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

Li Feng and George Hendrikse

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 considers 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).

L. Feng (✉)
Department of Economics, Swedish University of Agricultural Sciences, PO Box 7013, 750 07 Uppsala, Sweden
e-mail: li.feng@slu.se

G. Hendrikse
Rotterdam School of Management, Erasmus University, PO Box 1738, Office T08-56, 3000, Rotterdam, The Netherlands
e-mail: ghendrikse@rsm.nl

T. Ehrmann et al. (eds.), *Network Governance*, Contributions to Management Science,
DOI 10.1007/978-3-7908-2867-2_10,

We compare these two governance structures from the perspective of managerial incentive provision. The members-CEO relationship in cooperatives is similar to the investors-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 of the similarities, the issue of incentive provision in cooperatives is more complex than a standard principal-agent relationship (Feng and Hendrikse 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 (Trechter et al. 1997). Trechter 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).

Trechter 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). Hueth 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 management 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: a_{1i} denoting the action to advance the downstream value, and a_{2i} denoting the action adding value to the upstream producers. The CEO's total contribution to firm value is denoted by y_i. The marginal product of action a_{ji} is f_{ji}. The production function is $y_i = f_{1i}a_{1i} + f_{2i}a_{2i} + \varepsilon$, where ε 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 y_i can be enforced in court. An alternative performance measure p_i becomes therefore necessary. Suppose the technology of performance measurement is $p_i = g_{1i}a_{1i} + g_{2i}a_{2i} + \phi$, where g_{ji} denotes the performance measurement parameter, i.e. the weight attached to a_{ji}, and ϕ denotes the noise in performance measurement with expected value of 0.

The compensation contract in governance structure i specifies the wage w_i paid to the CEO as a linear function of p_i, i.e. $w_i = s_i + b_i p_i$, where s_i stands for the salary and b_i for the bonus rate. The CEO's payoff is the difference between the wage and the cost of actions: $U_i = w_i - c_i(a_{1i}, a_{2i})$. We assume that the cost function takes the form $c_i(a_{1i}, a_{2i}) = \frac{a_{1i}^2}{2} + \frac{a_{2i}^2}{2}$. The principal receives the difference between the CEO's total contribution to firm value and the CEO's wage: $\pi_i = y_i - w_i$. Notice that with this specification, the CEO's incentives are to produce a high value of p_i, not of y_i, whereas the principal does not directly benefit from increased realizations of measured performance p_i, rather, he/she benefits from increased realizations of the CEO's total contribution y_i. As a result, the incentives may be distorted. To minimize the distortion the principal wants to minimize the divergence between p_i and y_i.

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. $\max_{a_{1i},a_{2i}} E(U_i)$, where $E(U_i) = E[w_i - c_i(a_{1i}, a_{2i})] = s_i + b_i(g_{1i}a_{1i} + g_{2i}a_{2i}) - c_i(a_{1i}, a_{2i})$. The first

[1] We assume the actions taken by the CEO only have consequences for the principal, which excludes the possibility for tunneling and the CEO directly benefiting from acting against the interests of the principal.

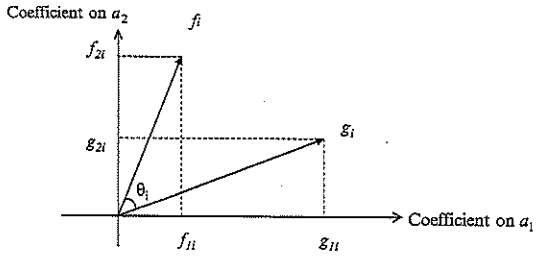

Fig. 1 The scale and alignment effect of the performance measure

order condition $b_i g_{ji} = \frac{\partial c_i}{\partial a_{ji}}$, $j = 1,2$, characterizes the CEO's equilibrium actions $a^*_{ji}(b_i) = b_i g_{ji}$. 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 $\max_{b_i} E(\pi_i + U_i)$, where $E(\pi_i + U_i) = E[y_i - c_i(a_{1i}, a_{2i})] = f_{1i}a^*_{1i} + f_{2i}a^*_{2i} - c_i(a^*_{1i}, a^*_{2i})$ results in the efficient bonus rate $b^*_i = \frac{f_{1i}g_{1i}+f_{2i}g_{2i}}{g^2_{1i}+g^2_{2i}} = \frac{\sqrt{f^2_{1i}+f^2_{2i}}}{\sqrt{g^2_{1i}+g^2_{2i}}} \cos(\theta_i)$, where θ_i is the angle between the vectors $f_i \equiv (f_{1i}, f_{2i})$ and $g_i \equiv (g_{1i}, g_{2i})$ as depicted in Fig. 1.

There are two important features in the expression of efficient bonus rate, scale and alignment. More specifically, $\frac{\sqrt{f^2_{1i}+f^2_{2i}}}{\sqrt{g^2_{1i}+g^2_{2i}}}$ reflects the relative scale of f_i and g_i. A high $\frac{\sqrt{f^2_{1i}+f^2_{2i}}}{\sqrt{g^2_{1i}+g^2_{2i}}}$ 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 (θ_i) captures the alignment effect. To the extent that the performance measure induces CEO's actions less aligned with firm value, θ 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. $f_{1C}>0, f_{2C}>0$. Investors of an IOF processor care only about value added to the downstream stage, i.e. $f_{1F}>0, f_{2F} = 0$. 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. $g_{1F}>0$, $g_{2F} = 0$. This instrument is lacking in cooperatives and we

Table 1 Marginal product and performance measure parameters

	F	C
f_{1i}	>0	>0
f_{2i}	0	>0
g_{1i}	>0	0
g_{2i}	0	>0

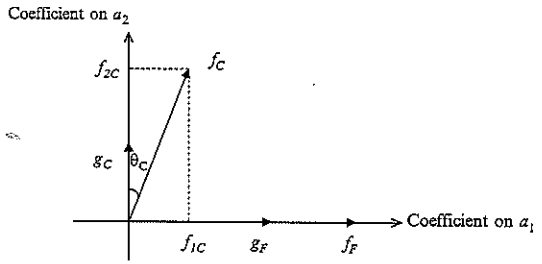

Fig. 2 Scale and alignment differences between a cooperative and an IOF

capture this by $g_{1C} = 0$.[2] 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 $g_{2C}>0$. To wrap up, members' plurality of interests is represented by $f_{2C}>0$, while the absence of patron-members, and therefore serving their interests, in an IOF is represented by $g_{2F} = 0$. The absence of public listing of a cooperative is embodied by $g_{1C} = 0$, while the use of the stock price in an IOF's performance measure is captured by $g_{1F}>0$. 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 $b^*_F = f_{1F}/g_{1F}, b^*_C = f_{2C}/g_{2C}$. Subsequently, the CEO's equilibrium actions are determined $a^*_{1F} = f_{1F}$, $a^*_{2F} = 0$ and $a^*_{1C} = 0$, $a^*_{2C} = f_{2C}$. 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_{1F} because the investors care only about a_{1F} and make the CEO's pay dependent only on a_{1F}. Members of cooperatives, however, appreciate the CEO's actions on both dimensions but are able to compensate only for a_{2C}. Thus, only an incentive to increase a_{2C} is created and no incentive for a_{1C} 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' 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 are 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 (Staatz 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 are $y_{C(q)} = \frac{1}{n}f_{1C}a_{1C} + \frac{1}{n}f_{2C}a_{2C} + \varepsilon$ and $\sum_n y_{C(q)} = f_{1C}a_{1C} + f_{2C}a_{2C} + n\varepsilon$, respectively. Assuming that errors are independent and all members will agree on a single way of evaluating the CEO, the performance measure remains $p_C = g_{1C}a_{1C} + g_{2C}a_{2C} + \phi$. Let r denote the CEO's risk aversion, R the risk aversion of each member, R_0 the risk aversion of the group of members, v' the variance of ε, and v the variance of ϕ. When members act collusively and pool risks, $\frac{1}{R_0} = \sum_n \frac{1}{R} = \frac{n}{R}$, i.e. the existence of multiple members decreases members' risk aversion. The efficient bonus rate is now $b_C{}^* = \frac{f_{2C}g_{2C}}{g_{2C}^2 + v(r - R/n)}$, which is smaller than f_{2C}/g_{2C} given that r > R. 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 homogeneous 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 (Cook 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_{1C} 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_{2C} in different ways. Suppose n cooperative members differ regarding risk aversion and valuation of a_{2C}. The individual benefit of member q is $y_{C(q)} = \frac{1}{n}f_{1C}a_{1C} + \frac{1}{n}f_{2C(q)}a_{2C} + \varepsilon_{(q)}$, where $f_{2C(q)}$ denotes the value member q assigns to a_{2C}. Consequently the total benefits of the society of members is $\sum_n y_{C(q)} = f_{1C}a_{1C} + f_{2C}a_{2C} + \sum_n \varepsilon_{(q)}$, where $f_{2C} = \sum_q f_{2C(q)}$. Now the joint risk aversion of the members R_0 becomes $\frac{1}{R_0} = \sum_n \frac{1}{R_{(q)}}$, where R_q denotes the risk aversion of member q. The efficient bonus rate becomes $b_C{}^* = \frac{f_{2C}g_{2C}}{g_{2C}^2 + v(r - R_0)}$. It can be shown that if the sum of all members' risk aversions is fixed, R_0, 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 are 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 (Hansmann 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.

References

Baker G (2000) The use of performance measures in incentive contracting. Am Econ Rev 90 (2):415–420
Cook ML (1994) The role of management behavior in agricultural cooperatives. J Agric Cooperatives 9:42–58
Cook ML (1995) The future of U.S. agricultural cooperatives: a neo-institutional approach. Am J Agric Econ 77:1153–1159
Feng L, Hendrikse GWJ (2012) Chain interdependencies, measurement problems, and efficient governance structure: cooperatives versus publicly listed firms. Eur Rev Agric Econ 39 (2):241–255
Fulton M (1988) Cooperative Organizations in Western Canada. Occasional Paper 88.03. Center for the Study of Cooperatives, University of Saskatchewan, Saskatchewan
Fulton M (1995) The future of cooperatives in Canada: a property rights approach. Am J Agric Econ 77(5):1144–1152
Galbraith JK (1952) American capitalism: the concept of countervailing power. Houghton-Mifflin, Boston
Gibbons R (1998) Incentives in organizations. J Econ Perspect 12:115–132
Hansmann H (1996) The ownership of enterprise. The Belknap Press of Harvard University Press, Cambridge
Hueth B, Marcoul P (2008) Incentive pay for CEOs in cooperative firms. Am J Agric Econ 91 (5):1218–1223
Kerr S (1975) On the folly of rewarding for A while hoping for B. Acad Manage J, 18(4):769–83
Staatz JM (1987) The structural characteristics of farmer cooperatives and their behavioral consequences. In: Royer J (ed) Cooperative theory: new approach. ACS Service Report no. 18. USDA, Washington, pp 33–60
Trechter DD, King RP, Cobia DW, Hartell JG (1997) Case studies of executive compensation in agricultural cooperatives. Rev Agric Econ 19(2):492–503
Trifon R (1961) The economics of cooperative ventures: further comments. J Farm Econ 43:215–235

Uncertainties and Governance Structure in Incentives Provision for Product Quality

Wendong Deng and George Hendrikse

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. Saitone 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

W. Deng (✉) • G. Hendrikse
Rotterdam School of Management, Office T8-56, Erasmus University, Burgermeester Oudlaan 50, 3062PA Rotterdam, The Netherlands
e-mail: wdeng@rsm.nl; ghendrikse@rsm.nl

T. Ehrmann et al. (eds.), *Network Governance*, Contributions to Management Science, DOI 10.1007/978-3-7908-2867-2_11,