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The Value of a Norm: Open Membership and the Horizon Problem in Cooperatives

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Abstract

The horizon problem has long been identified as being important to the functioning and behavior of cooperatives. This paper shows that the investment disincentive that a cooperative (both at start-up and ongoing) has vis-à-vis an IOF is less severe than has been typically argued. There are two main findings. The first is that the standard intuitive understanding of the effect of different horizons typically starts from the implicit assumption that cooperative members have the same objective as their IOF counterparts. When this assumption is relaxed it is shown that even when the horizon problem is at its most severe (e.g., during the creation of a cooperative by the original members), the cooperative may – under certain conditions – be more likely to make an investment than a profit-maximizing IOF. The second key finding is that once the cooperative is operating, the horizon problem is mitigated by the open membership policy of cooperatives. However, the open membership policy, which specifically does not assign property rights to specific groups, is not one that is chosen as an equilibrium strategy by the members. Instead, it is a policy that is adopted on the basis of principle. To sustain this policy, the cooperative needs to maintain features such as a strong identity that serve to make deviation from the open membership principle difficult.

Keywords: horizon problem, open membership, institutional norms.

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Introduction

Due to their collective nature, cooperative organizations are often believed to be inefficient relative to their investor-owned firm (IOF) counterparts. One source of this inefficiency is the so-called horizon problem (Furubotn and Pejovich, 1970; Jensen and Meckling, 1979; Vitaliano, 1983; Porter and Scully, 1987, Cook, 1995, Olesen 2007). The horizon problem emerges because the horizon – or lifespan – of many investments exceeds that of the members who make the investment, which, combined with lack of tradable shares, reduces the members' incentive to make such investments.

Rey and Tirole (2007) argue that the horizon problem has two effects on a cooperative relative to an IOF. The first reduces the incentive for the members of an existing cooperative to make the investment required to sustain their organization. The result is that the cooperative may cease to exist even when the IOF finds it profitable to operate. The second effect is to reduce the incentive for the original cooperative members to make the investment to start the cooperative. As a consequence, the cooperative may not be established, even though it would be economical to do so.

The purpose of this paper is to revisit these results and to show that the disincentive that a cooperative (both at start-up and ongoing) has vis-à-vis an IOF is less severe than has been argued. While it is true that, relative to an IOF, the collective nature of the cooperative organization creates conditions where members are less able to capture the benefits created by an investment, it is also true that this collective nature alters the benefits of the investment.

Building on the overlapping generations framework used in Rey and Tirole (2007), we show that the traditional result that the open membership cooperative is less likely to form and to continue its operations once it is formed depends critically on a monopoly IOF being able to perfectly price discriminate and thereby capture all the benefits the cooperative is able to capture. When the IOF is not able to perfectly price discriminate, then conditions exist under which the cooperative may be more willing that the IOF to make the initial investment required to start the cooperative.

Thus, to the extent that a cooperative maximizes the welfare of its members rather than the profit accruing to the enterprise, the benefits created by the investment are greater in the case of the cooperative. If these additional benefits are substantial enough, the overall incentive for cooperative members to invest is greater than that for the IOF – i.e., the more broadly defined objective function can offset the limitations on the members' horizon. As a result, we find that the horizon problem need not emerge in cooperatives. A similar result – albeit for different reasons – is found in Oleson (2007). The

argument that the horizon problem may be less of a problem than typically expected finds empirical support in Fahlbeck (2007).

Building on the examination of the horizon problem, we also analyze the organizational stability of open membership cooperatives. Although these cooperatives face difficulties at the time of formation, they are more likely than IOFs to make the ongoing investments necessary for sustained operation. However, since open membership is not an organizational structure that would be chosen by either the younger or the older generation if they had control (see Oleson (2007) for a similar point), this structure cannot be sustained by economic arguments alone – values and principles also play key roles in the persistence of this organizational form.

The model

Following Rey and Tirole (2007), consider an overlapping generations model in which individuals live for two years. Thus, each time period sees the arrival of a new generation at the beginning of the year and the departure of the previous generation at the end of the year. There are N members in each generation; to simplify the notation, $N = 1$. The individuals receive utility from the consumption of a good x. The demand curve for x is given by $x(p)$ where p is the price paid by the individuals to access the good.

It is assumed that the provision of x in time period t requires an investment I in time period $t - 1$; thus, to supply this good on an ongoing basis, the investment I must be also made on an ongoing basis. With this investment, the good is supplied at a marginal cost of m. The good can be supplied through a number of different organizational forms. The individuals can decide to provide the good themselves via a cooperative. This cooperative can take the form of an open membership cooperative or a closed membership cooperative. Alternatively, a set of outside investors (each of whom also lives for two generations) can provide the good via an investor-owned firm (IOF).

Consider first the provision of the good by a monopoly IOF. Assuming that the investors have a discount factor of $\delta_m = 1/(1 + r_m)$, where r_m is the discount rate, the net profits earned over the lifetime of the investors is $\Pi = 2\delta_m\pi - I$, where π is the per-period profits earned from selling the good to each generation. The IOF makes an investment I in the first of the two periods during which the investors are alive; this investment then generates profits the next year of 2π from the two generations that are living in that period (Rey and Tirole, 2007). The IOF finds it profitable to make the investment if $\Pi > 0$, or alternatively if

$$(1) \qquad \frac{2\pi}{I} > 1 + r_m .$$

Equation (1) indicates that investment occurs if the benefit-cost ratio $2\pi/I$ is greater than the investors' opportunity cost of capital ($1 + r_m$). As expected, the investors are more likely to invest the larger is π, the smaller is I and the smaller is r_m. To ensure that the investment is economically profitable from a social planning perspective, assume that equation (1) holds for a social discount rate r_s. Thus, the investors will always make the investment if their discount rate is less than or equal to the social discount rate.

Now suppose that the consumers of x form an open membership cooperative – or, as Rey and Tirole (2007) describe it, a nondiscriminatory cooperative – to supply the good. Let S_f be the additional economic surplus (i.e., consumer surplus plus profits) that the members earn from the formation of the cooperative. If the members price the good at marginal cost and provide the investment cost I through a yearly membership fee, then $S_f = \delta_c s - I - \delta_c I / 2$, where s is the yearly consumer surplus obtained by each generation of consumers and δ_c is the consumers' discount rate.

The logic behind the determination of S_f is as follows. Like the IOF, the original cooperative members make an investment I in the first period. This investment generates a benefit s in the second period. It is also assumed that the original members make an additional investment of $I/2$ in the second period (the investment cost is shared with the new generation that appears in the second period) – the desirability of making this second investment is examined below. The consumers form a cooperative (i.e., make the initial investment) if $S_f > 0$ – i.e., if

$$(2) \qquad \frac{2s}{I} > 3 + 2r_c .$$

Equation (2) shows the impact of the horizon problem. The horizon of the original members is limited because they only see the benefits of the investment that accrue to them in the second period of their life cycle – they do not see the benefits that will accrue to the next generation of members. In addition, the open membership policy, and the corresponding non-discriminatory behaviour it entails, means that the original members have to invest twice – one in the first period where they have to invest the entire I on their own, and again in the second period when they share in the cost of I with

the second generation. As a consequence, the original members will only invest if the benefit-cost ratio $2s/I$ is greater than $3 + 2r_c$, a value that is substantially above their opportunity cost of capital $(1 + r_c)$. In effect, the horizon problem has the impact of raising the required rate of return, which, with everything else the same, lowers the likelihood of the investment being made. Equation (2) also shows that the cooperative is more likely to make the initial investment the larger is s, the smaller is I and the smaller is r_c.

It is important to note that the benefit-cost ratio for the IOF and the cooperative are not the same. For the IOF, the benefits come in the form of profits, π, while for the cooperative, the benefits come in the form of consumer surplus, s. If these two benefit measures are the same – i.e., $\pi = s$ – then it is clear from a comparison of equations (1) and (2) that the IOF is more likely to form than the cooperative (see Rey and Tirole (2007) for this result).

The condition $\pi = s$ holds when the IOF is able to perfectly price discriminate and extract the entire consumer surplus available. Since the informational and structural requirements that are necessary to achieve this result cannot be met in practice (in addition to highly detailed knowledge of each consumer, perfect price discrimination requires that the IOF is able to limit sales between consumers), it is necessary to consider the outcome when $s > \pi$. As will be shown formally in the next section, explicit consideration of the two benefit measures indicates that there are conditions under which the cooperative is more likely than the IOF to invest.

It should be noted that the analysis above does not explicitly consider the redemption of member investment at the time that members leave the cooperative, a practice that is often followed in cooperatives. The addition of this dimension requires modeling a situation where investment in one period generates benefits for a number of periods (rather than the single period assumed here). Expanding the model in this way alters the analysis of both the cooperative and the IOF, and is left as a subject for future research.

Equation (2) applies to the case where the cooperative is being formed. Once the cooperative is up and running, the cost-benefit analysis is different. With an open membership/nondiscriminatory policy in place, both generations of members pay the same price $I/2$ to access the cooperative. Moreover, with an access price of $I/2$, both generations find it economically desirable to join the cooperative.

Although the older generation of members – i.e., those who have already made an investment the period before – would prefer not to pay for access to the cooperative, they will nevertheless do so if this is the rule that is in place. Paying the membership fee in order to have access to the good is profitable, since, by assumption, $s - I/2 > 0$. The assumption that $s - I/2 > 0$ follows from

the fact that $s \geq \pi$ and that $\pi > I/2$ from equation (1). Similarly, while the new generation would like to free ride off the investment of the older generation (i.e., pay no access fee and thus gain the surplus s at no cost), they too are prepared to pay an access fee of $I/2$, since $s - I/2 > 0$.

Given that both generations are willing to pay the access fee of $I/2$, the members of each generation can share the investment cost with the members of the other generation living at the time. As a result, the economic surplus associated with joining the cooperative and making an investment in its ongoing operations, S_o, is given by $S_o = (1 + \delta_c)(s - I/2)$. Members find it economically advantageous to make the ongoing investment if $S_o > 0$, or if

$$\text{(3)} \qquad \frac{2s}{I} > 1 .$$

By assumption, equation (3) is always satisfied. It is also, of course, less restrictive than equation (2) (and, for that matter, equation (1)). Thus, if the members find it economical to establish the cooperative they will find it economical to maintain the cooperative.

Results and analysis

The model in the previous section established the rules that different organizations use to make investment decisions. The purpose of this section is to analyze these different rules and to determine their implications. Of particular interest will be a comparison between the investment decisions made by IOFs and by cooperatives.

The simple world outlined in Rey and Tirole (2007) serves as the starting point for this analysis. The consumers in the Rey and Tirole (2007) model have a unit demand curve – consumers receive a benefit θ from the consumption of one unit of the good. Rey and Tirole (2007) also assume that the marginal cost of producing the good is zero, and that the discount rates for the IOF and the cooperative are the same (i.e., $r_m = r_c = r_s$). Since the monopoly IOF sets its access price equal to θ – i.e., $p_m = \theta$ – to maximize profits, it follows that $\pi = \theta$. For the cooperative, $s = \theta$, since the good is priced at marginal cost. The result is that $\pi = s = \theta$. Put another way, the Rey and Tirole framework assumes that the IOF is able to perfectly price discriminate. As a result, the benefit-cost ratio is the same for both the IOF and the cooperative, and the inequality in equation (2) is always stricter than the inequality in equation (1).

Thus, with perfect price discrimination, an open membership cooperative is less likely to be started than an IOF, all else being equal. This result is a direct consequence of the horizon problem. As was noted in the previous section, the horizon problem effectively raises the cost of capital for the cooperative, even though the underlying discount rates are the same (recall that $r_m = r_c = r_s$). The impact of this higher effective cost of capital is that there may exist a range of discount rates that result in the IOF being created and the cooperative not being created.

The results described above only hold if the benefit-cost ratios are the same for both the IOF and the cooperative (i.e., $s = \pi$). If the consumers have a downward sloping demand curve for x and if the IOF is not able to perfectly price discriminate, then the IOF's profits are not equal to the consumer surplus earned by the members. Indeed, given a downward sloping demand curve, $s > \pi$. One implication of this relationship is that the inequality in equation (2) may not always be stricter than the inequality in equation (1). Indeed, as will be shown, there are conditions under which an open membership cooperative is more likely to be formed than an IOF.

To see this more formally, assume the individuals in each generation have a demand $x = ap^{-\eta}$ for good/service x, where p is the price of the good, a is a demand shifter, and η is the elasticity of demand. Assuming that the IOF cannot price discriminate, the IOF provides the good at a monopoly price p_m, where

$$(4) \qquad p_m = \underset{p}{\operatorname{argmax}} \{px - mx\} = \frac{\eta}{\eta - 1} m$$

The yearly profits, π, are thus

$$(5) \qquad \pi = px - mx = \frac{a}{\eta - 1} \frac{1}{m^{\eta - 1}} \left(\frac{\eta - 1}{\eta} \right)^{\eta}$$

Note that $\pi'(\eta) < 0$ – i.e., profits decline as demand becomes more elastic.

Assuming that the cooperative maximizes the economic surplus available by pricing the good in each period at marginal cost m, the cooperative's price, p_c, is given by

$$(6) \qquad p_c = m\,.$$

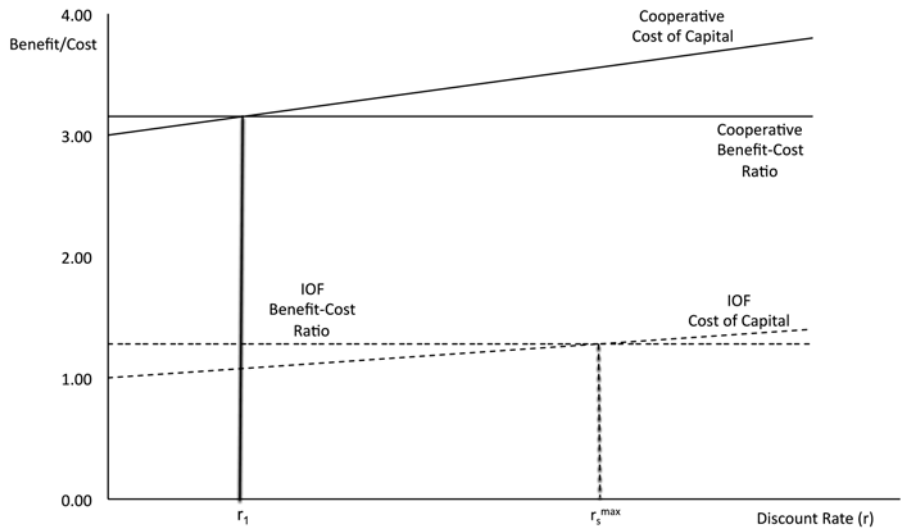
If the individuals have access to an alternative good at price p_a, the yearly consumer surplus s obtained by each generation of consumers from purchasing x rather than the alternative is given by

$$(7) \qquad s = \int_m^{p_a} ap^{-\eta}\mathrm{d}p = \frac{a}{\eta - 1}\left[\frac{1}{m^{\eta-1}} - \frac{1}{p_a^{\eta-1}}\right]$$

Note that $s'(\eta) < 0$ – i.e., consumer surplus declines as demand becomes more elastic. It is also useful to note that $|s'(\eta)| > |\pi'(\eta)|$; thus, in anticipation of a result that is required below, a decrease in η has a larger positive impact on s than on π.

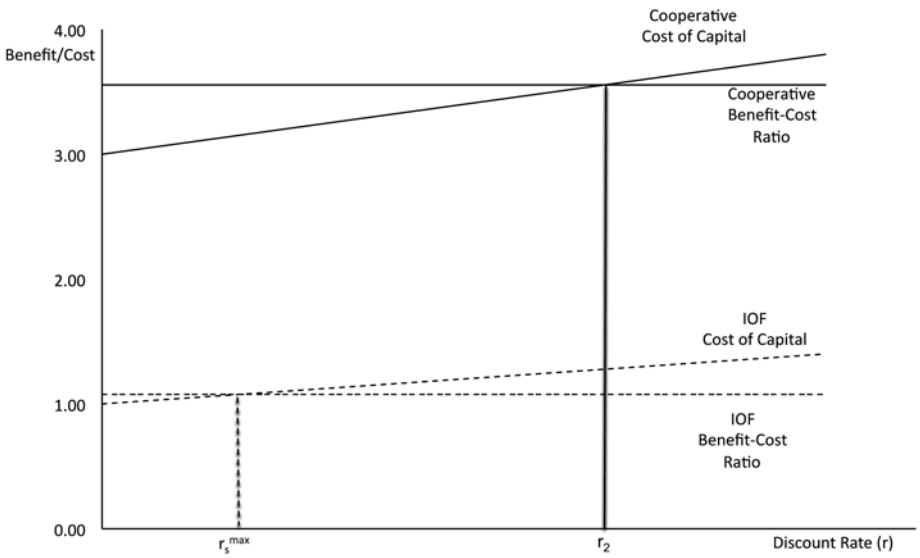
The expressions for π and s allow for an examination of the conditions under which cooperatives and IOFs are likely to form. Figure 1 graphs the relationships in equations (1) and (2) for the case where the horizon problem exists. The upward sloping lines represent the effective cost of capital for the cooperative and the IOF for different discount rates r. Note that the effective cost of capital for the cooperative is always greater than that of the IOF. The horizontal lines represent the benefit-cost ratios for the cooperative and the IOF, with the cost-benefit ratio for the cooperative lying above that of the IOF.

Figure 1: Illustration of the horizon problem in cooperatives



Consider the case where $r_m = r_c = r_s$. As illustrated in Figure 1, if the social discount rate r_s is less than r_1, then both the cooperative and the IOF will make the initial investment and good x will be supplied. If r_s is greater than r_s^{max}, then neither the cooperative nor the IOF will make the investment; this case is rule out by assumption, since it is assumed that the investment is always profitable at r_s. If $r_1 < r_s < r_s^{max}$, then the IOF will undertake the investment and the cooperative will not. This situation illustrates the horizon problem.

Figure 2: Illustration of the case in which the horizon problem does not exist



The situation illustrated in Figure 1 need not be the only one that prevails. Consider, for example, the situation illustrated in Figure 2. In this situation, the IOF will make the investment if $r_s < r_s^{max}$, which by assumption always holds. Since the cooperative will make the investment if $r_s < r_2$, the cooperative will also make the investment at discount rates less than r_s^{max}. Thus, the horizon problem does not emerge.

What are the conditions under which the horizon problem does not emerge? Comparing Figures 1 and 2, it can be seen that the situation in Figure 2 emerges if the cooperative's benefit-cost line could be shifted up sufficiently

relative to that of the IOF – i.e., if the gap between the lines can be increased. One way of shifting up both lines is to lower the demand elasticity, η. Recall that since a unit change in the demand elasticity has a larger impact on the cooperative's benefit-cost line than on the IOF's, lower demand elasticities result in an increased gap between the lines.

Another way of shifting up the benefit-cost line for the cooperative relative to that of the IOF is to increase the alternative price, p_a, since an increase in p_a increases the gain in consumer surplus that the cooperative members experience and has no impact on π. Finally, a third way of increasing the gap between the two lines is to reduce the size of I. Since I enters into benefit-cost ratios via the denominator, a unit decrease in I results in a greater shift in the cooperative's benefit-cost line. Thus, the horizon problem is less likely to occur when the demand for x is relatively inelastic, when the price of the alternative good is relatively high and when the investment cost is relatively low.

These conclusions can be formalized in the following result.

> **Result 1**. *The horizon problem is less likely to occur when individuals in the economy have no realistic alternatives to the provision of good* x, *when the demand for good* x *is relatively inelastic and when the cost of investment is relatively low.*

The proof of this result is straightforward. We want to show that the cooperative finds it beneficial to invest at the discount rate r_s^{max} that just allows the IOF to break even on its investment. Thus, $r_s^{max} = 2\pi/I - 1$. Substituting this expression into equation (2) and requiring that the investment be beneficial to the cooperative at this discount rate gives:

$$\frac{2s}{I} > 1 + 4\frac{\pi}{I} \tag{8}$$

Substituting the expressions for π and s from equations (5) and (7), and simplifying, gives

$$\frac{1}{\eta-1}\frac{1}{m^{\eta-1}}\left[1-2\left(\frac{\eta-1}{\eta}\right)^{\eta}\right]-\frac{1}{\eta-1}\frac{1}{p_a^{\eta-1}} > \frac{I}{2} \tag{9}$$

As outlined in Result 1, this expression is more likely to hold the larger is p_a. Indeed, in the limiting case where p_a goes to infinity (i.e., there is no alternative available), the second term on the left-hand side of the expression vanishes. The remaining term on the left-hand side is decreasing in η, so the overall expression is more likely to be positive when η is small. The expression is also more likely to hold the smaller is the investment cost I.

The conditions under which cooperative ownership is relatively more beneficial than investor ownership match those that are known to exist when cooperatives have been formed. For instance, the formation of grain cooperatives in Canada and the United States, rural electric and telephone cooperatives in the United States, and credit unions in numerous regions around the world (e.g., Quebec, Germany) all took place to provide goods and services that had relatively inelastic demands and for which, at the time, there were few if any alternatives. For instance, the initial cost of forming credit unions was often very low – in part because credit unions were often run out of existing cooperative enterprises. While in some cases the investment cost was large (as was the case for grain elevators), higher costs can still lead to cooperative formation if the demand elasticity is sufficiently small or the price of the alternative is sufficiently high – conditions that characterize the grain industry at the time. In some cases – such as the rural electric and telephone cooperatives – the government subsidized the investment cost.

The analysis above is carried out under the assumption that both the consumers of x and the investors have the same discount rate, and that this rate is equal to the social rate. Such an assumption is unlikely to hold. For instance, investors may wish a significantly higher rate of return than is required by society. Once reason is risk – as individual investors they may be sensitive to risk that is not a factor for society as a whole. Another is imperfect competition – if the next best option for investors is an investment in an industry that generates excess profits, then the discount rate will be higher. In a similar manner, consumers may have a different rate of return than society. If the consumers are relatively poor and are struggling to make ends meet, they may have a very high discount rate.

The impact of differing discount rates can be examined using Figures 1 and 2. In Figure 1, the IOF would not undertake the investment if $r_m > r_s^{max}$ (it is assumed that $r_s < r_s^{max}$). However, the cooperative would undertake the investment if $r_c < r_1$. While such a situation – e.g., $r_c < r_1 < r_s < r_s^{max} < r_m$ – would occur, for instance, if the IOF had a very large discount rate because of imperfect competition, while the cooperative members had a relatively low discount rate, this is unlikely to be the case most relevant for cooperative formation.

The case that corresponds to situations of cooperative formation is more likely to be the one illustrated in Figure 2. In this situation, the IOF will not carry out the investment if $r_m > r_s^{max}$ (note that it is assumed that $r_s < r_s^{max}$). The cooperative, however, will carry out the investment, even if its discount rate is at or above that of the IOF. As Result 1 indicates, the situation in Figure 2 is more likely to emerge when the price of the alternative good is high, when the demand for good x is relatively inelastic and when the cost of investment is relatively low. The following result can be stated.

> **Result 2**. *Socially desirable investments that are not made by an IOF may be carried out by an open membership cooperative. This situation is likely to occur when individuals in the economy have no realistic alternatives to the provision of good* x, *when the demand for good* x *is relatively inelastic and when the cost of investment is relatively low.*

The idea that cooperatives may be formed in situations where private investors do not find it profitable to do so is one that has been remarked upon often in the cooperative literature. For instance, Hetherington concludes that, "Proprietary firms tend to be more aggressive, innovative, and flexible competitors, while mutuals, particularly cooperatives, continue to serve markets at rates of return at which proprietary firms would withdraw from business" (Hetherington, 1991, p. 247). Rural electric and telephone cooperatives were often formed because the monopoly utilities did not want to expand their service beyond urban areas. Similarly, credit unions and caisse populaires were often formed because financial institutions had pulled out of rural areas.

The value of a norm – organizational stability of open membership cooperatives

The analysis above is predicated on the assumption that the cooperative operates with an open membership policy. The purpose of this section is to show that open membership does not emerge as a policy that would be agreed to by all the members (e.g., both the old and the new generations) if they were motivated solely by a desire for greater economic benefit. Instead, the source of an open membership policy has to be a value or principle to which the cooperative members have agreed to adhere. The analysis in this section shares some similarity with Oleson (2007) who, in an examination of a cooperative

with young and old members, examines the incentive that each group has to invest.

To show that open membership would not be agreed to by all members, consider first the original members of the cooperative – the ones that make the initial investment to get the cooperative started. Having made the investment in the initial period (call this period zero), the first generation of members do not want to make an additional investment in the subsequent period (period one). Indeed, if the first generation had control of the cooperative, it would introduce a policy that has the second generation paying them. If there were no restrictions on the amount that the first generation could charge, it would demand a payment that would be equivalent to what an IOF would charge. In effect, the first generation members would form a closed cooperative. As Rey and Tirole (2007) show, the pricing of such a cooperative would be the same as that of an IOF. Once a closed membership cooperative is formed, each subsequent generation can be expected to behave in the same way as the first generation, since to do otherwise would result in an economic loss. The outcome would be a series of closed membership cooperatives.

Now consider the problem from the perspective of the second-generation members. (i.e., those that enter in the first period). If they were able to gain control of the cooperative and to choose the membership structure, they would charge the first generation members the monopoly price, thereby extracting as much surplus from them as possible. In doing so, the second generation has effectively created a closed membership cooperative.

This structure will be maintained over time, since control can be passed to the older generation of members in each time period by having them effectively purchase the cooperative in the previous period. This ownership, in turn, gives them the ability to determine membership during the second period of their life cycle, at which time they will chose the closed membership structure because it maximizes the returns that they receive.

As can be seen from the discussion above, the open membership cooperative does not emerge as the solution chosen by any of the membership generations. However, as the analysis in the previous section shows, while the open membership cooperative may have difficulty in getting started under some conditions, it has an advantage once it is up and running in terms of its ability to maintain its operations. This membership policy also generates a significant surplus for all generations, unlike the IOF or the closed membership cooperative where the benefits go to either the initial investors or the initial members.

Specifically, the open membership structure has an economic value to future generations, a value that can only be realized if the structure is

maintained. However, since the open membership policy is not chosen if members make their ownership decisions on the basis of self-interest, open membership can only be maintained if the members choose to abide by it as a matter of principle. Deviating from this principle – e.g., through demutualization or the selling of investment shares – makes the generation that does so better off, albeit at the expense of future generations.

Thus, the situation is not that of the Prisoners' Dilemma where deviation by both parties makes them both ultimately worse off. As a consequence, the usual techniques used to solve the Prisoners' Dilemma – e.g., Tit-for-Tat strategies, provision of private goods – are not available in this situation. Given this game theoretic structure, why would any generation agree to abide by the open membership policy? Since the answer cannot be self-interest, the reason has to be found elsewhere.

The implication of the above is that successful open membership cooperatives have to be governed at some level by a set of values or principles that then result in certain types of behavior. Indeed, open membership is one of the so-called cooperative principles. The open membership principle can also be thought of as a norm or an institution, in this case one that applies only to cooperatives that have chosen this as the code of conduct to which they will adhere. As Douglass North argues, "Institutions are the humanly devised constraints that structure human interaction. They are made up of formal constraints (rules, laws, constitutions), informal constraints (norms of behavior, conventions, and self imposed codes of conduct), and their enforcement characteristics" (North, 2010, section II).

While the open membership concept is challenged from time to time (a good example is found in the so-called New Generation Cooperatives that formed in the upper mid-west of the United States in the 1990s (Harris, Stefanson, and Fulton 1996); the selling of shares by cooperatives such as the Saskatchewan Wheat Pool is another example (Fulton and Larson 2009)), it has been fairly robust as a principle. Since each generation would find it advantageous to deviate from these values or principles, there must be a reason why these values have been retained.

One of the reasons why norms and institutions are difficult to change is that they involve belief structures or cognitive models. As North points out, "Mental models are the internal representations that individual cognitive systems create to interpret the environment; institutions are the external (to the mind) mechanisms individuals create to structure and order the environment" (North, 2010, section IV). In the case of open membership, the interpretative system is one where members are willing to share the costs of forward investments because they are the beneficiaries of similar sharing by previous

generations. Mental models are slow to change because of path dependence and positive feedback effects that derive from sunk costs, adaptive expectations, network effects, and the emergence of complementary institutions (Arthur, 1989, North, 2010, Pierson, 2004).

An important complementary institution is that of common property. At the most basic level, the idea of common property contrasts with individual property – the right to exclude (which is embodied in individual property) versus the right not to exclude (Fulton, 1995). As a result, cooperatives based on well-defined individual property rights can be expected to be ones where the opportunity exists for one group of members (e.g., the original members, or a group of members at some point in time) to set the terms of access so that they themselves benefit. As discussed above, given such an opportunity, neither the younger nor the older generation will choose the open membership structure.

Thus, open membership in a cooperative is maintained in part because of the absence of well-defined individual property rights. While the absence of well-defined property rights can, under some conditions, deter the formation of cooperatives, it does ensure that the cooperative is able to effectively generate benefits for many generations of members. The legal enforceability of common property, of course, is derived from a set of values held by the population that support it as a right (Fulton, 1995). If these values change, so too can the property rights.

Norms and institutions are also supported because the cognitive cost of breaking them can be significant. For instance, if cooperative members take on a cooperative identity when they join a cooperative and the cooperative identity indicates that members should abide by the open membership principle, then as Akerlof and Kranton (2005) point out, breaking the identity can be very costly.

The principle of open membership is very important in addressing the horizon problem. As was shown earlier, the adoption of an open membership cooperative provides the ongoing cooperative with what is in effect a longer time horizon than that of the IOF (recall that equation (3) is much less restrictive than equation (1). The cooperative does this by sharing both the costs and the benefits across two periods; in contrast, the IOF concentrates all the costs in the first period and all the benefits in the second period.

Since the open membership principle or norm is successful in maintaining the cooperative and in generating benefits for the members, it can be expected to persist, since there is no need to change an interpretative system that generates benefits. This positive feedback mechanism provides one of the reasons why this principle has remained in existence for a significant period of time.

Concluding remarks

The horizon problem has long been identified as an issue that is important to the functioning and behaviour of cooperatives. Most of the discussion of the problem, however, has been informal, with use being made of intuitive arguments – e.g., if the older members have control of the cooperative they will underinvest in long-term projects.

The purpose of this paper was to examine more formally the horizon problem. The paper has two key findings. The first is that the standard intuitive understanding of the effect of different horizons typically starts from the implicit assumption that cooperative members have the same objective as their IOF counterparts. When this assumption is relaxed (or, alternatively, the assumption of perfect price discrimination is relaxed), it is shown that even when the horizon problem is at its most severe (e.g., during the creation of a cooperative by the original members), the cooperative may – under certain conditions (e.g., highly inelastic demand, lack of alternatives) – be more likely to make an investment than a profit-maximizing IOF.

The reason for this different result is that the cooperative members have a different objective function than investors – in addition to the profit that can be earned, they also value the consumer surplus that can be generated by the cooperative. This different objective function provides sufficient additional incentive to invest that, even with a shorter horizon, the cooperative may choose to make investments similar to the ones made by organizations (e.g., IOFs) that it has been suggested do not suffer from the horizon problem.

The second key finding is that once the cooperative is operating, the horizon problem is mitigated by the open membership policy of cooperatives. However, the open membership policy, which specifically does not assign property rights to specific groups, is not a policy that is chosen as an equilibrium strategy by the members. Instead, it is a policy that is adopted on the basis of principle. To sustain this policy, the cooperative needs to maintain features such as a strong identity that serve to make deviation from the open membership principle difficult.

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