

The Construction and the Application of Incentives Model Theory for Cooperatives Agents

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Abstract—The purpose of this paper is to construct the model of incentive theory for agent issues and to discuss the mechanism of the internal benefit distribution and its influencing factors. The principal-agent relationship of Chinese farmer cooperatives has its own characteristics. By constructing theoretical models of agent incentives which suit for Chinese farmer cooperatives, and based on it, this paper analyzes those related factors, and discovers that the degree of effort made by the core members is inversely proportional to their rents obtained; the incentive for core members' effort has positive correlation with the proportion of their own agricultural products to the total; the higher proportion that the core members shares is, the larger the incentive for them is, the higher the degree of their effort is, and the higher output and surplus to be distributed are. So it is of crucial role that explicitly motivating and implicitly motivating the core members, raising the proportion of ordinary members in leadership structure, increasing internal information transparency to effectively curb the opportunism behavior of the core members and ease the principal-agent problem of the farmer cooperatives.

Keywords—the farmer specialized cooperatives; principal-agent problem; agent Incentives; profit distribution mechanism

I. INTRODUCTION

The differences in resource endowment lead to varying participation purposes, input elements, and contribution to the cooperatives as well as assumed risks among members. And then form a distinctly heterogeneous members structure: common members (small and medium farmers) and core members (large production households, leading enterprises, supply and marketing cooperatives, agricultural technicians and rural elites) [1]. As principal participants clearly differ in interest preferences, resource endowment, positions of strength, roles and functions, China's farmer cooperatives are based on the cooperation of significantly heterogeneous members right after the establishment. It is the distinguishingly heterogeneous member structure that complicates the coordination requirements for members and cooperatives. As a result, principal-agent problems are prominent in China's farmers' cooperatives since the very beginning [2]. Compared with common members, core ones often exert more significant influence whether on initial establishment of organizations, system establishment or on routine management and decision in cooperatives. During the daily operation of cooperatives, there is a widespread phenomenon that core members also

serve as administrators at the same time. Lin Jian (2007) implied that, it was no deny that core member becomes the chairman of farmer cooperatives no matter from the perspectives of the elements contribution, individual ability or social resources. While seizing natural control power of cooperatives, the core part has already obtained primary residual control and claim power [3]. Principal-agent problems would be unavoidable once they command the cooperatives. For organizations like farmers cooperatives stressing on fairness and not-for-profit, the administrators cannot increase their properties by privatizing cooperatives profits they made through improving operation and management, because they did not receive a grant of residual claim right, causing more serious opportunism tendencies and more conspicuous principal-agent problems than other types of organizations [4], which was mentioned and worried by Demsetz (1988).

Akwabi et al. (1997) found that the farmer cooperatives often suffer from core members' moral hazards and then fall into dilemmas through studying the African cooperatives [5]. The key problem China's farmers cooperatives meet now, is that whether a logic interest coupling mechanism can be built between core members and common members or not [6]. Casson (1982) believed that relying on superior information and abilities to common members, core ones could coordinate scarce resources discreetly with valid judgments [7].

When the farmer cooperatives fail to satisfy managers' demand of incentive compatibility for their endeavors and sacrifice, why minority rural elites who are qualified as entrepreneurs are still willing to take the chair of the cooperatives leaders instead of other organizations which can provide higher rewards? Liao Zulu (2010) put forward a theory called "market dominance power", which deemed the return of market dominance power from their human capital property invested in the cooperatives, as the main reason that rural elites who are qualified as entrepreneurs made choices in accordance with the cooperatives' benefits [8]. In the developmental process of China's farmer cooperatives, common members are normally in disadvantage. However, core members take charge of the rules of residual claim as well as residual distribution, controlling the daily operation and management out of multiple reasons. When the cooperatives have evolved to the minority controlled institutions, self-seeking core members are probable

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to steal common ones' behalf. Thus, conflicts appeared between two types of members.

Apparently, there are dual principal-agent relationships in the cooperatives with the characteristic of minority controlled institutions: one is traditional principal-agent relationship for all members and managers (the first kind agent relationship for short); another one is for common members and core members (the second kind agent relationship for short) (Feng Genfu, 2004) [9]. How to prevent a few core members from invading benefits belonging to large number of common members occupies the main position of the contraction. That is why we focus on the agent issue between common members and core members.

Then what makes core members-common members agent issue unique? Core minority possess more and stronger control power or decision-making power, so what are the rationalities of that kind of phenomenon? This paper attempt to explore theoretical answers of the questions above by, building a model of incentive theory suitable for the operation practices of China's farmer cooperatives.

II. UNIQUENESS OF NEW PRINCIPAL-AGENT RELATIONSHIPS IN FARMERS COOPERATIVES

Eilers & Hanf (1999) held that the verification methods for identities of the principal and the agent in cooperatives are different with those in investor-owned firms (IOFs). What are the unique characteristics that principal-agent relationships in the cooperatives and related incentive systems possess in comparison with IOFs?

A. *Strong agents, weak principals.*

The IOFs principal-agent agreement stipulates that, principals empower agents to engage in some businesses activities in a form of contract; in return, agent gets paid for their agency acts, while principals should determine the final form and the content of contract as the principal is the only party who has the initiative to design the contract provisions. However, in terms of operation performances, relationships between principals and agents in China's farmer cooperatives are contrary to the IOF agreement with characteristics of strong agents and weak principals. The disadvantaged common member refers to the principal party while the core member refers to agents. Cooperatives agents decide final form and content of contract instead of principals as core members own much more physical capitals and human capitals. Under that circumstance, agents become the rules-makers determining cooperatives' regulations and schedules, exerting great influence on business decisions.

B. *Dissimilated surplus distribution mode and benefit expropriation concealment.*

The nature of cooperatives surplus defines a different surplus distribution mode from IOFs. The nature of capital joint and the prominent role of capital in enterprises codetermine the core distribution mode in IOFs that shares profits by the amount of invested capital; and the nature of human joint and the importance of participation make the transaction volume the core position in the farmers

cooperatives' system, ensuring a allocation priority of patronage fund on the basis of trading volumes.

According to Article 37 of China's farmer cooperatives Law- cooperatives regulations of profit distribution: profit refund is based on proportions of transaction volumes between members and cooperatives, and total patronage fund shall not be less than sixty percent of surplus available for allocations, which guarantees a profit distribution principle based on patronage fund. Capital return was limited to the remaining forty percent of surplus due to the total patronage fund occupying more than sixty percent of surplus available.

Despite the regulation takes patronage fund as principal profit distribution object, dissimilated profit distribution phenomena are widespread in practices of China's cooperatives. Profits are normally distributed according to the percentage of shareholdings yet hardly be refunded according to patronage times. Sun Yafan (2008) conducted a field investigation among 84 farmers' cooperatives: only twenty-eight cooperatives had implemented patronage fund, which makes up approximately a quarter of the eighty-four cooperatives and mass cooperatives didn't refund profits. Generally, surplus of return ratio are pretty low in these twenty-eight cooperatives.

Farmers are unfamiliar with a second return on the basis of trading volumes, so few people realized a second return waiting for members after trades. Not only that, the distribution mode of shareholdings percentage is simple and feasible, which is easily accepted by farmers. However, as core members, major shareholders usually perform as managers at the same time. Naturally, they expect that the profits would be distributed by shareholdings percentages only, rejecting a second return of surplus, which equips the expropriation behaviors with natural concealment. Given the situations, it can be well explained that why the profits are normally distributed according to the percentage of shareholdings instead of patronage times in current cooperatives operation.

C. *Overlapping principal-agent relationships.*

Normally, principals are owners of companies with ownership while managers are agents with management power in principal-agent relationship of IOFs, leaving a distinct line between agents and principals. But in China's farmer cooperatives, managers are usually promoted from owners (core members) and the role of owner is highly overlapping with manager. Most cooperatives agents are managers, investors, patrons, and even laborers of self-produced agricultural products, fixing both ownerships and management power to managers. Compared to common members, core ones generally occupy a higher proportion of the cooperatives property. Hence, agents not only manage members' assets but also their own assets. As a consequence, the principal-agent relationships of cooperatives are not purely principal-agent relationships.

III. INCENTIVE THEORY MODEL FOR COOPERATIVES AGENTS

With the unique characteristics of strong agents with weak principals, dissimilated surplus distribution mode and benefit as well as overlapping relationships in cooperatives principal-agent relationship, we take the mechanism analysis method to

construct the cooperative agent incentive model. The model is based on the understanding of realistic object characteristics in cooperative and the analysis of its causal relationship, which reflect its internal mechanism of the incentive model. The construction of incentive model has a clear practical significance. Based on the improved Holmstrom & Milgrom model [10], the paper is going to build an incentive theory model for cooperatives agents with the function of combination of constraint and incentive, analyzing influencing factors associated with principals and agents thoroughly.

A. Hypotheses and descriptions

For observing the impacts brought by the policies and approaches that core members run the cooperatives on common members' profits, in the view of moral risks and uniqueness of the new principal-agent relationships in farmer cooperatives, the paper concluded basic hypotheses and descriptions of incentive theory model for cooperatives agent in cases of incomplete contract and asymmetry information.

- Supposing that principals and agents are rational economic men, principals represent for small and medium- sized members while agents for core members.
- In order to rectify deviations of dissimilated surplus distribution mode and benefit expropriation concealment in China's farmer cooperatives, we assume that the total patronage fund is about sixty percentages of surplus available for allocation, and capital returns are constrained to the remaining forty percentages based on the Article 37 of China's farmers' cooperatives Law. As a result of non-pure principal-agent relationships, Cooperatives agents are controllers, investors and patrons as they sell self-produced agricultural products to the cooperatives. Considering agents have multiple identities, we divide agents' income into two parts: One is the remuneration for their engagement in agents' work, which is defined as $w(r)$. ($w(r)=w+r$, w refers to management compensation and r refers to the improper profit obtained from common members by abusing control power out of the natures of economic man (seeking rents of controlling rights); the rest one is the reward for investment and patronage, which is defined as $w(q)$. ($w(q)=m+\eta q \times 60\% + \tau q \times 40\%$), w refers to management compensation; m refers to sales revenue from agricultural products produced by core members; $\eta q \times 60\%$ refers to the second return acquired by core members; q refers to profits available for distribution in cooperatives; η refers to the ratio of trading volumes pertaining to agents' agricultural products (core members) to the turnovers of cooperatives; $\tau q \times 40\%$ refers to the capital return belonging to core members after finishing the second return of profit distribution; τ refers to the ratios of core members' shareholding.
- Supposing that the more monetary income members receive, the more utility they gain.
- We assume that current earnings would be distributed at one hundred percent for the sake of analysis simplification.

- The variable a - defined as efforts agents put in cooperatives, reflecting the degree of motivation that agents get. The quantity of variable a determines the degree of motivation. $c(a, r)$ represent the cost of efforts agents put in the cooperatives and the cost of grabbing rent through controlling rights. According to the definition, when a and r equal zero, $c(0, 0) = 0$. Namely, the cost comes to zero if agents does not make any effort and seek any rent. Supposing that $c(a, r) = a^2 r^2 b / 2$, $a^2 r^2 b / 2$ reflects the monetary value of $c(a, r)$. (b refers to cost coefficient ($b > 0$)). The harder agents work; the heavier expropriation small and medium-sized members suffer, and the higher cost agents pay. (Holmstrom and Milgrom, 1987).
- Let Q be the total outputs of cooperatives' agricultural products, unit price of outputs being one. And we take all the farm produces brought from different members as the same quality completely.

$$Q = ka, \quad q = k'a$$

K and k' are the coefficients of two equations respectively ($K > 0$, $k' > 0$). Obviously, if agents put more efforts (a) into cooperatives, then two kinds of outputs (Q and q) tend to rise. Therefore, the sales revenue (m) of self-produced products by agents (core members) can be expressed as $m = \eta Q$, $Q = \eta ka$

B. Models construction and solution

1) Expected utility modeling.

Given a series of hypotheses above, we can conclude the expression of total income of core members in cooperatives as follow :

$$\begin{aligned} X &= w(r) + w(q) - c(a, r) \\ &= w + r + m + \eta q \cdot 60\% + \tau q \cdot 40\% - c(a, r) \end{aligned} \quad (1)$$

Accordingly, we consider the following expected utility model for core members

$$EU[w + r + m + \eta q \cdot 60\% + \tau q \cdot 40\% - c(a, r)] \quad (2)$$

To simplify analysis, we measure the utility function for core members of (2) in monetary; That is to say, more monetary revenue they obtain signifies more utility. Thus, we use the monetary quantities of incomes directly replacing the degrees of utility from monetary revenue $u(\bullet)$. The foregoing analysis informs us that ($w + r + m + \eta q \times 60\% + \tau q \times 40\%$) reflects numerical values of monetary return. Besides, we have already assumed that $a^2 r^2 b / 2$ reflects monetary value of $c(a, r)$. Hence, with the equations of $m = \eta ka$, $q = k'a$ and $c(a, r) = a^2 r^2 b / 2$, we could transfer equation (1) into

$$X = w + r + \eta ka + \eta k'a \cdot 60\% + \tau k'a \cdot 40\% - \frac{b}{2} a^2 r^2 \quad (3)$$

Then expected utilities of core members are equivalent to expected return :

$$\begin{aligned}
 EU[w+r+m+\eta q \cdot 60\% + \tau q \cdot 40\% - c(a, r)] \\
 = E[w+r+m+\eta q \cdot 60\% + \tau q \cdot 40\% - c(a, r)] \\
 = w+r+\eta ka + \eta k' a \cdot 60\% + \tau k' a \cdot 40\% - \frac{b}{2} a^2 r^2
 \end{aligned} \quad (4)$$

Similarly, the expected utilities of common members (principals) are as follow :

$$\begin{aligned}
 Eu[n+(1-\eta)q \cdot 60\% + (1-\tau)q \cdot 40\% - d(r)] \\
 = E[n+(1-\eta)q \cdot 60\% + (1-\tau)q \cdot 40\% - (w+r)] \\
 = n+(1-\eta)q \cdot 60\% + (1-\tau)q \cdot 40\% - (w+r) \\
 = (1-\eta) \cdot ka + (1-\eta)k' a \cdot 60\% + (1-\tau)k' a \cdot 40\% - (w+r)
 \end{aligned} \quad (5)$$

n is the sales revenue of agricultural products produced by common members $n=Q-m=Q-Q\eta=(1-\eta) \cdot ka$; $(1-\eta)q \times 60\%$ refers to the second return for common members; $(1-\tau)q \times 40\%$ stands for the capital return for common members; $d(r)$ refers to agency cost- management compensation paid by common members and control rent by grabbing improper profit, $d(r)=w+r$.

2) *Constraints that agent incentive must follow: incentive constraints and involving restraints.*

Incentive constraints (IC). Once agents of cooperatives (core members) accept the contracts, they would be devoted to maximize their own expected utility functions, before considering the expected utility of principals (common members). Since the common members expect to maximize their utility, they need to encourage core members to make efforts to defend their interests with proper cost by setting clauses of contracts. Owing to the information asymmetry, core members' efforts (variable a) can not be observed directly by the common members. Only through satisfying core members' goals of maximizing their utility, can the core members' efforts (a) that common members expected achieve. We could deduct expression (3) by taking the first derivative of X (income of core members) with respect to variable a , which defines the incentive constraints of agents (core members).

$$(I.C.) \quad \eta k + \eta k' \times 60\% + \tau k' \times 40\% - abr^2 = 0 \quad (6)$$

Involving restraints (IR). Usually, agents (core members) have already anticipated their minimum income which stand for their lowest revenue targets X_0 (Retained income level. Agents would lose interest in the contracts which offer rewards (X) from principals less than X_0 , So the involving restraints can be expressed as follow :

$$(I.R.) \quad w+r+\eta ka + \eta k' a \cdot 60\% + \tau k' a \cdot 40\% - \frac{b}{2} a^2 r^2 \geq X_0 \quad (7)$$

C. Solution of models.

According to expression (5) , we can calculate the expected income of common members by:

$$(1-\eta) \cdot ka + (1-\eta)k' a \cdot 60\% + (1-\tau)k' a \cdot 40\% - (w+r) \quad (8)$$

Every incentive method favored by common members has a corresponding contract set ensuring realization of incentive and participation of agents (core members). Common members also want to maximize their profits, but they cannot make it

happen because of control power rent for core members. Given that, common members need to cope with the issues of incentive and constraint to core members. So common members try to sell the contracts that would maximize their profit and rationalize their control power rent. In that way, considering the incentive constraints and the involving restraints, we can find the contracts common members desired through optimal solution to the following problems :

$$\begin{aligned}
 \max & ((1-\eta) \cdot ka + (1-\eta)k' a \cdot 60\% + (1-\tau)k' a \cdot 40\% - (w+r)) \\
 s.t. & \begin{cases} (I.C.) \quad \eta k + \eta k' \times 60\% + \tau k' \times 40\% - abr^2 = 0 \\ (I.R.) \quad w+r+\eta ka + \eta k' a \cdot 60\% + \tau k' a \cdot 40\% - \frac{b}{2} a^2 r^2 \geq X_0 \end{cases}
 \end{aligned} \quad (8)$$

The anticipated income of core members (agents) have a minimum income limit (X_0) , therefore, the contracts requirements that core members are willing to take are:

$$(I.R.) \quad w+r+\eta ka + \eta k' a \cdot 60\% + \tau k' a \cdot 40\% - \frac{b}{2} a^2 r^2 \geq X_0 \quad (9)$$

To achieve the best income for common members (principals) before satisfying core one's minimum earnings X_0 , the optimal solution demands X_0 should amount to the best income for agents. And foregoing optimal problems are equivalent to following expressions :

$$\begin{aligned}
 \max & ((1-\eta) \cdot ka + (1-\eta)k' a \cdot 60\% + (1-\tau)k' a \cdot 40\% - (w+r)) \\
 s.t. & \begin{cases} (I.C.) \quad \eta k + \eta k' \times 60\% + \tau k' \times 40\% - abr^2 = 0 \\ (I.R.) \quad w+r+\eta ka + \eta k' a \cdot 60\% + \tau k' a \cdot 40\% - \frac{b}{2} a^2 r^2 = X_0 \end{cases} \\
 \Leftrightarrow & \begin{cases} \max & ka + k' a - \frac{b}{2} a^2 r^2 - X_0 \\ s.t. & abr^2 = \eta k + \eta k' \times 60\% + \tau k' \times 40\% \end{cases}
 \end{aligned} \quad (10)$$

Lagrange equation :

$$F(a, r, \mu) = ka + k' a - \frac{b}{2} a^2 r^2 - X_0 + \mu(\eta k + \eta k' \times 60\% + \tau k' \times 40\% - abr^2) \quad (11)$$

(μ refers to Lagrange multiplier). According to the first-order approach, we takes the first derivative of the Lagrange equation :

$$F'_{(a)} = \frac{\partial F}{\partial a} = k + k' - abr^2 - \mu br^2 \quad (11')$$

$$F'_{(r)} = \frac{\partial F}{\partial r} = -a^2 br - 2\mu abr \quad (12)$$

When the two first order partial derivatives above equal zero, we could get following results:

$$\mu = \frac{-a}{2}, \quad a = \frac{2(k+k')}{br^2}$$

$$2(k+k') = abr^2 = \eta k + \eta k' \times 60\% + \tau k' \times 40\%$$

$$a = \frac{2(k+k')}{br^2} = \frac{\eta k + \eta k' \times 60\% + \tau k' \times 40\%}{br^2};$$

$$\therefore Q = ka = \frac{\eta k^2 + \eta k k' \cdot 60\% + \tau k k' \cdot 40\%}{br^2},$$

$$q = k'a = \frac{\eta k k' + \eta (k')^2 \cdot 60\% + \tau (k')^2 \cdot 40\%}{br^2}$$

IV. INFLUENTIAL FACTORS ANALYSIS AND CONCLUSIONS

Following conclusions can be drawn from foregoing model solutions :

First, agent's efforts (core members) --a have a positive correlation with η (the ratio between trading volume of agent's produces and the turnover of cooperatives) [11] . In other words, if agents' produces share a larger proportion in cooperatives, they tend to work harder, which also explains why mass marketing households and large production households are enthusiastic about the establishments of farmers' cooperatives and devote to the development of the cooperatives, thus further validating the significant roles of mass households theoretically for today's development of farmers' cooperatives.

Secondly, with results of higher total outputs for cooperatives (Q) and more surpluses available for distributions, core members would receive a higher degree of incentive and put more efforts into the cooperatives if they own a higher proportions of shares. So one hand, it can be argued theoretically that, this kind of property structure still makes sense only if the cooperatives can promote common members' benefits through core members' control and management; on the other hand, it further proves in theory that core members, as the most valuable human resource, how much their talents and efforts have served to the cooperatives is the key of the development of cooperatives, but they need to endow with the rights of residual controls and residual claims, matching their talents with rights. While they have a natural tendency of opportunism, we could eliminate those opportunistic behaviors effectively by designing explicit incentives methods and implicit incentives methods

Last ,when core members take opportunistic actions to grab common members' profit with the minimum invading rent (r),the total output of cooperatives(Q) and available profits for distribution(q) come to top levels, which reflects a maximum profit for whole cooperatives members; yet when they grab more profits from common members for larger control rent(r),the total yields(Q) and available surplus for

distribution(q) tend to be diminishing, leading to a small amount of a second return and dividend profits. The current leadership structure blocks the tunnel common members supervising the agents' behaviors validly and easily induce invisible operations by core members. So it is necessary to increase the proportion of common members in cooperatives boards. Increasing proportion would influence the distribution and management policies, and improve transparency of internal information from the cooperatives, decreasing agents' opportunistic actions.

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