Research on Cooperative R&D between Enterprise and Venture Capital with R&D Organization of Valuation Adjustment Mechanism Design Based on Double Principal-agent Theory

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Abstract
Through collaborative innovation establishes game model of enterprises, investment funds and scientific research organization, to study how the company by agreement on gambling (also known as the valuation adjustment agreement) and other mechanisms designed to solve the adverse selection problem in cooperative R&D enterprises, investment funds and scientific research organizations, and the risks in the process of cooperation studies. Enterprises in the investment fund, and the agreement on gambling, the optimal market investment in the good market environment was identified as the target market revenue gains, and promised to reach the target profit will be enough share of the shares free transfer to investment funds, at the same time, requirements of investment funds in the free transfer of shares corresponding to the in order to reach the target value, and the low profit enterprises to distinguish, the promotion of R&D cooperation reached, and maximize their own profits.

Keywords: Cooperative R&D; valuation adjustment mechanism; double principal-agent; adverse selection; venture capital

1. INTRODUCTION

The Chinese government has been using financial grants, tax incentives and other direct funding mode for R&D cooperation in the past time, but due to financial constraints and capacity in the evaluation of government funded projects on limited selection constraints, the effect is not ideal. To this end, governments at all levels have been established by the fund to entrust professional institutions set up investment funds, to attract private capital and the effective use of professional institutions in the project selection on the professional skills, to solve the direct subsidy mode, and achieved good results. However, because of the information asymmetry, investment funds still face enterprises hidden information, adverse selection problem, posing as high Luoli project again, the problem also exists in the process of enterprises to choose the suitable scientific research institutes or universities cooperate in R&D, how to solve the adverse selection of partner selection, and the moral hazard in the process of cooperation still, is one of the key problems of investment funds and enterprises in the cooperative development.

How to solve the moral hazard and adverse selection in cooperative R&D in-depth research at home and abroad on, Sinclair (1985) studied how to solve the adverse selection and moral risk in two stages of development in the league by amending the franchise contract; Feng (2016) believes that phased payment and annual payment methods can solve the adverse selection and the moral risk in research alliance; Feldhütter and Nielsen(2015) consider the research value for R&D and private information, enterprises are unable to control the efforts of universities or research institutions, research how to design the optimal external contract to prevent moral hazard; Anesi&Seidmann(2015) analysis of the government role in solving the adverse selection problem in international technology cooperation; Che&Langli(2015) found that the phased payment bit concession contract can effectively prevent the moral risk of university enterprise cooperation in technology; Cline et al.(2015) design Mixed allocation mode a share plus fixed transfer payments, to solve the adverse selection and moral hazard in R&D outsourcing; Fehr et al.(2015) comparative analysis of the effect of the fixed payment contract and cost plus contract to solve the adverse selection; Mazursky-Horowitz et al.(2015) use principal-agent theory and static game The internal and external institutional environment for innovation group is analyzed; Bielecki&Rutkowski(2015) use the multi task principal-agent model of school enterprise collaborative innovation, how to design the incentive rate interval optimal allocation of knowledge owners innovation and knowledge sharing. Such as Pagnozzi&Saral (2016)innovation investment fund through collaborative innovation interest distribution mechanism and fund investment strategy for the design, carried out exploratory research on how to prevent moral hazard, but this paper does not involve such as How to solve the problem of adverse selection?

In addition, the existing research on solving the adverse selection using agent theory and contract theory, mostly through multiple principal agent contract design, and according to the contract, realize separating equilibrium, solve the adverse selection on how to use the agreement on gambling (valuation adjustment mechanism) as the representative of the signal transfer research rarely solve adverse selection in fact, the signal transmission is one of the two kinds of adverse selection, the agreement on gambling is widely used and
This paper establishes a game model of enterprise and cooperative R&D investment fund and scientific research organization, how to design and fund agreement on gambling research enterprise, to solve the adverse selection and moral hazard in cooperative R&D, promote investment funds, enterprises and research organizations of cooperative research and development form, and through the study of theory and simulation design the optimal R&D cooperation agreement on gambling, and provide a theoretical basis for the investment funds, enterprises and research organizations to develop relevant strategies of cooperative research and development.

2. DESCRIPTION AND MODEL ESTABLISHMENT OF COLLABORATIVE R & D PROBLEMS

2.1. Description of Collaborative R & D Problems

A company plans to develop a new product, in order to make better use of the advantages of external innovation resources, the enterprise decided to R&D activities outsourced to universities or research institutions and other scientific research organization, responsible for the market development of new products, production, sales and other links. Because of the information asymmetry, the existence of adverse selection of enterprises and research organizations (the hidden information) and moral hazard (i.e. hidden action), mainly in the enterprise cannot accurately grasp the complete information of the scientific research organization and the ability of innovation; the enterprise is also unable to research organization innovation activities are completely controlled, difficult to urge the scientific research organization agreed to innovate. At the same time, because of funding and resource constraints, enterprises unable to bear all the costs of developing new products, therefore, enterprises find investment fund cooperation by guiding fund initiated the establishment of enterprises. Industry and investment fund cooperation also exists information asymmetry, mainly for investment, although the fund has R&D project selection of professional skills, but can not fully understand the enterprise and the project to profitability, and related research organization research and development ability; at the same time, the whole monitoring can in enterprise project operation and scientific research organization research activity. In other words, the enterprise and the investment fund cooperation also has adverse selection and moral hazard.

Between enterprises and scientific research organization of the investment fund and the existence of adverse selection, may make the enterprise to choose qualified research organizations, may lead to investment funds for enterprises and projects to benefit the ability of error rather than investment; moral hazard may lead to the overall benefits of cooperative R&D loss, even lead to rupture or failure of this cooperative research and development. As the core, cooperative research and development organizations, through some mechanism design (including cooperation and scientific research organization and the investment fund contract and agreement on gambling) to solve the adverse selection and moral hazard in cooperative R&D, in order to promote R&D cooperation reached and the final success.

The process of cooperation of enterprises and scientific research organization and the investment fund are as follows: (1) the enterprise to design a only R&D innovation capability of high scientific research organizations dare to accept the contract, and the contract for scientific research organizations, scientific research organizations if the rejection of the contract, the enterprise will continue to look for other enterprises, to find willing to accept the contract research organization; (2) The enterprise to design a high Luoli only with the ability of the enterprise to put forward the agreement on gambling, to seek cooperation and investment funds, investment funds through the agreement on gambling can make sure the enterprise and innovation project has high profitability, and enterprises in the process of cooperation will invest according to the agreement, in order to encourage investment fund the investment in enterprise innovation project; (3) Enterprises to pay a certain scientific research start-up funds, by the scientific research organization of product development, and the research achievements in the development of successful transfer to the enterprise by the enterprise, then the market of the new product development, production, marketing and other aspects of activities; the enterprises, scientific research organizations and investment funds for R&D cooperation income distribution according to the original contract.

This paper will study how to design a scientific research organization and enterprise cooperation contract, through the scientific research organization of the contract to choose to identify private information research organization, judge the scientific research organization research and development ability, and prevent the scientific research organization in cooperation in the process of moral hazard; at the same time, design and investment fund on the gambling agreement to the agreement on gambling to communicate and make them believe that the investment fund enterprises and projects with high Luoli ability of private information, and make them believe that the enterprise can't take hidden action of speculative behavior in the process of cooperation, and ultimately promote cooperative research and development success.

2.2. MODEL ESTABLISHMENT

An enterprise (represented by e) plans to develop a new product and, in order to take full advantage of external advantages and innovate resources, enterprises decide to outsource research and development activities
to scientific research organizations (represented by $r$), cooperating with scientific research organizations, they are only responsible for the market development, production and sales of new products. Because of the limitation of funds and resources, enterprises can not afford all the expenses of new product development independently, invest $K_s$ self-owned capital. As a result, companies seek cooperation with investment funds (represented by $f$), expect investment funds to invest in their R&D projects $K_i$. The participation of an investment fund is restricted to the rate of return on investment in its cooperative research and development (the ratio of the market gain to its investment) shall not be lower than that of the investment fund $I_f$.

There are technical risks in R&D of new products, and the probability of R&D success $P$ is the type of R&D capability $A_i$ and the function of R&D input of scientific research organizations $\theta$, This paper considers two types of R&D capability in scientific research organizations, that is high ability types $\overline{A}_i$ and low ability types $A_i$, the probability of successful research and development of these two types of scientific research organizations is $\overline{P} = P(\theta)$. Obviously, the R&D organizations with high capacity types under the same R&D input have higher probability of R&D success $\overline{P}(\theta_1) > P(\theta_2)$. The two types of R&D organizations participate in R&D participation constraints, respectively, to obtain minimum profits $\Pi_f$ and $\Pi_i$, in the above information, the capability types of scientific research organizations and their innovation inputs are private information, and the rest are common knowledge.

The market of the new product revenue $M$ for the enterprise and project win profit ability type $A_b$, the investment level of enterprises in the development, production and sale of new products $\theta_e$ (hereinafter referred to as "market investment"), and the function of the market environment type $m$, this paper considers there are two kinds of businesses and projects to win the benefit ability type, which are high profit ability $\overline{A}_i$ and low profit ability type $A_i$, function type market environment $m$. There are two kinds of market environment: good market environment $\overline{m}$ and poor market environment $m$, among them, the probability of a good market environment $\overline{m}$ is $\rho$ and the probability of a poor market environment $m$ is $1 - \rho$. Two win profit ability of enterprises by market revenue respectively are $\overline{M}(\theta_e, \overline{m}) = \overline{R}(\theta_e) + \varepsilon(\overline{m})$ and $M(\theta_e, m) = R(\theta_e) + \varepsilon(m)$, among them, $\varepsilon(m)$ is a result of market environment type revenue changes, the level of investment enterprises and projects to profitability types and enterprises for their private information, the rest are common knowledge.

The enterprise provides a cooperative contract to the scientific research organization $\{B^*, \alpha^*, \theta_i^*\}$, $B^*$ is the research and development organization in the scientific research and development after the success of the payment of research results buyout fees, $\alpha^*$ is the start-up funds paid by enterprises to scientific research organizations, and the starting expenses are generally the average level in the technology market, $\theta_i^*$ is R&D investment in scientific research organizations. If scientific research and development of a successful organization $B^*$ can be obtained. If R&D fails and cooperative R&D is over, the research organization does not need to return the start-up funds, nor does the enterprise bear the other expenses of the scientific research organization.

The enterprise offers a bet agreement to the investment fund $\{K_v, \theta_e, M, \kappa_v, \kappa_i\}$, $K_v$ is the capital invested by enterprises in cooperative R&D, $K_i$ is the capital invested by the investment fund to cooperative R&D, which is the investment of the enterprise in the development, production and sale of new products, $M$ is the target income of R&D cooperation between enterprise and investment fund, the investment fund transfers the share capital free of charge to the enterprise $\kappa_v$; If the enterprise does not achieve the target income, the enterprise transfers the share capital free of charge to the investment fund $\kappa_i$. The proceeds of the allocation of capital after the transfer of equity have been assigned by both parties. Of course, it is impossible for
the enterprise to achieve the target income because the scientific research organization may fail in R&D and lead to the failure of the whole R&D project. In order to prevent the enterprise and therefore need to be transferred to the equity investment fund, can sign a contract with the conditions of investment fund, agreed that the agreement on gambling is not effective in scientific research and development organization after the success of investment fund is also only at this time to the enterprise capital.

As a result, the expected profits between the enterprises of different capacities and the scientific research organizations are

\[
\pi = \begin{cases} 
  P(\theta_r) \left[ \bar{M}(\theta_r, \theta^*_e) - \theta_r \right] - \theta_r & A^*_e A^* \\
  P(\theta_r) \left[ \bar{M}(\theta_r, \theta^*_e) - \theta_r \right] - \theta_r & A^*_e A \\
  P(\theta_r) \left[ \bar{M}(\theta_r, \theta^*_e) - \theta_r \right] - \theta_r & A^*_e A \\
  P(\theta_r) \left[ \bar{M}(\theta_r, \theta^*_e) - \theta_r \right] - \theta_r & A^*_e A 
\end{cases}
\]

(1)

3. COOPERATIVE R & D AGREEMENT ON VAM

3.1. Cooperation mechanism between enterprises and scientific research organizations

Because of the agreement on gambling is high Luoli ability of the enterprise to win profit and low ability of the enterprise to distinguish the signal transmission mechanism, therefore, considering the enterprise and project for the high Luoli ability type, study on how to use the contract design to identify the high R&D ability type scientific research organization, and promote its R&D investment according to the contract; at the same time, a feasible agreement on gambling, the Investment Fund believe its high capacity and Luoli will promote cooperation in R&D investment according to the agreement, and the formation of success.

The enterprise needs to design the research and development ability of the research organization through the contract design first. The research results will be transferred to the enterprise organization in the development of innovation by enterprises after the success of subsequent links, and the level of investment enterprises and projects to profitability types and enterprises for their private information, therefore, the enterprise should adopt the fixed fee buyout of the research and development innovation and scientific research organization of cooperative research and development, the research of organizational innovation investment the expected return is clear, the scientific research organization to make correct decisions according to the type of cooperation research and development capabilities, enterprises can thus identify the scientific research organization research and development capabilities.

In reality, although the enterprise may not innovation of scientific research organizations into full supervision, but also hard to do scientific research organization in enterprise give start-up funds, without any research activity directly declared R&D lost, this occupation of start-up funds, therefore, this paper does not consider the scientific research organization directly seizes the enterprise start-up funds possible. Thus, in the buyout payment, the profit for the scientific research organization

\[
\pi^* = \begin{cases} 
  \bar{P}(\theta_r) B^* + \alpha^* - \theta_r & A^* \\
  \bar{P}(\theta_r) B^* + \alpha^* - \theta_r & A 
\end{cases}
\]

(2)

The total expected profits of an enterprise and an investment fund are

\[
\pi_{ef} = \begin{cases} 
  \bar{P}(\theta_r) \left[ \bar{M}(\theta_r, \theta^*_e) - \theta_e - B^* \right] - \alpha^* & A \\
  \bar{P}(\theta_r) \left[ \bar{M}(\theta_r, \theta^*_e) - \theta_e - B^* \right] - \alpha^* & A 
\end{cases}
\]

(3)

Scientific research organizations aim at maximizing their profits and determine their optimal R&D inputs, solving \( \frac{\partial \pi^*}{\partial \theta_r} = 0 \) can be obtained, and the optimal R&D input of scientific research organizations is

\[
\theta^* = \theta_r \left( \frac{1}{B^*} \right) A^* 
\]

(4)
R&D research organization investment firms that pay buyout costs. Because the reaction function of the profit function of scientific research organizations for common knowledge, therefore, the enterprise will know the reaction function of the scientific research organization, and according to the reaction function to maximize the gross profit and the investment fund as the target to determine the optimal market investment $\theta^*_e$ and buyout fees $B'$. By substituting (4) into (3), and by simultaneous solving $\frac{\partial \pi_e}{\partial \theta^*_e} = 0$ and $\frac{\partial \pi_e}{\partial B} = 0$, the optimal market investment can be obtained

$$\theta^*_e = \frac{1}{\rho \epsilon (m) + (1 - \rho) \epsilon (m)}$$

Optimal buyout fee $B'$ is the solution of formula(6)

$$0 = \overline{P} \left[ \theta_e (B') \right] \theta^*_e (B') \left[ \overline{R} (\theta^*_e) + \rho \epsilon (m) + (1 - \rho) \epsilon (m) - \theta^*_e - B' \right] + 
\overline{P} \left[ \theta_e (B') \right] \left[ \overline{R} (\theta^*_e) + \rho \epsilon (m) + (1 - \rho) \epsilon (m) - \theta^*_e \right]$$

The best buyout fee is $B' = B (\theta^*_e, m, \rho)$. Because of the design of enterprise can through cooperation and scientific research organization contract, to identify and find high R&D capability of scientific research organization, therefore, need analysis of enterprise and high R&D capability research organization cooperation market investment and the buyout fee. By substituting $B' = B (\theta^*_e, m, \rho)$ into (4), the optimal R&D input of the scientific research organization can be obtained

$$\theta^*_i = \overline{\theta}(B') = \frac{1}{\overline{P} \left[ \theta_e (B') \right]} \left[ \overline{A} \right]$$

$\overline{\theta}$ represents the optimal input of R&D organizations with high R&D capability, $\theta^*_i$ represents the best R&D investment in low R&D capability research organizations, may get proposition 1 as follows:

Proposition 1 when an enterprise pays a buyout fee to a research organization $B^* \geq \left( \frac{\overline{P} \left[ \theta^*_e (\theta^*_i - \alpha^*) \right]}{\overline{P} \left[ \theta^*_e \right]} \right)$ and $B^* < \left( \frac{\overline{P} \left[ \theta^*_e (\theta^*_i - \alpha^*) \right]}{\overline{P} \left[ \theta^*_e \right]} \right)$,Highly R&D capability research organizations are willing to accept contractual contracts provided by enterprises.

Certification process: the willingness of the scientific research organization to accept the cooperation contract provided by the research organization is that the expected profit of the research organization under the contract is not lower than the minimum profit requirement $\Pi^r$ or $\Pi^r$, when $B^* \geq \left( \frac{\overline{P} \left[ \theta^*_e (\theta^*_i - \alpha^*) \right]}{\overline{P} \left[ \theta^*_e \right]} \right)$ and $B^* < \left( \frac{\overline{P} \left[ \theta^*_e (\theta^*_i - \alpha^*) \right]}{\overline{P} \left[ \theta^*_e \right]} \right)$, expected profits of scientific research organizations with high R&D capability $B^* \overline{P} \left[ \theta^*_e \right] - \theta^*_i + \alpha^* \geq \Pi^r$. Low R&D capacity, expected profits of research organizations with high R&D capability $B^* \overline{P} \left[ \theta^*_e \right] - \theta^*_i + \alpha^* < \Pi^r$. Therefore, the research and development organizations with high R&D capability are willing to accept the contracts provided by the enterprises, and the research and development organizations with low R&D capability will refuse to accept the contract. 1 propositions are proved

Proposition 1 shows that enterprises in order to be able to through the design of cooperation and scientific research organization and scientific research organization contract on contract choice behavior, determine the
If the enterprise R&D cooperation is negative, in other words, \( \alpha > 0 \), the total profit has low \( \alpha \), and the high Luoli ability of enterprises need to solve the problem of adverse selection by signal transmission.

Proposition 3 when low profitability of enterprises and investment funds to meet the expected total profit of R&D cooperation \( \bar{P} \left[ \theta_r \left( B^* \right) \right] \left[ R \left( \theta_\theta \right) + \alpha e \left( m \right) - \theta_\theta B \right] - \alpha^* > 0 \), and the high Luoli ability of enterprise income in the poor market environment is less than the low profit ability of enterprise in the market to win good environment benefits, \( \bar{R} \left( \theta_\theta \right) + e \left( m \right) < R \left( \theta_\theta \right) + e \left( m \right) \), and the high Luoli ability of enterprise income in the poor market environment is less than the low profit ability of enterprise in the market to win good environment benefits.

Proof process: When \( \bar{P} \left[ \theta_r \left( B^* \right) \right] \left[ R \left( \theta_\theta \right) + \alpha e \left( m \right) - \theta_\theta B \right] - \alpha^* > 0 \), the total profit has low profit ability enterprise cooperation and investment fund research and development of more than 0, low profitability enterprises can win from R&D cooperation in making money, would be willing to cooperate with the investment fund, therefore, the market will be cooperative R&D and high ability and low profit enterprises Luoli ability of enterprise income in the poor market environment is less than the low profit ability of enterprise in the market to win good environment benefits.
the enterprise and project win profit ability. At this time, the high Luoli ability of enterprises need to design a reasonable agreement on gambling, the low ability of the enterprise itself and making money to distinguish, the investment fund will cooperate.

$\bar{\theta}_e$ is the low profit ability win enterprise to achieve its expected profit maximization and investment fund market investment. Proposition 4 enterprise provides gambling agreement $\{k_e, k_f, \theta_e, M, \kappa, \kappa_t\}$, make sure the investment fund for the high Luoli capability of enterprises, promote investment fund and enterprise cooperation development, the enterprise promised to invest in the new product market development, production, sales and other links $\theta_e$, and commitment to research and development with investment funds will achieve target income $M^* = R(\theta_e^*) + \epsilon(m)$, the high profit ability of enterprise investment $\theta_e^*$, the market gain that can be obtained in a good environment; if the target income is not realized, the enterprise will transfer the share capital free of charge to the investment fund $\kappa_t$, when $\kappa_t > 0$.

$$k_e - \frac{P(\theta_t^*)(2\theta'_e - \theta'_e + B^*) + \alpha^*}{P(\theta_t^*)M(\theta'_e, m)} (k_e + k_f) \quad \text{if} \quad \theta_e^* < \theta_e^*$$

free of charge to the investment fund $\kappa_t$, when $\kappa_t > 0$. If

$$k_e - \frac{P(\theta_t^*)(\theta'_e + B^*) + \alpha^*}{P(\theta_t^*)M(\theta'_e, m)} (k_e + k_f) \quad \text{if} \quad \theta_e^* > \theta_e^*$$

the target income is realized, the investment fund is required to transfer the share capital free of charge to the enterprise $\kappa_e = \frac{(k_e + k_f)(1-\rho)\left[R(\theta'_e) + \epsilon(m)\right] + k_f\rho\left[R(\theta'_e) + \epsilon(m)\right] - I_t k_ik_{ef}}{\rho\left[R(\theta'_e) + \epsilon(m)\right]}$, the proceeds shall be distributed by the proportion of the share capital after the transfer of the share capital.

proof process: enterprises in cooperative R&D expenditure, R&D organization research start-up costs $\alpha^*$, Transfer fees for scientific and technological achievements $B^*$, and new product market development, production, sales and other aspects of investment $\theta_e^*$, total expenditure $k_{ef} = \theta_e^* + B^* + \alpha^*$, the enterprise can only invest its own capital $k_e$. Equity financing of investment funds is required $k_t = k_{ef} - k_e$.

As enterprises in the new product market development, production, sales and other aspects of investment $\theta_e^*$, the total expected profits of an enterprise and an investment fund will be greatest, so enterprises will need to invest in these investments in the agreement $\theta_e^*$.

The objective of the enterprise's R&D cooperation with the investment fund is set as $M^* = R(\theta_e^*) + \epsilon(m)$, the high profit ability of enterprise investment $\theta_e^*$ to get good returns in the market environment, low profit enterprises want to win the ability to achieve the target revenue, the investment must be higher than the market $\theta_e^*$ (otherwise, the low profit ability of enterprise cooperation and win investment fund development profits but high profitability, it is obviously not possible), due to capital constraints, low profit ability of enterprises can win investment market investment $\theta_e^*$, therefore, has low profitability enterprises cannot achieve the target revenue, it is necessary to free transfer of equity investment fund $\kappa_t$.

There are two kinds of market investment strategy has low profitability of enterprise cooperation Luoli posing high ability of enterprises and the investment fund: (1) When $\theta_e < \theta_e^*$, Invest in market investments that maximize the expected profits of an investment fund $\bar{\theta}_e$, as long as the transfer of equity funds to the investment fund free of charge $\kappa_f = k_e - \frac{P(\theta_t^*)(2\theta'_e - \theta'_e + B^*) + \alpha^*}{P(\theta_t^*)M(\theta'_e, m)} (k_e + k_f)$, expected net profit is negative, not necessarily cooperation profit posing high ability of enterprises and investment fund: (2) When $\theta_e > \theta_e^*$, market investment at the capital ceiling is subject to the transfer of equity capital to the investment fund without interest.
\( \theta^*_e \), as long as the transfer of equity funds to the investment fund free of charge \( \kappa^*_t > k^*_C \) \( \frac{\bar{P}(\theta^*_t) \left( (\theta^*_e + b^*_e) + \alpha^* \right) (k^*_C + k^*_I)}{\bar{P}(\theta^*_t) M(\theta^*_C, m)} \), the expected net profit is negative, is not as high Luoli cooperation ability of enterprises and investment fund. Therefore, the agreement on gambling, dare to the agreement on gambling cooperation and investment fund is the inevitable result of high profitability, high Luoli ability of business success through the agreement on gambling and its ability to win profit the enterprise to distinguish.

Because the investment fund requires its participation in R&D, the rate of return on investment shall not be lower than that of the investment fund \( I_t \). Therefore, the enterprise will transfer its share capital with the investment fund \( \kappa^*_C \) and \( \kappa^*_I \) set as follows: the investment fund just gets the minimum income required by the investment fund, that is, when the enterprise achieves the target return rate, the investment fund transfers the share capital to the enterprise free of charge.

\[
\kappa^*_C = \frac{(k^*_I + k^*_f)(1-\rho) \left[ \bar{R}(\theta^*_e) + \epsilon \left( \bar{m} \right) \right] + k^*_f \rho \left[ \bar{R}(\theta^*_e) + \epsilon \left( \bar{m} \right) \right] - I^*_t k^*_I k^*_e f}{\rho \left[ \bar{R}(\theta^*_e) + \epsilon \left( \bar{m} \right) \right]} \]

under this agreement, the investment fund receives the minimum income which it requests, and the investment fund also is willing to cooperate with the enterprise to research and develop.

Since the agreement on gambling, investment funds in fact only the minimum income requirements, residual income of R&D cooperation by the enterprise, the enterprise is the R&D cooperation surplus value only obtained, therefore, the company will according to its commitment to make the largest investment enterprises \( \theta^*_e \) and the investment fund market expectations the total profit of investment, so as to maximize their profit.

To sum up, the gambling agreement offered by the enterprise to the investment fund \( \{ \kappa^*_C, \ k^*_I, \ \theta^*_e, \ M^*, \kappa^*_C, \ \kappa^*_I \} \), the investment fund ensures that firms and their projects are high profitability types and that the minimum return on investment funds is met, Businesses will also invest \( \theta^*_e \) in the market, to maximize its profits, the two sides are willing to cooperate with each other in research and development.

The enterprise can be in agreement on gambling will target income as business investment to maximize its cooperation with R&D investment fund profit market investment, can get in a good market returns. Under this condition, the low profit ability of enterprises will win because of capital constraints to achieve the goal of income, it will go into investment the free transfer of a share of the equity fund. At this time, as long as the business will not reach the goal of enterprise income, transfer to investment fund equity share a large enough, can cause low profitability for enterprises win and loss in equity transfer and investment fund development cooperation, and low profitability enterprises would not win with the investment fund cooperation, realize the win and low profit ability to distinguish enterprises. At the same time, enterprises can also according to the minimum return of investment funds to participate in cooperative R&D According to requirements, did not reach the target return to investment fund transfer corporate equity share, making target income investment funds must be transferred to the enterprise equity share, making the investment fund just to get the minimum income required to promote its success, and the investment fund cooperation reached, and maximize their own profits.

4. CONCLUSION

This paper establishes game model of enterprise and cooperative R&D investment fund and scientific research organization, the research design of the enterprise how to through cooperation with scientific research organizations to contract, information screening, identification of high R&D capability of scientific research organizations; at the same time, with the investment fund design of gambling agreement, based on the signal transmission way to investment the fund confirmed that the high Luoli ability of the enterprise, at the same time to solve the adverse selection and moral hazard of enterprise cooperative R&D investment fund, and in scientific research organization.

Research shows that enterprises in the investment fund and the agreement on gambling, the enterprise investment to maximize the total profit of the cooperative R&D investment market, have encountered good market environment of market return targeted revenue, and promised to reach the target income will be enough shares free transfer to investment funds, the low profit ability and capital for enterprises to win the capacity constraint is not up to the target profit, to the transfer of shares and investment fund losses in R&D cooperation, will not through the agreement on gambling cooperation and investment fund, and compare it with low profit.
enterprises win can be separated from the area, to solve the adverse selection; at the same time, according to the R&D investment fund cooperation participation constraint, the number of shares in cooperative R&D investment fund set to reach the target profit to the enterprise when free transfer, the investment fund is just the co
For the lowest income development requirements, enterprises become the R&D cooperation surplus value only claimants, will not reduce the investment power, to prevent moral hazard, promote cooperation in R&D formed at the same time, the maximization of enterprise profit.

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