

Research on Incentive and Constraint Mechanism of Government Entrust to Enterprise Agent Reserve Emergency Material

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Abstract: Government entrust to enterprise agent reserve emergency material is a important way for reducing reserve costs and improving the using efficiency of reserve funds. Aiming at the problem of asymmetric information in the process of enterprise agent reserve, this paper use enterprise in the pursuit of maximize their own utility while meeting the government utility maximization as the goal, use the principal-agent theory to establish a long-term and short-term incentive and constraint model of enterprise agent reserve emergency material, and analyze the model in detail, then puts forward some suggestions of establish enterprise agent reserve emergency material incentive and constraint mechanism.

Keywords: Asymmetric information, emergency material, enterprise agent reserve, incentive and constraint, principal-agent.

1. INTRODUCTION

Enterprise agent reserve emergency material, refers to a behavior of the government entrust to enterprise agent reserve, for the purpose of reducing the costs of emergency material reserve and improving the using efficiency of reserve funds. Among them, the ownership of emergency material belongs to the enterprise, the enterprise responsible for reserve; The right of use belong to the government, enterprise can't use agent reserve meet an emergency without government approval; At ordinary times the government will give enterprise certain subsidy, to promote enterprise take good care of emergency material, and ensure the quality and quantity of emergency material intact; When government use emergency material in case of emergency, government will be settled with enterprise according to the use of emergency material numbers and its market prices.

Therefore, the government and the enterprise signed the following contract in essence: the government entrust enterprise take care of emergency material, enterprise take good care of emergency material according to the request of the government, the government will give enterprise certain subsidy according to the reserve status of emergency material. It can clearly be seen, between the government and the enterprise is a kind of principal -- agent relation. In this case, the government and the enterprise goals are inconsistent, the government's goal is to ensure the quality and quantity of emergency material intact, and give the subsidy as little as possible; But enterprise take to maximize their own interests as the goal, under a fixed subsidy case, enterprise may reduce the manpower and material resources, endanger the safety of emergency material. In addition, the government and the enterprise information is asymmetric, the enterprise has more information than the government, and the

government is not possible to do entire regulation on enterprise reserve process due to the high cost of regulation. This information asymmetry will generate principal-agent problem [1], that is, the enterprise may be pursue the maximization of their own interests at sacrifice the expense of the interests of the government. So the government must design an incentive and constraint mechanism, encourage and guide enterprise to take action to maximize their own interests, but also fully in line with the government's interests. Therefore, this paper will use the principal-agent theory to establish a long-term and short-term incentive and constraint model of enterprise agent reserve emergency material, and analyze the model in depth, provide a theoretical basis for establish effective enterprise agent reserve emergency material incentive and constraint mechanism.

2. MODEL PREMISE, VARIABLE AND ITS CHARACTERISTIC

2.1. Model Premise

(1) Information asymmetry between the two sides of the game. In the process of enterprise agent reserve emergency material, the government is the principal, the enterprise is the agent, enterprise have internal information advantage, the government is unable to fully observe and understand the extent of the efforts of enterprise, at an information disadvantage, but the government can observed the effort result of enterprise, namely the quantity and quality of enterprise agent reserve emergency material.

(2) Under the constraint of objective conditions, the government and the enterprise are able to make optimal rational choice to achieve their own decision goals.

(3) Emergency material reserve status except directly related with the enterprise's own efforts, reserve facilities condition and other factors, but also influenced by some beyond enterprise's own control objective conditions and random events, therefore, the final reserve status of emergency mate-

rial may be uncertain, the government and the enterprise decision-making consequences exist some uncertainty.

(4) The sequential of decision-making is as follows: ① Government sign an agent reserve contract with enterprise, the contract specify the way and standard to enterprise subsidy. Under normal circumstances, the enterprise subsidy includes two parts, one part is a fixed subsidy, that is a necessary expense of enterprise during reserve process of emergency material; The other part is the incentive subsidy, such as bonus, directly linked with the achievement of enterprise reserve emergency material. ② The enterprise according to contract and their own reserve facilities condition, select the appropriate action to make their benefit maximum. In the process of enterprise reserve emergency material, some objective events may occur that beyond the enterprise control, therefore, the enterprise's own efforts, reserve facilities condition and some random events together determine the quality and quantity of emergency material. ③ Because of the asymmetries of information, government unable to determine the reserve status of emergency material is how much extent aroused by the enterprise's effort, but government can observe the quality and quantity of emergency material, and give enterprise corresponding subsidy according to the contract signed before.

2.2. Model Variable

(1) Enterprise agent reserve emergency material actual inventory value is y (the actual inventory value of emergency material is y_t at time t);

(2) Enterprise's effort for the reserve of emergency material is p (the effort degree of enterprise is p_t at time t);

(3) Enterprise reserve facilities condition for the reserve of emergency material is q (enterprise reserve facilities condition is q_t at time t , q_t is related to the previous period enterprise effort degree p_{t-1} , that is $q_t = q_t(p_{t-1})$, it should be noted that, when $t = 0$, q_0 is the contract initial enterprise reserve facilities condition, it is not affected by the enterprise reserve behavior, is a constant);

(4) In the process of reserve emergency material, the influence that enterprise affected by outside uncontrolled random events is ε .

2.3. Model Variable Characteristic

(1) In the process of enterprise reserve emergency material, government is unable to grasp the enterprise effort degree, but the government can through the inspection, observed the i kind emergency material's (assuming keep a total of l kinds emergency material) quality grade m_i (assuming a total of k quality grade) and emergency material quantity x_{m_i} in this quality grade, then according to observation calculate emergency material actual inventory value y . It is calculated as: the government determines the price of

emergency material $s(m_i)$ for different quality grade reasonably in advance, ($i = 1, \dots, l; m_i = 1, \dots, k$), then through the formula $y = \sum_{i=1}^l \sum_{m_i=1}^k s(m_i) \times x_{m_i}$, calculate actual inventory value of enterprise agent reserve emergency material.

(2) The enterprise effort degree p can be regarded as the situation that enterprise executes warehouse management system, including warehouse inspection, regular maintenance, moisture, temperature control etc. Obviously, the enterprise effort degree p is directly affect the emergency material quality grade m_i , quantity x_{m_i} and inventory value y . In addition, the enterprise reserve facilities condition q can be regarded as enterprise owned various kinds of hardware facilities and equipment for emergency material reserve, such as three-dimensional warehouse, a variety of storage devices and monitoring network. Similarly, the enterprise reserve facilities condition q will directly affect the emergency material quality grade m_i , quantity x_{m_i} and inventory value y . For the convenience of calculation, assuming enterprise effort degree p and reserve facilities condition q are direct linear correlate with actual inventory value y , is $y = p\alpha + q\beta + \varepsilon$.

(3) ε is a random variable, and meet the normal distribution, and $E(\varepsilon) = 0$, $V(\varepsilon) = \sigma^2$. There are many factors impact emergency material actual inventory value, such as climate, environment, emergency material inherent quality and social security etc, these factors are independent of each other, and the generated impact of each factor is not great, and their combined effect can be approximately regarded as a normal random variable. The variance value σ^2 is greater illustrate the random variable to enterprise emergency material reserve interference is bigger, emergency material actual inventory value may occur greater volatility in different periods.

3. MODEL FUNCTION RELATIONSHIPS

3.1. Emergency Material Actual Inventory Value Function

The emergency material actual inventory value is $y = p\alpha + q\beta + \varepsilon$, α and β respectively are the impact factor of enterprise effort degree p and reserve facilities condition q to y . Because ε meet the normal distribution, so y also meet the normal distribution, $E(y) = p\alpha + q\beta$, $V(y) = \sigma^2$.

3.2. Enterprise Subsidy Function

The government signed a contract with the enterprise, stipulating if enterprise reaches emergency material reserve requirements, the government will give enterprise subsidy as

an encouragement. Assuming subsidy function is linear function; uses w represent the subsidy that enterprise obtained, $w = h + \mu y$. Among them: h represent the fixed subsidy of government give enterprise, the change of fixed subsidy h will not cause the change of enterprise effort degree p ; μ represent the influence coefficient, the change of μ will cause the change of enterprise subsidy, and then cause enterprise choose the different effort degree p . In the case of other factors remain unchanged, the rise of influence coefficient μ will cause the increase of enterprise subsidy w , thus make the enterprise work harder (p go up), so the enterprise effort degree p is the monotonically increasing function about the influence coefficient μ , namely $p = p(\mu)$ and $p'(\mu) > 0$. Therefore, during the contract period, the government can through determine reasonable fixed subsidy h and influence coefficient μ for the enterprise to encourage enterprise to select the optimal action.

3.3. Government and Enterprise Earnings Function

(1) Government Earnings Function

The emergency material actual inventory value of government entrust enterprise reserve is y , the subsidy of government paid to enterprise is w , uses π represent government's earnings, so:

$$\begin{aligned} \pi &= y - w = -h + (1 - \mu)y \\ &= -h + (1 - \mu)(p\alpha + q\beta + \varepsilon) \end{aligned} \quad (1)$$

(2) Enterprise Earnings Function

Enterprise need paid effort cost while obtained subsidy, so the enterprise's earnings is the subsidy minus the effort cost. Assuming the enterprise's effort cost function is $c(p)$, uses x represent enterprise's earnings, so:

$$x = w - c(p) = [h + \mu(p\alpha + q\beta + \varepsilon)] - c(p) \quad (2)$$

Due to the enterprise's effort cost $c(p)$ is determined for themselves, therefore, after the contract is signed, according to the change degree of different effort p brought to cost $c(p)$, enterprise will select the optimal effort p^* make themselves earnings x maximum.

The enterprise's effort cost function $c(p)$ is increasing function of the enterprise's effort degree p , and with the effort degree increase, the marginal cost increase. That is, the enterprise's effort cost function has the following properties: $c'(p) > 0$, $c''(p) > 0$. In addition, if the enterprise doesn't work, $p = 0$, then effort cost $c(0) = 0$. For the convenience of calculation, this paper assuming the enterprise's effort cost function is $c(p) = \frac{1}{2} p^2$.

3.4. Government and Enterprise Utility Function

Economic agents have different attitudes toward risk determine each have different utility function, while in different utility function conditions, various constraint conditions stipulated in the contract will guide participants take different actions. Now follow the usually assumption of the information economics, regard the principal (government) as risk neutral, the agent (enterprise) as a risk aversion [2].

(1) Government Utility Function

The government is risk neutral, its expectation of earnings utility is equal to the utility of expectation earnings, namely $E(u(\pi)) = u(E(\pi))$. Among them, π represent government's earnings, u represent utility function, and is a monotonically increasing linear function [3, 4]. Therefore, if government want to realize the maximize expected utility $E(u(\pi))$, it can be achieved through maximize expected revenue $E(\pi)$. Because ε follow normal distribution, and $\pi = -h + (1 - \mu)(p\alpha + q\beta + \varepsilon)$, so π also follow normal distribution. That is $E(\pi) = -h + (1 - \mu)(p\alpha + q\beta)$. Therefore, the government's expected utility $E(u(\pi))$ maximize can be transformed into:

$$\begin{aligned} \max_{h, \mu} E(u(\pi)) &= \max_{h, \mu} E(\pi) = \\ \max_{h, \mu} [-h + (1 - \mu)(p\alpha + q\beta)] \end{aligned} \quad (3)$$

(2) Enterprise Utility Function

Enterprise is risk aversion, and its pursuit is earnings brought the utility maximization, which is enterprise will choose the appropriate action under the existing constraint conditions to make its expected utility maximization. Assuming the utility function of enterprise has constant absolute risk aversion characteristics, $u(x) = -e^{-\rho x}$, among them, ρ is the measure of absolute risk aversion of enterprise, x is corporate enterprise earnings. The calculation formula for ρ is $\rho = -\frac{u''(x)}{u'(x)}$, if $\rho > 0$, represent enterprise is risk aversion; If $\rho = 0$, represent enterprise is risk neutral; If $\rho < 0$, represent enterprise is risk preference [5]. This paper assuming enterprise is risk aversion, so $\rho > 0$. According to the definition of expectation:

$$\begin{aligned} E(u(x)) &= \int_{-\infty}^{+\infty} -e^{-\rho x} \frac{1}{\sqrt{2\pi V(x)}} e^{-\frac{(x-E(x))^2}{2V(x)}} dx \\ &= -e^{-\rho[E(x) - \frac{1}{2}\rho V(x)]} \end{aligned} \quad (4)$$

According to the definition of certainty equivalent (CE for short) [6], under uncertainty conditions, the enterprise obtained earnings brought expected utility is equal to the enterprise obtained fully determine earning CE brought utility, $E(u(x)) = u(CE)$. Therefore, according to the formula (4) and $u(x) = -e^{-\rho x}$, can prove that the enterprise under the uncertain conditions obtained fully determine earnings are:

$$CE = \left[E(x) - \frac{1}{2} \rho V(x) \right] \tag{5}$$

This indicate under the situation of assume the utility function is $u(x) = -e^{-\rho x}$ and the risk aversion is $\rho > 0$, the enterprise's certainty earnings is lower than expected earnings, this gap is $\frac{1}{2} \rho V(x)$, this is the price enterprise voluntary paid for to avoid the risk, also known as the risk premium.

Because ε follow normal distribution, and $x = [h + \mu(p\alpha + q\beta + \varepsilon)] - c(p)$, so x also follow normal distribution, that is, $E(x) = [h + \mu(p\alpha + q\beta)] - c(p)$, $V(x) = \mu^2 \sigma^2$. So the enterprise's certainty earnings are:

$$CE(h, \mu) = [h + \mu(p\alpha + q\beta)] - c(p) - \frac{1}{2} \rho \mu^2 \sigma^2 \tag{6}$$

Since $E(u(x)) = u(CE)$, to realize enterprise expected utility $E(u(x))$ maximization is equal to realize $u(CE)$ maximization, through $u'(x) = \rho e^{-\rho x} > 0$, we can know the enterprise's utility function is monotonically increasing, So in order to realize $u(CE)$ maximization, enterprise only need to take appropriate action p to make their certainty equivalent CE maximum. In addition, enterprise obtained expected utility through emergency material reserve cannot be lower than engage in other business, its meaning is the enterprise's expected utility can't lower than the opportunity cost, otherwise, the enterprise is unwilling to undertake the work of agent reserve emergency material.

4. THE INCENTIVE AND CONSTRAINT MODEL OF EMERGENCY MATERIAL ENTERPRISE AGENT RESERVE

Usually, the principal will be subject to two constraints from the agent while realizing their own utility maximization. One is the agent's incentive compatibility constraint (IC for short), because of asymmetric information, the principal can't observe the agent's action p , and the desired optimal action p^* of principal can only be achieved by maximizing the utility of the agent behavior, otherwise, the agent will take measures to realize their own utility maximization; Another is the individual rationality constraint (IR for short), the expected utility of the agent from the contract can't be lower than engage in other business [7, 8]. As a result of the enterprise can achieve the expected value of subsidy in the contract is clearly, according this, enterprise will compare it with the earnings and costs of the action p of their own able to choose. Therefore, for the government, the problem of enterprise emergency material enterprise agent reserve incentive and constraint mechanism can be expressed as under

the constraint of enterprise incentive compatible constraint and personal participation constraint, how can the government realize their own expected utility maximization.

4.1. The Short-Term Incentive and Constraint Model of Emergency Material Enterprise Agent Reserve

In the short-term model, the principal-agent model basic structure can be expressed as:

$$\max_{h, \mu} [-h + (1 - \mu)(p^* \alpha + q\beta)] \tag{7}$$

$$s.t \max_p \left[h + \mu(p\alpha + q\beta) - c(p) - \frac{1}{2} \rho \mu^2 \sigma^2 \right] \tag{8}$$

$$h + \mu(p\alpha + q\beta) - c(p) - \frac{1}{2} \rho \mu^2 \sigma^2 \geq CE^* \tag{9}$$

Formula (7) show that the government should determine a reasonable fixed subsidy h and incentive coefficient μ , make its earnings expectation maximization (assuming enterprise will take the optimal action p^* according to h and μ); Formula (8) is the "incentive compatible constraint", according to the contract which enterprise signed with the government (h and μ have been clear), enterprise select the optimal action p^* to make the expected utility maximum, according to the definition of certainty equivalent, it is equivalent to make the certainty equivalent CE maximum; Formula (9) is the "individual rationality constraint", the enterprise's certainty equivalent can't be less than the opportunity cost CE^* .

By the formula (8) take the necessary condition of maximum value is $\frac{\partial s.t \max_p}{\partial p} = 0$, we can obtain the optimal action of enterprise is:

$$p^* = \mu \alpha \text{ (At this time, } \mu \text{ is constant)} \tag{10}$$

In order to obtain the optimal incentive coefficient of government, establish Lagrange function for formula (7) and (9):

$$L = -h + (1 - \mu)(p^* \alpha + q\beta) + \lambda \left[h + \mu(p^* \alpha + q\beta) - c(p^*) - \frac{1}{2} \rho \mu^2 \sigma^2 - CE^* \right] \tag{11}$$

From $\frac{\partial L}{\partial h} = 0$, we can obtain $\lambda = 1$, bring into formula (11), we can obtained:

$$L = (p^* \alpha + q\beta) - c(p^*) - \frac{1}{2} \rho \mu^2 \sigma^2 - CE^* \tag{12}$$

Make $\frac{\partial L}{\partial \mu} = 0$, and known the enterprise's optimal ac-

tion $p^* = \mu\alpha$ and $c(p^*) = \frac{1}{2}p^{*2}$, so the optimal incentive coefficient of government is:

$$\mu^* = \frac{\alpha^2}{\alpha^2 + \rho\sigma^2} \tag{13}$$

At this time, the emergency material actual inventory value is:

$$y = p^*\alpha + q\beta + \varepsilon = \mu^*\alpha^2 + q\beta + \varepsilon \tag{14}$$

4.2. The Long-Term Incentive and Constraint Model of Emergency Material Enterprise Agent Reserve

In the long-term model, the following marked t indicate the value of each variable at period t , so the certainty equivalent of enterprise selected the optimal action is:

$$CE_t(h, \mu) = h + \mu[p_t^*\alpha_t + q_t(p_{t-1}^*)] - c(p_t^*) - \frac{1}{2}\rho\mu^2\sigma^2 \tag{15}$$

Assuming θ^t represents the discount factor of the t period, $0 < \theta < 1$, the time variable t take from the period zero to period n . Since the agent reserve project that government signed with enterprise are generally stable, as long as the value n is relatively large, it may represent a long-term effect. In the long-term model, the principal-agent model basic structure can be expressed as:

$$\max_{h, \mu} \sum_{t=0}^n \theta^t \{-h + (1-\mu)[p_t^*\alpha_t + q_t(p_{t-1}^*)\beta_t]\} \tag{16}$$

$$s.t \max_{p_t} \sum_{t=0}^n \theta^t \left\{ \begin{array}{l} h + \mu[p_t\alpha_t + q_t(p_{t-1})\beta_t] \\ -c(p_t) - \frac{1}{2}\rho\mu^2\sigma^2 \end{array} \right\} \tag{17}$$

$$\sum_{t=0}^n \theta^t \left\{ \begin{array}{l} h + \mu[p_t\alpha_t + q_t(p_{t-1})\beta_t] \\ -c(p_t) - \frac{1}{2}\rho\mu^2\sigma^2 \end{array} \right\} \geq \sum_{t=0}^n \theta^t CE_t^* \tag{18}$$

The significance of the above three formulas are similar to the short-term model. Among them, b_0 is a constant;

$t = 0, 1, \dots, n-1$, so $\frac{\partial q_{t+1}}{\partial p_t} = k_{t+1}$; $c(p_t) = \frac{1}{2}p_t^2$. By the formula

(8) take the necessary condition of maximum value is:

$$\frac{\partial s.t \max \sum_{t=0}^n \theta^t \left\{ \begin{array}{l} h + \mu[p_t\alpha_t + q_t(p_{t-1})\beta_t] \\ -c(p_t) - \frac{1}{2}\rho\mu^2\sigma^2 \end{array} \right\}}{\partial p_t} = 0 \quad (t = 0, 1, \dots, n),$$

we can obtain the enterprise optimal action in each period is:

$$p_t^* = \mu(\alpha_t + \theta\beta_{t+1}k_{t+1}), \quad (t = 0, 1, \dots, n-1) \tag{19}$$

$$p_n^* = \mu\alpha_n, \quad (t = n) \tag{20}$$

Similar as the short-term model, in order to obtain the optimal incentive coefficient of government in long-term, establish Lagrange function for formula (16) and (18):

$$L = \sum_{t=0}^n \theta^t \{-h + (1-\mu)[p_t^*\alpha_t + q_t(p_{t-1}^*)\beta_t]\} + \lambda \sum_{t=0}^n \theta^t \left\{ \begin{array}{l} h + \mu[p_t^*\alpha_t + q_t(p_{t-1}^*)\beta_t] \\ -c(p_t^*) - \frac{1}{2}\rho\mu^2\sigma^2 - CE_t^* \end{array} \right\} \tag{21}$$

As a result of $\frac{\partial L}{\partial h} = 0$, we can obtained $\lambda = 1$, and bring it into formula (11), we can obtained:

$$L = \sum_{t=0}^n \theta^t \left[\begin{array}{l} p_t^*\alpha_t + q_t(p_{t-1}^*)\beta_t \\ -c(p_t^*) - \frac{1}{2}\rho\mu^2\sigma^2 - CE_t^* \end{array} \right] \tag{22}$$

Make $\frac{\partial L}{\partial \mu} = 0$, and bring $p_t^* = \mu(\alpha_t + \theta\beta_{t+1}k_{t+1})$,

$p_n^* = \mu\alpha_n$, $c(p_t^*) = \frac{1}{2}p_t^{*2}$ and $q_{t+1} = k_{t+1}p_t$ into this formula, we can get the government give the optimal incentive coefficient to enterprise in long-term cooperation is :

$$\mu^* = \frac{\theta^n \alpha_n^2 + \sum_{t=0}^{n-1} \theta^t (\alpha_t + \theta\beta_{t+1}k_{t+1})^2}{\theta^n \alpha_n^2 + \sum_{t=0}^{n-1} \theta^t (\alpha_t + \theta\beta_{t+1}k_{t+1})^2 + \rho\sigma^2 \sum_{t=0}^n \theta^t} \tag{23}$$

Then, the emergency material actual inventory value in each period is:

$$y_0 = \alpha_0(\alpha_0 + \theta\beta_1k_1)\mu^* + \beta_0q_0 + \varepsilon, \quad (t=0) \tag{24}$$

$$y_t = \alpha_t(\alpha_t + \theta\beta_{t+1}k_{t+1})\mu^* + \beta_tq_t[\mu^*(\alpha_{t-1} + \theta\beta_tk_t)] + \varepsilon, \quad (t=1, \dots, n-1) \tag{25}$$

$$y_n = \alpha_n^2\mu^* + \beta_nq_n[\mu^*(\alpha_{n-1} + \theta\beta_nk_n)] + \varepsilon, \quad (t=n) \tag{26}$$

5. ANALYSIS OF INCENTIVE AND CONSTRAINT MODEL OF EMERGENCY MATERIAL ENTERPRISE AGENT RESERVE

Through analysis of the long-term and short-term incentive and constraint model of enterprise agent reserve emergency material, we can get some reasonable suggestions and measures to establish an effective incentive and constraint mechanism.

(1) Reduce the proportion of fixed subsidy, improve the incentive subsidy proportion. From formula (14), (24), (25), (26) can be seen that the emergency material actual inventory value y is positively related to the enterprise effort degree ρ in each period. Also from formula (10), (19), (20) can be seen that the enterprise effort degree p is positively related to the influence coefficient μ , but nothing to do with

the fixed subsidy h . Therefore, the government should make the enterprise cost subsidy pegged to its reserve achievement (emergency material actual inventory value), reduce the proportion of fixed subsidy, improve the incentive subsidy proportion, in order to mobilize the enthusiasm of enterprise reserve emergency material.

(2) Encourage enterprise raise the capacity to undertake risk. From formula (13), (23) can be seen that the incentive coefficient μ is negatively related to the enterprise risk aversion degree ρ in equilibrium state. So the optimal incentive coefficient μ can be seen as a combination of incentive and risk expression. As a result of enterprise is risk aversion, so $\rho > 0$, this time, if $\rho = \infty$, indicating that the enterprise do not have the capacity to undertake risk, emergency material reserve risk can only be undertaken by the government (It would be difficult to ensure the quality and quantity of emergency material intact in this case), then the incentive coefficient is zero, enterprise can only get fixed subsidy h ; if $\rho \neq \infty$, from formula (5) can be seen that the enterprise risk premium is $\frac{1}{2}\rho\mu^2\sigma^2$, When the incentive coefficient μ is fixed, with the increases of ρ , $\frac{1}{2}\rho\mu^2\sigma^2$ will increase, which means the risk aversion degree ρ will offset some of the incentive effect of the incentive coefficient μ , enterprise will lose their motivation to work hard. Therefore, establishing the incentive and constraint mechanism of enterprise agent reserve emergency material, the government should not only make the enterprise cost subsidy pegged to its reserve achievement, but also encourage enterprise to raise the capacity to undertake risk.

(3) Overcome short-term effect; establish long-term incentive and constraint mechanism. From formula (10), (19), (20) can be seen that the enterprise effort degree p is positively related to the influence coefficient μ , and nothing to do with the fixed subsidy. Notably, In long-term contracts, the enterprise effort degree in the final stage $p_n^* = \mu\alpha_n$ is less than the other stages effort degree $p_t^* = \mu(\alpha_t + \theta\beta_{t+1}k_{t+1})$. As a result of the emergency material actual inventory value y is directly related to the enterprise effort degree p and reserve facilities condition q , and from formula $\frac{\partial q_{t+1}}{\partial p_t} = k_{t+1} > 0$ can be seen that the enterprise reserve facilities condition is positively related to the enterprise pro-phase effort degree p . Therefore, in order to ensure the quality and quantity of emergency material intact for a long time, the government should establish long-term effective incentive and constraint mechanism, make the enterprise cost subsidy pegged to its long-term reserve achievement, overcome the short-term effect, encourage enterprise to pursue their own long-term interests, thereby working hard for the long-term interests of government.

(4) Encourage enterprise to improve reserve facilities condition. From formula (14), (24), (25), (26) can be seen that the emergency material actual inventory value y is positively related to the reserve facilities condition q and influence coefficient β , (the influence coefficient is determined by reserve facilities quality, equipment quantity and other factors. the greater influence coefficient, the more influence on the emergency material actual inventory value). As a result of the incentive coefficient μ will affect the enterprise effort degree p , and the enterprise reserve facilities condition is positively related to the enterprise pro-phase effort degree p , so increasing the incentive coefficient μ will improve the reserve facilities condition q , thus increase the influence coefficient β . Therefore, the government should be targeted encourage enterprise to improve reserve facilities condition, this can not only increase the enterprise effort degree p , but also can increase the influence coefficient β , so as to improve the emergency material actual inventory value.

(5) Establish reasonable warehouse management regulation. From formula (14), (24), (25), (26) can be seen that the emergency material actual inventory value y is positively related to the influence coefficient α , also from formula (10), (19), (20) can be seen that the enterprise effort degree p is positively related to the influence coefficient α . The greater influence coefficient indicates that the effect of enterprise effort degree p to the emergency material actual inventory value y is greater. The influence coefficient α is determined by enterprise warehouse management regulation and other factors. Therefore, enterprise should establish reasonable warehouse management regulation according to the task of agent reserve, in order to increase the influence coefficient α , so as to improve the emergency material actual inventory value.

CONFLICT OF INTEREST

The authors confirm that this article content has no conflict of interest.

Effective incentive and constraint mechanism is an important part of government entrust to enterprise agent reserve emergency material. Through analysis of the long-term and short-term incentive and constraint model of enterprise agent reserve emergency material, we can get to some conclusions, the government should establish a long-term effective incentive and constraint mechanism, reduce the fixed subsidy, increase incentive intensity, promote enterprise to improve reserve facilities condition and raise the capacity to undertake risks by the way of incentive as far as possible, and encourage enterprise to establish a reasonable warehouse management regulation, so that make the enterprise to maximize their own utility while meeting the government utility maximization.

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