CEO Incentive Provision in Cooperatives: The Impact of Membership Size and Heterogeneity

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Abstract A multi-task principal-agent model is formulated to capture the effect of membership size and heterogeneity on the incentive provision of the CEO in a cooperative. An increase in membership size as well as an increase in member heterogeneity decreases the optimal incentive intensity of the CEO.

Keywords Cooperatives • Governance • Performance measurement

1 Introduction

A cooperative is an enterprise collectively owned by many independent suppliers. It involves both a horizontal arrangement among many independent farmers and a vertical coordination mechanism between the upstream members and the downstream processor. Members of a cooperative have two roles. On the one hand, a member is a patron, implying a transaction relationship with the enterprise by providing inputs. On the other hand, a member is an owner. Members collectively possess the residual rights over the cooperative and take decisions regarding it. Many cooperative researchers consider the cooperative as an inherently less efficient governance form when compared to IOF (investor-owned firm), mainly due to a number of property rights constraints (Cook 1995; Fulton 1995).
We compare these two governance structures from the perspective of managerial incentive provision. The members-CEO relationship in cooperatives is similar to the investor-CEO relationship in IOFs to the extent that the members exercise their decision rights mainly by critically following the policies of the management, rather than by giving it directions (Trifon 1961).

Despite the similarities, the issue of incentive provision in cooperatives is more complex than a standard principal-agent relationship (Feng and Hendriks 2012). First, a managerial incentive contract is based on a performance measurement system, creating incentives that align the goal of the agent with that of the organization. However, there are no simple indicators of cooperative managerial performance or automatic incentive systems (such as a stock price) to close the gap in interests. Giving a CEO equity, a common way to tie the CEO’s wealth to firm performance and thus to alleviate the interests conflict in IOFs, is not feasible in cooperatives. The reason is that a cooperative CEO is not eligible to hold equity in the business and receives only limited benefits from such ownership given the fact that most cooperative stocks do not appreciate in value (Trehber et al. 1997). Trehber et al. (1997) document various CEO compensation schemes in cooperatives. Some use pre-set performance-based bonuses, some allow for bonuses paid on past performance, and others do not use bonuses.

Second, there is a group of principals whose interests differ. What distinguishes a cooperative from an IOF with a single locus of profit maximization is members’ plurality of interests (Trifon 1961). The guiding principle regarding understanding a cooperative is that members advance the interests of their own farm portfolios through a cooperative (Fulton 1988). Members differ from each other in terms of size, location, risk aversion, attitude towards innovation, growth potential, member involvement, and financial contribution to the cooperative. When colliding interests exist among principals, the agent’s tasks involve devising workable compromises and acting as a neutral guardian of everybody’s priorities (Trifon 1961).

Trehber et al. (1997) conduct a series of studies on the executive compensation practices in US cooperatives and identify some alternative sources of information revealing the performance of cooperatives. Some use patronage refunds per member as a factor of the financial performance measure. Others tie the CEO bonuses to some accounting measures (such as accounts receivable). Hathc and Marcoul (2008) investigate how the unique features of cooperatives influence the managerial incentives and information asymmetry between the CEO and the owners. They suggest subjective performance assessment as another source of information, based on the stable long-run relationships between owners and the managers and the fact that the patrons are in a privileged position to observe and monitor managerial operations. We model the cooperative CEO’s incentive provision based on these observations and focus on a special feature of this governance structure, i.e. the multiplicity of owners, and its impact on the incentive intensity.

This article is organized as follows. The next section formulates a multi-task principal-agent model and tailors it to the differences between cooperatives and IOFs. The impact of the membership size and heterogeneity on the cooperative CEO’s incentives are analysed in Sect. 3. Finally, Sect. 4 concludes.

2 Model

A multi-task principal-agent model (Gibbons 1998) consisting of a two-stage non-cooperative game is presented in this section. In the first stage, the principal chooses the strength of incentives while the agent’s optimal choice of activities is determined in the second stage. Assume that the CEO in governance structure i (C for cooperative and F for IOF) can take two actions: a1 denoting the action to advance the downstream value, and a2 denoting the action adding value to the upstream producers. The CEO’s total contribution to firm value is denoted by yi. The marginal product of action a2 is g2. The production function is y1 = f1(a1) + f2(a2) + s, where s is a stochastic variable with expected value of 0, representing the noise in the production process that is beyond the agent’s control.1

Since it is difficult to measure the overall effect of the CEO’s actions on firm value, no compensation contract based on y1 can be enforced in court. An alternative performance measure y2 becomes therefore necessary. Suppose the technology of performance measurement is p1 = y1 + y2 = y1 + y1 + s, where y2 denotes the performance measurement parameter, i.e. the weight attached to y1, and s denotes the noise in performance measurement with expected value of 0.

The compensation contract in governance structure i specifies the wage w paid to the CEO as a linear function of p1, i.e. w1 = s1 + b1, where s1 stands for the salary and b1 for the bonus rate. The CEO’s payoff is the difference between the wage and the cost of actions: Ui = w1 - c1(a1, a2). We assume that the cost function takes the form c1(a1, a2) = d1 + d2. The principal receives the difference between the CEO’s total contribution to firm value and the CEO’s wage: p1 = y1 - w1. Notice that with this specification, the CEO’s incentives are to produce a high value of p1, not of y1, whereas the principal does not directly benefit from increased realizations of measured performance p1, rather, he/she benefits from increased realizations of the CEO’s total contribution y1. As a result, the incentives may be distorted. To minimize the distortion the principal wants to minimize the divergence between p1 and y1.

The game is solved by backward induction. The CEO’s optimal action in the second stage is determined by maximizing his/her expected utility, i.e. max E(U1), where E(U1) = E[w1 - c1(a1, a2)], s1 = b1( y1 + y2) - c1(a1, a2). The first

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1We assume the actions taken by the CEO only have consequences for the principal, which excludes the possibility of maneuvering and the CEO directly benefiting from acting against the interests of the principal.
order condition $b_i g_i = \frac{b_i}{g_i}$, $j = 1, 2$, characterizes the CEO’s equilibrium actions $a_i^e(h_i) = b_i g_i$. The payoff-maximizing reply in the second stage is anticipated in the first stage when the principal determines the efficient intensity of incentives. Maximizing the expected total surplus $E(n_i + U_i)$, where $E(n_i + U_i) = E(n_i) - c_i(a_{i1}, a_{i2}) = f_i a_i^e + f_i a_i - c_i(a_{i1}, a_{i2})$, results in the efficient bonus rate $b_i^e = \frac{a_i}{f_i a_i + c_i} = \frac{\sqrt{a_i^e + c_i}}{\sqrt{a_i^e + c_i}} \cos(\theta_i)$, where $\theta_i$ is the angle between the vectors $f_i \equiv (f_{i1}, f_{i2})$ and $g_i \equiv (g_{i1}, g_{i2})$ as depicted in Fig. 1.

There are two important features in the expression of efficient bonus rate, scale and alignment. More specifically, $\frac{\sqrt{a_i^e + c_i}}{\sqrt{f_i a_i + c_i}}$ reflects the relative scale of $f_i$ and $g_i$.

A high $\frac{\sqrt{a_i^e + c_i}}{\sqrt{f_i a_i + c_i}}$ indicates that the weights of actions are higher in the production function compared to those in the performance measure. As a result, the firm will optimally increase the incentive intensity based on such a performance measure. Cos($\theta_i$) captures the alignment effect. To the extent that the performance measure induces CEO’s actions less aligned with firm value, $\theta$ will increase, and the performance measure will distort incentives more (Baker 2000). As a result, the firm will optimally reduce the incentive intensity.

Next we identify the differences between a cooperative and an IOF in terms of the parameters in the production function and performance measure. First, the CEO’s contribution to firm value depends on organizational form. In cooperatives, it is equivalent to the change in total member value. Members want to bring both upstream farms and the downstream cooperative to value, i.e., $f_{iC} > 0, f_{iC} > 0$. Investors of an IOF processor care only about value added to the downstream stage, i.e., $f_{iF} > 0, f_{iC} = 0$. Second, the performance measures of IOFs and cooperatives differ. It is common in IOFs that the CEO’s bonus is paid in the form of firm shares, i.e., $g_{iF} > 0, g_{iC} = 0$. This instrument is lacking in cooperatives and we capture this by $g_{iC} = 0$. However, member interests are usually present in the incentive scheme for a cooperative CEO, e.g., by benchmarking the transfer price or production volume. This results in $g_{iC} > 0$. To wrap up, members’ plurality of interests is represented by $g_{iC} > 0$, while the absence of patron-members, and therefore serving their interests, in an IOF is represented by $g_{iF} = 0$. The absence of public listing of a cooperative is embodied by $g_{iC} = 0$, while the use of the stock price in an IOF’s performance measure is captured by $g_{iF} > 0$. The distinct features of two governance structures are displayed in Table 1 and Fig. 2.

Plugging these parameter values in the expressions of efficient bonus rates results in $b_i^e = f_{iF}/g_{iF}, b_i^e = f_{iC}/g_{iC}$. Subsequently, the CEO’s equilibrium actions are determined $a_{iC}^e = f_{iC}, a_{iC}^e = 0$ and $a_{iC}^e = f_{iC}, a_{iC}^e = 0$. As shown in Fig. 2, the production function and performance measure are perfectly aligned in an IOF, while they are not in a cooperative. In equilibrium, an IOF CEO has incentives to undertake only $a_{iF}$ because the investors care only about $a_{iF}$ and make the CEO’s pay dependent only on $a_{iF}$. Members of cooperatives, however, appreciate the CEO’s actions on both dimensions but are able to compensate only for $a_{iC}$. Thus, only an incentive to increase $a_{iC}$ is created and no incentive for $a_{iC}$ exists even though it contributes to the firm value. In other words, when an action increases the member value without simultaneously increasing the performance measure, the CEO has no incentives to do it. When the available performance measures are incomplete, the incentive contract will lead to distortion, or the folly of rewarding A while hoping for B” (Kerr 1975). With the complex and sometimes ambiguous

2 We are not stating that a cooperative has no information at all about the downstream activities, but our model will focus on the impact of lacking certain information.
goals of cooperatives, the incentive contact may provide only a partial representation of its objectives. The misalignment between the performance measure and the production function persuades the CEO to pay unbalanced attention to actions that positively affect their scores on the performance measures, neglecting areas for which performance is not assessed.

3 Society of Members: Size and Heterogeneity

The above model refers to members in general. The results can be best understood as the extent to which the CEO's interest accords with the average member's interest. Now we turn to explore the impact of membership size and member heterogeneity on the incentives provision. In the standard principal-agent model, the agent is usually assumed to be risk averse whereas the principal is assumed to be risk neutral. The assumption that the principal is risk neutral will now be relaxed. Members' risk attitude is different from that of the investors of an IOF because the latter could diversify their portfolio to spread risks. Due to the immobility of cooperative capital, members usually exhibit financial commitment to a particular line of business, having all their eggs in one basket (Staats 1987). But we maintain that the agent is more risk averse than the principal.

Suppose there are \( n \) identical members in the cooperative. The CEO's contribution to member \( q \) and to the society of members is

\[
\eta_{C(q)} = \frac{1}{n} \eta_{C(q)} + \frac{1}{n} \eta_{C(q)} + \varepsilon + \sum_{i} \eta_{C(q)} = \frac{1}{n} \eta_{C(q)} + \frac{1}{n} \eta_{C(q)} + \varepsilon + \sum_{n} \eta_{C(q)}
\]

Respective. Assuming that errors are independent and all members will agree on a single way of evaluating the CEO, the performance measure remains

\[
\phi = g_{C(q)} + g_{C(q)} + \varepsilon + \phi
\]

Let \( r \) denote the CEO's risk aversion, \( R \) the risk aversion of each member, \( R_{i} \) the risk aversion of the group of members, \( \alpha \) the variance of \( \varepsilon \), and \( \nu \) the variance of \( \phi \). When members act colludiously and pool risks, \( R_{i} = \sum_{n} R_{i} = R_{i} \), i.e., the existence of multiple members decreases members' risk aversion. The efficient bonus rate is now

\[
R_{i} = \sum_{n} R_{i} = R_{i} = \frac{R_{i}}{R_{i} + \alpha + \nu}
\]

This is in line with the results in the standard principal-agent problem regarding risk-aversion. If the agent is more risk-averse, the equilibrium compensation scheme specifies a lower incentive intensity and higher base wage. The expression also indicates that the efficient bonus rate decreases with \( n \).

That is, a larger society of members decreases the efficient bonus rate. The increasing ability of a larger membership to bear risks further widens the gap between the risk aversion of the CEO and that of the members.

Proposition 1. The managerial incentive intensity decreases with the number of members.

Next we relax the assumption of member homogeneity and keep the size of the membership fixed. Hansmann (1996) stresses the importance of a homogenous membership for the efficiency of decision-making. However, cooperative members often differ in various dimensions, like age, location, size, investment portfolio, amount of capital investment attitude towards risk, and being an active or retired member. The result is that members will have different preferences regarding the decisions made by the cooperative. For example, good performance for the inactive or over-invested member is associated with the amount of returned equity, but good performance for the under-invested or new member means the competitiveness of current prices or services (Cock 1994).

The investor and owner roles of members entail that they share the same goal of bringing the downstream stage of production to value in order to receive dividends. That is, they value the CEO's action \( a_{C(q)} \) in the same way. As independent farmers, each of them derives individual benefits from the cooperative and its services and therefore may value the CEO's action \( a_{C(q)} \) in different ways. Suppose a cooperative members differ regarding risk aversion and valuation of \( a_{C(q)} \). The individual benefit of member \( q \) is

\[
\gamma_{C(q)} = \frac{1}{n} \eta_{C(q)} + \frac{1}{n} \eta_{C(q)} + \varepsilon_{q}
\]

where \( \eta_{C(q)} \) denotes the value member \( q \) assigns to \( a_{C(q)} \). Consequently the total benefits of the society of members is

\[
\sum_{n} \eta_{C(q)} = \frac{1}{n} \eta_{C(q)} + \frac{1}{n} \eta_{C(q)} + \varepsilon_{q}
\]

where \( \gamma_{C(q)} = \sum_{n} \gamma_{C(q)} \). Now the joint risk aversion of the members becomes

\[
\frac{1}{n} = \sum_{n} \frac{1}{R_{i}}, \quad \text{where } R_{i} \text{ denotes the risk aversion of member } q.
\]

The efficient bonus rate becomes

\[
\frac{1}{n} = \frac{\gamma_{C(q)}}{\frac{1}{n} \eta_{C(q)} + \frac{1}{n} \eta_{C(q)} + \varepsilon_{q}}
\]

It can be shown that if the sum of all members' risk aversions is fixed, \( R_{i} \), and subsequently the efficient bonus rate, takes highest possible value when members have identical risk aversions. In other words, the heterogeneity of members' risk aversions leads to lower joint risk aversion and consequently a lower efficient bonus rate.

Proposition 2. The heterogeneity in the members' risk aversions decreases the incentive intensity of a cooperative CEO.

This proposition provides an explanation for the phenomenon that, compared with investors of an IOF, members of a cooperative usually are more homogeneous with regard to their social backgrounds, investment portfolios, attitudes towards risk, and so on. This finding suggests that the negative relationship between member heterogeneity and the strength of CEO incentives might be one of the considerations regarding the evolution of membership heterogeneity in the course of time. The membership may be quite heterogeneous at the founding stage of a cooperative, but the development of cooperatives is geared towards attracting more homogeneous members and encouraging heterogeneous members to leave in subsequent stages. This reduces the impact of member heterogeneity on the managerial incentive intensity.

4 Conclusion

Cooperatives have been, and are, formed by many small producers to build countervailing power (Galbraith 1952) in order to mitigate the adverse effects of a few powerful buyers as well as to exploit power on their own. The growth of
membership, however, brings also challenges to the development of cooperatives. How to reduce the heterogeneity of cooperative membership has drawn considerable attention from cooperative researchers. This can be justified for a number of reasons, for example, to decreases the costs of voice and collective decision making (Hanneman 1996), and to facilitate the pooling arrangement in cooperatives. By presenting a model that highlights the principal-agent tension between members and the cooperative CEO, we formulate results regarding the sensitivity of the optimal incentive intensity to the membership size and composition. We have shown that the managerial incentive in a cooperative decreases as the cooperative membership grows larger and more diverse.

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Uncertainties and Governance Structure in Incentives Provision for Product Quality

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Abstract This paper compares the product quality provision of cooperatives and investor-owned firms (IOFs) by highlighting the impacts of uncertainties in agricultural production and marketing, and farmers' risk aversion. In a principal-agent model, we show that the linear contract can shift the risk of market uncertainty from farmers to processors, and pooling can share the risk of production uncertainty among cooperative members. Complete pooling places the cooperative at a disadvantage relative to the IOF in a quality-differentiated market due to the loss of free-riding dominating the gain of risk-sharing. Product quality of cooperatives decreases when the membership size increases. Cooperatives can overcome this disadvantage by partial pooling. Product quality of cooperatives will be equivalent to that of IOFs when an optimal income rights structure with partial pooling is adopted.

Keywords Cooperative • Investor owned firm • Pooling • Quality

1 Introduction

In the organizational economics literature, cooperatives are commonly considered as less efficient in terms of delivering high-quality products to the market. Stötter and Sexton (2009, p. 1224) list a number of disadvantages of cooperatives in the provision of product quality, including: (i) revenue pooling, which in quality-differentiated markets is generally regarded as disadvantageous due to the potential for adverse selection; (ii) patronage-based financing, which leads to the horizon problem and underinvestment in long-term strategies that can enhance objective or perceived product quality; (iii) providing a "home" for member production, which is

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