

# Design of Dynamic Incentive Contract of Sales Personnel Based on Multitask Objectives\*

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**Abstract**—Based on the multi-task principal-agent model proposed by Holmstrom, the article divides the sales staff's work into two dimensions: pursuit of current performance and improvement of corporate reputation. The single-cycle static contract and multi-cycle dynamic contract were constructed respectively, and the changes of sales staff's work input and enterprise income under the two types of incentive contracts were compared and numerical analysis was carried out. The results show that when the company signs a dynamic incentive contract with the sales staff, the sales staff will make greater efforts for the long-term reputation of the company. The better the corporate reputation, the greater the efforts of sales people to increase their reputation. The greater the sales staff's efforts to contribute to the output in the current period, the more the sales staff and the company pay attention to the short-term benefits. The dynamic incentive contract for businesses and salespeople is Pareto improvement.

**Keywords**—*multitask objectives; dynamic incentive; salesperson*

## I. INTRODUCTION

Enterprises are in a complex and ever-changing competitive environment, and the successful sales of products are the key factors for the sustainable and stable development of enterprises. The salesperson is the bridge between the enterprise and the customer. The company realizes the successful sales of the product or service through the interaction between the salesperson and the customer. The improvement in the sales staff's performance can bring the market share to the enterprise. However, short-term market expansion is not the only goal pursued by companies. To achieve long-term stable development, enterprises need to meet customer needs to the greatest extent and improve customer satisfaction. Enhancing corporate reputation is also an important part of sales staff. Therefore, sales personnel must not only complete short-term performance, but also take responsibility for the improvement of corporate reputation. The multi-work requirements of the sales staff of the enterprise mean the multi-dimensionality of the sales staff's work tasks.

The salesperson and the enterprise are principal-agent relationships, and the multi-dimensionality of the salesperson's work conforms to the characteristics of the multi-task objectives. Holmstrom et al. proposed the multi-task principal-agent model [1] in 1991. Subsequently, based on Holmstrom and Milgrom's multi-task principal-agent model, scholars have conducted extensive research on various agents' multi-task characteristics and obtained more research results. However, most of these results are based on horizontal task relationships [2]-[17]. Hart believes that the agent's multi-task has two basic forms: horizontal multitasking and vertical multitasking. In the vertical multitasking scenario, there is an interaction between the output functions of multiple tasks [18]. Thiele believes that previous multi-task research has paid too much attention to the conflict and substitution effects of agents at the horizontal level, while ignoring the coordination and complementation effects between vertical level tasks [19]. Based on the interaction effect between multi-tasks, Xu Xixiong et al first divided the manager's input into two dimensions of pursuing current financial performance and pursuing enterprise capability, and constructing a vertical multi-task dynamic contract model [20]. Subsequently, Huang Yan studied the longitudinal multi-task characteristics of the tour guide, and divided the work input of the tour guide into two dimensions of multi-task problem, which is to pursue the current performance and pursue the reputation of the travel agency [21]. Fan Ruguo and others studied the vertical multi-task of enterprises' carbon emissions, and divided the enterprise's efforts into two dimensions of pursuing current emission reductions and low-carbon technology advancement, and constructed a multi-cycle dynamic incentive contract [22]. In the research of Huang Yan and Fan Ruguo, the current efforts and long-term effects have the same impact on output, and did not break through the research framework of Xu Xixiong[20] et al. [20][21][22]. In different industries, the current efforts and long-term effects of people's work inputs have different effects on output. For example, the current efforts to improve the sales of daily fast-moving consumer goods are greater. The role of corporate reputation and brand in home appliances, automobiles and other industries is more important, and the original research did not discuss the different effects of current efforts and long-term effects on output. In this paper, the current Dagr output function in the Xu Weixiong and Gan Weiyu models is modified to a linear function, which gives different weights to the current

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efforts and long-term effects, and expands the research content of the dynamic multi-task objectives. The article studies the vertical multi-task incentives under the influence of current efforts and long-term effects on output. The study found that current efforts and long-term effects have different impacts on the work effort of business people. The greater the sales staff's efforts to contribute to the output in the current period, the more the sales staff and the company pay attention to the short-term benefits. These findings provide a reference for companies to develop incentives for salespeople.

**II. MODEL ESTABLISHMENT**

It is assumed that the salesperson undertakes two tasks of the enterprise, one is to undertake the sales of the current product and complete the performance assessment task. The second is to improve customer satisfaction, enhance corporate reputation, and maintain long-term stable development of the company. These two tasks interact with each other. Based on the multidimensional nature of the sales interactions of the sales staff, the basic model assumptions are as follows:

(1) The effort cost of the salesperson is related to the degree of effort.  $c(e)$  is a function of the cost of sales effort and has the following functional form:

$$c(e) = \frac{b}{2}e^2 \quad b > 0 \tag{1}$$

Where,  $b$  represents the coefficient of the sales staff's effort cost (can be explained as the tendency to be lazy, the larger the value of  $b$  is, the higher the tendency to be lazy), and the  $e$  is the degree of effort of the salesperson.

(2)  $P_{t+1}$  is the corporate reputation function, which is the cumulative effect of the sales staff's efforts. The reputation of the company is influenced by the previous reputation and previous efforts. The function form:

$$P_{t+1} = P_t(1 + \sqrt{k_t e_t}) \tag{2}$$

$e_t$  indicates the level of effort of the salesperson in the  $t$ -term period. The salesperson divides the work effort into two parts.  $k_t$  is part of the effort of sales people to improve customer service and corporate reputation. In reality, sales personnel strengthen customer service levels, improve customer satisfaction, and ultimately improve corporate reputation in the long run, thus promoting long-term stable development. The  $1-k_t$  section is part of the effort of salespeople to improve current sales. Its role is to increase the current sales volume, complete the current sales performance assessment, showing the short-term behavior of sales staff.

(3)  $Y_t$  is the output function of the salesperson's  $t$ -term, and the output is affected by the efforts of the current sales staff and the reputation of the company, using a linear function.

$$Y_t = A[\lambda(1 - k_t)e_t + (1 - \lambda)p_t] + \theta \tag{3}$$

Where,  $\theta$  is the influence of market uncertainty on the output level of current sales personnel. And  $\theta: N(0, \sigma^2)$ ,  $\lambda$  is the contribution coefficient of the current effort, indicating the degree of contribution of the current efforts to the output.  $1-\lambda$  is the contribution coefficient of corporate reputation, indicating the degree of contribution of corporate reputation to output.  $A$  is the basic sales volume, which is the natural sales that the sales staff can complete without any effort.

(4)  $s(Y)$  is the revenue model of the salesperson,  $s(Y) = \alpha + \beta Y$ . Where  $\alpha$  is a fixed income.  $\beta$  is the profit-sharing coefficient, indicating the degree of incentives for the sales staff. The salesperson has a constant risk aversion coefficient  $\rho$ , and its utility function is  $u(s) = -e^{-\rho s}$ .

The actual income of a salesperson with an effort level of  $e$  at the enterprise output level of  $Y$  is:

$$W = s(Y) - \frac{b}{2}e^2 = \alpha + \beta Y - \frac{b}{2}e^2 + \beta\theta \tag{4}$$

Expected value of the actual income of the salesperson  $W$ :  $E(W) = \alpha + \beta Y - \frac{b}{2}e^2$ . Risk is  $\text{var}(W) = \beta^2 \sigma^2$ .

The deterministic equivalent income of the salesperson's random income is:

$$E(W) - \frac{1}{2}\rho \text{var}(W) = \alpha + \beta Y - \frac{b}{2}e^2 - \frac{1}{2}\rho\beta^2\sigma^2 \tag{5}$$

$\alpha + \beta Y - \frac{b}{2}e^2$  is the expected income of the salesperson, and the risk cost brought by the market uncertainty factor is:  $\frac{1}{2}\rho\beta^2\sigma^2$ .

(5)  $\pi_s$  is the expected return function of the salesperson, and  $\pi_m$  is the expected return function of the enterprise.

**III. DESIGN OF INCENTIVES FOR SINGLE-CYCLE STATIC SALESPERSONS**

In the static sales force incentive contract, sales personnel will not consider putting more efforts to improve service levels and corporate reputation. The initial reputation value of the enterprise is  $p_1$ , and the expected return function of the salesperson's single cycle is:

$$\pi_s = E[s(Y) - c(e) - \frac{1}{2}\rho\beta^2\sigma^2] = \alpha + \beta A[\lambda(1 - k)e + (1 - \lambda)p_1] - \frac{b}{2}e^2 - \frac{1}{2}\rho\beta^2\sigma^2 \tag{6}$$

Considering that the enterprise is risk neutral, the expected return function of the enterprise is:

$$\pi_m = E[Y - s(Y)] = -\alpha + A(1 - \beta)[\lambda(1 - k)e + (1 - \lambda)p_1] \tag{7}$$

Salespeople have no incentive to invest in improving the long-term corporate reputation, but instead put all their efforts into short-term sales.

According to the first-order condition of equation (6):

$$k^* = 0, e^* = \frac{\lambda\beta A(1-k)}{b} = \frac{\lambda\beta A}{b} \quad (8)$$

The enterprise optimization model under the single-cycle static contract is:

$$\max_{\alpha, \beta} \pi_m = -\alpha + A(1-\beta)[\lambda(1-k)e + (1-\lambda)p_1] \quad (9)$$

$$s.t. (IR) \pi_s = \alpha + \beta A[\lambda(1-k)e + (1-\lambda)p_1] - \frac{b}{2}e^2 - \frac{1}{2}\rho\beta^2\sigma^2 \geq \bar{\pi} \quad (10)$$

$$(IC) k^* = 0, e^* = \frac{\lambda\beta A(1-k)}{b} = \frac{\lambda\beta A}{b} \quad (11)$$

$\bar{\pi}$  is the retained income of the sales staff, and the solution to the optimization model is:

$$\frac{\partial \pi_m}{\partial \beta} = \frac{A^2\lambda^2}{b} - \frac{A^2\lambda^2\beta}{b} - \rho\beta\sigma^2 = 0 \quad (12)$$

$$\beta^* = \frac{\lambda^2 A^2}{b\rho\sigma^2 + \lambda^2 A^2} = \frac{1}{1 + \frac{b\rho\sigma^2}{\lambda^2 A^2}} \leq 1 \quad (13)$$

The incomes of enterprises and sales personnel under a single-cycle static contract are:

Enterprises income:

$$\pi_m^* = -\alpha + A(1-\beta)\left[\frac{\lambda^2\beta A}{b} + (1-\lambda)p_1\right] \quad (14)$$

Sales staff's income:

$$\pi_s^* = \alpha + A\beta\left[\frac{\lambda^2\beta A}{2b} + (1-\lambda)p_1\right] - \frac{1}{2}\rho\beta^2\sigma^2 \quad (15)$$

#### IV. DESIGN OF SALARY INCENTIVES FOR MULTI-CYCLE SALES STAFF

The sales staff's work is not only responsible for the sales of the current company, but also for the promotion of corporate reputation. The reputation of the company in turn affects the performance of sales staff. There is complementarity and synergy between the multitasking of sales people. The article analyzes the long-term dynamic contract of the sales staff through a two-phase contract model (non-infinitely long period). The second phase is the final phase. The article assumes that the salesperson and the company have signed a two-phase contract, and the contract is still a linear contract model:  $S(y) = \alpha + \beta Y$ . The article refers to the research of Xu Xixiong and Gan Weiyu, and assumes the two-stage effort level as the average value  $e$  of the two-stage effort level. The two stages of the salesperson incentive contract have different output functions, and the first stage salesperson benefits:

$$Y_1 = A[\lambda(1-k_1)e + (1-\lambda)p_1] + \theta \quad (16)$$

As the second phase of the contract is about to expire, the salesperson will maximize the profits and not consider improving the company's reputation. Only all the work will

be used to improve the individual's current performance. The output function is:

$$Y_2 = A[\lambda e + (1-\lambda)p_2] + \theta \quad (17)$$

The two-stage salesperson's total output function is:

$$Y = Y_1 + Y_2 = A[\lambda(1-k_1)e + (1-\lambda)p_1] + A[\lambda e + (1-\lambda)p_1(1 + \sqrt{k_1 e})] + 2\theta \quad (18)$$

The two-stage expected total return function of the salesperson is:

$$\begin{aligned} \pi_s &= E[s(Y)] - be^2 - \rho\beta^2\sigma^2 \\ &= 2\alpha + \beta A[\lambda(2-k_1)e + (1-\lambda)p_1(2 + \sqrt{k_1 e})] - be^2 - \rho\beta^2\sigma^2 \end{aligned} \quad (19)$$

According to first order condition of equation (19):

$$k_1^{**} = \frac{(1-\lambda)^2 p_1^2}{4A^2\beta^2\lambda^2} e \quad (20)$$

$$e^{**} = \frac{\lambda\beta A}{b} \quad (21)$$

The enterprise optimization problem is translated into:

$$\max_{\alpha, \beta} \pi_m = -2\alpha + A(1-\beta)[\lambda(2-k_1)e + (1-\lambda)p_1(2 + \sqrt{k_1 e})] \quad (22)$$

$$s.t. (IR) \pi_s = 2\alpha + \beta A[\lambda(2-k_1)e + (1-\lambda)p_1(2 + \sqrt{k_1 e})] - be^2 - \rho\beta^2\sigma^2 \geq 2\bar{\pi} \quad (23)$$

$$(IR) \pi_s \geq 2\pi_s^* \quad (24)$$

$$(IC) k_1^{**} = \frac{(1-\lambda)^2 p_1^2}{4A^2\beta^2\lambda^2}, e^{**} = \frac{\lambda\beta A}{b} \quad (25)$$

The solution to the optimal plan is:

$$\beta^{**} = \frac{2\lambda^2 A^2}{2b\rho\sigma^2 + 2\lambda^2 A^2} = \frac{1}{1 + \frac{b\rho\sigma^2}{\lambda^2 A^2}} \leq 1 \quad (26)$$

The two-stage dynamic contract total income of enterprises and sales personnel are:

Enterprises income:

$$\pi_m^{**} = -2\alpha + A(1-\beta)\left\{\lambda\left[\frac{2\lambda\beta A}{b} - \frac{(1-\lambda)^2 p_1^2}{4b^2}\right] + (1-\lambda)p_1\left[2 + \frac{(1-\lambda)p_1}{2b}\right]\right\} \quad (27)$$

Sales staff's income:

$$\pi_s^{**} = 2\alpha + A\beta\left\{\lambda\left[\frac{\lambda\beta A}{b} - \frac{(1-\lambda)^2 p_1^2}{4b^2}\right] + (1-\lambda)p_1\left[2 + \frac{(1-\lambda)p_1}{2b}\right]\right\} - \rho\beta^2\sigma^2 \quad (28)$$

#### V. COMPARATIVE ANALYSIS OF TWO KINDS OF CONTRACTS

The mathematical and numerical analysis methods are used to analyze the contract between the company and the sales staff, comparing and analyzing the changes in the income of enterprises and sales personnel under the two contract forms and the influencing factors of the efforts of

sales staff. In order to analyze the problem in detail, some parameters of the model are set as follows:

TABLE I. PARAMETER VALUE TABLE

Parameter	A	$\beta$	$\sigma$	b	$\rho$	$\alpha$
Value	2	0.5	0.5	1	1.5	0

A. Analysis of the Work Effort of the First and Second Stage Sales Personnel

From  $k^* = 0$ , it can be known  $k_1^{**} = \frac{(1-\lambda)^2 p_1^2}{4A\beta\lambda b}$ . The following relationship can be obtained for  $k_1$  regarding the excitation coefficient  $\beta$ , the current effort contribution coefficient  $\lambda$ , and the corporate reputation  $p_1$ :  $\frac{\partial k_1^{**}}{\partial \beta} \leq 0; \frac{\partial k_1^{**}}{\partial \lambda} \leq 0; \frac{\partial k_1^{**}}{\partial p_1} \geq 0$ . When a salesperson signs a static contract with a company, the salesperson does not work hard to improve the reputation of the company. When signing a dynamic contract, salespeople are more committed to improving their reputation. The greater the incentive of the company to the sales staff, the greater the proportion of sales staff's efforts to the current performance. The better the reputation of the company, the more the sales staff pays more attention to the long-term reputation of the company. As the reputation of the company increases, the sales staff will reduce the proportion of the current efforts, and the more willing to work hard for the long-term reputation of the company.

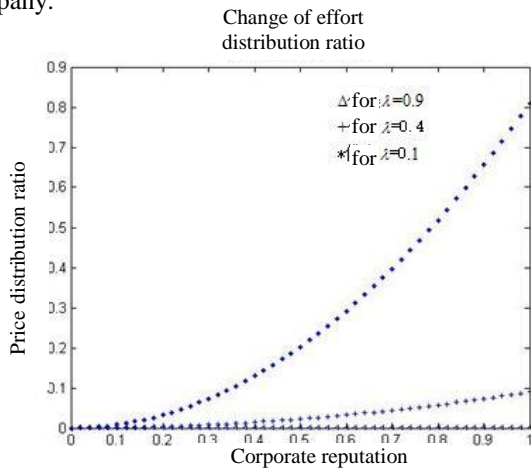


Fig. 1. Change of sales staff's effort distribution ratio

"Fig. 1" shows that under the dynamic incentive enterprise contract, the distribution ratio of current efforts increases with the increase of corporate reputation. The more the distribution ratio of current efforts is affected by the current efforts on output, the lower the proportion of current efforts. This verifies the relationship between the sales effort distribution ratio and the current effort contribution coefficient and corporate reputation.

Conclusion 1: When a salesperson signs a static compensation contract with a company, the salesperson pays

all efforts for the current performance. When a salesperson signs a dynamic incentive contract with a company, the salesperson makes an effort for the reputation of the company. As the reputation of the company increases, the efforts of business people to improve their reputation are greater. The greater the contribution of current efforts to output, the higher the incentive level of the contract, and the more willing the salesperson is to make more efforts for short-term performance.

It can be seen from  $e^* = e^{**} = \frac{\lambda\beta A}{b}$  that if the characteristics of multi-cycle multitasking faced by sales personnel are considered, the level of effort paid by the salesperson under the dynamic incentive contract is equal to that under the static contract. The efforts of the sales staff are directly proportional to the level of incentives. The higher the incentive level of the company, the harder the sales staff is. The greater the contribution of current efforts to output, the greater is the sales staff's current efforts. Combined with the conclusion 1, it is found that the degree of incentive has a positive effect on the sales staff's current work effort, and has a negative effect on the long-term reputation of the sales staff. The company needs to consider the coordination between the two in the contract design.

Conclusion 2: The sales effort of the sales staff changes positively with the degree of incentives and the contribution of the current efforts to the output.

B. Analysis of the Income of Enterprises and Sales Personnel and Incentive Degree

Comparing formula (13) and formula (26), it can be found:  $\beta^* = \beta^{**}$ . The optimal incentive level for the salesperson is the same in both forms of contract. Due to the influence of long-term credit accumulation effect under dynamic incentive contract, under the same incentive level, the enterprise income and salesman's income under the two-phase dynamic contract is better than the static total return.

Comparison of the incomes of enterprise static incentive contracts and dynamic incentive contracts:

$$\sqrt{\pi_m} = \pi_m^{**} - 2\pi_m^* = \frac{A(1-\beta)(1-\lambda)^2 p_1^2}{2b} (1 - \frac{\lambda}{2b}) \geq 0 \quad (1 - \frac{\lambda}{2b} \geq 0) \quad (29)$$

Comparison of the incomes of salesperson static incentive contracts and dynamic incentive contracts:

$$\sqrt{\pi_s} = \pi_s^{**} - 2\pi_s^* = \frac{A\beta(1-\lambda)^2 p_1^2}{2b} (1 - \frac{\lambda}{2b}) \geq 0 \quad (1 - \frac{\lambda}{2b} \geq 0) \quad (30)$$

It can be seen from equations (29) and (30) that both the salesperson and the enterprise profit from the dynamic incentive contract, and the total revenue is improved. Through numerical analysis, the relationship between the change in the difference between the income of different contract forms (static incentives and dynamic incentive contracts) and the current contribution coefficient and corporate reputation is as follows: (See "Fig. 2", "Fig. 3")

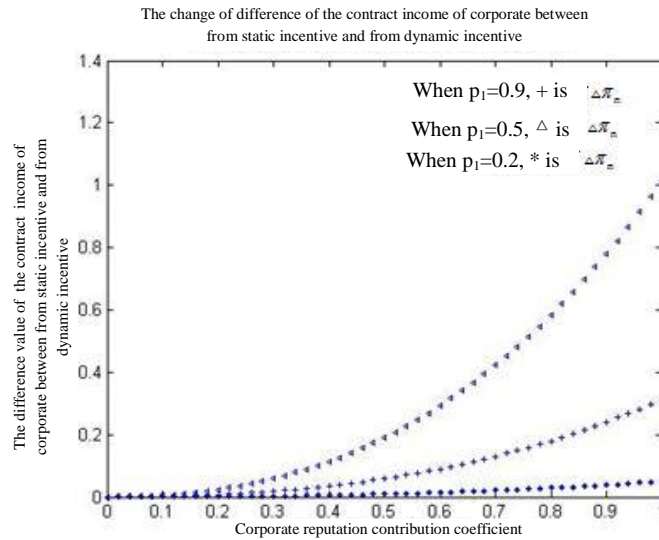


Fig. 2. Changes in the difference between the two phases of the business and sales staff (Differences in corporate income).

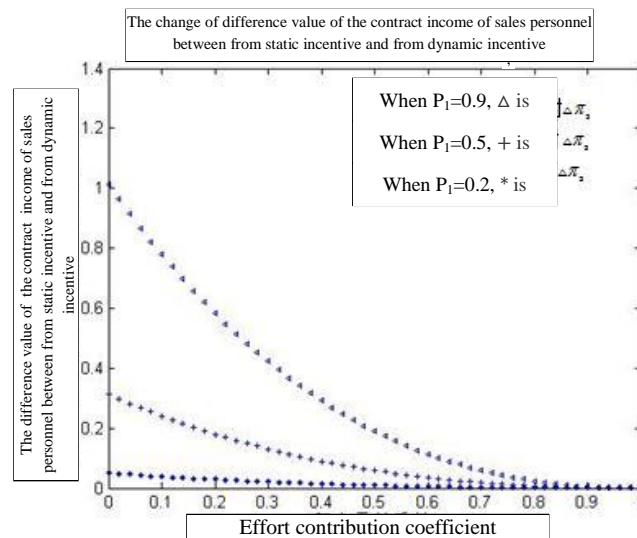


Fig. 3. Changes in the difference between the two phases of the business and sales staff (Differences in sales staff's income)

“Fig. 2” shows that the difference between the contract income of corporate by static incentives and dynamic incentive increases with the company's reputation and its contribution to output. With the increase of the contribution of corporate reputation to output and the improvement of corporate reputation, the effect of dynamic contract form on improving corporate income is more obvious. “Fig. 3” shows that the difference between the contract income of sales personnel by static incentive and dynamic incentive increases with the increase of corporate reputation, but shrinks as the sales staff's current efforts contribute to the increase in output. As the sales staff strives to increase the contribution to the output in the current period, the impact of the sales staff's current efforts on the income increase, and the role of the corporate reputation declines. In short, the improvement of corporate reputation is conducive to the improvement of the income of enterprises and sales personnel. The increase in the contribution of corporate

reputation to output expands the difference between the two types of contractual returns. The increase in the contribution of the sales staff to the output in the current period narrows the difference between the two types of contract benefits.

Conclusion 3: The enterprise's two-stage dynamic contract enterprise income and sales staff income are higher than the static incentive contract income level. The difference between the two types of contract revenues increase with the increase of the reputation of the company and the contribution of the company's reputation to the output, and shrinks as the sales staff's current efforts contribute to the increase in output.

## VI. CONCLUSION AND SUGGESTION

Based on the Holmstrom multitasking agent model, this paper studies the issue of vertical multitasking incentive contracts for sales personnel. First, a static incentive contract

between the company and the sales staff is established, and the income of the enterprise and sales staff of the static contract is analyzed. Then, a two-stage dynamic contract is established through the multi-task objectives, and the two-stage dynamic incentive contract and the two-stage static incentive contract equilibrium solution are compared and analyzed by numerical methods. Research shows that when a salesperson signs a traditional static compensation contract with a company, the sales staff puts all efforts into the individual's current performance, and there is no incentive to make efforts for the company's long-term reputation improvement. When the sales personnel sign a dynamic compensation contract with the enterprise, the sales staff pays attention to the enterprise reputation, strives to improve the customer service quality and customer satisfaction, and improves the corporate image. With the improvement of corporate reputation, the proportion of efforts made by sales personnel to enhance corporate reputation is greater. The degree of effort of the salesperson to invest in the current performance is positively different from the degree of incentives of the contract and the contribution of the current efforts to the output. The enterprise income and sales personnel income under the two-stage dynamic contract of the enterprise are higher than the income level under the enterprise static incentive contract. The difference between the two types of contract benefits increase with the reputation of the company and its contribution to output, and shrinks as the sales staff's current efforts contribute to the increase in output. In short, when companies adopt dynamic incentive contracts, the profits of both the company and the sales staff are improved.

Based on the above conclusions, the following recommendations are made:

By comparing and analyzing the two types of contracts, the long-term dynamic incentive contract signed by the enterprise and the sales personnel has obvious effect on improving the enterprise's income. Keeping the sales force team stable is beneficial to the long-term stable development of the enterprise. The more reputable companies, the higher the incentives for dynamic incentive contracts for companies and salespeople, and the more reputable companies tend to adopt dynamic incentive contracts.

The current efforts and long-term reputation of employees in different industries have different effects on the output of enterprises. The greater the contribution of current efforts to output, is the more the salespeople focusing on short-term benefits. Therefore, companies need to pay attention to the impact of current efforts on output, so as to deal with the relationship between short-term incentives and long-term stability of sales personnel, and avoid short-term behavior of sales personnel.

For sales personnel, when choosing employment, they should choose companies with good reputation and sign long-term dynamic contracts. At the same time, sales personnel should correct their work attitude and invest more efforts in the long-term stable development of the company, thereby improving their long-term interests.

The article assumes that the enterprise is risk-neutral. If you consider the risk characteristics of SMEs, the conclusions will be different. If more factors affecting output are introduced, such as market coverage, adding more dimensions, and the conclusions need to be further explored.

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