

Are Cooperatives Efficient When Membership Is Voluntary?

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If profit-maximizing farmers are free to join or not to join a cooperative, it may appear reasonable to assume that a cooperative will exist only when it has cost advantages over non-cooperative marketing. This paper presents a model in which that result fails. Every individual farmer chooses either to join or not join a cooperative depending on whether transactions costs are lower from cooperative membership or nonmembership. As cooperative membership increases, transactions costs for members decline, but for nonmembers these costs increase. Results of this analysis reveal that an equilibrium exists in which all farmers voluntarily choose to join the cooperative, but more than half of the members wish the cooperative had not been formed, and transactions costs in the aggregate are higher with the cooperative than without it.

Key words: cooperatives, transactions costs

Introduction

This study draws upon two important elements of the literature on agricultural cooperatives: (a) cooperatives are formed by the individual decisions of farmers to join or not join (e.g., see Karantininis and Zago, 2001; Sexton, 1986); and (b) net farm returns may be different for cooperatives and investor-owned marketing firms because of differences in transactions costs between the two institutional arrangements, and therefore one reason farmers form cooperatives is to reduce transactions costs (Cook, 1994; Sykuta and Cook, 2001). If farmers base their decisions to join a cooperative solely on net returns, one is tempted to conclude that cooperatives will thrive only when they have a transactions cost advantage over investor-owned firms. Using a recent model set forth by Dixit (2003), this study explores a situation in which this conclusion is incorrect, i.e., transactions costs are higher in the cooperative, but farmers voluntarily join the cooperative.

The notion that the institutional arrangements of agricultural production and marketing evolve in such a way as to minimize production, marketing, and transactions costs arises from the insights of Coase (1937) and Williamson (1985). Moreover, it is perfectly reasonable to ask: If there are no barriers to protect these arrangements from competition, how could an institutional arrangement that was inefficient (or less efficient than some alternative arrangement) develop and survive?

Dixit (2003) provides a possible answer to this question by developing a model of club formation “with entrapment.” In the current paper, the Dixit model is applied

to cooperatives in order to draw the following conclusions: (a) individual farmers may join a cooperative even though their transactions costs would be lower if no cooperative were formed, and (b) cooperatives may form even when the aggregate transactions costs of farmers are higher with the cooperative than without it.

The logic behind these results is this: As more farmers in an area join the cooperative, the cooperative becomes more efficient, and the per farmer costs of marketing through the cooperative decline; at the same time, as more farmers in an area join the cooperative, it becomes more difficult for nonmembers to find buyers. When this occurs, there can be an equilibrium in which all farmers join the cooperative even though most of the farmers prefer there were no cooperative.

In order to focus on transactions costs, this analysis deliberately assumes a simple production process with fixed cost and fixed output. Therefore, the farm-level production is independent of the choice of institutional arrangements for marketing. Here we assume the institutional arrangements for marketing arise endogenously as a result of the choices made by individual farmers. Each farmer faces the decision about whether to join a cooperative and market her output through the cooperative, or to sell independently to a private, investor-owned firm.

Reasons for Joining a Cooperative

The farmer's decision about whether to join a cooperative is assumed to be made solely on the basis of economic considerations. Specifically, does the farmer expect to make more money from joining or from not joining the cooperative? Before proceeding, however, we note that early agricultural economics literature on cooperatives put a substantial emphasis on non-economic motivations for membership. In his early work on cooperative marketing, Nourse (1922) wrote of the need for a spirit of cooperation among farmers, stating they should not rely solely on monetary incentives for their cohesiveness. Tobriner (1924, p. 369) recognized both economic motivation ("the farmer joins the association ... in order to get more money"), and non-economic motivation ("or he joins because he is afraid to brave the social ostracism of the farmers who do become members"), but saved his greatest approbation for a spiritual motivation—the "need for cooperation."

Economic motivations for cooperative membership fall into three categories:

- When marketing costs are lower with a cooperative,
- When cooperative marketing reduces marketing risk and uncertainty faced by risk-averse farmers, and
- When selling prices are higher with a cooperative.

In the model below, an economic motivation is treated as a difference in transactions costs. Superficially, this is a rather limited conception of what influences farmer choice, and appears to correspond to only the first of the three categories above. However, the concept of transactions costs is broader than just marketing costs, and all three economic motivations can be subsumed within a broad interpretation of the transactions costs variable in our model.

Transactions costs can be defined broadly as costs incurred as a result of a transaction, such as a sale or purchase of a good or service. Transactions costs include direct marketing costs (handling, transportation, storage, grading), but also include costs associated with information imperfections in a transaction—searching for a buyer or seller, negotiating and enforcing contracts, and costs associated with risk sharing between buyer and seller (Karantininis and Zago, 2001).¹

The reduction in expected utility as a result of increased risk or uncertainty about market security has exactly the same impact as an increase in marketing costs. In the context of cooperatives, and in order to reflect the third item on the above list of economic motivations, it is helpful to include as a sort of “negative” transaction cost the effectiveness in bargaining a higher price through exercise of market power. In the following section, T is used to refer to transactions costs. In light of the above discussion of the economic reasons for cooperative membership, it may be useful to note that T is the sum of three components: $T = MC + RP - PP$, where MC represents the ordinary marketing costs, RP is the risk premium (or dollar value) associated with marketing risk and uncertainty, and PP is the price premium negotiated by a cooperative with market power.

The model below examines the situation in which transactions costs are different for a farmer who joins a cooperative and an otherwise identical farmer who does not join. Cooperatives may have marketing cost advantages over investor-owned marketing firms for a variety of reasons. Farmers may share information more readily with cooperatives, thereby reducing informational asymmetries. If a higher degree of trust exists between cooperative management and members, cooperatives may benefit from lower contract enforcement costs and lower costs of contract negotiation. Peer monitoring may be less costly than other forms of monitoring. [See Sykuta and Cook (2001) for a fuller discussion of transactions costs advantages of cooperatives.] Cooperative members may pay lower “risk premia” (lost expected utility resulting from marketing risk and uncertainty) if the cooperative provides a more secure market for the farmer members. Cooperatives may also generate marketing power that increases the price paid for farm commodities by a processor. As noted above, in the context of this model, the impact of a higher price paid to the cooperative is indistinguishable from the impact of a lower operating cost for the cooperative.

Basic Assumptions

Consider a population of N farmers. Each farmer has a fixed output to sell and has incurred a fixed production cost.² The farmers can form a cooperative and market their output jointly, or each farmer can individually market output. Each farmer must decide whether to join the cooperative or not. The activity of marketing farm output entails transactions costs. The cooperative undertakes some of the marketing activities for the farmer members, and therefore alters the transactions costs of the farmer. Consequently,

¹ It may be useful to expand the definition of transactions costs to include costs associated with avoiding certain transactions by vertically integrating to perform more activities within a single firm (Sexton, 1986).

² The foundations of “transactions costs literature” (Williamson, 1985; Coase, 1937) are based on the notion that firms will wish to minimize the sum of transactions and production costs. The assumption that production costs are fixed allows us to focus only on the minimization of transactions costs.

there are two possible transactions cost functions for a farmer: $T_c(i, m)$ is the transactions cost of farmer i if she joins the cooperative (subscript c denotes cooperative membership) and if the cooperative has m members; $T_n(i, m)$ is the transactions cost of farmer i if she does not join the cooperative (subscript n denotes nonmembership) and if the cooperative has m members.

- ASSUMPTION 1. Farmers are heterogeneous in their transactions costs for individual marketing [see Karantininis and Zago (2001) for a further discussion of farmer heterogeneity]. Farmers are ordered whereby farmer 1 has the highest transactions cost, farmer 2 has the next highest, and so on. Thus, $T_n(1, m) > T_n(2, m) > \dots > T_n(N, m)$. Why do farmers differ in their transactions costs when they market as individuals? Low-transaction-cost farmers may live close to a concentration of buyers, or have internet access, or have an educational or experience advantage.
- ASSUMPTION 2. All cooperative members are treated the same, i.e., $T_c(i, m) = T_c(j, m) = T_c(m)$ for all i and j who choose to join the cooperative. This is a fundamental tenet of cooperative organization.
- ASSUMPTION 3. As cooperative membership increases, transactions costs for members decline, or $T_c(m) > T_c(m + 1)$, for all m . There are two possible explanations for this. A cooperative may have economies of size in marketing. For example, a cooperative manager can make a series of telephone calls and market the output of 10 farmers, or can make the same telephone calls and market the output of 25 farmers; the transaction cost per farmer declines as the number of farmers increases.³ A second explanation has to do with market power. The cooperative's ability to command a higher price from buyers may increase as the cooperative's membership increases. Note: This requires a view of transactions costs that is expansive enough to include (as a negative component) the success in searching for or bargaining for the highest possible price.
- ASSUMPTION 4. As cooperative membership increases, transactions costs for nonmembers increase, or $T_n(i, m) < T_n(i, m + 1)$ for all i and m . This assumption reflects a competition in marketing between the cooperative and the independent farmer. As the cooperative grows in membership, the costs to the independent (nonmember) farmer of finding a buyer and negotiating the highest possible price increase.⁴
- ASSUMPTION 5. For ease of exposition and solution, transactions costs are linear:

$$(1) \quad T_c = a - b(m - 1),$$

and

$$(2) \quad T_n = c + d(m - 1) - ei.$$

³ In a model of monopolistic competition, where the existence and functions of firms is endogenous, all firms will operate at a point where average costs are declining. See Leathers (2005) for an example of a model where market development is endogenous.

⁴ A reviewer points out that as cooperative membership increases (and if the cooperative has sufficient market power to increase price), revenues to both cooperative members and nonmembers may increase. In order for assumption 4 to hold, the (negative) marginal impact on nonmember marketing costs must exceed the (possibly positive) impact on nonmember revenues. Recall, however, that the assumptions here demonstrate conditions under which cooperatives *may* form when the cooperatives are not the most efficient kind of organization.

A Cooperative All Farmers Join

The above assumptions create a situation in which the formation of a cooperative has a cascade effect. As the cooperative grows in size, its average costs decline (i.e., its market power increases and it more fully exploits size economies), and the costs of remaining outside the cooperative increase (i.e., it becomes harder and harder for the independent farmer to find a buyer). Under some circumstances, this cascade effect will sweep all farmers into membership in the cooperative. Two additional assumptions create a situation in which all farmers join the cooperative.

- ASSUMPTION 6A. The farmer with the highest independent transaction cost (farmer 1) gets higher returns as a result of formation of the cooperative, expressed mathematically as $T_c(m = 1) < T_n(i = 1, m = 1)$, or $c > a + e$. (Recall, farmers have been sorted so that the lower the index number i , the higher the transaction cost for independent marketing.) Therefore, this assumption states that at least one farmer wants to join a cooperative, even if she is the only member. The notion of a “one-farmer” cooperative is admittedly artificial.
- ASSUMPTION 6B. For any individual, the increase in $T_n - T_c$ caused by adding one more member exceeds the difference in non-cooperative transactions costs between farmer $i + 1$ and farmer i . Mathematically, this means $b + d > e$.

Later in the paper, assumptions 6A and 6B will be relaxed or modified, without changing the fundamental character of the model. Assumptions 6A and 6B are sufficient to ensure that the equilibrium will have all farmers joining the cooperative. A farmer’s decision about whether to join the cooperative is based on whether her revenue, net of transactions costs,⁵ is higher as a member or as a nonmember. Farmer i will join if:

$$R - T_c(i, m) \geq R - T_n(i, m),$$

where m is the equilibrium number of cooperative members.

There are two pivotal steps in showing the equilibrium. First, assumptions 3 and 4 are sufficient to ensure that:

$$(3) \quad \begin{aligned} &\text{if } R - T_c(i, m) \geq R - T_n(i, m) \text{ for } m, \\ &\text{then } R - T_c(i, m^*) \geq R - T_n(i, m^*) \quad \forall m^* > m; \end{aligned}$$

and second, assumptions 6A and 6B are sufficient to ensure that:

$$(4) \quad \begin{aligned} &R - T_c(i, i) \geq R - T_n(i, i), \\ &\text{since } T_n(i, i) - T_c(i, i) = c + d(i - 1) - ei - a + b(i - 1) \\ &= (c - a - e) + (b + d - e)(i - 1) > 0. \end{aligned}$$

The first term in parentheses is positive by assumption 6A, and the second term in parentheses is positive by assumption 6B.

⁵ And net of production costs, as explained in footnote 2.

The “everyone joins” equilibrium is an equilibrium because joining is the dominant strategy⁶ for all farmers. For farmer 1, joining is dominant since, by (4),

$$R - T_c(1, 1) \geq R - T_n(1, 1),$$

and by (3),

$$R - T_c(1, m) \geq R - T_n(1, m), \text{ for any } m > 1.$$

Therefore, for farmer $i = 1$, joining is a dominant strategy. Farmer 2 makes the decision with the knowledge that farmer 1 will join regardless of what other farmers choose (i.e., farmer 2 knows her decision will not affect farmer 1’s decision, because farmer 1’s choice is a dominant strategy). Joining is the dominant strategy for farmer 2 also, since, by (4),

$$R - T_c(2, 2) \geq R - T_n(2, 2),$$

and by (3),

$$R - T_c(2, m) \geq R - T_n(2, m), \text{ for any } m > 2.$$

Likewise, for all farmers $1, \dots, N$, joining is the dominant strategy. In equilibrium, all N farmers have joined the cooperative, and farmer i ’s revenue net of transactions costs is denoted by:

$$(5) \quad R - T_c(i, N) = R - a + b(N - 1).$$

Even Though Everyone Joins, Some Cooperative Members May Be Unhappy

One surprising aspect of this equilibrium is that some farmers who voluntarily join the cooperative would be better off if the cooperative had never been formed. If the cooperative were never started, farmer i ’s transactions costs are calculated as $T_n(i, m = 0)$, and thus revenues net of transactions costs are:

$$(6) \quad R - c + d + ei.$$

A farmer is better off with no cooperative if (6) exceeds (5), or if

$$(7) \quad i \geq \frac{c - d - a + b(N - 1)}{e} = i^*.$$

For some values of the parameters, i^* exceeds N , in which case *all* the cooperative members are happier with the cooperative than without it.

Nevertheless, the possibility exists that some (but not all) of the cooperative members are actually made worse off by the formation of the cooperative. If there are some farmers of this type (if $i^* < N$), then the proportion of dissatisfied farmers is expressed as:

$$\omega = \frac{N - i^*}{N} = 1 - \frac{c - d - a + b(N - 1)}{Ne},$$

which gets larger as c and b get smaller, or as a , d , and e get larger.

⁶ A dominant strategy is one that is the best choice regardless of what other players choose (see Dixit and Skeath, 1999, p. 83).

Cropp's (1994) survey of cooperative members found there is a substantial degree of dissatisfaction among cooperative members. However, the dissatisfaction described in this paper (comparing the actual cooperative to the theoretical position if no cooperative had ever been formed) is unlikely to be the same as the dissatisfaction registered in Cropp's survey. The surveyed farmers complained about poor or unreliable service by the cooperative, or about the cooperative's method of allocating profits to farmer-members. By focusing on the simplest kind of marketing cooperative, our model side-steps a number of issues regarding asymmetric information and ownership rights, such as those discussed by Menard and Klein (2004) or Hendrikse and Bijman (2002).

Even Though the Cooperative Is Formed, Aggregate Transactions Costs May Be Higher with the Cooperative than Without It

What is more, there is no guarantee that the cooperative provides a net benefit to its members in the aggregate. Using (5) and (6), the aggregate revenue net of transactions costs with the cooperative exceeds the aggregate revenue without the cooperative if:

$$(8) \quad N[R - a + b(N - 1)] > N(R - c + d) + e \sum_{i=1}^N i = N(R - c + d) + e \frac{N(N + 1)}{2},$$

or if $-a + b(N - 1) > -c + d + e \frac{(N + 1)}{2}$.

If less than half of the farmers are dissatisfied with the cooperative (i.e., if $\omega < \frac{1}{2}$), then this inequality (8) will hold:

$$\omega = \frac{N - i^*}{N} = 1 - \frac{c - d - a + b(N - 1)}{Ne} < \frac{1}{2},$$

$$\frac{c - d - a + b(N - 1)}{Ne} > \frac{1}{2},$$

$$c - d - a + b(N - 1) > \frac{1}{2}Ne \approx \frac{1}{2}(N + 1)e.$$

However, if more than half of the farmers are dissatisfied with the cooperative, then the possibility exists for inequality (8) to be reversed—i.e., the formation of the cooperative has a drain on aggregate net income of farmers. The interesting implication of the above is that cooperatives may exist in situations in which aggregate transactions costs are not minimized by the cooperative's existence. Thus, under these assumptions, Sexton's (1986, p. 214) commonsense conclusion—"a stable coalition structure must provide benefits at least as great as those attainable under any alternative group configuration"—may not hold. The following two sections show how this result can be retained while relaxing assumptions 6A and 6B.

A Cooperative Some Farmers Join and Some Do Not Join

It is easy to find situations in which one or more farmers in an area fail to join a local cooperative. Relaxing assumption 6B yields a model where some farmers do not join the cooperative in equilibrium.

- ASSUMPTION 6B'. $\frac{-(c-a-e)}{i^{**}} > b+d-e > \frac{-(c-a-e)}{i^{**}-1}$ for some $i^{**} \in (1, N)$.

Here we maintain assumption 6A, so $(c-a-e) > 0$. Assumption 6B', which allows $(b+d-e)$ to be negative, but not too negative, is a relaxation of assumption 6B which requires $(b+d-e) > 0$. Assumption 6B' implies that for farmers with a relatively strong propensity to join the cooperative (farmers indexed $i \leq i^{**}$), $T_n(i, i) - T_c(i, i) > 0$; and for other farmers, $T_n(i, i) - T_c(i, i) < 0$. An equilibrium exists in which i^{**} farmers join the cooperative and $N - i^{**}$ remain as independent marketers.

The possibility raised in the previous section continues to exist here. Some farmers who join the cooperative may actually be better off without the cooperative. Those farmers cannot reestablish the "before the cooperative" position by dropping out of the cooperative: the costs of independent marketing are increased by the existence of the cooperative, whether or not the specific individual farmer chooses to join or not. And obviously, the farmers who refuse cooperative membership are hurt by the formation of the cooperative, since their costs of independent marketing increase.

Preemptive Commitment to Join or Not Join

Another possibility is that the cooperative can thrive if those who gain the most from cooperative membership are able to stake out a preemptive commitment to join no matter what others do. In this case, assumption 6A ($a+e-c < 0$) can be replaced with a different set of assumptions 6A':

- ASSUMPTION 6A'. Relaxing 6A ($c-a-e > 0$), we now let $c-a-e < 0$, but require that $c-a-e > e-b > d-b$. Thus, assumption 6A' implies $a-b-c+2e < 0$, and $d-e < 0$. Here, the assumption of $c-a-e < 0$ means that person 1 will not want to form a one-person cooperative.

However, if the cooperative formation game is viewed not as a simultaneous choice game described above, but as one in which farmers move sequentially, with farmer 1 acting first, followed by farmer 2, etc., we see that this weaker condition is sufficient to create the cascade into universal membership. To observe this, consider farmer N 's decision and work backward. If all $N-1$ farmers acting before farmer N have committed to join the cooperative, then farmer N will join if $T_c(i=N, m=N) - T_n(i=N, m=N-1) < 0$:

$$(9) \quad T_c(i=N, m=N) - T_n(i=N, m=N-1) = a - b(N-1) - c - d(N-2) + eN \\ = (a - b - c + 2e) - (b + d - e)(N-2) = \Delta_N < 0.$$

The first expression in parentheses is negative by assumption 6A', and the second expression in parentheses is positive by assumption 6B.

Next consider farmer $N - 1$'s decision, given that all $N - 2$ farmers acting before have committed to join the cooperative. If farmer $N - 1$ joins, she knows farmer N will also join, so transactions costs will be $T_c(i = N - 1, m = N)$. If farmer $N - 1$ fails to join, transactions costs will be at a minimum $T_n(i = N - 1, m = N - 2)$. Farmer $N - 1$ will join the cooperative if $T_c(i = N - 1, m = N) - T_n(i = N - 1, m = N - 2) < 0$:

$$\begin{aligned}
 (10) \quad T_c(i = N - 1, m = N) - T_n(i = N - 1, m = N - 2) \\
 &= a - b(N - 1) - c - d(N - 3) + e(N - 1) \\
 &= (a - b - c + 2e) - (b + d - e)(N - 2) + (d - e) = \Delta_N + (d - e) < 0.
 \end{aligned}$$

Equation (10) uses the $d - e < 0$ part of assumption 6A'. Generally, for person $N - n$, the difference is $\Delta_N + n(d - e) < 0$.

Therefore, person 1, knowing that all other farmers will join the cooperative if she takes the lead in forming one, will form a cooperative, even though this individual would not want to join a cooperative in which she was the only member.

Implications and Concluding Comments

A common rule in economics is that freedom of action leads to efficiency of result. In the literature on agricultural marketing cooperatives, this rule has been explored from two directions. The implications of freedom of action in establishing and joining a cooperative have been examined by Karantininis and Zago (2001), and Sexton (1986). The notion that institutional arrangements such as cooperatives will emerge to deal with information problems in an efficient way has been investigated by Sykuta and Cook (2001). In light of this general economics rule, and especially in light of the "new institutional economics," it seems logical to expect that, with voluntary membership, cooperatives will arise if and only if they can contribute to aggregate economic efficiency, by reducing the aggregate transactions plus production costs of farmers.

This paper sounds a cautionary note regarding this apparently logical conclusion. Even with freedom of choice (i.e., farmers are free to join or not join the cooperative), and even when each farmer makes this decision to maximize her own wealth, a cooperative can emerge and dominate even when cooperative marketing is *less* efficient in the aggregate. Specifically, in a situation where increased cooperative membership simultaneously reduces average costs to members and increases transactions costs of nonmembers, the possibility exists for farmers to be swept along into cooperative membership even when a majority of farmers (and farmers in the aggregate) would have lower costs if the cooperative did not exist.

The principal difference between the model adopted in this paper and those used in other analyses in the cooperative literature is that here we explicitly consider the effects on other farmers of one farmer's decision to join the cooperative. Our model demonstrates that taking this interaction into account can radically change the conclusion about whether freely formed cooperatives are efficient. This study therefore has implications for both strands of the cooperatives literature. Explorations of the impacts

of voluntary cooperative membership and discussions of the existence of cooperatives as efficient institutional arrangements should consider whether interactions among the decisions of farmer members are relevant to those studies.

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References

- Coase, R. "The Nature of the Firm." *Economica* 4(1937):386–405.
- Cook, M. L. "The Future of U.S. Agricultural Cooperatives: A Neo-Institutional Approach." *Amer. J. Agr. Econ.* 77(1994):1153–1159.
- Cropp, R. "Farmers Opinions of Agricultural Cooperatives." *Working Together: Newsletter of the Wisconsin Center for Cooperatives* 2,3(1994). Online. Available at <http://www.wisc.edu/uwcc/ici/orgs/uwcc/news/dec94/farmer.html>.
- Dixit, A. "Clubs with Entrapment." *Amer. Econ. Rev.* 93(2003):1824–1829.
- Dixit, A., and S. Skeath. *Games of Strategy*. New York: W. W. Norton, 1999.
- Hendrikse, G. W. J., and J. Bijman. "Ownership Structure in Agrifood Chains: The Marketing Cooperative." *Amer. J. Agr. Econ.* 84(2002):104–119.
- Karantininis, K., and A. Zago. "Endogenous Membership in Mixed Duopsonies." *Amer. J. Agr. Econ.* 83(2001):1266–1272.
- Leathers, H. D. "Transactions Costs and the Endogenous Emergence of Markets." Dept. of Agr. and Resour. Econ., University of Maryland, College Park, 2005.
- Menard, C., and P. Klein. "Organizational Issues in the Agrifood Sector: Toward a Comparative Approach." *Amer. J. Agr. Econ.* 86(2004):750–755.
- Nourse, E. G. "Outline for Cooperative Marketing." *J. Farm Econ.* 4,2(1922):80–91.
- Sexton, R. "The Formation of Cooperatives: A Game Theoretic Approach with Implications for Cooperative Decision Making and Stability." *Amer. J. Agr. Econ.* 68(1986):214–225.
- Sykuta, M. E., and M. L. Cook. "A New Institutional Economics Approach to Contracts and Cooperatives." *Amer. J. Agr. Econ.* 83(2001):1273–1279.
- Tobriner, M. O. "How Shall Cooperatives Be Organized?" *J. Farm Econ.* 6,4(1924):367–377.
- Williamson, O. *The Economic Institutions of Capitalism*. New York: Free Press, 1985.