac{2\alpha-2}{2-\alpha}}}{\mathrm{b}_1^{\frac{\alpha}{2-\alpha}}(2+\alpha\mu_2-2\mu_2)^{\frac{4-\alpha}{2-\alpha}}(2-\alpha)}(2+\alpha\mu_2-4\mu_2). \tag{13}$$

Let $\frac{\partial\pi_{the\ employer}}{\partial\mu_2}=0$, then: $\mu_2^{o}=\frac{2}{4-\alpha}$. (14)

From (13) we get

$$\frac{\partial^2 \pi_{the\ employer}}{\partial \mu_2^2} = \frac{\alpha^{\frac{4}{2-\alpha}} \mathrm{R}^{\frac{2}{2-\alpha}} e_2^{\frac{2}{2-\alpha}} \mu_2^{\frac{\alpha}{2-\alpha}}}{\mathrm{b}_1^{\frac{\alpha}{2-\alpha}} (2-\alpha)^2 (2+\alpha\mu_2-2\mu_2)^{\frac{4}{2-\alpha}}}$$
$$[(\frac{4\alpha-4}{\mu_2}+\alpha^2-4\alpha)(2+\alpha\mu_2-2\mu_2) \quad . \quad (15)$$
$$+(2+\alpha\mu_2-4\mu_2)(8-6\alpha+\alpha^2)]$$

From (14) and (15), we get

$$\frac{\partial^2 \pi_{the\ employer}}{\partial \mu_2^2}\Big|_{\mu_2=\mu_2^o} = -\frac{\alpha^{\frac{4}{2-\alpha}} \mathrm{R}^{\frac{2}{2-\alpha}} e_2^{\frac{2}{2-\alpha}} (\frac{2}{4-\alpha})^{\frac{\alpha}{2-\alpha}}}{\mathrm{b}_1^{\frac{\alpha}{2-\alpha}} (2-\alpha)^2 (\frac{4}{4-\alpha})^{\frac{2+\alpha}{2-\alpha}}} (\alpha-2)(\alpha-4) \quad . \quad (16)$$

From (12) we get

$$\frac{\partial \pi_{the\ employer}}{\partial e_2} = \frac{\alpha^{\frac{2+\alpha}{2-\alpha}} R^{\frac{2}{2-\alpha}} \mu_2^{\frac{\alpha}{2-\alpha}} (1-\mu_2)}{b_1^{\frac{\alpha}{2-\alpha}} (2+\alpha\mu_2-2\mu_2)^{\frac{2}{2-\alpha}}} \cdot \frac{2}{2-\alpha} e_2^{\frac{\alpha}{2-\alpha}} - b_2 e_2 \quad . \quad (17)$$

Let $\frac{\partial \pi_{the\ employer}}{\partial e_2}=0$, then

$$e_2^o = \frac{\alpha^{\frac{2+\alpha}{2-2\alpha}} R^{\frac{2}{2-2\alpha}} \mu_2^{\frac{\alpha}{2-2\alpha}} (1-\mu_2)^{\frac{2-\alpha}{2-2\alpha}} (\frac{2}{2-\alpha})^{\frac{2-\alpha}{2-2\alpha}}}{b_2^{\frac{2-\alpha}{2-2\alpha}} b_1^{\frac{\alpha}{2-2\alpha}} (2+\alpha\mu_2-2\mu_2)^{\frac{2}{2-2\alpha}}} \quad . \quad (18)$$

From (17) we get

$$\frac{\partial^2 \pi_{the\ employer}}{\partial e_2^2} = \frac{\alpha^{\frac{2+\alpha}{2-\alpha}} R^{\frac{2}{2-\alpha}} \mu_2^{\frac{\alpha}{2-\alpha}} (1-\mu_2)}{b_1^{\frac{\alpha}{2-\alpha}} (2+\alpha\mu_2-2\mu_2)^{\frac{2}{2-\alpha}}} \cdot \frac{2}{2-\alpha} \cdot \frac{\alpha}{2-\alpha} e_2^{\frac{2\alpha-2}{2-\alpha}} - b_2 \quad . \quad (19)$$

From (18) and (19), we get

$$\frac{\partial^2 \pi_{the\ employer}}{\partial e_2^2}\Big|_{e_2=e_2^o} = b_2 \frac{2\alpha-2}{2-\alpha} \quad . \quad (20)$$

From (13) we get

$$\frac{\partial^2 \pi_{the\ employer}}{\partial \mu_2 \partial e_2} = \frac{\alpha^{\frac{4}{2-\alpha}} \mathrm{R}^{\frac{2}{2-\alpha}} \mu_2^{\frac{2\alpha-2}{2-\alpha}} (2+\alpha\mu_2-4\mu_2)}{\mathrm{b}_1^{\frac{\alpha}{2-\alpha}} (2+\alpha\mu_2-2\mu_2)^{\frac{4-\alpha}{2-\alpha}} (2-\alpha)} \cdot \frac{2}{2-\alpha} e_2^{\frac{\alpha}{2-\alpha}} \quad . \quad (21)$$

From equation (14), (18) and (21) we get:

$$\frac{\partial^2 \pi_{the\ employer}}{\partial \mu_2 \partial e_2}\Big|_{\mu_2=\mu_2^o, e_2=e_2^o} = 0 \quad . \quad (22)$$

From above we get: $A = \frac{\partial^2 \pi_{the\ employer}}{\partial e_2^2}\Big|_{e_2=e_2^o} = b_2 \frac{2\alpha-2}{2-\alpha}$;

$$B = \frac{\partial^2 \pi_{the\ employer}}{\partial \mu_2 \partial e_2}\Big|_{\mu_2=\mu_2^o, e_2=e_2^o} = 0 \quad .$$

$$C = \frac{\partial^2 \pi_{the\ employer}}{\partial \mu_2^2}\Big|_{\mu_2=\mu_2^o} = -\frac{\alpha^{\frac{4}{2-\alpha}} \mathrm{R}^{\frac{2}{2-\alpha}} e_2^{\frac{2}{2-\alpha}} (\frac{2}{4-\alpha})^{\frac{\alpha}{2-\alpha}}}{\mathrm{b}_1^{\frac{\alpha}{2-\alpha}} (2-\alpha)^2 (\frac{4}{4-\alpha})^{\frac{2+\alpha}{2-\alpha}}} (\alpha-2)(\alpha-4) \quad . \quad (23)$$

According to the necessary and sufficient condition to determine the binary function's extremum, only when $AC-B^2>0$, the binary function has the extreme point; only when $A<0$, it has the maximum value

From $A<0$ we get: $\begin{cases}2\alpha-2>0\\2-\alpha<0\end{cases}$ or $\begin{cases}2\alpha-2<0\\2-\alpha>0\end{cases}$ that is:

$\alpha>2$ or $\alpha<1$. (24)

From $C<0$, we get: $\begin{cases}\alpha-2>0\\\alpha-4>0\end{cases}$ or $\begin{cases}\alpha-2<0\\\alpha-4<0\end{cases}$ that is:

$\alpha>4$ or $\alpha<2$. (25)

Simultaneous equations (24) and (25), then:

$\alpha>4$ or $\alpha<1$. (26)

Since μ_1 and μ_2 are the sharing ratios, then the ranging scope is $[0,1]$.

From (12) we get: $\mu_2^o = \frac{2}{4-\alpha}$, thus $\alpha<2$. (27)

From equations (9) and (12) we get:

$$\mu_1^{\ o} = \frac{\alpha}{2+\alpha(\frac{2}{4-\alpha})-2(\frac{2}{4-\alpha})} = \frac{\alpha(4-\alpha)}{4} \quad . \quad (28)$$

Thus $0<\alpha<4$. (29)

Consider equations (26), (27) and (29) at the same time we get:

If and only if $0<\alpha<1$, this model achieve it optimum.

Proposition 1:

Under the double moral hazard, the sharing ratios, optimal effort degree and revenues of the dispatching

unit, the accepting entity and the dispatched employee are respectively as follows:

$$\mu_2^o = \frac{2}{4-\alpha};\ \mu_1^o = \frac{\alpha(4-\alpha)}{4};\ e_2^o = \frac{\alpha^{\frac{2+\alpha}{2-2\alpha}} R^{\frac{2}{2-2\alpha}}}{2^{\frac{2}{2-2\alpha}} b_2^{\frac{2-\alpha}{2-2\alpha}} b_1^{\frac{\alpha}{2-2\alpha}}};$$

$$e_1^o = \frac{\alpha^{\frac{3}{2-2\alpha}} R^{\frac{2}{2-2\alpha}}}{2^{\frac{2}{2-2\alpha}} b_2^{\frac{1}{2-2\alpha}} b_1^{\frac{1}{2-2\alpha}}};$$

$$\omega^o = s_1 + v + \frac{\alpha^{\frac{4+2\alpha}{2-2\alpha}} R^{\frac{4}{2-2\alpha}}}{2^{\frac{6-2\alpha}{2-2\alpha}} b_2^{\frac{2}{2-2\alpha}} b_1^{\frac{2\alpha}{2-2\alpha}}}(\alpha-2);$$

$$\pi_{\text{the employer}} = \frac{\alpha^{\frac{4+2\alpha}{2-2\alpha}} R^{\frac{4}{2-2\alpha}}(1-\alpha)}{2^{\frac{6-2\alpha}{2-2\alpha}} b_2^{\frac{2}{2-2\alpha}} b_1^{\frac{2\alpha}{2-2\alpha}}} + v;$$

$$\pi_{\text{the accepting}} = \frac{\alpha^{\frac{4+2\alpha}{2-2\alpha}} R^{\frac{4}{2-2\alpha}}}{2^{\frac{6-2\alpha}{2-2\alpha}} b_2^{\frac{2}{2-2\alpha}} b_1^{\frac{2\alpha}{2-2\alpha}}} \cdot \frac{2(2-\alpha)}{\alpha} - s_1 - v \qquad (30)$$

Also, from the above we get:

$$\frac{\partial \mu_2^o}{\partial \alpha} = \frac{2}{(4-\alpha)^2} > 0\ ;\ \frac{\partial \mu_1^o}{\partial \alpha} = \frac{2-\alpha}{2} > 0\,. \qquad (31)$$

Proposition 2:

The sharing ratios paid by the accepting entity to the dispatching unit and paid by the dispatching unit to the dispatched employee will increase with the increase of the dispatched employee's effort degree.

4 Conclusion

This paper makes an analysis of the incentives of skill-oriented dispatched employees based on the bi-level program (i.e. when the work ability is stronger than the work effort) while taking the dispatching unit as the first principal and the accepting entity as the second principal under the circumstances of double moral hazard. The sharing revenues of the three parties are manifested through the models. The author wishes it a valuable reference to the practice of the enterprises.

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