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## The Neoclassical Theory of Cooperatives: Part I

Jeffrey S. Royer

### **Contact:**

Jeffrey S. Royer, Professor, Department of Agricultural Economics, University of Nebraska–Lincoln, [jroyer@unl.edu](mailto:jroyer@unl.edu)

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# The Neoclassical Theory of Cooperatives: Part I

*Jeffrey S. Royer*

The theory of the firm contained in most textbooks is inadequate for understanding the economic behavior of cooperatives because some assertions about firm behavior, such as profit maximization, may be inappropriate for cooperatives. This article provides an introduction to the neoclassical theory of cooperatives, which has been useful for generating insights into the behavior of cooperatives in various market structures, helping cooperatives develop business strategies consistent with their objectives, and informing public policy decisions concerning cooperatives. Part I of this article presents the basic elements of the neoclassical theory as it pertains to farm supply cooperatives.

**Keywords:** Cooperatives, farm supply cooperatives, neoclassical theory, objectives, strategies, equilibria

## Introduction

This article provides an introduction to the neoclassical theory of cooperatives. *Theory* is a tool economists use to study the behavior of economic agents such as consumers and firms. An economic theory begins with assertions about behavior, such as *consumers maximize utility* or *firms maximize profits*. Then a *model*, which is a simplified representation of reality, is constructed by specifying a set of assumptions about how the elements of the theory relate to the real world. By using models, economists reduce the complexities of the real world so they can focus on understanding essential economic relationships. Utilizing logical arguments of deduction or mathematical techniques, economists derive conclusions or predictions about economic behavior from a model.

The *neoclassical* approach to theory is the one economists use most often. In neoclassical economics, the value of products and the allocation of resources are determined by the costs of production and the tastes and preferences of consumers. Neoclassical theory relies on *marginal analysis*, in which the quantity of a

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*Jeffrey S. Royer is professor, Department of Agricultural Economics, University of Nebraska–Lincoln.*

*This article was originally developed as a chapter for a planned revision of the textbook, Cooperatives in Agriculture, edited by David W. Cobia (1989). Accordingly, some of the material presented here reflects ideas contained in a chapter of that book written by the late Brian H. Schmiesing, formerly of South Dakota State University and Southwest Minnesota State University.*

*The author appreciates helpful comments by Joan Fulton, Claudia Parliament, and Richard Sexton in their reviews of an earlier version of this article.*

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product that is purchased or sold is based on the additional utility, revenue, or cost associated with the last unit.

The neoclassical theory of the firm found in most economic textbooks is inadequate for understanding the economic behavior of cooperatives because assertions about cooperative behavior are generally quite different than those for investor-owned firms (IOFs). For example, the standard theory of the firm begins with the assertion that firms maximize profits. This assertion is usually rejected by cooperative theorists, who have ascribed other objectives to cooperatives, including maximization of member returns, maximization of patronage refunds, and minimization of costs. Each of these objectives requires a separate analysis, and conclusions about IOF behavior, based on profit maximization, do not necessarily apply to cooperatives.

The theory presented in this article uses the neoclassical approach, including marginal analysis, to derive conclusions about the economic behavior of cooperatives. The neoclassical theory of cooperatives is useful because it generates valuable insights into the expected behavior of cooperatives in various market structures and the differences between the behavior of cooperatives and IOFs. Because the theoretical analysis of cooperatives can be based on several different assertions about cooperative objectives, it also sheds light on the economic implications of a cooperative's choice of objectives and aids in the development of business strategies for cooperatives that are consistent with their objectives. In addition, cooperative theory yields some important implications for public policy based on the expected effects of cooperatives on economic welfare, including their effects on the performance of other firms in imperfect markets.

Although most of the neoclassical theory of cooperatives has been developed in the context of marketing cooperatives, we will focus our attention in Part I of this article on the theory of farm supply cooperatives. That theory is less complex than the theory of marketing cooperatives, and the concepts used in the theory of farm supply cooperatives will be more familiar to individuals with knowledge of the standard theory of the firm. In Part II, we will build on the theory of farm supply cooperatives in developing the theory of marketing cooperatives. Following that model, there is a discussion of the effects of cooperatives on economic welfare and the performance of imperfect markets. Individuals with an understanding of fundamental economic principles should be able to comprehend the material in this article, which is presented verbally and graphically. Mathematical models of both farm supply and marketing cooperatives are included in a supplement. The material in the supplement should be appropriate for graduate students, advanced undergraduate students, and others with elementary skills in calculus.

Not all theoretical analyses of cooperatives have been conducted using the neoclassical approach. Game theory, which is used to study strategic decision making, and a variety of other theoretical methods—such as transaction cost econom-

ics, agency theory, and property rights economics—that may be conveniently labeled “new institutional economics” have been used to provide additional insights into cooperative behavior and address shortcomings in the neoclassical theory. Both game theory and new institutional economics are beyond the purpose and scope of this article.

### **Theory of Farm Supply Cooperatives**

Farm supply cooperatives are cooperatives that supply members with inputs they use in farm production. Farm supply cooperatives may manufacture these inputs or purchase them from other firms. For simplicity, we assume the cooperative in our model supplies a single input to farmers. We also assume the cooperative produces the input it sells to its members. The model can be extended to a cooperative that purchases the input from another firm by considering the production costs as consisting of the costs of acquiring, transporting, and merchandizing the input.

#### *Roles of the Manager, Board of Directors, and Members*

Although most economic analyses of the firm are based on the assertion that firms maximize profits, there is no clear consensus about the objective of cooperatives. Indeed, while the standard theory of the firm is based on the existence of an entrepreneur who makes decisions about the allocation of capital, labor, and other factors of production in the creation of profits, there has been disagreement about who the decision maker is in a cooperative. Some early analyses of cooperatives, such as those by Emelianoff (1942) and Phillips (1953), did not acknowledge that entrepreneurial decisions were made by cooperatives. Instead, Phillips assigned the decision-making role to the cooperative’s members, who individually allocated their resources between their farming operations and the cooperative.

In 1962, Helmberger and Hoos presented a model of a marketing cooperative in which the cooperative was given a decision-making role and the objective of maximizing the price it paid its members for the raw product. Helmberger and Hoos did not specify whether it was management or the board of directors that played this decision-making role. Instead, they assumed the existence of a “*peak coordinator*,” consisting of an individual or group of individuals who wielded effective control over the organization. The peak coordinator was not necessarily associated with the manager or the board of directors, but rather with the individual or group that specified the cooperative’s objective and engaged in strategies to attain it.

Since Helmberger and Hoos, neoclassical models of cooperatives generally have assigned the decision-making role to the cooperative, although not addressing the issue of whether management or the board of directors was in control.

Some of those models have been based in part on the Helmberger and Hoos model, and they have assumed the objective of maximizing the raw product price paid members. However, several other cooperative objectives also have been used or discussed.

More recently, in some theoretical work on cooperatives, there has been a renewed focus on the role of individual members as decision makers. In those models, cooperatives are treated as coalitions of members with different and frequently conflicting interests. Within that framework, game theory has been used to analyze the internal decision-making processes of cooperatives by examining the strategies members and managers use to achieve their goals.<sup>1</sup>

### *Possible Cooperative Objectives*

Because cooperatives are complex business organizations that serve a wide variety of purposes and perform a wide variety of functions, there is no single objective, like maximizing profits, that is generally accepted by all managers, boards of directors, and members. Furthermore, because an individual cooperative may represent different and conflicting interests of its membership and management, there may be substantial disagreement within a cooperative about which objectives it should pursue.

A cooperative may pursue several objectives at the same time. For example, a cooperative may attempt to earn a certain level of net income, maximize operating efficiency, maintain and expand its facilities, and increase its sales volume. However, these objectives can all be interpreted as strategies a cooperative might follow in pursuing a single, broader long-term objective such as maximizing member returns.

Because the analytical techniques used in neoclassical economic theory usually work best when a single objective is specified, we will follow that approach here. However, we will examine several alternative objectives that seem plausible given the principles of cooperation, the objectives of cooperative members, and the competitive environment in which cooperatives operate.<sup>2</sup> As we will see, the output and pricing decisions of a cooperative will often differ depending on which objective is pursued.

One possible objective for a cooperative is to *maximize its net earnings* in the same manner an IOF maximizes profits. Several reasons have been offered for why cooperatives might seek to maximize net earnings or profits. By pursuing this objective, a cooperative will maximize funds available for paying patronage refunds or internally financing growth, and it can avoid hostility and retaliatory pricing by rival firms (Enke 1945, pp. 149–50). Maximization of net earnings also may result in higher measures of financial performance. To the extent that cooperative managers, boards of directors, and members use financial standards based on profit maximization, the pursuit of other objectives may result in poorer

comparisons. It is also possible that profit maximization may become part of a cooperative's corporate culture through hiring managers from IOFs or because it is the objective cooperative directors pursue in their individual farming operations.

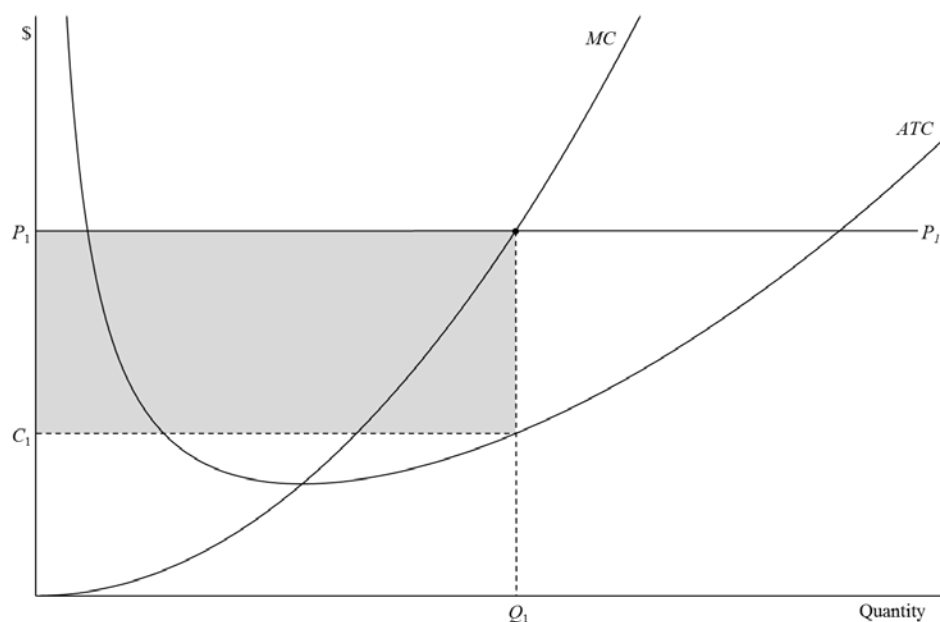
Other possible objectives may stem from recognition of the concept that the purpose of a cooperative is to operate, not for its own economic gain, but for the benefit of its members. Two objectives that members might consider appealing and consistent with this concept are *maximization of the per-unit patronage refund* and *minimization of the net price* paid by members. The first of these might at first appear to be an obvious goal for a cooperative. However, minimization of the net price paid by members may be a more attractive objective because it takes into consideration the value of both the patronage refund and the cash price. This objective may be particularly appealing to members whose decisions to purchase farm inputs from the cooperative are based on comparison of the prices charged by the cooperative and competing firms.

Another objective consistent with the purpose of a cooperative is *maximization of member returns*, which consist of the total profits of the individual members, including the net earnings of the cooperative, which are distributed to members as patronage refunds. Support for this objective has been offered by Ladd (1982), LeVay (1983), and Sexton (1984). The objective is consistent with the profit-maximizing behavior ascribed to producers in most neoclassical models, and it would seem to be a more effective means of enhancing the benefits members receive from the cooperative than focusing on a single indicator, such as the price of the farm input. A disadvantage of the objective is it does not provide managers an easily measurable target, such as cooperative net earnings, the per-unit patronage refund, or the net price.

Finally, there are reasons why a cooperative might seek to *maximize the quantity of the farm input* it produces. Managers, boards of directors, and members may be inclined to judge the cooperative's success in terms of its size and growth. In fact, in some cases management salaries may be linked to sales or turnover. A cooperative also may want to maximize output to achieve economies of scale, reduce excess capacity, or increase its market share.

#### *Profit-Maximizing (IOF) Farm Supply Firm*

To compare the behavior of a farm supply cooperative to that of an IOF, we must first briefly review the standard theory of the firm. Assume the IOF is a profit-maximizing firm that sells a single farm input to farmers in a perfectly competitive market. In other words, the firm competes with a large number of other firms. Therefore, its market share is so small it cannot affect the price it receives for the input no matter how many units it sells.



**Figure 1. Profit maximization by a farm supply firm (IOF) given perfect competition**

The IOF's demand curve and cost curves are shown in figure 1. Under perfect competition, the firm faces a horizontal demand curve, reflecting that the price the firm receives ( $P_1$ ) is constant regardless of the quantity it sells. The cost curves represent the costs of manufacturing or procuring the farm input and selling it to farmers. Average total cost ( $ATC$ ) is simply the total cost of producing the input divided by the number of units produced. Marginal cost ( $MC$ ) is the change in total cost due to producing one additional unit of the input. The average total cost curve shown in figure 1 is U-shaped, representing conventional ideas about costs. Average cost at first decreases over a range before increasing. Marginal cost is assumed to be generally increasing, at least over the relevant range. It intersects the minimum of the average cost curve from below. As long as the marginal cost of producing the farm input is less than average cost, average cost is declining. However, once marginal cost is greater than average cost, the average cost curve is positively sloped.

A profit-maximizing farm supply firm in a perfectly competitive market will produce the quantity of farm input  $Q_1$  for which marginal cost equals the market price. As long as the marginal cost—the cost of producing an additional unit—is less than the market price, as for quantities less than  $Q_1$ , the firm can increase its profits by producing more of the input. By producing  $Q_1$ , the firm earns profits



equal to the shaded area. That area represents the difference between the firm's total revenue (which is the market price  $P_1$  times the quantity  $Q_1$ ) and its total cost (which is the average total cost  $C_1$  times  $Q_1$ ).

### *Monopoly and Monopolistic Competition*

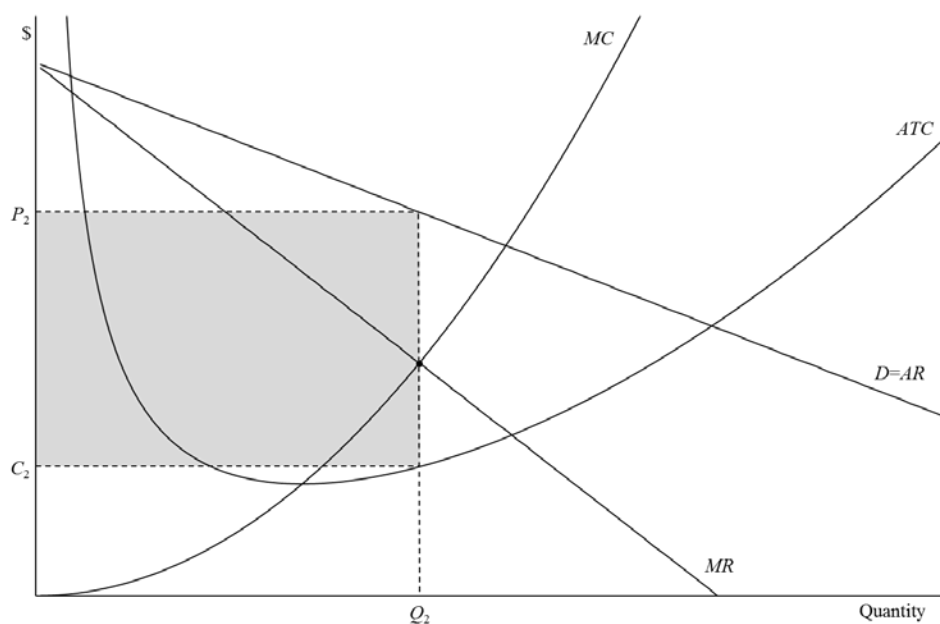
Many markets for farm inputs are not perfectly competitive. Farm supply firms often face downward-sloping demand curves. Instead of selling whatever quantity they produce at a constant price set by the market, these firms must lower the price they charge to increase sales. The flexibility a firm facing a downward-sloping demand curve has in setting its price provides it *market power*, i.e., the ability to raise its price to a level greater than its marginal cost.

A firm may face a downward-sloping demand curve if it is a *monopoly*, i.e., it is the only supplier of the farm input in the market. It also may face a downward-sloping demand curve if the market is characterized by monopolistic competition. Under *monopolistic competition*, there is competition from other sellers, but each firm faces a downward-sloping individual demand curve and has some market power.

In markets for farm inputs, downward-sloping demand curves frequently result from the spatial distribution of competing firms. If a farm supply firm sets a high price, it may sell only to farmers located nearby. At lower prices, the firm may attract additional sales from farmers who are farther away and relatively closer to competing suppliers. Downward-sloping demand curves also may be due in part to customer loyalty or product differentiation. Farm supply firms use various means to differentiate their products from those of competitors, including advertising, brand creation, and the provision of credit or delivery and application services.<sup>3</sup>

A profit-maximizing farm supply firm facing a downward-sloping demand curve is illustrated in figure 2. Because the demand curve ( $D$ ) represents the quantity that would be demanded at each price, it also represents the firm's average revenue ( $AR$ ). The marginal revenue curve ( $MR$ ) extends beneath the demand curve. Marginal revenue is the added revenue the firm receives from each additional unit of sales. When the demand curve facing a firm is downward sloping, the marginal revenue curve lies beneath the demand curve because the price of all units must be lowered to sell an additional unit.

The slope of the demand curve depends on the availability of close substitutes for the product. If the input supplier is a monopoly, the demand curve will be steeper than under monopolistic competition. The introduction of similar products by firms competing in the same market would flatten a firm's demand curve. At the extreme, if there were many firms offering perfect substitutes, the market would be characterized by perfect competition. Then the firm's demand curve



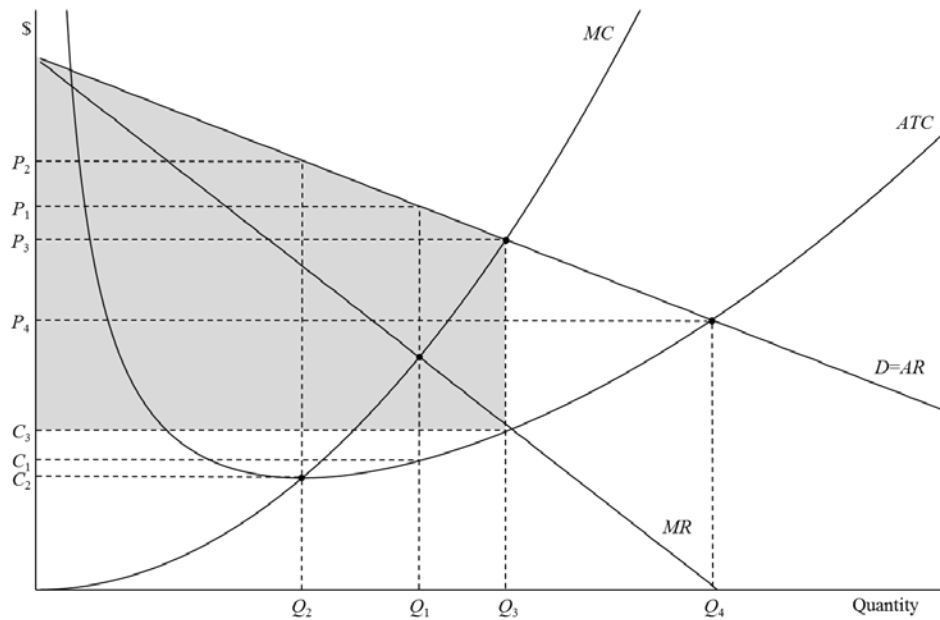
**Figure 2. Profit maximization by a farm supply firm (IOF) given a downward-sloping demand curve**

would be horizontal, as in figure 1, and it would represent both the firm's average revenue and its marginal revenue.

A profit-maximizing farm supply firm facing a downward-sloping demand curve will produce the quantity of farm input for which marginal cost equals marginal revenue, represented by  $Q_2$  in figure 2. As long as marginal cost is less than marginal revenue, as for quantities less than  $Q_2$ , the firm can increase its profits by producing additional units. At  $Q_2$ , the firm's profits equal the shaded area, which represents the difference between the firm's total revenue  $P_2 \times Q_2$  and its total cost  $C_2 \times Q_2$ .

#### *Price and Output Solutions for Cooperative Objectives*

The price and output solutions for four cooperative objectives commonly considered by cooperative theorists are illustrated in figure 3 for cases in which the cooperative faces a downward-sloping demand curve. For convenience, these solutions are summarized in table 1. In these examples, we assume the cooperative sells the farm input only to its members so the demand curve facing the cooperative represents the demand of its members for the input. However, we also assume members are free to purchase the input from other farm supply firms.



**Figure 3. Price and output solutions for a farm supply cooperative under various objectives given a downward-sloping demand curve**

If the cooperative maximizes its net earnings, it will produce at level  $Q_1$ , which is determined by the intersection of its marginal revenue and marginal cost curves ( $MR = MC$ ). The price, which is read from the demand curve, is  $P_1$ , and the average total cost is  $C_1$ . The net earnings of the cooperative are  $(P_1 - C_1) \times Q_1$ . Assuming the cooperative returns all net earnings to members as patronage refunds, the per-unit patronage refund is  $P_1 - C_1$  and the net price paid by members is  $C_1$ .

Minimization of the net price occurs at quantity  $Q_2$ , which corresponds to the minimum of the average total cost curve—the point at which average total cost is intersected by marginal cost ( $MC = ATC$ ). The cash price  $P_2$  is relatively high compared to the other solutions. However, after deducting the per-unit patronage refund  $P_2 - C_2$ , the net price is  $C_2$ , which represents the lowest possible cost at which the input can be produced.

Maximization of member returns occurs at  $Q_3$ , determined by the intersection of the demand and marginal cost curves ( $AR = MC$ ). The cooperative's net earnings  $(P_3 - C_3) \times Q_3$  are less than when the cooperative's objective is maximization of net earnings. This is because member returns consist of two components—the cooperative's net earnings, which are distributed to members as patronage refunds, and the consumer surplus members receive as consumers of the farm input.

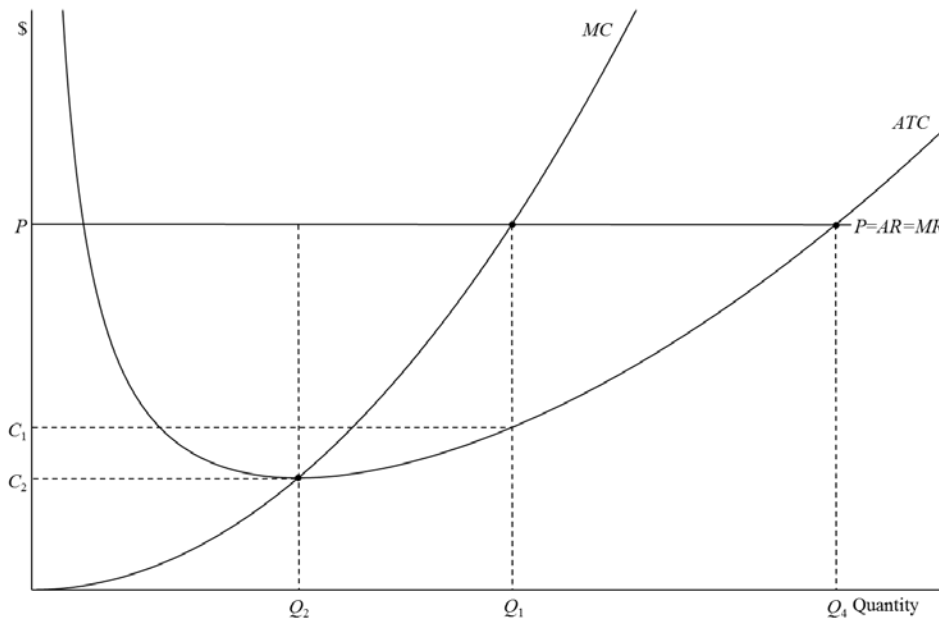
**Table 1. Price and output solutions for a farm supply cooperative under various objectives**

Objective	Criterion	Quantity	Price	Patronage refund	Net price
Maximization of cooperative net earnings	$MR = MC$	$Q_1$	$P_1$	$P_1 - C_1$	$C_1$
Minimization of net price	$MC = ATC$	$Q_2$	$P_2$	$P_2 - C_2$	$C_2$
Maximization of member returns (including patronage refunds)	$AR = MC$	$Q_3$	$P_3$	$P_3 - C_3$	$C_3$
Maximization of quantity	$AR = ATC$	$Q_4$	$P_4$	0	$P_4$

*Consumer surplus* is the difference between what consumers individually would be willing to pay for a product, as indicated along the demand curve, and what they actually pay when a single market price is charged for all units. In effect, consumer surplus consists of what consumers save because there is a single market price. Graphically, it is equal to the area below the demand curve and above the market price. In the current context, consumer surplus is represented by the triangular area below the demand curve  $D$  and above the price  $P_3$ . That area, plus the cooperative's net earnings  $(P_3 - C_3) \times Q_3$ , constitutes the member returns attributable to the cooperative's sales of the farm input. Maximum member returns are represented by the shaded area.

Maximization of the quantity of the farm input produced by the cooperative occurs at  $Q_4$ , determined by the intersection of the demand and average total cost curves ( $AR = ATC$ ). Both the price and average cost are  $P_4$ . Thus both the cooperative's net earnings and the per-unit patronage refund are zero. Accordingly, this solution is often called the "breakeven" solution. Production of quantities greater than  $Q_4$ , although technically possible, would result in losses for the cooperative.

If the cooperative sells the farm input in a perfectly competitive market, the solutions for maximization of net earnings and maximization of member returns are identical, as shown in figure 4. Under perfect competition, the cooperative is a price taker, and the price it receives for the input is constant regardless of the quantity it sells. The price dictated by the demand curve represents both the cooperative's average revenue and marginal revenue. Consequently, the criterion for maximization of net earnings ( $MR = MC$ ) is the same as for maximization of member returns ( $AR = MC$ ). In other words, the cooperative can ensure member



**Figure 4. Price and output solutions for a farm supply cooperative under various objectives given perfect competition**

returns are maximized simply by setting the quantity it produces to maximize its own net earnings, in the same manner as an IOF would maximize profits. In figure 4, that quantity is  $Q_1$ , and the average cost of producing the farm input is  $C_1$ . The cooperative's net earnings are  $(P - C_1) \times Q_1$ , and the per-unit patronage refund is  $P - C_1$ .

Minimization of the net price occurs at the quantity corresponding to the minimum of the average total cost curve regardless of the slope of the demand curve. Thus under perfect competition, the net price is once again minimized at  $Q_2$ , which corresponds to the intersection of the marginal cost and average total cost curves ( $MC = ATC$ ). At  $Q_2$ , average cost is  $C_2$ . The cooperative's net earnings are  $(P - C_2) \times Q_2$ , and the per-unit patronage refund is  $P - C_2$ .

If the cooperative maximizes the quantity of the farm input it produces, output is again determined by the intersection of the demand and average total cost curves ( $AR = ATC$ ). Quantity is  $Q_4$ , and both the price and average cost are  $P$ . Consequently, both the cooperative's net earnings and the per-unit patronage refund are zero.

*Stability of Cooperative Price and Output Solutions*

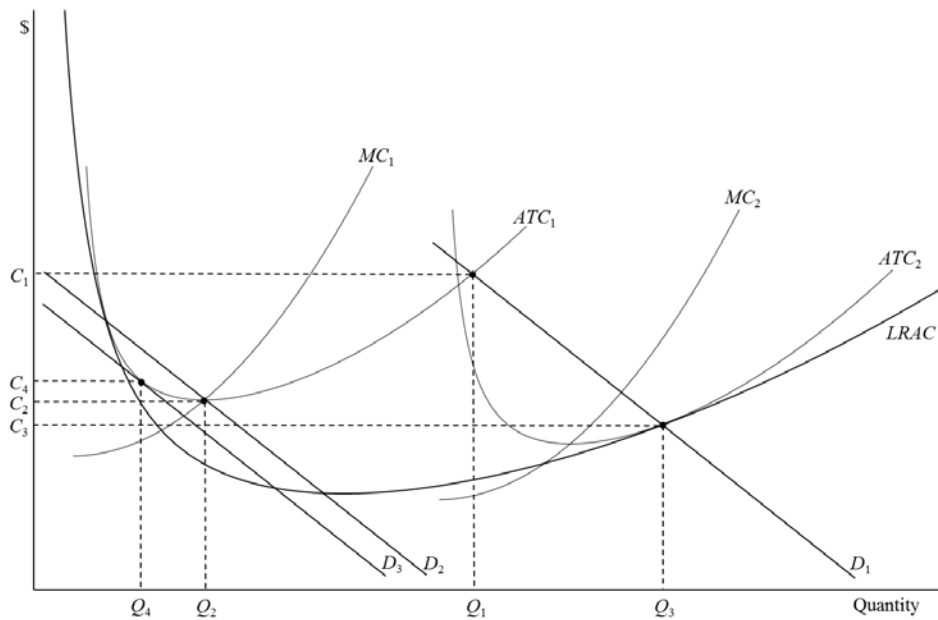
An important issue concerns the stability of the cooperative price and output solutions. In all solutions, except for the one corresponding to the maximization of quantity, members receive a patronage refund. If they recognize the refund when making their purchasing decisions, they will have an incentive to expand their use of the farm input beyond the level associated with the cooperative's objective. Thus the output solutions associated with objectives other than maximization of quantity may not represent equilibrium solutions because they are unstable. Purchases of the input will continue to expand until they reach  $Q_4$  in figure 3. At that level, which corresponds to the intersection of the demand and average total cost curves, the price of the farm input equals the average cost of producing it. The patronage refund is zero, so members no longer have an incentive to increase their purchases. Thus this solution represents an equilibrium, unlike the others.

The instability of the other solutions has important implications for cooperatives that pursue those objectives. Because the receipt of patronage refunds provides members an incentive to expand their use of the input beyond the optimal level, a cooperative may not be able to achieve another objective unless it imposes some sort of restriction on the purchase of the farm input. However, restrictions, such as quotas on purchases from the cooperative, could create member relations problems and contribute to erosion in customer loyalty over time.

The significance of this problem will depend on the extent to which members take patronage refunds into consideration when making purchasing decisions. It has been argued that members may not expect to receive patronage refunds when purchasing farm supplies or may consider the effective after-tax present value of cash and noncash patronage refund distributions to be zero. If so, the price and output solutions associated with other objectives may be stable. In addition, some research (Royer and Smith 2007) suggests that cooperatives may be able to use pricing strategies to achieve and maintain output levels consistent with other objectives.

*Strategies for Reducing Costs*

Cooperatives must develop business strategies consistent with their objectives to successfully adapt to changing market conditions. For example, a cooperative that seeks to minimize the net price its members must pay for the farm input may find it can reduce the average cost of producing the input by shifting the demand curve or its cost curves. Consider the cooperative represented by the cost curves  $ATC_1$  and  $MC_1$  in figure 5. So we can focus on costs, assume the cooperative charges a price for the farm input just sufficient to cover its costs. Thus if the



**Figure 5. Strategies for reducing average total cost**

cooperative faces the demand curve  $D_1$ , it will produce  $Q_1$  units of the input and charge a price equal to the average total cost  $C_1$ . As the figure shows,  $C_1$  represents a relatively high average cost compared to other points on  $ATC_1$ . Therefore, the cooperative might consider moving to another point on the curve to reduce its average cost.

One strategy might be for the cooperative to lower the demand it faces for the input. Assume the cooperative currently serves both member and nonmember patrons. For example, the cooperative might sell fertilizer for use both on farms and on residential lawns and gardens. The cooperative could discontinue sales to nonmembers, shifting the demand curve it faces from  $D_1$  to  $D_2$ . The new demand curve intersects the cooperative's average total cost curve at the minimum. By reducing the quantity it produces from  $Q_1$  to  $Q_2$ , the cooperative can lower its average cost from  $C_1$  to  $C_2$ . Thus as a result of discontinuing service to nonmembers, the cooperative is able to lower the cost of providing the input to members.

In this example, the cooperative shifts its demand curve so it can operate at a different point on its short-run average total cost curve.<sup>4</sup> In the *short run*, at least one of the cooperative's factors of production is fixed. In other words, we assume the plant the cooperative uses to produce the farm input is of a fixed capacity. In the *long run*, all factors of production can be varied. Consequently, an alternative long-run strategy might be for the cooperative to move along its long-run average

cost curve by constructing a larger manufacturing plant or expanding the capacity of its existing plant.

Assume the cooperative continues to sell the farm input to nonmembers, so its demand curve remains  $D_1$ . By building a new plant, represented by the cost curves  $ATC_2$  and  $MC_2$ , the cooperative can operate on the long-run average total cost curve ( $LRAC$ ) where it is intersected by the demand curve. The cooperative will produce  $Q_3$  units of the farm input at an average cost of  $C_3$ , which is lower than either  $C_1$  or  $C_2$ .

In other situations, the problem may be that the cooperative is *underutilizing* its existing plant capacity. Assume the cooperative's manufacturing plant is once again represented by the cost curves  $ATC_1$  and  $MC_1$  but the demand curve is  $D_3$ . The cooperative produces  $Q_4$  units of the input at an average cost of  $C_4$ . Increasing production to  $Q_2$  would lower the average cost from  $C_4$  to  $C_2$  at the minimum of  $ATC_1$ . The difference between  $Q_2$  and  $Q_4$  is referred to as *excess capacity*—the cooperative's existing plant is too large relative to its use. Because the cooperative is using only a small proportion of its existing plant's capacity, those units of the farm input that are produced must cover a disproportionately large share of the plant's fixed costs. The cooperative would be able to lower its average cost by either decreasing its plant size or increasing the demand for its production.

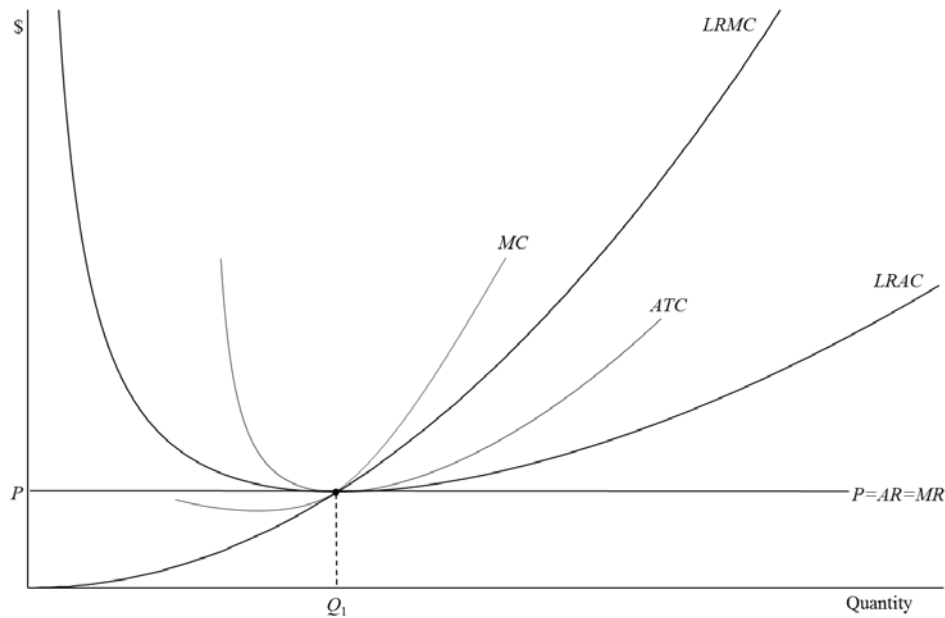
Neighboring cooperatives might consider merger as a means of reducing excess capacity and achieving economies of scale. Consider two cooperatives, each of which operates a propane delivery truck at 40 percent capacity. By merging their propane operations, the cooperatives might be able to eliminate one of the trucks, as well as some excess propane storage capacity, and reduce labor expenses. Cooperatives also might consider increasing the demand for their products by promoting sales to nonmembers.

### *Long-Run Equilibria for Various Objectives*

In the long run, a firm can vary its capacity by expanding or reducing the size of its manufacturing plant or by building a new plant. Similarly, new firms can enter the industry or existing firms can exit. In addition, the demand curve for the cooperative's production can shift, and its costs can change over time.

If the industry is perfectly competitive, there are no barriers to entry and the existence of *excess profits*—profits in excess of the normal return on capital included in average total cost—will attract new firms into the industry. The entry of those firms will shift the market supply curve for the farm input to the right, and the market price will fall. This process will continue until price equals minimum long-run average cost. At that point, profits are zero and the firms in the industry will receive only a normal return equal to the opportunity costs of the factors of production they employ.

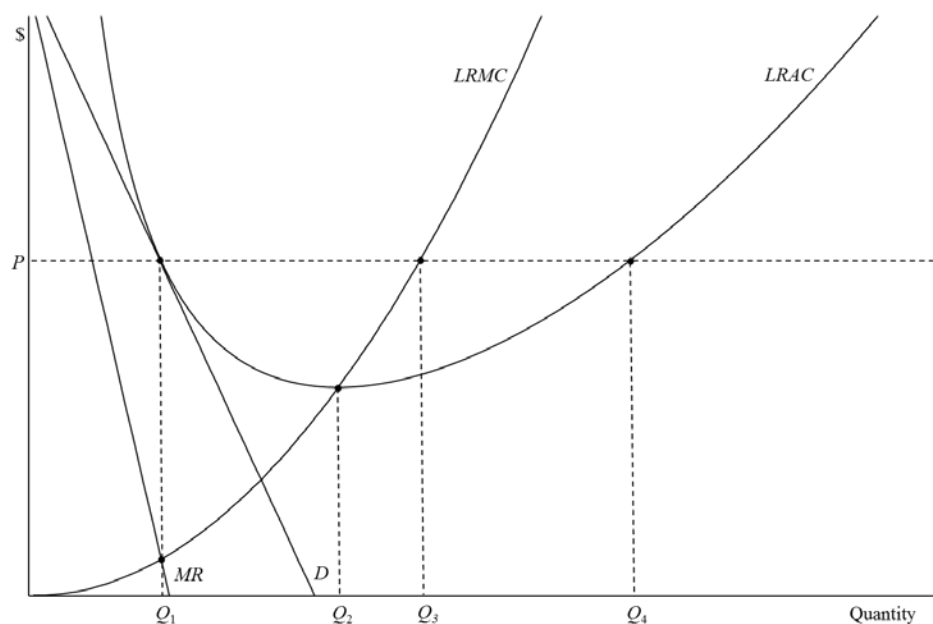




**Figure 6. Long-run equilibria for IOFs and cooperatives given perfect competition**

Figure 6 represents the long-run equilibrium for a profit-maximizing IOF. The equilibrium market price is  $P$ , and the demand curve facing the firm is tangent to the firm's long-run average cost curve ( $LRAC$ ) at quantity  $Q_1$ . For the minimum of the long-run average cost curve to occur at  $Q_1$ , so must the minimum of the short-run average cost curve ( $ATC$ ). Thus  $LRAC$ ,  $ATC$ ,  $LRMC$  (long-run marginal cost), and  $MC$  (short-run marginal cost) all are equal to the market price  $P$  at  $Q_1$ . Moreover,  $P$  is equivalent to  $AR$  (average revenue) and  $MR$  (marginal revenue) given the horizontal demand curve. The market is in equilibrium because the condition for profit maximization ( $P = MC$ ) is satisfied and there is no incentive for the entry or exit of firms when profits are zero ( $P = ATC$ ).

Price  $P$  and quantity  $Q_1$  would also represent the long-run equilibrium for a cooperative, regardless of its objective. All cooperatives would operate at  $Q_1$  because the criteria for maximization of net earnings ( $MR = MC$ ), minimization of net price ( $MC = ATC$ ), maximization of member returns ( $AR = MC$ ), and maximization of quantity ( $AR = ATC$ ) all are satisfied at that level. Thus under perfect competition, the long-run equilibria for cooperatives are identical to that for a profit-maximizing IOF.



**Figure 7. Long-run equilibria for IOFs and cooperatives given monopolistic competition**

A cooperative that is in a monopoly market will continue to face a downward-sloping demand curve in the long run if there are barriers to the entry of new firms into the industry. For convenience, assume figure 3 now reflects the long-run demand and costs facing the cooperative.<sup>5</sup> Then the figure can be used to represent the long-run price and output solutions for the objectives listed in table 1. Given these conditions, the long-run price and output solutions for a cooperative will be identical to the short-run solutions already discussed.

Under monopolistic competition, there are no barriers to entry, and in the long run the existence of excess profits provides an incentive for the entry of new firms into the industry. According to standard theory, a firm will maximize its profits by producing at the level where its marginal revenue curve intersects its long-run marginal cost curve. With additional entry, the demand curve facing the firm will shift to the left until it is tangent to the firm's long-run average cost curve and its profits are driven to zero.

This is illustrated in figure 7. Assume the industry consists of profit-maximizing IOFs with identical costs and market demand is distributed equally among all firms. At long-run equilibrium, the demand curve facing each individual firm, which is labeled  $D$ , is tangent to the long-run average cost curve  $LRAC$  at  $Q_1$ . At that quantity, each firm's marginal revenue curve  $MR$  intersects its

long-run marginal cost curve  $LRMC$ . The market price is  $P$ , and profits are zero because price is equal to average total cost. Output is at equilibrium because there are no profits or losses in the industry. Consequently, there is no incentive for entry or exit.

Notice that because the demand curve facing the firm is downward sloping, the tangency between the demand curve and the long-run average cost curve must occur to the left of the cost curve's minimum. As a result, monopolistic competition among profit-maximizing firms is characterized by excess capacity. In this example, the excess capacity is  $Q_2 - Q_1$ .

We typically would not expect to observe farm input markets consisting of cooperatives engaged in monopolistic competition with one another. More often we would expect a market in which there is a mix of IOFs and cooperatives. To construct a model of such a market, we must make additional assumptions about the structure of the market and the behavior of the firms. The results of the model will depend on the assumptions we make.

For example, consider an industry consisting of several IOFs and a single cooperative. Assume the market price is determined by competition among the IOFs and the cooperative is a price taker that can sell whatever quantity it chooses at that price. Market demand, less the quantity sold by the cooperative, is distributed equally among the IOFs. Then entry by new IOFs will continue until the demand curve facing each IOF is tangent to its long-run average cost curve, as at  $Q_1$  in figure 7. The output of the cooperative will depend on its objective. Depending on whether the cooperative minimizes net price, maximizes member returns, or maximizes quantity, its output would be  $Q_2$ ,  $Q_3$ , or  $Q_4$  respectively. If its objective is maximization of net earnings, its output would be  $Q_3$ , the same as for maximization of member returns. Because we have assumed the cooperative is a price taker, its marginal revenue is the market price  $P$  instead of  $MR$ , the marginal revenue for the IOFs. Regardless of its objective, the cooperative will produce a greater quantity of the farm input than an IOF, and in most cases its average cost will be lower.

## Conclusions

The development of the neoclassical theory of cooperatives represents an important step in understanding cooperatives because the standard theory of the firm is inadequate for analyzing these organizations given assertions about their behavior are generally different than those for other firms. Specifically, cooperative theorists usually have ascribed objectives other than profit maximization to cooperatives.

The neoclassical theory of cooperatives has generated valuable insights into the expected behavior of cooperatives in various market structures and the differences between the behavior of cooperatives and IOFs. An analysis of farm supply

cooperatives suggests the price and output solutions of cooperatives may differ substantially from those of IOFs both in the short run and the long run, especially if the demand curve is downward sloping.

The stability of the cooperative price and output solutions is an important issue. Because the receipt of patronage refunds provides members an incentive to expand their use of the farm input beyond the optimal level, a cooperative may not be able to pursue its objective without imposing some sort of restriction on the purchase of the input. The significance of this problem depends on the extent to which members take patronage refunds into consideration when making purchasing decisions.

Cooperatives must adopt business strategies to successfully adapt to changing market conditions. Because they may have objectives other than profit maximization, strategies used by IOFs may not be appropriate for them. Neoclassical cooperative theory has led to the development of strategies for cooperatives that are consistent with their objectives. Both short-run and long-run strategies for reducing the average cost of producing the farm input are described here. Those strategies, which consist of shifting either the demand curve or the cost curves for the input, are consistent with the cooperative objective of minimizing the price it charges members for the input.

No attempt has been made here to determine the expected effects of cooperatives on economic welfare, including their effects on the performance of other firms in imperfect markets. Instead, those aspects of cooperative theory are discussed in Part II, which focuses primarily on marketing cooperatives.

## Notes

1. Cooperative theory has evolved over several decades, and a thorough review of its development is beyond the scope of this article. See Staatz (1987 or 1989) for excellent surveys of this topic.
2. Many possible objectives have been suggested for cooperatives. This section considers only five objectives, those analyzed by LeVay (1983). For a more thorough discussion of cooperative objectives, see Bateman, Edwards, and LeVay (1979).
3. When there is an *oligopoly*, i.e., several firms selling the same product, each firm will face a downward-sloping individual demand curve. If one firm lowers its price or increases its output, the other firms in the market can be expected to react by adjusting their prices or output. The various models used to explain and predict the behavior of an oligopolistic market are beyond this article's purpose and scope.
4. All curves depicted in the figures are for the short run unless otherwise indicated.
5. Long-run demand and cost curves generally are not as steep as their short-run counterparts because decisions made in the long run are more responsive to price changes given consumers and producers have additional choices and more time to adjust.

## References

- Bateman, D.I., J.R. Edwards, and C. LeVay. 1979. "Agricultural Cooperatives and the Theory of the Firm." *Oxford Agrarian Studies* 8:63–81.
- Cobia, D.W., ed. 1989. *Cooperatives in Agriculture*. Englewood Cliffs, NJ: Prentice Hall.
- Emelianoff, I.V. 1942. *Economic Theory of Cooperation: Economic Structure of Cooperative Organizations*. Washington, DC: I.V. Emelianoff.
- Enke, S. 1945. "Consumer Coöperatives and Economic Efficiency." *American Economic Review* 35:148–55.
- Helmberger, P., and S. Hoos. 1962. "Cooperative Enterprise and Organization Theory." *Journal of Farm Economics* 44:275–90.
- Ladd, G.W. 1982. "The Objective of the Cooperative Association." In *Development and Application of Cooperative Theory and Measurement of Cooperative Performance*. Washington, DC: U.S. Department of Agriculture, ACS Staff Rep., February, pp. 1–23.
- LeVay, C. 1983. "Agricultural Co-operative Theory: A Review." *Journal of Agricultural Economics* 34:1–44.
- Phillips, R. 1953. "Economic Nature of the Cooperative Association." *Journal of Farm Economics* 35:74–87.
- Royer, J.S., and D.B. Smith. 2007. "Patronage Refunds, Producer Expectations, and Optimal Pricing by Agricultural Cooperatives." *Journal of Cooperatives* 20:1–16.
- Schmiesing, B.H. 1989. "Economic Theory and Its Application to Supply Cooperatives." In D.W. Cobia, ed. *Cooperatives in Agriculture*. Englewood Cliffs, NJ: Prentice Hall, pp. 137–55.
- Sexton, R.J. 1984. "Perspectives on the Development of the Economic Theory of Co-operatives." *Canadian Journal of Agricultural Economics* 32:423–36.
- Staatz, J.M. 1987. "Recent Developments in the Theory of Agricultural Cooperation." *Journal of Agricultural Cooperation* 2:74–95.
- . 1989. *Farmer Cooperative Theory: Recent Developments*. Washington, DC: U.S. Department of Agriculture, ACS Res. Rep. 84, June.