Economic Analysis of Accident Concealment

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Abstract. In order to deeply reveal the economic relationship between the main stakeholders of accident concealment, this paper constructed a "principal-agent" model and incorporated rent-seeking behavior into the model, and analyzed the two cases of agent corruption and rent-seeking corruption respectively. The results show that: Agent corruption can be avoided by reducing the benefits of corruption and weakening the agent's function in the distribution of public power. The high cost of rent-seeking will increase the probability that rent-seekers will choose to conceal accidents. The cost of the inspection set by the client should not be too high. Control measures such as rectifying the law enforcement team, encouraging multi-party supervision, and raising the threshold for rent-seeking can effectively reduce the occurrence of accident concealment.

Keywords: Accident concealment; corrupt; Principal-agent; Rent-seeking; Security management.

1 Introduction

The form of production safety in China is severe, and the total number of accidents is on the high side. Accidents often result in a large number of casualties and property damage. In order to avoid punishment, accidents are concealed from time to time. According to the accident inquiry system of the State Administration of Work Safety, between 2022 and 2012, there were 10 cases of accident concealment in China's coal industry, resulting in 44 deaths. The occurrence of accident concealment is not only affected by the psychological factors of the parties evading responsibility, but also by economic interests. Taking this factor into account, this paper analyzes the act of concealment of accident and the act of embezzlement and corruption as a whole.

The principal-agent theory was proposed in the 30s of the last century, and has since been widely used to analyze problems such as official abuse of power and corruption[1-3]. Rent-seeking, as one of the important economic activities, is often applied to economic analysis together with principal-agent theory[4].

Considering that few scholars have analyzed the deep laws of accident concealment from the perspective of economics, this paper considers the central government, local governments and enterprises as the main stakeholders of accident concealment behavior, and uses economic methods to analyze the strategy choices of the three parties. By

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constructing the model of "principal-agent and rent-seeking behavior", the economic relationship behind the accident concealment behavior is analyzed. Based on the results of the analysis and combined with China's national conditions, control measures and suggestions are proposed.

2 The convergence of the principal-agent relationship and rent-seeking activities

In the normal and legal accident reporting process, the enterprise needs to bear the responsibility for the accident. In order to avoid punishment, some companies tend to establish some kind of economic or political relationship with the government after an accident in an attempt to reduce or evade responsibility for the accident. In turn, corruption has been raised[5]. In other words, there is corruption behind most of the accident concealment, which can be regarded as a corruption problem. This paper regards corruption as a comprehensive problem that integrates principal-agent relationship and rent-seeking behavior. Under the principal-agent relationship, the "principal" is the people and the central government, the "agent" is the local government, and the "rent-seeker" is the demander of scarce resources at the disposal of public power[6].

Through a specific contract of social relations, the people delegate a particular public right to government officials, who rely on this public power to rent important resources that are monopolized by the state. In this context, rent-seeking activities take place and further evolve into corrupt practices. In the presence of information asymmetry, adverse selection, and moral hazard issues, agents will deviate from the principal's optimal goals. The masses of the people in the client are unable to exercise their rights in person due to certain restrictive factors, so they entrust this part of their rights to the agent. Because of the pursuit of maximizing their own utility, the agent may deviate from the principal's purpose of entrustment, resulting in deviation, which provides the possibility for rent-seeking behavior.

The process of concealment of accidents can be seen as the state (on behalf of the people) entrusting local government officials to exercise their rights. In order to meet their own economic needs, local governments have led to the occurrence of rent-seeking activities of enterprises. When an accident occurs, in order to reduce economic losses, the local government in order to obtain excess profits, that is, rent, eventually leads to the occurrence of accident concealment.

3 Basic assumptions and model building

3.1 Model assumptions

In the hypothetical model, Y represents the expected value or market value of a public power or important resource, and y represents the transfer price set by the agent in an exchange of public power. y can be understood from the following two aspects.

In rent-seeking, rent-seekers pay a price y in order to obtain a specific right or resource. Therefore, in rent-seeking activities, rent-seekers will pay agents y, that is, rent-

seeking costs, in order to obtain benefits beyond market value. At the same time, in order to provide rent-seeking space for rent-seekers and get paid, the agent will set the price y, deliberately causing a deviation between y and Y, and eventually making $y < Y$. The amount of income that the rent-seeker receives in excess of the market value is $Y - y$, and the amount of bribes paid by the rent-seeker to the agent is $C_1 (0<C_1<Y - y)$.

From the agent's point of view, when the agent illegally exercises his public power, it will cause the deviation of Y, and y is only the transfer price set by the agent in order to obtain benefits in the whole process of the activity, so there is $y < Y$.

Based on the above assumptions, in the process of concealing the accident, the amount of bribes paid by the enterprise to the relevant administrative departments and officials of the higher-level government is C_1. The amount of income from the relevant administrative departments and officials of the local government that shields or obstructs the reporting of accidents constitutes corruption is C_2.

This paper defines the cost of investigating and dealing with accident concealment and exposing corruption as s, and s is a function of the probability q of detecting the concealment. Since the marginal cost of obtaining the degree of accident concealment increases with the enhancement of the degree of information, there are $S'(q) > 0$ and $S''(q) > 0$.

3.2 Construction of the "principal-agent relationship and rent-seeking activities" model

3.2.1 Surrogate's behavioral expectations.

$$R_A = (1 - q)(C_1 + C_2) - qT(C) \tag{1}$$

In Eq. (1): R_A refers to the agent's expected return in the event of concealment.

q refers to the probability that the entrusting party will find out the concealment.

T(C) is a function of the degree of punishment to which the agent is punished when the concealment of an accident is discovered. $T(C) = \alpha (C_1 + C_2)$, where α represents the penalty factor from the principal for the agent's concealment.

The proceeds of corruption in which an agent conceals an accident can be expressed in terms of a mathematical expectation. When the accident concealment is not investigated, the benefit is $(C_1 + C_2)$, and once it is investigated, it will be punished by $\alpha (C_1 + C_2)$. Therefore, the sufficient condition to prevent the agent (relevant government departments and officials) from covering up or helping to conceal the accident is $R_A \leq 0$, which can be expressed by the following formula.

$$R_A = (1 - q)(C_1 + C_2) - qT(C) \leq 0 \tag{2}$$

$$q \geq \frac{1}{1 + \alpha} \tag{3}$$

3.2.2 Behavioral expectations of rent-seekers.

$$R_R = (1-q)(Y-y) - qF(Y-y) - C_1 \tag{4}$$

In Eq. (4): R_R refers to the expected return of a rent-seeker in the event of an accident concealment.

q refers to the probability that the entrusting party will find out the concealment.

F (Y - y) is a function of the degree to which rent-seekers are punished when accident concealment is discovered. F (Y - y) = β (Y - y), where β refers to the penalty factor for rent-seekers who are found to have underreported and corrupted their behavior.

When a rent-seeker conceals a successful accident, he does not have to pay the corresponding penalty penalty. At this time, the monopoly income obtained by the agent by relying on the public power in his hands is (Y - y), and the rent-seeking cost is $\gamma = C_1 / (Y - y)$. When the concealment of an accident is discovered, the rent-seeker will be subject to a penalty of β (Y - y). Therefore, a sufficient condition to avoid accident concealment and corruption by rent-seekers is $R_R \leq 0$, which can be expressed by the following formula.

$$R_R = (1-q)(Y-y) - qF(Y-y) - C_1 \leq 0 \tag{5}$$

$$q \geq \frac{(Y-y) - C_1}{(1+\beta)(Y-y)} = \frac{1-\gamma}{1+\beta} \tag{6}$$

3.2.3 Principal's behavioral expectations.

$$R_P = \left[q(\alpha+\beta+1) - 1\right](Y-y) - S(q) \tag{7}$$

In Eq. (7): R_P represents the expected return of the delegator, and $R_P > 0$.

4 Model Solving and Model Analysis

4.1 Mathematical solution of the model

With the increase of the supervision of the client, the probability of investigating and dealing with the concealment of accidents is higher. Therefore, the optimal solution of q can be solved by maximizing the expected utility of the principal. At this time, q is the maximum probability of preventing accident concealment.

The above descriptions can be translated into mathematical problems to solve. Solve the maxima of the function Eq. (7) under Eq. (3) and Eq. (6), respectively.

$$F(q) = q\left[\alpha(Y-y) + \beta(Y-y)\right] - (1-q)(Y-y) - S(q) \tag{8}$$

$$F'(q) = (\alpha+\beta+1)(Y-y) - S'(q) \tag{9}$$

$$F''(q) = -S''(q) \neq 0 \tag{10}$$

When $F'(q) = 0$, if $F''(q) < 0$, $F(q)$ takes the maximum value. Through the above solution process, the following results can be obtained.

$$q^* = S^{r-1}(q)\left[(\alpha+\beta+1)(Y-y)\right] > \max\left[\frac{1}{1+\alpha}, \frac{1-\gamma}{1+\beta}\right] \tag{11}$$

4.2 Model Analysis

4.2.1 Model analysis when $1 / (1 + \alpha) > (1 - \gamma) / (1 + \beta)$.

When $1 / (1 + \alpha) > (1 - \gamma) / (1 + \beta)$, there are $q^* > 1 / (1 + \alpha)$, and q^* is a function of α. In this case, agents dominate the misreporting of accidents and corrupt practices.

By comparing the mathematical expression of the agent's behavior expectation with the reasoning results in Section 4.1, it can be seen that the optimal solution of q^* depends on the size of the penalty factor α, and increasing α can increase the probability of investigating and dealing with accident concealment. It should be emphasized that if a one-sided increase in α does not bring better results to the investigation and punishment of accident concealment, the impact of inspection costs on the investigation and punishment of accident concealment should also be considered. From $S' > 0$, it can be seen that an unplanned increase in α will lead to an increase in the cost of social audit, which will increase the burden on society.

When the accident concealment is not investigated, the agent receives $(C_1 + C_2)$ from corruption. From the mathematical relationship, it can be found that the size of the proceeds of corruption does not play a direct role in avoiding the problem of agents covering up enterprises to conceal accidents. However, when analyzed from the perspective of the agent's expected benefits and psychology, it can be found that the larger the amount of corruption, the more likely it is that government departments and officials will cover up the company.

At the same time, as $(Y – y)$ increases, so does q^*. However, this increase does not directly increase the probability of accident concealment being investigated and punished. This phenomenon should be understood to mean that the increase in $(Y – y)$ leads to an increase in the cost of inspection, which in turn increases the cost of anti-corruption work. The larger the difference between Y and y, the higher the rent is set, the more rent-seeking behaviors can be induced.

4.2.2 Model analysis when $(1 - \gamma) / (1 + \beta) > 1 / (1 + \alpha)$.

When $(1 - \gamma) / (1 + \beta) > 1 / (1 + \alpha)$, there are $q^* > (1 - \gamma) / (1 + \beta)$, and q^* is a function of β and γ. In this case, rent seekers dominate the misreporting of accidents and corrupt practices.

Since the analysis of the effect of β on q^* is similar to the analysis in Section 4.2.1, this section focuses on the effect of γ on q^*. From the expression of the expected return of the rent-seeker, it can be seen that the larger the amount of bribes C_1 paid by the rent-seeker to government officials, the higher the cost of rent-seeking. If an accident occurs in the subsequent revenue generation process, due to the impact of economic costs, the

rent-seeker will consider making up for this expenditure and choose to conceal the accident.

5 Countermeasures for the control of accident concealment

According to the results of the model analysis above, the following control countermeasures are proposed.

5.1 Rectify the law enforcement contingent and strengthen law enforcement capabilities.

(1)Client's perspective

The law enforcement team should be effective for a long time, and the law enforcement process should be fair and open. Responsible leaders must be held accountable for corruption in the law enforcement ranks.

The leadership team should attach importance to the public's complaints and information, and protect the personal privacy and personal safety of the masses and law enforcement personnel. Improve the welfare of law enforcement officers. The results of dealing with those who are corrupt should be made public, and the opinions of the masses should be fully considered.

(2)Agent's perspective

The rights and responsibilities of the supervisory and law enforcement teams should be separated so that they can supervise each other. The promotion of local government officials should be based on their own performance as the main reference criterion, and the supervisory team should supervise them. Popularize law enforcement procedures to the public, promptly handle complaint information and disclose the results of the handling.

5.2 Optimize the regulatory environment and encourage multi-party supervision.

(1)Give play to the supervisory role of the media and public opinion.

After an accident occurs, the media should disseminate true and effective information about the accident through various channels such as the Internet. With the help of public opinion, the information barriers formed by local governments and accident companies are broken.

(2)Give play to the supervisory role of the masses.

Encourage the public to report accident information to the relevant departments as supervisors. Cultivate the masses' sense of social morality, and encourage the masses to dare to expose accidents and concealment of accidents and corruption.

5.3 Increase the cost of rent-seeking and raise the threshold for rent-seeking.

(1) Directly increase the amount of rent-seeking payments.

This method plays a role in screening rent-seekers before rent-seeking behavior occurs. Raise the amount you need to pay for rent-seeking to the point where only well-capitalized businesses can afford to pay. However, such enterprises often have rich production experience, attach importance to safety issues, have the economic basis to bear the responsibility for accidents, and have the awareness of accident reporting.

(2) Improve the conditions for rent-seekers, such as education and work experience.

Rent-seekers with higher education and work experience generally have stronger safety concepts, richer safety knowledge and moral constraints because they are more educated. These people have a deep understanding of the severity of the consequences of accident concealment and are more willing to invest in increased safety efforts.

6 Conclusion

(1) In order to prevent corrupt practices by agents, the central government should reduce the benefits that agents derive from rent-seeking activities and weaken the distribution of public power by agents.

(2) Excessive rent-seeking costs will lead rent-seekers to make up for rent-seeking costs in business activities and choose to conceal accidents.

(3) In the process of controlling corruption, the client should reasonably set the inspection cost to avoid the waste of social resources.

(4) Through these three management measures, the occurrence of accident concealment can be effectively prevented: ① Rectify the law enforcement contingent and strengthen law enforcement capabilities. ② Optimize the regulatory environment and encourage multi-party supervision. ③ Increase the cost of rent-seeking and raise the threshold for rent-seeking.

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