Analysis of Game Model Hypothesis Between Management and Sales Staffs Based on XY Theory by Douglas

Design of Compensation Incentive for Sales Personnel in Financial Industry

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Abstract. In terms of compensation incentives for sales personnel in domestic financial industry, there are uncertainties in the applicability of the research results. At present, it is rare to use game theory to study the compensation incentive of salesmen in financial industry, which is exactly the major point this paper tries to discuss. According to the XY theory of management, the sales staff in the financial industry are divided into two categories: the positive state and the negative state. The game model between the management and the sales staff under this situation is also constructed.

Keywords: game theory · Financial industry sales staffs · compensation incentive mechanism

1 Introduction

Compared with the traditional game analysis model between management and sales staff, the model analysis in this section introduces the concepts of fixed compensation and floating compensation, as well as the characteristics of high-risk investment in the financial industry, so as to conduct targeted analysis for the financial industry environment. According XY theories of management, the sales staff of enterprises in the financial industry are divided into two categories: the positive state and the negative state, and the game model between the management and the sales staff under this situation is constructed. At the same time, the following hypotheses are proposed:

1.1 Hypothesis 1

The condition of "work enthusiasm" of salespeople is introduced into the game model, and sales staffs are divided into two categories by this feature: one is positive, one is negative. This characteristic is exogenous, that is, it is not affected by any factors in the model; It will not be changed in the model analysis. At the same time, assuming that sales staffs' work attitude also can be divided into two kinds: hard and slack; Positive sales

J. Yang et al. (Eds.): ICMSEM 2022, AHE 12, pp. 239–246, 2023.
https://doi.org/10.2991/978-94-6463-038-1_22

staffs will try their best to complete the corresponding work (that is, they will choose the hard work attitude), while the other type of negative staffs may try their best (there is a certain probability) or slack off. Because of information asymmetry, the characteristics of sales staffs (positive or negative) are private information that management does not know about. If the probability of positive employees is γ, then the probability of negative employees is $1 - \gamma$. At the same time, the company's management does not know the sales staff will choose which kind of type (hard or slack) to finish the work, but he only know, negative sales staffs make every effort(hard) to finish the tasks is the possibility of α, the possibility of not doing everything them can to complete tasks is $1 - \alpha$ (positive sales staffs will make every effort to finish all the work tasks). α can be counted as self-selection by sales staffs, i.e. the value of α in this case is not constant but varies with a range of other characteristics, such as compensation structure, probability of behavioral selection by management, and so on. Sales personnel do not know whether the management will implement the inspection, only know that the possibility of inspection is β, the possibility of management will not implement the inspection is $1 - \beta$, this coefficient belongs to the personal information of the management, but also reflects the self-selection of the management, that is, it will change with the salary structure, the probability of the behavior of the sales staffs, etc. [1].

1.2 Hypothesis 2

Identify applicable sponsor/s here. (sponsors).

All participants in the model are rational economic men whose purpose is to maximize their own interests. Further, for the convenient and the general, simple and do not break in this model, we assume that the participants only enterprise managers and sales staff, and they always exists between game: financial firms with the lowest level of the sales staff will try to pay to obtain the biggest benefit, the management wants to gain maximum benefit from the lowest administrative costs. The two are contradictory, so the game between them is a non-cooperative game.

1.3 Hypothesis 3

Corporate sales staffs in the financial industry have two ways to complete the work assigned from management: one is to do their best to complete their work (hard); And the other is to deliberately delay the implementation, or not in accordance with the requirements of the quality of the work tasks (slack). Considering the risk characteristics of the financial industry, we assume that the success rate of the project is not 1, but a probability. At the same time, there is a difference in the probability of project success between hard work and slack work: The probability of project success with hard work is P_h, The probability of project success under slack work is P_i, $P_h > P_i$ at the same time. The success or failure of a project can significantly affect the income of sales staff and managers (note that this is not net income, which is calculated after deducting various costs). When the project is successful, the manager's income is x_h, the manager's income in the event of failure is x_I ($x_h > x_I$). When the project is successful, the salary income of sales staff is $w_0 + w_h$; When the project fails, the salary income of the sales staff is $w_0 + \mathrm{w}(w_h > w_I)$. For sales staffs, the choice between hard work and slack work has

different work costs (cost of time, energy, etc.). Suppose the cost of slacking is 0 and the cost of hard work is C.

1.4 Hypothesis 4

In the course of business sales in the financial industry, managers have two choices: to check (probability β) or not to check. If you examine the progress of corporate sales staffs in the financial industry, it will take your time and effort. we could assume the cost as I.

1.5 Hypothesis 5

In the case of the management's inspection of work, if the sales staffs choose to slack off, they will be found out. For those staffs who choose to slack off, the management has the right to punish them according to the relevant employee rules or company rules and regulations, with a fine as F. If sales staffs choose to work hard, they will not be penalized.

1.6 Hypothesis 6

This model is a dynamic game with incomplete information: the sales staffs in the financial industry have a complete understanding of their own abilities and types, while the information of the managers is in an incomplete state. The management does not know the characteristics of the sales staff (positive or negative staff), nor do they know whether the staff will choose to work hard or slack off, and the enterprise sales staffs also do not know whether the management will check their work or not. The two sides of the strategic selection are selected in chronological order rather than at the same time [3].

Here is a summary of the meaning of all variables used:

C: Represents the sales staffs, relative to slack off work, the physical cost of choosing to work hard.

I: The cost of conducting inspections of the management.

F: Penalty received by a sales staffs when management inspects and finds that the sales staffs are slacking off instead of working hard.

χ_h *and* χ_l: Represents, respectively, the revenue of management at the time of project success and failure (ignore cost).

w_o, w_h *and* w_l: Fixed pay, variable pay when projects succeed and variable pay when projects fail.

P_h *and* wP_l: Success rate of projects when sales staffs work hard and slack off.

γ: Represents the possibility that sales staffs are positive employees.

$1 - \gamma$: Represents the possibility that sales staffs are negative employees.

α: Possibility of work hard of sales staffs.

$1 - \alpha$: Possibility of work slack of sales staffs.

β: Possibility of management's inspection of work.

$1 - \beta$: Possibility of management do not do the inspection of work.

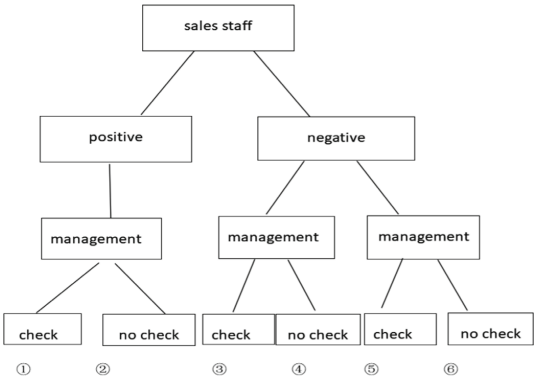

Fig. 1. Management and sales staff game tree

2 Construction of Game Model Between Management and Sales Staff

The game model of compensation incentive design of sales staffs in financial industry belongs to incomplete information dynamic game. First, according to this situation, natural selection results in two types of employees, namely positive employees (probability γ) and negative employees (probability $1-\gamma$). Positive employees will always choose to work hard, while negative employees will choose to work hard (probability alpha) or slack off (probability $1-\alpha$) based on information such as salary system and their own guesses about whether management checks. Then, in the course of the sales staff's work, management needs to make choices about its own behavior. However, due to the information asymmetry in the process, the management does not know whether the sales staff are positive or negative. It is also not known which state the sales staff choose to be in, whether to work hard or slack off. Management only knows how likely the relevant features and states are. In this case, what the management needs to decide is what kind of compensation incentive strategy to adopt and whether to take check measures. Through the analysis of the above models, a game tree with nature is established, as shown in Fig. 1 [2].

The game tree between management and sales staffs is shown in Fig. 1. There are six possible result nodes in this game, which are denoted as ① to ⑥ respectively. According to the assumptions and the game tree, the profit values of management and sales staff at each node of the game model can be determined (in parentheses, the former is the net profit of sales staff, and the latter is the net profit of management):

① $w_o + P_h \cdot w_h + (1-P_h) \cdot w_l - C$;

$$P_h \cdot x_h + (1-P_h) \cdot x_l - w_o - P_h \cdot w_h - (1-P_h) \cdot w_l - \mathrm{I};$$

② $w_o + P_h \cdot w_h + (1-P_h) \cdot w_l - C$;

$$P_h \cdot x_h + (1-P_h) \cdot x_l - w_o - P_h \cdot w_h - (1-P_h) \cdot w_l$$

③ $w_o + P_h \cdot w_h + (1-P_h) \cdot w_l - C$;

$$P_h \cdot x_h + (1-P_h) \cdot x_l - w_o - P_h \cdot w_h - (1-P_h) \cdot w_l - \mathrm{I};$$

④ $w_o + P_h \cdot w_h + (1 - P_h) \cdot w_l - C$;

$$P_h \cdot x_h + (1 - P_h) \cdot x_l - w_o - P_h \cdot w_h - (1 - P_h) \cdot w_l$$

⑤ $w_o + P_h \cdot w_h + (1 - P_h) \cdot w_l - F$;

$$P_h \cdot x_h + (1 - P_l) \cdot x_l - w_o - P_l \cdot w_h - (1 - P_l) \cdot w_l + F - \mathrm{I}$$

⑥ $w_o + P_l \cdot w_h + (1 - P_l) \cdot w_l$;

$$P_h \cdot x_h + (1 - P_l) \cdot x_l - w_o - P_l \cdot w_h - (1 - P_l) \cdot w_l$$

According to the above results, it can be concluded that when the negative sales staff choose whether to work hard or slack off, their expected net income is:

$$\pi_1 + \alpha \cdot \beta \cdot (w_o + P_h \cdot w_h + (1 - P_h) \cdot w_l - C)$$

$$+\alpha \cdot (1 - \beta) \cdot (w_o + P_h \cdot w_h + (1 - P_h) \cdot w_l - C)$$

$$+(1 - \alpha) \cdot \beta \cdot (w_o + P_h \cdot w_h + (1 - P_l) - F)$$

$$+(1 - \alpha) \cdot (1 - \beta) \cdot (w_o + P_l \cdot w_h + (1 - P_l) \cdot w_l)$$

For the negative sales staff, the expected net income that the management chooses to inspection or not is:

$$\pi_2 + \alpha \cdot \beta \cdot (P_h \cdot x_h + (1 - P_h) \cdot x_l - w_o - P_h \cdot x_h - (1 - P_h) \cdot w_l - \mathrm{I})$$

$$+\alpha \cdot (1 - \beta) \cdot (P_h \cdot x_h + (1 - P_h) \cdot x_l - w_o - P_h \cdot w_h) - (1 - P_h) \cdot w_l)$$

$$+(1 - \alpha) \cdot \beta \cdot (P_l \cdot x_h + (1 - P_h) \cdot x_l) - w_o - P_l \cdot w_h - (1 - P_l) \cdot w_l + F - 1$$

$$+(1 - \alpha) \cdot (1 - \beta) \cdot (P_l \cdot x_h + (1 - P_l) \cdot x_l - w_0 - P_l \cdot w_h) - (1 - P_l) \cdot w_l$$

After sorting, it can be concluded that:

$$\pi_1 = w_o + P_l \cdot w_h + (1 - P_l) \cdot w_l)\beta F + \alpha\beta F + \alpha(P_h \cdot w_h + (1 - P_h) \cdot w_h$$

$$-P_l \cdot w_h - (1 - P_h) \cdot w_h - C) \tag{1}$$

$$\pi_2 = \alpha(P_h \cdot x_h + (1 - P_h) \cdot x_l - w_o - P_h \cdot w_h - (1 - P_h) \cdot w_l - \alpha\beta I$$

$$+(1 - \alpha) \cdot \beta(F - 1) + (1 - \alpha)P_l \cdot x_h + (1 - P_l) \cdot x_l - w_o - P_l \cdot w_h$$

$$-(1 - P_l) \cdot w_l \tag{2}$$

Calculate the first partial derivatives of α and β for Eqs. (1) and (2) respectively, then let the partial derivatives be equal to zero, and it can be concluded that:

$$\alpha^* = 1 - \frac{I}{F} \tag{3}$$

$$\beta^* = \frac{C - (P_h \cdot w_h + (1 - P_h) \cdot w_l) - (P_l \cdot w_h +)(1 - P_l) \cdot w_l))}{F} \tag{4}$$

(α^*, β^*) is the mixed strategy Nash equilibrium of sales staff and management.

3 Game Model Analysis Between Management and Sales Staff

Next, we analyze the management's strategic choice (inspection or not inspection):

(1) The probability of whether the management chooses inspection is directly related to the income gap between the sales staffs and the success or failure of the project. When the income gap is large, the probability of management choosing inspection will be appropriately reduced, because the large income gap at this time will make the passive sales staff more likely to choose to work hard rather than slack off.
(2) Whether the management chooses to check the probability is also related to the extra cost of sales staff working hard. When the work is difficult or intense, more extra costs are required for employees to work hard (C), and the probability of management review is also increased, because employees are more motivated to choose to slack off.
(3) Whether the management chooses to check the probability is also related to the amount of fines. The greater the fine, the less likely the inspection. That is because a bigger fine would have a better deterrent effect, making it less likely that an employee would choose to slack off.

Furthermore, we analyze the choices of sales staffs in a negative state (working hard or slacking off):

(1) First of all, we find that the choice of sales staff has nothing to do with the income of management and staffs themselves. This is because, unlike the income structure of management, there is no opportunity cost in the income of sales staff; That is, our model does not assume that employees can have other job choices if they do not do this job (for the management, employee income is deducted from the management's own income).
(2) The probability that sales staffs choose to work hard is related to both the penalty and the cost of management inspection. The higher the penalty, the more likely you are to choose hard work. It's easy to see why: higher fines are more of a deterrent, and employees are less likely to slack off. At the same time, the higher the cost of inspection, the less likely they are to choose hard work. This is because the higher the cost of inspection, the less likely employees think management will choose inspection, and thus the less likely they will be caught slacking off. Note that the cost of inspection is not greater than the penalty in the model setting, otherwise management will never choose inspection.

It can be seen from the above description that when the management personnel choose whether to inspect, they should consider appropriately. For example, when designing a salary structure, reducing the gap between the salaries of sales staff when a project succeeds and when it fails can reduce the likelihood of inspections. Similarly, managers should also consider the difficulty of the work: for difficult work, they should consider the possibility that employees are more likely to slack off, thus increasing the possibility of inspection. Finally, higher fines can be a simple and straightforward way to reduce inspections, although this approach is more likely to provoke conflict in a company's content than others. In this way, reasonable arrangement of inspection frequency and intensity according to the actual situation will help reduce the inspection and supervision cost of the company, and improve the supervision efficiency of the company to a certain extent [4].

Moreover, managers must fully understand the actual needs of employees. For employees in negative situations, in addition to strengthening supervision and punishment, they can also provide some material rewards to improve the salary structure together. Active personnel do not need to be observed often, but only need to be motivated to their internal needs and spiritual aspects on the basis of some material basis. Therefore, enterprises should implement an effective management reward. Take steps, wherever possible, to provide reasonable protection and compensation to ensure that sales staff have the greatest incentive to work. Appropriate deterrence measures may generate appropriate external pressures, which may cause certain tensions and concerns among sales staff, which in turn may create feelings of insecurity among sales staff. There may be factors to avoid punishment and control. Therefore, appropriate pressure often becomes the motivation for sales staff to work hard [5].

The traditional game model between management and employees treats all employees as one kind of person. This is a mixed strategy game model, in which employees choose to do their best or not with a certain probability, while management chooses to check or not to check employees with a certain probability. The main difference between the game model in this paper and the traditional game model lies in the introduction of "natural" virtual players on the basis of the traditional game model. According to theory X and Theory Y in management, enterprise employees are divided into negative employees and positive employees. Employees with a positive attitude will try their best to finish their work under any circumstances, while employees with a negative attitude will choose whether to try their best according to the changes in the external environment.

4 Conclusions

Through the analysis and solution of the model, it is concluded that the positive staffs always choose to do their best to complete the work, the negative staffs choose to do their best or not according to the situation, the management should do the inspection to check out the employees who do not do their best to complete the works; After classifying the employees of the enterprise, there is no need for inspection and supervision because the positive employees will do their best to complete the work. The management only needs to check and supervise the negative employees, thus reducing the cost of inspection and supervision.

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