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The Optimal Design of Hotel Staff Incentive Compensation Contract under Turnover Rate

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***Abstract*—In this article, assuming the output of staff can be observed,we construct the principal-agent incentive model between staff and hotel based on utility maximization. The optimal incentive contract including staff turnover rate are respectively constructed under two cases: the staff's effective working time is symmetric information and asymmetric information. Then, it is discussed that how the turnover rate affects the incentive contract and the enthusiasm of staffs.**

Keywords- hotel Industry; the utility function; symmetric information; asymmetric information; turnover rate; salary design

I. INTRODUCTION

Along with the development of China's economy and tourism, the hotel industry is developing rapidly. Our hotel hardware has caught up with the international level, but the quality of the hotel staff, management level and service quality still lags behind international standards in the same industry. However the management level and service quality of a hotel depend largely on the utilization and management of hotel human resources. Salary management is not only one of the most important part of hotel human resources management but also the most sensitive part. Because it relates to the vital interests of every staff and thus closely affects the hotel's development. How to build an objective, reasonable salary management system and achieve the goal of using the most important assets of the hotel—employees rationally has become a problem that must to be solved.

The level of salary attraction decreases largely due to the lack of reasonable and effective compensation structure and a good salary system. In recent years hotel staffs loss seriously (especially new student staffs from tourism colleges). The high staff turnover rate has become a big problem for hotel managers. According to statistics, the turnover rate of new student staffs Graduated from Departmen of Tourism in a Shanghai university is 50% in the fist year and 80% in the second year; the turnover rate of staffs graduated from tourism management in a university in Hangzhou in recent 5 years is as high as 77.6% in the hotels in Hangzhou; the turnover rate of new student staffs in the hotels in Hangzhou is 73% less than a year. One of the important reasons for staff turnover is the lack of good human resources management system and salary management is not attractive. This discourages the staffs, so "centrifugal force" appears.

The previous research on salaries and benefits of front-line staff in hotel is not rich in the domestic and foreign literature. The few studies that have been done are vague and scattered. They ignore the effect of first-line staff's salary and benefits on the whole hotel's operation. In this article, we designed an incentive compensation contract including staff turnover and studied the effect of turnover rate on the incentive compensation contract and the positivity of the staff using H-M framework and Mirrlees's production function principle.

II. CONSTRUCTION AND SOLUTION OF INCENTIVE COMPENSATION CONTRACT MODEL

A. Construction and Solution of Incentive Compensation Contract Model

Hypothesis 1 The output of hotel staff depends on their work ability and the effective working time.

In the famous H-M parameterized principal-agent model, the output function chiefly depends on the staff's effort level. Mirrlees points out that effort level can be substituted with ability and the effective working time. So, the output function can be expressed as the following form:

$$\pi = kt + \varepsilon . \tag{1}$$

In which k is the ability influence coefficient, t is the effective working time. The larger k is, the stronger staff' ability is. The larger t is, the more effective working time is. They are proportional to the output; $\varepsilon \sim N\left(0,\sigma^2\right)$, it represents exogenous uncertain facors. Obviously

$$E\pi = E\left(kt+\varepsilon\right) = kt \text{ , } Var\left(\pi\right) = \sigma^2 . \tag{2}$$

That is, staff's behavior determines the mean value of output but does not affect the variance of output.

Hypothesis 2 The client—hotel is risk-neutral. It's risk-neutral utility function is $V = \omega$, in which ω is hotel revenue. The staff—operator is absolute risk aversion, it's utility function is

$$U = 1 - \exp\left(-rM\left(x\right)\right) \tag{3}$$

In which r is the measure of absolute risk aversion and $M(x)$ is staff's monetary income.

Hypothesis 3 Under the condition of staff is on-the-job, staff benefits through labor but also pay labor costs: $C(k,t)=\frac{ct^2}{k}$, in which c is the coefficient of labor cost. In a period of time we can think that the staff's ability is the same, so $\frac{c}{k}$ is still a const, and we denote it by $\frac{1}{2}c$, so $C(t)=\frac{1}{2}ct^2$. Similarly, the hotel also pay the related training cost in order to make staff competent for the position: $D(t)=\frac{1}{2}dt^2$, where d is scaling factor. Obviously, staff's labor costs satisfy: $\frac{\partial C}{\partial t}>0$, $\frac{\partial^2 C}{\partial t^2}>0$. That is, the impact of effective working time on the costs is rising and the rising velocity is larger and larger. At the same time because the staff's energy is limited, the more effective working time they invest the higher hard-working cost will be, and vice versa. Similarly, the cost function of the hotel is $D(t)$, which satisfies $\frac{\partial D}{\partial t}>0$, $\frac{\partial^2 D}{\partial t^2}>0$, that is , the more related training hotel invest the higher cost they will pay. Generally, $C(t)\neq D(t)$.

Hypothesis 4 When the staff leaves(resign or be fired), the hotel will give him a fixed proportion of severance pay $eW(t)$, where e is the scale factor. Generally it is very small. Many hotel data we investigate shows that: $W(t)=t$.

Hypothesis 5 The turnover rate (the probability of resigning or being fired) of hotel staff is p, so the probability of the staff on-the-job is $1-p$.

B. Construction of the Model

On the basis of the above hypothesis we designed the following contract of hotel staff incentive compensation using merit pay principle:

$$S(\pi)=a+b(\pi-\pi_0) \tag{4}$$

Where a is the fixed income, π_0 is the lowest output staff must create which the hotel stipulates, b is the incentive coefficient of staff's excess output.

Lemma(certainty equivalence theorem)We assume there exsists a utility function $U(x)=\exp(-rx)$, $r>0$ is risk-aversion coefficient, x follows the normal distribution. The mean is m, the variance is v, so

$$E[U(x)]=\exp\left[-r\left(m-\frac{rv}{2}\right)\right]=U(CE)$$

i.e.
$$\exp[-r(CE)]=\exp\left[-r\left(m-\frac{rv}{2}\right)\right] \tag{5}$$

Its economic meaning: certainty equivalence shows that the expected utility of stochastic income x and the utility of certain income are the same. When the player is risk-neutral the certainty equivalence is equal to the mean value of stochastic income. When the player is risk-aversion the certainty equivalence equals the mean walue of stochastic income minus risk cost.

Because

$$MaxE[U(M(x))]=1+MaxE[-\exp[-rM(x)]]$$

And by the lemma

$$\begin{aligned}&MaxE[U(M(x))]\Leftrightarrow Max(CE)\\&\Leftrightarrow Max\left[E(M(x))-\frac{r}{2}Var(M(x))\right]\end{aligned} \tag{6}$$

The expected utility function of staff's certain equivalent income is:

$$\overline{U}=(1-p)\left[a+b(kt-\pi_0)-\frac{1}{2}ct^2-\frac{1}{2}rb^2\sigma^2\right]+pet \tag{7}$$

So, by (6) we can get

$$\begin{aligned}Max\overline{U}=Max\{&(1-p)[a+b(kt-\pi_0)\\&-\frac{1}{2}ct^2-\frac{1}{2}rb^2\sigma^2]+pet\}\end{aligned} \tag{8}$$

Obviously, the first term on the right of (1) is the certainty equivalence of the staff when he is on-the-job, the second term on the right of (1)is the compensation income when the staff leaves. If the first term is less than the second term the staff will be offered to resign .

The income expected utility function of hotel is

$$\begin{aligned}\overline{V}&=(1-p)[\pi-s(\pi)-D(t)]-pet\\&=(1-p)\left[-a+(1-b)kt+b\pi_0-\frac{1}{2}dt^2\right]-pet\end{aligned} \tag{9}$$

So, by (6) we can get

$$Max\overline{V} = Max\left\{(1-p)\left[-a+(1-b)kt+b\pi_0-\frac{1}{2}dt^2\right]-pet\right\} \quad (10)$$

Similarly, if the first term is less than the second term on the right of (2) the hotel will fire the staff.

C. Solution of the Model

Now the problem needs to be solved is how to design the parameters a , b , t in the contract in order to achieve both the maximum hotel expected utility and the maximum staff expected income utility.

Let S_0 be the minimum expectations of staff's income utility. Known from the actual economic background:

$$pet < S_0 < -a+(1-b)kt+b\pi_0 \quad (11)$$

So the staff participation constraint is

$$(1-p)\left[a+b(kt-\pi_0)-\frac{1}{2}ct^2-\frac{1}{2}rb^2\sigma^2\right]+pet \geq S_0 \quad (12)$$

The incentive compatibility is

$$Max\overline{U} = Max\left\{(1-p)\left[a+b(kt-\pi_0)-\frac{1}{2}ct^2-\frac{1}{2}rb^2\sigma^2\right]+pet\right\} \quad (13)$$

We consider the design of parameters in incentive contract in the following two cases:

① Under symmetric information, the hotel can observe staff's effective working time and working ability. At this time the staff incentive compatibility does not work. (8) can achieve maximum under the staff participation constraint(12). Because the hotel does not need to pay the part exceeds S_0, equality holds in(12). By solving this equation for parameter a and substituting the expression into(8)we can get :

$$Max\overline{V} = Max\left\{-S_0+(1-p)\left(-\frac{1}{2}rb^2\sigma^2-\frac{1}{2}ct^2-\frac{1}{2}dt^2+kt\right)\right\} \quad (14)$$

Using the extreme condition of multivariate function we can get : $\tilde{b}=0$, $\tilde{t}=\frac{k}{c+d}$.

Substituting the above results into the participation constraint equation (12) we obtain:

$$\tilde{a} = \frac{S_0}{(1-p)}-\frac{pek}{(1-p)(c+d)}+\frac{1}{2}\frac{ck^2}{(c+d)^2} \quad (15)$$

Then, the optimal contract of hotel staff incentive compensation is $S(\pi)=\tilde{a}$.

② Under asymmetric information, the hotel can not observe staff's effective working time. At this time, the staff chooses the effective working time in order to make his own utility maximum, so the incentive compatibility constraint (13) is at work. Using the first-order extreme conditions for t we can obtain: $\hat{t}=\frac{pe}{(1-p)c}+\frac{bk}{c}$ .So the optimal design of the hotel incentive contract turns into

$$Max\overline{V} = Max\left\{(1-p)\left[-a+(1-b)kt+b\pi_0-\frac{1}{2}dt^2\right]-pet\right\} \quad (16)$$

where:

$$\begin{cases}(1-p)\left[a+b(kt-\pi_0)-\frac{1}{2}ct^2-\frac{1}{2}rb^2\sigma^2\right]\\ +pet \geq S_0\\ \hat{t}=\frac{pe}{c(1-p)}+\frac{bk}{c}\end{cases} \quad (17)$$

Solving the equality in (17) for a , substituting the expressions of a , $\hat{t}$ and using the first-order extreme conditions we can get $\hat{b}$:

$$\hat{b} = \frac{(1-p)ck^2-(c+d)pke}{(1-p)\left[(c+d)k^2+rc^2\sigma^2\right]} \quad (18)$$

Here, $\hat{b}$ is the optima risk sharing and the profit sharing coefficient which the hotel design for staff.

If $r=0$, the hotel staff is risk-neutral , then

$$\hat{b}_0 = \frac{(1-p)ck-(c+d)pe}{(1-p)(c+d)k} \quad (19)$$

III. Analysis and Concludion of the Incentive Contract under Two Different Imformation

A. Analysis of Incentive Contract under Symmetric Information

The staff does not take risks under symmetric information. Because the hotel has observed the staff's working ability and effective working time, it can control the behavior of the staff. Result of the model shows: the optima effective working time of hotel staff is in direct proportion to the working ability. The proportion coefficient is the reciprocal of sum of labor cost and input cost, it has nothing to do with the measure of absolute risk aversion and the turnover rate. In the on-the-job situation, suppose $k < c + d$, because

$\frac{\partial \tilde{a}}{\partial p} = \frac{1}{(1-p)^2}\left(S_0(c+d) - ek\right) > 0$, the optima fixed salary paid to the staff is related to the staff turnover rate only. The bigger staff turnover rate is, the higher on-the-job staff's salary will be. It is equal to retained salary plus labor cost and then subtract off the monetary compensation when the staff leaves. So, under symmetric information, the optima incentive contract designed by the hotel should be fixed income mechanism which is not affected by the staff turnover rate.

B. Analysis of Incentive Contract under Asymmetric Information

Under asymmetric information, both the staff and the hotel are risk-taking. The optimal risk sharing and the profit sharing coefficient of staff not only depend on the staff's ability coeffient but also depend on the cost coefficient of hotel and staff when the staff is on-the-job, the measure of absolute risk aversion, the variance of an exogenous random variable, the compensation coefficient when the staff leaves.

Because

$\hat{b} - \hat{b}_0 = -\frac{\left[(1-p)ck - (c+d)pe\right]r^2c^2\sigma^2}{(1-p)(c+d)k\left[(c+d)k^2 + rc^2\sigma^2\right]} < 0$, the optimal incentive coefficient under the risk-aversion condition is less than that under the risk-neutral condition. This is consistent with the actual operation of the hotel.

And because

$\frac{\partial \hat{b}}{\partial p} = -\frac{1}{(1-p)^2}\frac{(c+d)ke}{(c+d)k^2 + rc^2\sigma^2} < 0$, The optimal risk sharing and profit sharing coefficient of staff is in negative correlation to the turnover rate. Therefore, under asymmetric information, the optima contract designed by the hotel should be an income incentive mechanism with changing profit sharing coefficient which is affected by probability of the staff on-the-job. If the staff turnover rate increases, hotel should decrease the sharing coefficient. Otherwise should incease.

C. The Comparative Analysis of Two Kinds of Incentive Contract Design

Fist, because $\frac{\partial \tilde{t}}{\partial p} = 0$, $\frac{\partial \hat{t}}{\partial p} = \frac{e}{c(1-p)^2} > 0$ .The effective working time is not affected by the turnover rate under symmetric information. But the effective working time under asymmetric information is related to the turnover rate. There is a positive correlation between them. The effective working time will increase when turnover rate increases. This shows that: asymmetric imformation aggravate the working burden of staff and this will inevitably lead to the staff's working enthusiasm decline. It accelerates staff's flow and with the increasing flow of personnel the staff enthusiasm will be lower. So, as the hotel operator, it is necessary to make use of the relation that the effective working time and the ability determine output level. They must strengthen the regular management and the control of staff, reduce staff's invalid working time, improve and perfect the performance appraisal and target management, pay attention to the training and unearthing staff's ability, especially the technology ability which can be transformed into the actral production benefit, management ability and interpersonal skills. Combined with the staff's salary incentive mechanism, make the hotel develop continuously;

Second, because

$$\frac{\partial \tilde{b}}{\partial p} = 0 \quad , \quad \frac{\partial \hat{b}}{\partial p} = -\frac{1}{(1-p)^2}\frac{(c+d)ke}{(c+d)k^2 + rc^2\sigma^2} < 0 \quad .$$

Under symmetric information, the hotel only pay the staff fixed salary which has nothing to do with whether the hotel profits and how much the profit is. Under asymmetric information, the hotel should not only establish the profit sharing incentive mechanism but also make the changing incentive coefficient be inversely proportional to the turnover rate when there is turnover situation. This shows that: because the staff turnover not only causes losses to the enterprise but also gives staff a threat, the hotel operator should set up different incentive contracts according to whether the staff's effective working time is under symmetric information. When the probability of turnover increases the hotel should increase the incentive effect. Especially when there is asymmetric information, the hotel also needs to increase the changing incentive coefficient in order to mitigate the adverse effects of staff turnover brings to the hotel.

IV. Conclusion

Hotel is one of the important service industry. The more and more fierce competition in the hotel industry is essentially the hotel human resource competition. In the competiton, all the hotels are faced with high staff turnover rate. The causes of high turnover rate mainly is staff's salary design is unreasonable and the gap between staff's expected income and real income is too large. At the front, combining incentive theory, we investigate the effective incentive contract design for staff under principal-agent relationship and analysis the effect of turnover rate on the incentive contract and the staff. Analysis shows that: the turnover rate has different effect on

the hotel incentive contract and the enthusiasm of staff under different information. Under symmetric information, staff turnover rate will not affect the changing incentive coefficient and the enthusiasm of staff. Under asymmetric information, turnover rate has a negative impact on the enthusiasm of staff. When the hotel design contract, they need to improve the changing incentive coefficient to compensate the adverse effects. Especially when the turnover rate increases the incentive compensation should also be increased. From the optimality conditions, in the quantitative incentive mechanism combined fixed salary with variable salary which we established in this paper, for risk-averse workers, the hotel can use the inventive model with a higher proportion of fixed salary and lower proportion of variable salary. The incentive mechanism can play a unique role when adjusting the salary structure in incentive mechanism; for risk-preference workers, the hotel can use the inventive model with a lower proportion of fixed salary and higher proportion of variable salary in order to keep the excellent staff continue to work in hotel. This can not only ensure the competition in the same industry but also guarantee the relative fairness within the hotel. It plays a pretty good role in attracting foreign talent and retain the exsisting talent in hotel.

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