

A Study on the Incentive Mechanisms for Local Governments and Tourism Leading Enterprises Based on Principal Agent Relationship and Blockchain Governance

Yu Wang

School of Management, Chongqing Institute of Engineering, Chongqing, China

Abstract

The investment and development of tourism resources projects in rural tourism destinations is a specific form of rural industrial integration and development for local governments to carry out rural revitalization. The introduction of social capital to the countryside is an important source of rural tourism capital investment. Due to information asymmetry and inconsistent interest goals, there is a contradiction between efforts and supervision between local governments and leading enterprises with principal-agent relationship. Starting from Chongqing rural tourism destinations, this paper analyzes the Nash equilibrium under different comparisons of operating income and additional costs brought by enterprise efforts by constructing a static game model. Combined with the principal-agent theory, an incentive mechanism considering the uncertainty of efforts and the inability to effectively supervise is constructed. The research shows that under the condition of satisfying the incentive compatibility constraints and participation constraints, it can encourage enterprises to work hard at a high level, and can also effectively encourage enterprises to consciously choose the optimal level of effort expected by the government, so as to achieve the coordination of the interests of enterprises and the government. This paper introduces the research perspective of principal-agent game to explore the relationship between the level of enterprise efforts and government supervision and incentive, and also proposes to introduce an incentive mechanism of intelligent governance based on blockchain to alleviate the principal-agent relationship between government and enterprises. The research findings have important theoretical and practical significance for revealing how to achieve the incentive constraints of the coordination of the interests of tourism leading enterprises and the government.

Keywords: Rural tourism, local governments, leading enterprises, principal-agent game, incentive mechanism, blockchain governance

1. Introduction

Rural tourism is an important way to promote rural development through the revitalization of characteristic industries under the strategy of rural revitalization. After experiencing several stages of suburban farmhouse, rural leisure tourism, and vacation tourism, rural tourism has now become an industrial system that promotes the integration of primary, secondary, and tertiary industries [1].

Chongqing has achieved fruitful results in the construction of rural tourism. The development of rural tourism only by financial investment is far from enough to meet the needs, and it is necessary to increase investment through multiple channels. Through social capital to drive farmers to develop rural tourism, farmers can increase their income by means of land transfer income, operating income from tourism services provided by their own rural houses, equity income from equity investment projects of their own assets, commodity income such as selling agricultural products, and wage and labor income from participating in tourism project management [2]. However,

in the actual process of introducing social capital to invest in rural tourism destinations, in view of the natural weak position of farmers in terms of professional knowledge, technology, market information, and capital proportion, the government must strengthen the monitoring of social capital to protect the rights and interests of farmers.

Due to the inconsistency of the interests and goals of the government and leading enterprises, there are various phenomena such as blind investment of enterprises in the countryside, arbitrage policy subsidies, and damage to the interests of farmers. In some places, in order to attract social capital to obtain short-term economic benefits, the local government blindly complies with the unreasonable requirements of social capital, appear beyond the scope of development, destruction of farming culture and local original form, or in the absence of sufficient research and demonstration, lack of sufficient development capacity, allow social capital to carry out low-level extensive development [3]. For example, the brand of “Huangshui renjia” rural tourism professional cooperatives in Shizhu County, Chongqing, located in the southeast of Chongqing, has attracted a large number of imitation projects dubbed “someone's home”. Some projects have similar areas and similar themes, such as “Fenghuang Huahai” in Shapingba District of Chongqing and “Yidu Huahai” in Jiulongpo District, which are located in the main urban metropolitan area. The distance between the two places is only more than 30 kilometers [4]. Once faced with market operating risks, it is easy to withdraw capital and run away. In this regard, if the government lacks an effective supervision and assessment mechanism, or the effectiveness of incentives is insufficient, enterprises may slacken their operations, and are more reluctant to take the initiative to strengthen the degree of interest linkage with farmers, and will not put increasing farmers' income in an important position.

Therefore, based on the incentive mechanism design of the principal-agent relationship, this paper combines the static game model and the dynamic principal-agent game model to analyze the relationship between the enterprise's effort level and the government's incentive, so as to stimulate the enthusiasm of the enterprise. By solving the game equilibrium strategy, and then grasping the key points of the government's incentive policy [5], it also helps to enhance the interest linkage mechanism between tourism leading enterprises and farmers and protect the interests of farmers. This paper attempts to answer the following questions: Is the relationship between the government's incentives for enterprises and the level of corporate efforts affected by the additional costs of enterprises? How does the influence manifest? If the government cannot effectively supervise the enterprise, what kind of incentive mechanism should the government adopt to ensure that the enterprise is encouraged to work hard when the enterprise considers that the operating results obtained by its own efforts are uncertain? What are the conditions of this incentive mechanism? Can the governance of the principal-agent relationship between the government and enterprises be improved through the application of blockchain technology and its inherent characteristics? The possible contributions of this paper are as follows: Firstly, the game relationship between enterprise effort or slack and government incentive behavior is given under the condition of static game, and the key motivation of enterprise effort level is revealed. Secondly, from the reality that business risks lead to unpredictable business results and it is often difficult for the government to implement effective supervision, it is of great theoretical and practical significance to explore the two types of constraints of the incentive mechanism for the government to encourage enterprises to work hard, and how to design support and incentive policies for local governments in rural tourism destinations when attracting investment. Finally, it is proposed that the implementation of an intelligent governance mechanism grounded in blockchain technology offers a novel approach to mitigating the principal-agent dilemma between governmental bodies and enterprises.

2. Literature review

The game research on tourism development usually involves stakeholders involved in the investment and development of tourism resources, and the government, as the owner of resource ownership, usually plays the role of principal. The principal-agent relationship between government and enterprises in the development of scenic spots is the focus of academic circles. The research on the principal-agent relationship between local governments and leading tourism enterprises in rural tourism destinations involves the dilemma of the problem, the reasons behind it, and the solutions. Domestic and foreign scholars have gradually focused on the research proposition from three aspects. First, the principal-agent relationship between the government and tourism enterprises in tourist attractions. Yongbing, Y. et al. [6] uses the game model to analyze the double principal-agent relationship

of the transfer of management rights in scenic spots. Jiayi, L. et al. [7] studies the two layers of principal-agent relationship between government and enterprises in tourism project investment. In view of the supervision and incentive problems in the principal-agent relationship between the government and the enterprise, the multi-task principal-agent model can be used to construct the incentive mechanism [8]. An empirical study of tourist routes in northern Tanzania found that there are serious problems in the principal-agent relationship between government regulators and tourism enterprises, such as arbitrary taxation by regulators, which can be improved by strengthening the coordination between government regulators [9]. To expand the principal-agent relationship between the government and tourism enterprises, there is also a principal-agent relationship between community organizations and volunteer tourism organizations. Through research, it is found that the traditional principal-agent model can be subverted, which can effectively promote the host community to participate more effectively in the monitoring and evaluation of volunteer tourism [10].

Second, the principal-agent relationship in the natural ecological protection of scenic spots has also attracted the attention of scholars. Nurwati, Ammy, et al. [11] studied the principal-agent relationship between government regulators and development companies in view of the ecological destruction of mining activities by development companies in the reconstruction reserve of Merapi Mountain National Park in Indonesia, and found that the moral hazard implemented by agents may affect the decision-making process of principals. Meng, J. et al. [12] studied the coordination among local governments, tourism development enterprises and local residents in the development of national park tourism. An evolutionary game model was constructed to analyze the punishment, compensation and participation of different participants. The stable operation path and evolutionary trajectory of the game system were explained, and the driving mechanism was explained from the perspective of principal-agent. Lin, M. [13] used the multi-task principal-agent theory to explore the incentive problems of the central government and local governments in the management of national parks. By constructing a multi-task principal-agent model, it confirmed the necessity of the central government to carry out long-term incentives, and proposed measures to promote local governments to achieve effective management.

Third, in recent years, the principal-agent relationship in rural tourism has been valued. Chunfan G. and Yan T. [14] proposed a framework to solve the principal-agent problems such as moral hazard, agent collusion and weak supervision in the process of the transfer of scenic spot management rights, in view of the multi task and multi-level principal-agent relationship between the government, Diaolou owners, tourism development companies and other subjects in the development of world cultural heritage Kaiping Diaolou tourism resources. Aiming at the related problems of rural tourism land, considering the principal-agent relationship between enterprises, governments, village collectives and farmers, Yan, Lei, et al. [15] constructed a multiple principal-agent model to study the optimal benefit distribution mechanism of the above stakeholders in the marketization process of rural collective operating construction land. The optimal distribution ratio should be adjusted according to the regional and industrial differences of land use. Xu, Lu, et al. [16] used the dynamic game of incomplete information to discuss the unfair income distribution of rural tourism in two villages in Fu'an City, Fujian Province, and proposed to coordinate interests through government subsidies, property rights protection, and village regulations to achieve rural harmony. Pan, H. et al. [17] proposed a collaborative mechanism for rural comprehensive land consolidation, which takes Rural Collective Organization with multiple roles as collaborative leaders, which can effectively promote the collaboration of stakeholders such as local governments, rural residents and social enterprises in the development of primary, secondary and tertiary industrial integration projects such as rural tourism. Taking Yuanjia Village, which lies in Liquan County, Shaanxi Province of China as an example, Wang, Huizhan, et al. [18] analyzed the dynamic mechanism of rural tourism to promote rural rejuvenation, and pointed out that there is a principal-agent relationship between local governments guiding tourism enterprises to develop rural tourism. "Community-led, government participation" is the ideal state of the "government-community" linkage model, which verifies that the logic of the evolution of the incentive mechanism from "exogenous power" to "endogenous power" is a general path in line with China's national conditions. In view of the principal-agent problems such as conflicts of interest between local governments, development enterprises and villagers in rural tourism development, Feng, X. [19] proposed to clarify the relationship between the responsibilities, rights and interests of all parties, and to solve the problem of information asymmetry by improving the regulatory incentive system, improving information transparency, and increasing rent-seeking and default costs. Zhenhua H. et al. [20]

establishes an improved tripartite evolutionary game model of government, enterprises and farmers through the principal-agent theory, and believed that the government can strengthen incentives by providing dynamic subsidies linked to individual behavior.

Fourth, the conceptual framework for blockchain governance includes six dimensions: formation and context, roles, incentives, membership, communication, and decision-making [21], or can be divided into six principles: the degree of decentralization, decision rights, incentives, accountability, ecosystem, and legal and ethical responsibilities [22]. Among them, decision making and incentive are the core elements. Each of these governance frameworks takes into account the degree of decentralization of different blockchain types, distribution of incentives, decision-making power, and accountability of stakeholders. After The DAO, a decentralized autonomous organization on the Ethereum platform, was attacked in 2016, although it ended in failure, its practice based on blockchain governance put forward innovative ideas to alleviate the principal-agent problem in organizational governance. Blockchain technology has the characteristics of distribution, consensus mechanism, immutable, trustless, transparency, smart contract, etc., which can provide a new perspective for the study of organizational governance methods. The intelligent governance mechanism is based on the distributed record and data information generated by the consensus mechanism of blockchain, so as to establish the principal-agent relationship. It will greatly alleviate the problem of information asymmetry between the principal and the agent [23]. In general, the incentive mechanisms for blockchain stakeholders are still being studied [24].

It can be seen that the previous research focused on the multi-task principal-agent relationship between the government, tourism enterprises, farmers and other stakeholders in rural tourism, involving moral hazard, collusion, supervision, incentive, benefit distribution, development motivation mechanism and other issues. Information asymmetry and moral hazard are the main causes of principal-agent problems. The unfair distribution of benefits is the basic manifestation, and the design of incentive and supervision mechanism is the main solution. In general, it is urgent to further study the principal-agent relationship between the government and enterprise in rural tourism development from the perspective of incentive and supervision, and how to coordinate the interests of the government and enterprise in the case of information asymmetry.

3. Research object and Research Method

3.1 Research object

This paper takes the local government and leading enterprise in rural tourism destinations as the research object, and discusses the principal-agent game between the two major stakeholders.

Local government mainly refers to the township government where the rural tourism destination is located. In the process of attracting social capital to invest in rural tourism projects, local governments undertake the functions of infrastructure investment, attracting social capital investment, formulating preferential support policies, supervising project investment and development, guiding farmers.

The concept of “social capital” was first proposed by Hanifan, L. J. He believed that “social capital can be accumulated by reputation, friendship, sympathy and social interaction of residents. These capitals can directly meet the needs of individual society and can also make the living environment of the whole community substantially improved”. Yangjie, B. and Xuewang, W. [25] believes that social capital is a social resource that can be used to achieve goals in social relations. It is based on the support of an organization and social network based on mutual trust. On the whole, social capital is a social resource characterized by trust, norms and networks. In terms of China's policy level, social capital is more understood as industrial and commercial capital. Therefore, the social capital of this study refers to the leading enterprises that invest, develop and operate rural tourism projects in the countryside.

3.2 Research method

The principal-agent model can directly reflect the utility function of both sides of the game and find the optimal solution of utility maximization. Since the principal and agent are rational decision-makers, both parties will make strategic choices that are beneficial to themselves in order to maximize individual benefits and balance the interests of other stakeholders [26]. This study will construct different principal-agent models to analyze the

information asymmetry between local governments and leading enterprises in the principal-agent relationship of rural tourism project investment and operation, and try to find the constraints that meet the incentive mechanism.

From the stage of research attention, this paper studies the first and second stages of the dynamic principal-agent game as the game stage of whether the local government signs a contract with the investment enterprise before investment, that is, whether the government entrusts the project to the enterprise according to the investigation, and whether the enterprise accepts the entrustment. Then it focuses on the game between local governments and investment enterprises on the level of corporate efforts, government incentives, and project operating income levels in the development and operation of rural tourism projects after the investment is determined.

4. Game Model Analysis

According to the above analysis, for the integrated development of rural industries in local rural tourism destinations, local governments attract leading enterprises to invest in the countryside and develop and operate cultural and tourism projects through investment attraction, so as to promote the integrated development of rural primary, secondary and tertiary industries, realize the revitalization of rural resources through industrial revitalization, promote the increase of farmers' income and get rich, and finally realize the strategic objectives of rural industrial revitalization and agricultural and rural modernization. In the project development, enterprises will cooperate with farmers in some way to form a mechanism of interest linkage, and whether the government can successfully introduce high-quality leading enterprises will become the premise and key for the follow-up cooperation between enterprises and farmers to produce high benefits. In order to attract high-quality leading enterprises to invest locally, the government usually implements a series of preferential policies, including various policy support funds, incentives, subsidies and other incentives.

4.1 Static game model of local government and the leading enterprise

First of all, in a static game model to analyze the strategic choice of local governments and leading enterprises. The government hopes that enterprises can achieve good economic benefits by developing and operating cultural tourism projects, which depends not only on the level of efforts of enterprises, but also on the uncertain market management risks. In order to simplify the analysis, only the effort level of the enterprise is considered here.

4.1.1 Model assumptions

The game has two participants: local governments and the leading enterprise. Ignoring the order of action between the government and enterprises, it is regarded as a static game and analyzed in a standard (tabular form). Both sides of the game have two strategic choices: the local government's strategy set is "incentive" and "no incentive"; the strategy set of leading enterprises is "high effort" and "low effort". The high level of enterprise efforts includes careful market research, project feasibility analysis, input-output evaluation, strengthening project operation management, and fully mobilizing the enthusiasm of farmers. Because it is difficult for the government to observe whether the enterprise is high effort or low effort, it is impossible to implement different incentives for different levels of effort, and can only choose to implement a unified incentive or no incentive.

In order to simplify the analysis, it is assumed that if the enterprise makes high efforts, the government has increased income, otherwise there is no. If the enterprise makes high efforts, the enterprise has increased income, otherwise there is no. If the government implements incentives, the enterprise has increased income, and otherwise there is no. If the enterprise makes high efforts, the enterprise needs to pay extra costs, and otherwise there is no.

4.1.2 Model parameter

Let $R_g(t)$ denote the government's increased income (such as an increase in corporate tax payments) under the condition of the high effort of the enterprise, where $0 < t < 1$ is the tax rate, indicating that government income is a function of taxation, and C_g is the cost of government incentives (including support funds, incentives, subsidies, etc.); R_j represents the increased income of the enterprise in the case of incentives, R_h represents the increased income of the enterprise in the case of the high effort, and C_j represents the additional cost paid by the enterprise in the case of high efforts. Considering the uncertainty of income brought by market operation risks,

the additional cost paid by the high effort is usually higher, but whether the income brought by the high effort can be higher than the cost is not necessarily, so it is difficult to determine which one of R_h and C_j is large.

4.1.3 Profit matrix of incentive-effort game model

According to the hypothesis, the income matrix of local government incentives for the leading enterprise is shown in Table 1:

Table 1 Incentive-effort game payoff matrix.

		The leading enterprise	
		High effort	Low effort
Local government	Incentive	$R_g(t) - C_g, R_j + R_h - C_j$	$-C_g, R_j$
	No incentive	$R_g(t), R_h - C_j$	0,0

4.1.4 Nash equilibrium of payoff matrix in incentive-effort game model

Obviously, the cost of the government to implement incentives $C_g > 0$, for the government, there is a dominant strategy "No incentive".

For the enterprise, it needs to be discussed in two cases:

when $R_h > C_j$, that is, the income of the enterprise's high effort is higher than the additional cost, then $R_j + R_h - C_j > R_j$. According to the underlining method, there is a Nash equilibrium (No incentive, High effort), that is, the government chooses non-incentive, and the enterprise chooses the high effort. The economic significance behind it is that for the government, this is the most willing to accept the government's strategic choice, not only without spending incentive costs, but also to promote the enterprise to work hard; for the enterprise, although the government does not implement incentive policies, as long as the enterprise works hard, when the market risk is not high, the enterprise can achieve higher returns, enough to make up for the additional costs behind high efforts, so the enterprise is willing to work hard (Table 2).

Table 2 Incentive-effort game payoff matrix after underlining when $R_h > C_j$.

		The leading enterprise	
		High effort	Low effort
Local government	Incentive	$R_g(t) - C_g, R_j + R_h - C_j$	$-C_g, R_j$
	No incentive	$R_g(t), R_h - C_j$	0,0

When $R_h < C_j$, that is, the income increased by the high effort of the enterprise is lower than the additional cost. If the market operation risk is large or the economy is depressed, the income brought by the high effort of the enterprise is not high enough to make up for the higher additional cost, which makes the high effort of the enterprise become a kind of inefficient behavior. According to the underlining method, there is also a Nash equilibrium (No incentive, Low effort), that is, the government chooses "no incentive", and the enterprise chooses "low effort". The economic significance behind it is that due to the improper design of the incentive mechanism, the uncertainty of the income brought by the market operation risk is not considered enough, and the risk of the enterprise's efforts to operate is greater. The main purpose is to obtain the government's incentive, and only to deal with the project operation. This explains why many farmers in reality reflect that some leading enterprises mainly rely on government policies and financial support, and lack enthusiasm and initiative. If the corresponding regulatory measures and incentive mechanisms are not effective enough, in the case of unprofitable operation and no preferential policies, enterprises will rarely take the initiative to strengthen interest linkages with farmers, share various information and technologies, and benefit farmers. Once the operating losses increase, the farmers will withdraw quickly, and the farmers cannot really increase their income and become rich, leaving a mess to the government (Table 3).

Table 3 Incentive-effort game payoff matrix after underlining when $R_h < C_j$.

		The leading enterprise	
		High effort	Low effort
Local government	Incentive	$R_g(t) - C_g, R_j + R_h - C_j$	$-C_g, R_j$
	Non-incentive	$R_g(t), R_h - C_j$	0,0

It can be seen that the game between the government and the enterprise must also consider the uncertainty of the income brought by the market operation risk and the design of the government's supervision mechanism for enterprises.

4.2 The principal-agent game between local government and the leading enterprise

For the rural revitalization of rural tourism destinations, the government has implemented a series of investment promotion and capital introduction work. Through various preferential policies, the government has attracted industrial and commercial capital to invest in rural areas and operate cultural and tourism projects, which involves cooperation with farmers in land transfer, employment of migrant workers, joint-stock cooperation, shareholding management, etc., to drive farmers to increase their income and become rich, and promote the transformation of rural resources into assets. Therefore, the relationship between the government and the enterprise involves asymmetric information transactions. The government introduces the enterprise to develop tourism projects for rural resources. The enterprise has its own private information about whether it works hard, that is, it has information advantages. Therefore, the enterprise can be regarded as an agent and the government can be regarded as a principal. However, the interests of the principal government and the entrusted enterprise are not consistent, and the information is asymmetric. The government cannot directly observe the effort level of the enterprise, and there are difficulties in supervision. That is, the enterprise has the moral hazard of hidden actions, and the government can only indirectly affect the behavior of the enterprise through incentives. Therefore, the principal-agent theory can be used to analyze the relationship between the government and the enterprise. Because the main means that the government can use is the design of the entrustment contract (investment cooperation agreement), that is, the design of the incentive mechanism.

4.2.1 Uncertain and unsupervised principal-agent game

In order to conform to the reality as much as possible, we should not only consider the market operation risk, the agent's efforts (operating income) are uncertain, but also consider the principal-agent game model that the principal cannot supervise the agent's behavior.

i). Model assumptions

Players: There are two players in the game. Player 1 represents the principal local government, and player 2 represents the agent leading enterprise.

The order of action: there is a sequence of actions between the government and the enterprise, so it is a dynamic game, which is analyzed in an extended form (game tree form). The government acts first, and the enterprise observes the government's actions and then choose its own actions.

Action space: the government's strategy set is "entrust" and "not entrust", that is, the government first decides whether to sign investment cooperation agreements with the leading enterprise; the strategy set of the enterprise is first "accept" and "reject" the cooperation agreement, then "high effort" and "low effort". In the last stage, because it is not clear whether the enterprise is high effort or low effort, the introduction of a "nature" player 0 reflects this uncertainty and is selected according to the probability distribution.

In the case of uncertainty in the results of efforts, the principal cannot supervise the agent's behavior, and the principal can only be motivated according to the agent's work results rather than the work situation, unless a unified fixed incentive is carried out. This means that the principal believes that the business risk is not only from the random factors of the market, but also related to the behavior of the agent, that is, the risk of uncertainty is

shared by the principal and the agent. That is to say, the operating income of enterprises is directly affected by uncertainty, and the interests of the government are also directly affected by the tax payment of enterprises.

It is assumed that the uncertainty of the operating income of the enterprise is represented by two operating incomes: high income R_h and low income R_l . The probability of obtaining high income R_h when the enterprise works with high efforts is x , and the probability of obtaining low income R_l is $1 - x$. Conversely, the probability of obtaining high return R_h when the enterprise works with low efforts is $1 - x$, and the probability of obtaining low return R_l is x . $R_h(t)$ represents the income obtained by the government when the income is high, and $R_l(t)$ represents the income obtained by the government when the income is low, where $0 < t < 1$ is the corporate tax rate, indicating that the government income is a function of taxation. Obviously, $R_h(t) > R_l(t)$. $\omega(h)$ denotes the higher incentive paid by the government to the enterprise when the income is high, and $\omega(l)$ denotes the lower incentive paid by the government to the enterprise when the income is low. $C(h)$ represents the additional cost paid by the enterprise when it makes high efforts (which can be understood as a negative utility), and $C(l)$ represents the additional cost paid by the enterprise when it makes low efforts. Obviously, $C(h) > C(l)$.

ii). Model establishment and model parameters

This is a three-stage dynamic game. Because it is not clear whether the enterprise's choice is high effort or low effort before the action in the last stage of "nature", it is a complete but imperfect information game.

The first stage of the model is that the government chooses to entrust or not entrust. If the government chooses not to entrust, it will not get the service when the enterprise invests and operates, and the increased tax revenue will not be obtained. $R(0)$ indicates the government's income when there is no enterprise investment and tax payment. The income vector of the non-commissioning node is $[R(0), 0]$.

The second stage of the model is that the enterprise chooses to accept or reject. If it chooses to reject, the result is the same as that of the government choosing not to entrust, and the income vector is $[R(0), 0]$. If it chooses to accept, then enter the third stage.

The third stage of the model is that the enterprise continues to choose high effort or low effort. The government cannot know which kind of enterprise chooses, but no matter which kind of choice, it enters the fourth stage.

The fourth stage of the model is that "nature" is selected according to the probability distribution. If the high effort produces high returns, the return vector is $[R_h(t) - \omega(h), R_h + \omega(h) - C(h)]$; if it is a high effort to produce low returns, the return vector is $[R_l(t) - \omega(l), R_l + \omega(l) - C(h)]$. If low effort produces high yield, the yield vector is $[R_h(t) - \omega(h), R_h + \omega(h) - C(l)]$; if low effort leads to low yield, the yield vector is $[R_l(t) - \omega(l), R_l + \omega(l) - C(l)]$. Here, the income or incentive in the benefit function of both parties is the function of operating results, not the function of effort level, that is to say, nature's choice of high-yield and low-yield will directly affect the income of both parties.

iii). Model analysis

Now use backwards-induction to solve this dynamic game.

First, according to the above model, a game tree is established and drawn (Figure 1).

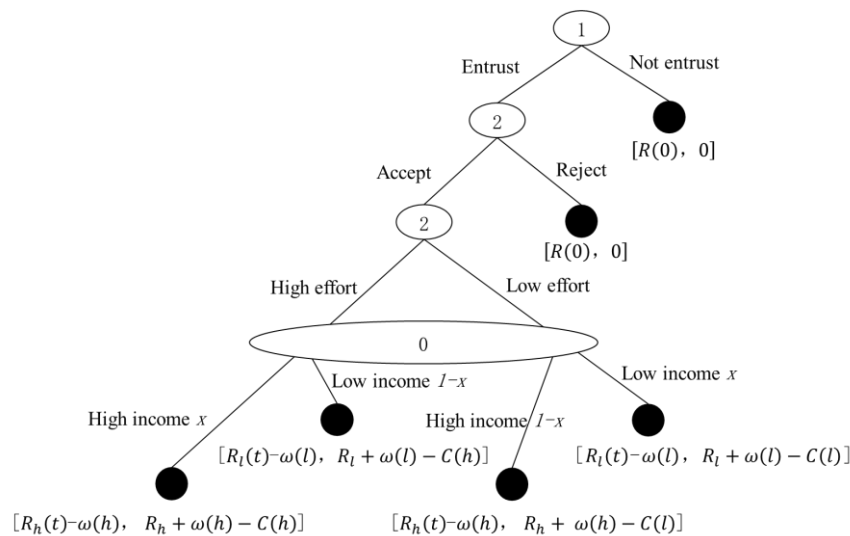


Figure 1 Principal-agent game tree with uncertain and unsupervised effort results

Second, consider from the decision-making of the participants in the third stage. Assuming that the enterprise is risk neutral, as long as the expected return of high effort is greater than that of low effort, the enterprise will choose high effort, that is, to meet:

$$x[R_h + \omega(h) - C(h)] + (1 - x)[R_l + \omega(l) - C(h)] > (1 - x)[R_h + \omega(h) - C(l)] + x[R_l + \omega(l) - C(l)] \quad (1)$$

Inequality (1) is the incentive compatibility constraint that the government promotes the high effort of the enterprise.

Third, consider the second stage of player decision-making. When the enterprise chooses high effort in the third stage, in the second stage, as long as the expected return of the enterprise chooses to accept is greater than the expected return of the enterprise chooses to reject, the enterprise will choose to accept, that is, to satisfy:

$$x[R_h + \omega(h) - C(h)] + (1 - x)[R_l + \omega(l) - C(h)] > 0 \quad (2)$$

Inequality (2) is that the enterprise is willing to accept the participation constraints entrusted by the government.

Third, consider the first stage of player decision-making. When the third stage the enterprise chooses high effort, the second stage the enterprise chooses to accept, then the first stage as long as the government chooses to entrust the expected return is greater than the choice does not entrust the expected return, then will choose to entrust, namely satisfy:

$$x[R_h(t) - \omega(h)] + (1 - x)[R_l(t) - \omega(l)] > R(0) \quad (3)$$

The inequality (3) is the participation constraint of the government's choice of entrustment.

Fourth, find the equilibrium path (Figure 2). When the above several inequalities are satisfied, the above choices of the two parties constitute the subgame perfect Nash equilibrium of the model. As long as the government determines the values of $\omega(h)$ and $\omega(l)$ according to the above incentive compatibility constraints, participation constraints, and the specific values of R_h , R_l , $C(h)$ and $C(l)$, it can solve the problem of incentive mechanism for the government to encourage the enterprise to work hard.

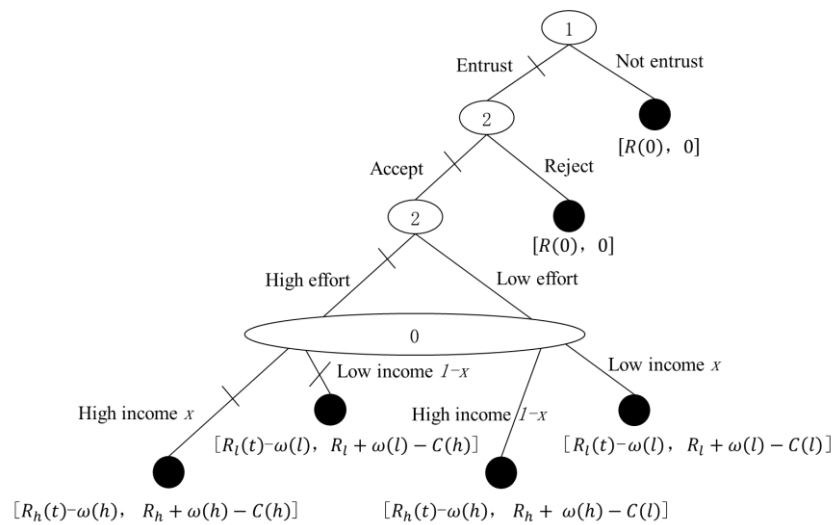


Figure 2 Equilibrium path of principal-agent game tree with uncertain and unsupervised effort results

4.2.2 Principal-agent game based on choice reward and continuous effort level

Further discussion aims to design incentive mechanisms that coordinate the interests of agents and principals through the selection of reward functions and effort levels, based on the uncertainty and unsupervised results of effort (operating income).

i). Model assumptions

Players, action sequence and action space are consistent with the above model.

The difference between this model and the previous model is that assuming that the enterprise does not choose the effort level according to the high or low situation, but chooses the effort level i according to the variable distributed in a continuous interval, the operating income (effort) of the enterprise is the function of i , expressed by $R(i)$. The revenue obtained by the government is $R(t, i)$. The government does not determine the incentive reward according to the high income and low income conditions, but chooses the reward function according to the effort-result function R , that is, $\omega(R)$. This means that at least part of ω is a profit commission, and ω is actually a composite function of i , that is, $\omega = \omega(R) = \omega[R(i)]$. At the same time, it is assumed that when the enterprise chooses to reject the entrustment, the income is no longer 0, but there is a positive opportunity cost, that is, the utility U of the income of other investment projects that may be obtained without signing the contract with the government. It is assumed that the additional cost of enterprise effort is no longer high or low, but the function of effort level i , $C = C(i)$.

ii). Analysis of incentive mechanism of model

For simplicity, the conditions of participation constraints and incentive compatibility constraints are directly used to discuss the incentive mechanism design of this model. In the first stage, when the government chooses to entrust, the second stage enterprise chooses to accept, and the third stage enterprise chooses the continuous effort level i , the government's benefit function is $R(t, i) - \omega[R(i)]$, and the enterprise's benefit function is $R(i) + \omega[R(i)] - C(i)$.

For the enterprise, as long as the benefit of accepting the entrustment is not less than the opportunity cost U , it will choose to accept the entrustment, that is, to meet:

$$R(i) + \omega[R(i)] - C(i) \geq U \quad (4)$$

Inequality (4) is that the enterprise is willing to accept the participation constraints entrusted by the government.

On the premise that the enterprise is willing to accept the entrustment, the government certainly wants to pay the minimum incentive, so the actual participation constraint is:

$$\omega[R(i)] = U - R(i) + C(i) \quad (5)$$

That is, the case where the inequality takes the equal sign is the minimum value of the incentive, and Equation (5) is the actual participation constraint that the enterprise is willing to accept the government's entrustment. At this time, the government's benefit function is $R(t, i) - \omega[R(i)] = R(t, i) + R(i) - U - C(i)$.

According to the above profit function, the government can calculate the specific effort level i^* of the enterprise that is most in line with its own interests. According to the law of diminishing marginal utility, with the increase of effort level i , the rate of increase in operating income is decreasing, that is, $R(i)$ is a monotonically increasing convex function (Figure 3). According to the law of increasing marginal cost, with the increase of effort level i , the rate of additional cost increase of enterprise effort is increasing, that is, $C(i)$ is a monotonically increasing concave function. Then i^* is the effort level in the graph that parallels the tangent of the curve $R(i)$ to the curve $C(i) + U$.

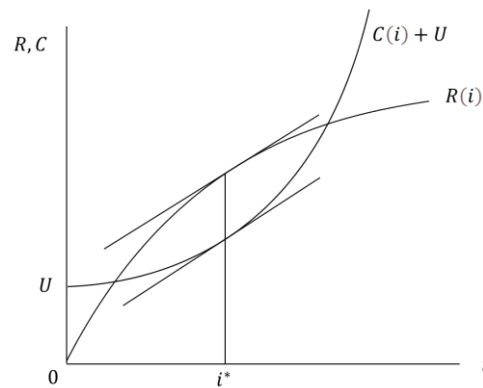


Figure 3 The level of enterprise effort that the government hopes under the premise of meeting the participation constraints

It should be pointed out that because the goal of maximizing the interests of the government and the enterprise is not consistent, the enterprise is willing to accept entrustment under the condition of meeting the participation constraints, but the level of effort chosen is not necessarily i^* , because the enterprise arranges actions according to maximizing its own interests. In order to coordinate the interests of the two, from the perspective of the government, it is necessary for the enterprise to consciously choose the level of effort i^* , and i^* is also in line with the government's own interest maximization goal. If, in addition to the specific effort level i^* , other effort levels are represented by i , then the following must be satisfied:

$$R(i^*) + \omega[R(i^*)] - C(i^*) \geq R(i) + \omega[R(i)] - C(i) \quad (6)$$

The inequality (6) is the incentive compatibility constraint of the level of effort to achieve the coordination of the interests of the government and the enterprise. Since both sides of the inequality are the profit function of the enterprise, if the enterprise is rational, it will maximize its own interests through the optimal effort level i^* . Therefore, according to the above participation constraints and incentive compatibility constraints, the government designs the incentive reward function $\omega[R(i)]$, which can promote enterprises to meet their own interests.

5. Conclusion and Suggestion

By constructing a static game model and a dynamic principal-agent game model between the local government and leading enterprise, this paper draws the following main conclusions: First, whether the benefits brought by the enterprise's efforts can be higher than the additional costs or negative effects of the efforts will directly affect the Nash equilibrium between the government and the enterprise. If the high effort income is higher than the additional cost, the enterprise will be willing to work hard without the government's incentive, otherwise it will fall into the most inefficient equilibrium between the enterprise's slack and the government's non-incentive or ineffective incentive. The market operation risk will affect the results of the enterprise's efforts to a greater extent.

Second, in the case of uncertain and ineffective supervision of the results of efforts, the government determines the size of the incentive according to the high or low operating results, and shares the uncertain income risk by the principal and the agent. In the case of satisfying the incentive compatibility constraints and participation constraints, the enterprise can be encouraged to work hard. Third, on this basis, through the incentive mechanism of agent and principal designed by the continuous interval reward function and the choice of effort level, the optimal effort level is when the change rate of the enterprise income curve is equal to the change rate of the enterprise effort cost curve. In the case of meeting the incentive compatibility constraints and participation constraints, it can effectively encourage the enterprise to consciously choose the optimal effort level expected by the government, so as to achieve the coordination of the interests of the enterprise and the government.

Based on the above research conclusions, the following policy recommendations are proposed for the rural tourism development of rural tourism destinations in Chongqing: First, local governments should try to reduce the investment and operating cost burden of enterprises when attracting investment, such as assisting in promoting land transfer, coordinating cooperation and exchanges between enterprises and farmers, and assisting in market research of enterprises. Second, the government's incentive policy should not adopt a unified fixed reward, to avoid some enterprises to adopt opportunism, which is not conducive to the formation of a closer relationship between enterprises and farmers. Third, in order to encourage enterprises to work at the optimal level of effort, the government can adjust the comprehensive income of enterprises through incentives. The incentive size should be determined according to the project operating income brought by the enterprise's efforts, so as to promote the coordination of the interests of enterprises and the government. Fourth, introduce an incentive mechanism based on blockchain governance to alleviate the principal-agent relationship between the government and enterprises. Local governments can build a distributed rural tourism development data sharing platform based on blockchain, and incorporate all tourism enterprises that plan to invest in local development into blockchain governance. If the government's supervision and management organization system of several enterprises is regarded as a corporate governance structure similar to the bureaucracy, the incentive mechanism can be designed according to the blockchain-based intelligent governance mechanism model. In terms of incentives such as government support funds or preferential policies for enterprises, because the efforts of enterprises are stored on the chain in a quantifiable way, and according to the agreement on investment promotion, when the enterprise completes specific business indicators, the smart contract will trigger the execution of the contract and automatically issue monetary or non-monetary rewards (such as certain policy advantages, privileges, etc.). It can be cashed without government approval, the contract relies on algorithm execution, information cannot be tampered with, and tends to be a complete contract, thus stimulating the enthusiasm of enterprises. Since the contract terms on the chain are open and transparent, information sharing makes the behavior of enterprises gradually transparent and clear, which can effectively restrain the opportunistic behavior of enterprises. The information symmetry environment based on blockchain can more effectively realize the real-time supervision of enterprises by the government and reduce the supervision cost.

Although this paper makes a static and dynamic game analysis of the supervision and effort between local governments and the leading enterprise through the principal-agent game model, and gives the incentive compatibility constraints and participation constraints of the incentive mechanism in theoretical analysis, there are still some limitations, which need to be supplemented and promoted in future research. (1) In terms of research methods, although the Nash equilibrium analysis of the game model explains the supervision mechanism of the enterprise's effort level at the theoretical level, and puts forward the basic conditions of the incentive mechanism based on the principal-agent game analysis, it lacks empirical support from the game relationship between the real enterprise and the government. In the future, empirical research can be used to analyze the relationship between the government's support policies, market risks, additional costs and other conditional factors and the performance output factors of leading enterprises. (2) The leading enterprises considered in this paper are usually the investment developers of large-scale tourism projects in rural tourism destinations, which are suitable for areas with more developed rural tourism. For less developed areas, there may not necessarily be leading enterprises, but there may be a large number of small and medium-sized tourism enterprises. Even farmers and village collectives and cooperatives set up village-level tourism companies and entrust professional managers and professional operation teams to manage them. Therefore, in the future, we can further study the game learning and evolutionary game

between local governments and a number of small and medium-sized tourism companies, and explore the limited rationality, simple imitation and herding of small and medium-sized enterprises as a group in the game. (3) The rural tourism stakeholders studied in this paper have not yet included farmer groups. Future research can analyze complex game relationships such as multiple principal-agent relationships among the government, enterprises, and farmer groups, so as to provide more theoretical support for the government to coordinate the degree of interest linkage between enterprises and farmers.

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