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ARTICLES

Agricultural Marketing Cooperatives, Allocative Efficiency, and Corporate Taxation

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The criterion for allocative efficiency is derived for a market system consisting of producers, a processor, and consumers and compared to the solution conditions for cooperative and profit-maximizing processors. A cooperative that maximizes total member returns will restrict output to less than the social optimum unless it is a price taker in the processed product market. A cooperative that processes whatever quantity of raw product members choose to deliver will overproduce relative to the social optimum unless marginal and average processing costs are equal. An income tax can be used to move a cooperative that restricts output toward the social optimum.

The primary purpose of this paper is to describe the conditions under which an agricultural marketing cooperative can be expected to market or process the quantity of product consistent with a social optimum, i.e., the quantity that corresponds to the maximization of total economic welfare as measured by the sum of producer and consumer surpluses. Although derivation of these conditions is fairly straightforward, they have not been rigorously specified or discussed in the existing literature. Consequently, the literature contains confusing and sometimes contradictory statements about the expected behavior of cooperatives and their effects on imperfect markets.

In this paper, the criterion for allocative efficiency is derived for a market system consisting of farm-level producers of a raw product, a processor that converts the raw product into a processed product, and consumers of the processed product. This criterion is then compared to the solution conditions for a profit-maximizing processor, a cooperative processor that maximizes the total returns to its member-producers, and a cooperative that processes whatever quantity of raw product its members choose to deliver. From

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these comparisons, clarifications can be made about both the conditions under which a cooperative can be expected to operate at the social optimum and the effects of cooperatives on imperfect markets. Although this analysis focuses exclusively on a cooperative that processes and markets a product produced by its members, the results can easily be extended to farm supply cooperatives.

This paper also examines the effects of corporate income taxation on the behavior of cooperatives. One author has concluded that the imposition of an income tax on a cooperative would lead the cooperative away from the social optimum and result in a misallocation of resources. Although the results presented in this paper are not inconsistent with that conclusion, they are more general, and they suggest that an income tax could be used to move cooperative output closer to the social optimum under some circumstances, a conclusion that has important implications for optimal cooperative tax policy.

Marketing Cooperatives and Allocative Efficiency

Taylor (1971) presented a model of a marketing cooperative in which the cooperative maximizes the total returns to its members.[1] According to Taylor, "Although the cooperative is operating in an imperfectly competitive market, it utilizes the socially optimum amount of input—that level of input which equates the price of the factor with its marginal revenue product" (p. 18). Taylor's conclusion about the social optimum was extended by LeVay (1983), who compared the behavior of a cooperative that maximizes total member returns to one that accepts whatever quantity of raw product its members choose to deliver. According to LeVay, "Perhaps the most appealing feature of setting output at [the level corresponding to the maximum total returns to members] lies in its conformity with Pareto optimality as the supply price of the input is equal to its derived demand . . ." (p. 107). LeVay concluded that by accepting whatever quantity of raw product members choose to deliver, a cooperative operates beyond the social optimum, selling more of the processed product at lower prices. "The only objection to this position is an allocational one, as the value of the input exceeds its derived demand" (p. 108). In a survey article, Sexton (1984) called the solution corresponding to the maximum total returns to members the "welfare-maximizing" solution and referred to its economic superiority (pp. 427–28).

In a more recent study, Royer and Bhuyan (1995) assumed a downward-sloping demand curve for the processed product in order to analyze the incentive of marketing cooperatives to integrate forward into processing activities due to the elimination of double marginalization.[2] The results from that study appear to contradict the conclusion that maximization of the total returns to members yields the greatest economic welfare. Instead, the total economic welfare associated with a cooperative that accepts whatever quantity of raw product members choose to deliver was greater than that for a cooperative that maximizes total member returns after integration and was greater or at least as great in each of two pre-integration states.

It is unclear whether Taylor or Sexton intended their conclusions about economic welfare to apply generally to both those cases where the cooperative is a price taker in the processed product market and those where it faces a downward-sloping demand curve.[3,4] However, LeVay argued that a cooperative that maximizes total member returns would be more effective than other cooperatives in encouraging its competitors to move toward the social optimum in an oligopolistic industry, where it presumably would face a downward-sloping demand for its output.

LeVay challenged Helmberger's (1964) conclusions about the socially undesirable consequences of output restriction by cooperatives. According to Helmberger, a cooperative that restricts output (in his case, to maximize the per-unit net return paid members) would result in lower output than a pure monopsony. In contrast, Helmberger concluded that a cooperative that does not restrict output would induce other firms in an imperfectly competitive market to expand their output so that total market output would approach that under perfect competition. LeVay argued that similar logic could be applied to cooperatives that restrict output in order to maximize total member returns and that the salutary effects of cooperatives on an imperfect market would best be achieved by these cooperatives because they do not overproduce relative to the social optimum.

Given the ambiguities and apparent inconsistencies in the literature, it seems that a closer examination of the conditions for cooperative allocative efficiency would be useful. In the following section, models of profit-maximizing and cooperative processors are developed, and their solutions are compared to the criterion for allocative efficiency derived for a market system consisting of farm-level producers, a processor, and consumers.

Producer and Processor Models

Price and output determination for a marketing cooperative is often analyzed using the concept of net revenue product, which is defined as total revenue of the processor less the total costs of processing or marketing the raw product. The net average revenue product (*NARP*), which is illustrated in figure 1, is defined as net revenue product divided by the quantity of product and is equivalent to the price received by the processor less its average processing cost. *NARP* represents the amount per unit that is available for raw product payment and profit. The net marginal revenue product (*NMRP*) is defined as the marginal change in net revenue product and is equivalent to marginal revenue less marginal processing cost. The *NMRP* curve intersects the *NARP* curve at the latter's maximum. Use of the *NARP* and *NMRP* curves is appealing because it allows revenues and costs at the processor level to be combined and facilitates graphical exposition of the relationship between the processor and producers.

Assume that producers seek to maximize their profits:

$$\pi = r \cdot q - f(q) \tag{1}$$

where r is the raw product price paid producers by the processor, q is the quantity of raw product produced and processed, and $f(q)$ is the total cost of producing the raw product.[5] Profit maximization occurs where the marginal cost of producing the raw product equals the raw product price:

$$\frac{d\pi}{dq} = r - f'(q) = 0. \tag{2}$$

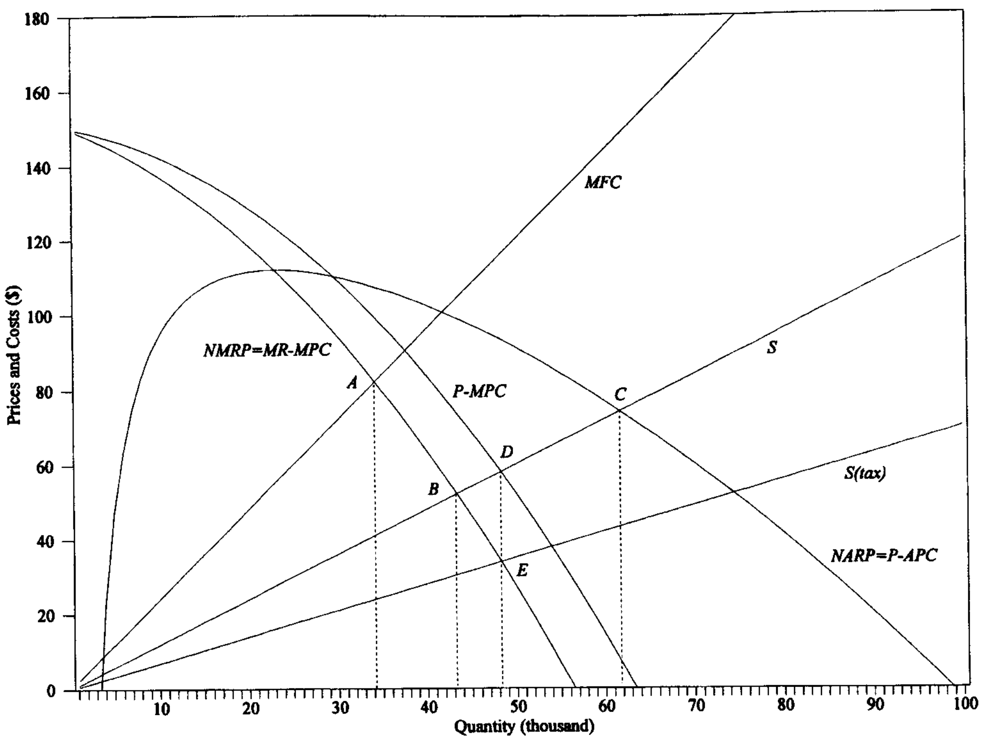
Solving (2) for r yields the inverse raw product supply function $r = f'(q)$.

The profit function of the processor can be written

$$\Pi = p(q) \cdot q - k(q) - r(q) \cdot q \tag{3}$$

where $p(q)$ is the processed product price and $k(q)$ represents total processing costs, exclusive of the cost of the raw product. Here the raw product price is written as $r(q)$ to acknowledge the processor's monopsony power in the raw product market. Substitut-

Figure 1. Alternative Processor Price and Output Solutions



ing the inverse raw product function for $r(q)$ in (3) and differentiating (3) with respect to quantity, the first-order condition for a profit-maximizing processor is

$$\frac{d\Pi}{dq} = [p(q) + q \cdot p'(q)] - k'(q) - [f'(q) + q \cdot f''(q)] = 0. \qquad (4)$$

According to (4), a processor maximizes its profit by setting its marginal revenue in the processed product market equal to the sum of its marginal processing cost and the marginal factor cost of the raw product (*MFC*). The first two of these terms are equivalent to *NMRP*. Thus the output of the profit-maximizing processor is determined by the intersection of the *NMRP* and *MFC* curves, represented by point *A* in figure 1. The price the processor pays producers is read from the raw product supply curve (*S*).

Now consider a cooperative processor that maximizes the total returns to its members, including its own earnings, which are returned to members as patronage refunds. Assume that all producers are members. Then the cooperative's objective function can be written

$$\Pi + \pi = p(q) \cdot q - k(q) - f(q). \qquad (5)$$

The corresponding first-order condition is

$$\frac{d}{dq}(\Pi + \pi) = [p(q) + q \cdot p'(q)] - k'(q) - f'(q) = 0. \qquad (6)$$

From (6), the cooperative maximizes total member returns by setting its marginal revenue in the processed product market equal to the sum of its marginal processing cost and the marginal cost of producing the raw product. Thus the output of the cooperative is determined by the intersection of the *NMRP* curve and the raw product supply curve, represented by point *B*. Once again, the price the processor pays producers is read from the supply curve. The cooperative distributes the difference between *NARP* and the raw product price to members as a per-unit patronage refund.

In the case of a cooperative that processes whatever quantity of raw product producers choose to deliver, the receipt of patronage refunds provides producers an incentive to expand output until the cooperative's *NARP* is equal to the raw product supply price, and the cooperative breaks even, as in the Helmberger and Hoos (1962) model. Producers seek to maximize their profits:

$$\pi = (r + s) \cdot q - f(q) \qquad (7)$$

where s represents the per-unit patronage refund. The first-order condition is

$$\frac{d\pi}{dq} = r + s - f'(q) = 0. \qquad (8)$$

The per-unit patronage refund is equal to the cooperative's earnings divided by the quantity of raw product processed:

$$s = [p(q) \cdot q - k(q) - r(q) \cdot q]/q$$
$$= p(q) - k(q)/q - r(q). \qquad (9)$$

Substituting (9) into (8), we obtain the equilibrium condition:

$$p(q) - k(q)/q - f'(q) = 0. \qquad (10)$$

Equilibrium occurs where the processed product price less the average processing cost equals the marginal cost of producing the raw product. The first two terms are equivalent to *NARP*. Thus the output of a cooperative that processes whatever quantity members choose to deliver is determined by the intersection of the *NARP* and raw product supply curves at point *C*.

Allocative Efficiency

Allocative efficiency refers to the efficient use of resources in the production and consumption of a product. Under allocative efficiency, the value consumers place on the product, as represented by the price they pay, equals the value or opportunity cost of the resources used in producing the last unit of the product, as measured by the marginal cost. It follows that economic welfare cannot be increased by reallocating these resources to other uses. When market power is used to set price greater than marginal cost, there is a misallocation of resources, and economic welfare could be improved by reallocation. Consequently, allocative efficiency is desirable.

To derive the criterion for allocative efficiency for a market system in which producers produce a raw product that is processed by a processor and sold to consumers, we seek to maximize total economic welfare, which consists of consumer surplus in the processed product market:

$$CS = \int_0^{q^*} p(q)\,dq - p^*q^* \tag{11}$$

plus producer surplus at the processor level:

$$PS_p = p^*q^* - \int_0^{q^*} k'(q)\,dq - r^*q^* \tag{12}$$

and producer surplus at the farm level:

$$PS_f = r^*q^* - \int_0^{q^*} f'(q)\,dq \tag{13}$$

where q^* is the quantity solution and p^* and r^* are respectively the processed and raw product price solutions. When these surpluses are summed, the raw and processed product revenues are eliminated. Consequently, total economic welfare can be written

$$W = \int_0^{q^*} [p(q) - k'(q) - f'(q)]dq, \tag{14}$$

and total economic welfare is maximized when

$$\frac{dW}{dq} = p(q) - k'(q) - f'(q) = 0, \tag{15}$$

which is the criterion for allocative efficiency. In other words, the value of the resources used to produce and process the last unit of output, as represented by the sum of the respective marginal costs, is equal to the price paid by consumers.

Notice in figure 1 that the *NARP* and *NMRP* curves by themselves are inadequate for graphing the solution corresponding to allocative efficiency. We must add the *P-MPC* curve, which represents the difference between the consumer price for the processed product and the marginal processing cost, i.e., the first two terms in (15). The welfare-maximizing solution is determined by the intersection of *P-MPC* (*not NMRP*) and the supply curve at point *D*.[6]

The conditions under which a processor will produce the welfare-maximizing level of output can be determined by comparing its first-order or equilibrium condition to (15). It follows that a cooperative that maximizes total member returns will operate at the social optimum only if $p'(q) = 0$, i.e., the cooperative is a price taker in the processed product market. If its processed product demand curve is downward sloping, the cooperative will use its market power to restrict output to a lower level.

On the other hand, a cooperative that processes whatever quantity of raw product members choose to deliver will operate at the welfare-maximizing level only if $k'(q) = k(q)/q$, i.e., its marginal and average processing costs are equal. Otherwise, its output will exceed the welfare-maximizing level, as LeVay concluded. Then the cooperative will violate the criterion for allocative efficiency because the marginal costs of producing and processing the raw product will exceed the price paid by consumers as long as $k'(q) > k(q)/q$. When both $p'(q) < 0$ and $k'(q) > k(q)/q$, as in figure 1, information about the specific demand and cost curves is necessary to determine which type of cooperative would produce the greatest economic welfare.

A profit-maximizing processor will not operate at the welfare-maximizing level if $p'(q) < 0$ or $f''(q) > 0$, i.e., its processed product demand curve is downward sloping or the raw product supply curve is upward sloping. Unless $k'(q) = k(q)/q$, information about the specific demand and cost curves is necessary to compare the levels of economic welfare associated with a profit-maximizing processor and a cooperative that processes whatever quantity members choose to deliver. In contrast, it can be stated unequivocally that the economic welfare associated with a profit-maximizing processor will be less than that associated with a cooperative that maximizes total member returns as long as the raw product supply curve is upward sloping. Unlike cooperative processors, the profit-maximizing processor will exercise monopsony power in the raw product market, resulting in a greater restriction of output than a cooperative that maximizes total member returns.[7]

Both those cooperatives that seek to maximize total member returns and those that process whatever quantity members choose to deliver will operate at the social optimum if $p'(q) = 0$ and $k'(q) = k(q)/q$, i.e., the processed product demand curve is horizontal and processing costs are constant.[8] Under these conditions, the *NARP* curve will be flat instead of ∩-shaped, as it is usually depicted.

In the long run, the failure of a cooperative to operate at the welfare-maximizing level is more likely to be attributable to the maximization of total member returns than processing whatever quantity members choose to deliver. As Helmberger (1964, 613) argued, imperfect competition is more attractive as an explanation for a downward-sloping long-run *NARP* curve than diseconomies of scale because the latter lacks a strong theoretical foundation and is inconsistent with the size of cooperative processors relative to the markets they serve. In addition, empirical evidence indicates constant long-run costs over substantial ranges of output (Scherer and Ross 1990, 22).[9]

Corporate Income Tax

In this section, the welfare effects of imposing a corporate income tax on the earnings of a marketing cooperative are analyzed. Taylor investigated the effects of a corporate income tax on a farm supply cooperative, using a model similar to Enke's (1945) model of a consumer cooperative. Taylor concluded that an income tax would encourage the cooperative to lower the price it charges members in order to avoid tax by distributing more of its returns as nontaxable consumer surplus instead of patronage refunds. As a consequence, the cooperative's output would increase, moving it away from the social optimum and resulting in a misallocation of resources. Taylor argued against taxation of cooperative earnings because of this misallocation and because tax revenues would be less than the loss of cooperative member returns. Although the results presented here for a marketing cooperative are consistent with Taylor's conclusions, they are more general, and they demonstrate that an income tax could be used to move cooperative output closer to the social optimum under some circumstances.

Assume the imposition of a corporate income tax with a single flat rate of t on a marketing cooperative's earnings. If the cooperative restricts producer output in order to maximize total member returns, it will seek to maximize the sum of after-tax cooperative earnings and farm-level profits after imposition of the tax. Its objective function becomes

$$(1 - t)\Pi + \pi = (1 - t)[p(q)\cdot q - k(q) - r(q)\cdot q] + [r(q)\cdot q - f(q)], \tag{16}$$

and its new first-order condition is

$$\frac{d}{dq}[(1-t)\Pi + \pi] = (1-t)[p(q) + q \cdot p'(q) - k'(q) - f'(q)] + t[q \cdot f''(q)] = 0$$

$$= [p(q) + q \cdot p'(q)] - k'(q) - f'(q) + \frac{t}{(1-t)} q \cdot f''(q) = 0, \quad (17)$$

which differs from the before-tax first-order condition in (6) only by the addition of the last term, $[t/(1-t)]q \cdot f''(q)$. This term is positive as long as $f''(q) > 0$, i.e., the marginal cost of producing the raw product is increasing. Consequently, the inclusion of $[t/(1-t)]q \cdot f''(q)$ in (17) is equivalent in effect to shifting either the *NMRP* curve upward or the raw product supply curve downward. The cooperative seeks to avoid tax by increasing the price it pays members for the raw product so earnings at the processing level are shifted to the farm level. Output increases, and the processed product price decreases, consistent with Taylor's results.

Generally speaking, the imposition of an income tax motivates a cooperative that maximizes total member returns to relax its restriction of output. Whether the increase in output due to the tax will result in attainment of the social optimum can be determined by comparing equations (15) and (17). In particular, output after imposition of the tax will be {greater than, equal to, less than} the welfare-maximizing level if

$$|p'(q)| \begin{Bmatrix} < \\ = \\ > \end{Bmatrix} \frac{t}{(1-t)} |f''(q)|. \quad (18)$$

Thus the level of output relative to the social optimum depends on the tax rate and the slopes of the raw product supply and processed product demand curves.

Some additional insight into the relationship in (18) can be gained by focusing on these parameters. Assume for the moment that the tax rate t is 50%. Then output after imposition of the tax will be greater than the welfare-maximizing level if the raw product supply curve is steeper than the processed product demand curve. Now, instead of assuming that t is 50%, assume that the absolute values of the slopes are equal. Then for any tax rate less than 50%, output will be less than the social optimum.

These results suggest that the tax rate can be adjusted to compensate for various relative slopes in the supply and demand curves such that the cooperative will be motivated to operate at the social optimum. Indeed, if the cooperative's raw product supply and processed product demand curves are linear, we can determine the tax rate t^* for which the cooperative will produce the welfare-maximizing quantity by solving the following, derived from (18):

$$t^* = \frac{p'(q)}{p'(q) - f''(q)}. \quad (19)$$

Taylor's conclusions can now be seen as applying to a special case of the cooperative that maximizes total member returns. If the cooperative is a price taker in the processed product market, $p'(q) = 0$, and the cooperative will operate at the social optimum prior to the imposition of an income tax. According to (18), when $p'(q) = 0$, output after imposition of the tax will be greater than the welfare-maximizing level for any tax rate t not equal to zero, a result consistent with Taylor's conclusions. However, here it has been shown that when $p'(q) < 0$, i.e., the processed product demand curve is downward sloping, a cooperative that maximizes total member returns will restrict output to a level below the social optimum. In that case, an income tax could be used to counteract the restriction of output due to market power in the processed product market and to move the cooperative toward the social optimum.

The imposition of a corporate income tax will have a neutral effect on the output of a cooperative that processes whatever quantity of raw product producers choose to deliver. The objective function and first-order condition for the cooperative's members will not change. However, the cooperative's earnings will be reduced proportionately by the tax:

$$(1-t)\Pi = (1-t)[p(q) \cdot q - k(q) - r(q) \cdot q]. \quad (20)$$

Consequently, the cooperative can be expected to shift all its earnings to members by increasing the raw product price in order to avoid tax. Set the cooperative's earnings to zero and solve (20) for the raw product price r:

$$r = p(q) - k(q)/q. \quad (21)$$

Substituting this result into (8) and recognizing that $s = 0$, we obtain an equilibrium condition equivalent to (10). As a result, the after-tax output of the cooperative will be identical to its before-tax output.[10] Again, unless $k'(q) = k(q)/q$, i.e., marginal and average processing costs are equal, the cooperative will overproduce relative to the social optimum.

Simulation

To illustrate a comparison of the price and output solutions for various processors to the social optimum and to demonstrate how a cooperative that maximizes total member returns might respond to the imposition of a corporate income tax, consider the following example. Assume a downward-sloping processed product demand curve and a U-shaped average processing cost curve in order to distinguish the two cooperative solutions from each other and from the welfare-maximizing solution.

Represent total processing costs by the cubic function

$$TPC = \beta_0 + \beta_1 q + \beta_2 q^2 + \beta_3 q^3 \qquad \beta_0, \beta_1, \beta_3 > 0; \quad \beta_2 < 0 \quad (22)$$

where q is expressed in thousands. Represent the processed product demand curve by

$$p = a + bq \qquad a > 0; \quad b \leq 0, \quad (23)$$

and the raw product supply curve (the marginal cost of producing the raw product) by

$$r = e + hq \qquad e \geq 0; \quad h > 0. \quad (24)$$

These functions and the parameters listed at the foot of table 1 are the same as used to create figure 1 and were chosen purely for illustrative purposes.

Table 1 presents various output, price, and welfare data for a profit-maximizing processor, a cooperative processor that maximizes total member returns (restricted output), a cooperative processor that accepts whatever quantity of raw product producers choose to deliver (unrestricted output), and the social optimum before imposition of a corporate income tax. It also shows these data for a cooperative that maximizes total member returns given three different income tax rates.

None of the processors in table 1 operates at the welfare-maximizing level of output before imposition of a tax. The cooperative that restricts output in order to maximize

Table 1. Simulated Output, Price, and Welfare Solutions, Selected Scenarios

	Profit-maximizing processor	Cooperative with restricted output	Social optimum	Cooperative with unrestricted output	Cooperative with restricted output (15% tax)	Cooperative with restricted output (29.4% tax)	Cooperative with restricted output (45% tax)
				(thousand)			
Quantity of output	34.19	43.34	48.26	61.75	45.33	48.26	53.74
				($)			
Processed product price	132.90	128.33	125.87	119.12	127.33	125.87	123.13
Raw product price	41.03	52.01	57.91	74.10[a]	54.40	57.91	64.49
Per-unit patronage refund		46.84	35.25	0.00	35.90	24.88	11.82
				($ thousand)			
Processor profit[b]	2,263.96	2,029.93	1,701.02	0.00	1,627.28	1,200.72	635.34
Producer profits[c]	701.55	1,127.07	1,397.26	2,287.90	1,233.03	1,397.26	1,733.01
Consumer surplus	292.31	469.61	582.19	953.29	513.76	582.19	722.09
Corporate tax					287.17	500.30	519.83
Economic welfare[d]	3,757.82	4,126.61	4,180.47	3,741.19	4,161.24	4,180.47	4,110.27

Parameters: $a = 150$, $b = -0.5$, $e = 0$, $h = 1.2$, $\beta_0 = 500$, $\beta_1 = 0.03$, $\beta_2 = -0.02$, $\beta_3 = 0.01$.
[a]Raw product price arbitrarily set to marginal cost of production.
[b]Exclusive of corporate income tax.
[c]Exclusive of patronage refunds.
[d]Inclusive of corporate income tax and fixed processing costs.

total member returns operates at the level closest to the social optimum. Although that cooperative restricts output, its output is greater than the output of the profit-maximizing processor. Output is greatest for the cooperative that processes whatever quantity of raw product producers choose to deliver. That cooperative overproduces relative to the social optimum. Although producer profits for the cooperative with unrestricted output exceed those corresponding to both the cooperative with restricted output and the welfare-maximizing solution, total member returns are less when patronage refunds are taken into account. The total economic welfare associated with the cooperative with unrestricted output is less than in all other scenarios, including the profit-maximizing processor.

In this case, when $b < 0$ and the cooperative that maximizes total member returns restricts output to less than the welfare-maximizing level, the imposition of a corporate income tax provides the cooperative an incentive to move toward the social optimum. At the optimal tax rate of 29.4%, calculated from equation (19), the cooperative processes the welfare-maximizing level of output, represented by point E in figure 1. Point E is determined by the intersection of the $NMRP$ curve and $S(tax)$, which is drawn by subtracting $[t/(1 - t)]q \cdot f''(q)$, the last term in equation (17), from the raw product supply curve.[11] Any tax rate below the optimal rate, such as the 15% rate shown in table 1, results in underproduction and a corresponding diminution of total economic welfare. Likewise, any tax rate above the optimal rate, such as the 45% rate shown in the table, results in overproduction and a similar loss of welfare.

Conclusions

The criterion for allocative efficiency has been derived for a market system consisting of farm-level producers, a processor, and consumers and has been compared to the solution conditions for cooperative and profit-maximizing processors. The results indicate that a cooperative that maximizes total member returns will operate at the social optimum if it is a price taker in the processed product market. If its processed product demand curve is downward sloping, the cooperative will use its market power to restrict output to a lower level. A cooperative that processes whatever quantity of raw product members choose to deliver will operate at the welfare-maximizing level if its marginal and average processing costs are equal. Otherwise, its output will exceed the social optimum, as LeVay concluded.

However, contrary to LeVay, the analysis presented here suggests that in the long run the failure of a cooperative to operate at the welfare-maximizing level is more likely to be attributable to the maximization of total member returns than processing whatever quantity members choose to deliver. This analysis also supports Taylor's conclusion that the imposition of a corporate income tax on a cooperative's earnings may result in an increase in output as the cooperative shifts earnings from the processing level to the farm level in order to avoid tax. However, it has been shown that Taylor's conclusion that an income tax on a cooperative's earnings will move the cooperative away from the social optimum does not always hold. Indeed, an income tax may provide a cooperative an incentive to move toward the social optimum if it exercises market power in the processed product market.

Notes

1. Taylor's objective function is similar to that of the model of a consumer cooperative developed earlier by Enke (1945). In Enke's model, the cooperative maximizes the net consumer surplus of members, defined as the sum of consumer surplus and the cooperative's earnings. At the margin, the interests of members as patrons (consumer surplus) and their interests as owners of the cooperative (its earnings) are balanced by setting the price of the product equal to its marginal cost. This solution maximizes net consumer surplus and also represents the social optimum.
2. For analyses of the incentives firms may have to integrate vertically in successive monopoly or oligopoly situations, see Waterson (1984, 83–86) and Wu (1992, 81–86 and 96–98), or Royer (1998, 74–87), the latter of which also includes a summary of the Royer and Bhuyan research.
3. Taylor's discussion is especially confusing because of repeated references to imperfect competition and marginal revenue product, the latter of which implies a downward-sloping demand curve in the output market. Only in an endnote does he state, "Competition in the product market is assumed to be perfectly competitive, thus the marginal revenue product equals the value of the marginal product" (p. 23).
4. Sexton indicated that the notation he used to represent a marketing cooperative was based primarily on Helmberger's analysis, which examined both price taking and price setting in the cooperative's output market, but he did not make explicit his own assumptions about the slope of the demand curve facing the cooperative. In a more recent article (Sexton 1990), he assumed the processed product price was fixed but suggested his analysis could readily be extended to incorporate the perception of market power by the cooperative.
5. An aggregate profit function is used in (1) to simplify the mathematical exposition. Alternatively, the raw product inverse supply function below could have been derived by aggregating the first-order conditions determined from individual member profit functions corresponding to (1).
6. The ambiguities concerning marketing cooperatives and the social optimum may be due in part to an exclusive reliance on the *NARP* and *NMRP* curves. Superficially, these curves may appear sufficient for representing the processor's revenues in the determination of prices and output. However, each consists of separate revenue and cost components, which must be considered individually, as shown in equation (15). An overreliance on using the *NARP* and *NMRP* curves to illustrate points relating to the social optimum probably can be attributed to the practice of treating the marketing cooperative model as an analogue of Enke's consumer cooperative model. This practice does not recognize that there is only one market stage, instead of two, in the Enke model. If a second market stage characterized by imperfect competition were introduced in the consumer cooperative model, similar difficulties would arise.
7. This is the opposite of Helmberger's result, which is based on the assumption that the cooperative maximizes the per-unit net return paid members.
8. Such would only be the case for a cooperative that provides marketing services but does not engage in processing activities and owns essentially no fixed assets.
9. There is a strong theoretical basis and substantial empirical evidence to suggest that short-run marginal and average variable costs in manufacturing industries are constant over broad ranges of output (Johnston (1960, 13) and Dean (1976, 3–35)). Consequently, the short-run *NARP* curve may not be ∩-shaped unless the processed product demand curve is downward sloping.
10. The imposition of a corporate income tax on the earnings of a profit-maximizing processor also would have a neutral effect on output. Although the processor's earnings would be reduced proportionately by the tax, the processor would not alter its output because it would lack the incentive of a cooperative to shift earnings to producers in order to avoid tax.
11. The optimal tax rate of 29.4% is associated with an increase in consumer surplus of $112,580, an increase in total economic welfare of $53,860, and tax revenues of $500,300. However, producers lose $559,020 in profits when the cooperative's after-tax earnings, which are distributed to members as patronage refunds, are considered. Thus, although Taylor's argument that corporate taxation of a cooperative results in a misallocation of resources does not apply here, his objection to the taxation of cooperatives on the basis that the revenues raised by the tax are less than the loss of returns to cooperative members is still relevant.

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