VERTICAL INTEGRATION BY MARKETING COOPERATIVES—THEORETICAL ECONOMIC FIRM MODELS AND THEIR APPLICATION

Mahmoud M. Badr

Department of Economics, Northwestern State College, Alva, Oklahoma

Marginal analysis was used to develop cooperative firm models in the short-run and long-run. The economies of vertical integration were investigated by deductive analysis. The vertically integrated marketing cooperative may differentiate homogeneous farm products in marketing. The firm would have some degree of market power. It can choose the optimal economic stage of vertical integration to maximize producers' price. With average cost less than the price, economic profit would exist.

Farmers integrate horizontally and vertically to form cooperative firms to market their farm products. Marketing cooperatives integrate horizontally and vertically to gain market power and, if marketing economies result, make it possible for farmer members to share these economies. Member-patrons may get above-existing prices by marketing cooperatively.

The purposes of this paper are: (*a*) to develop theoretical economic firm models for a vertically integrated marketing cooperative, (*b*) to present an example of vertically integrated cooperative marketing firm, and (*c*) to investigate the economic effects of vertical integration to cooperative patrons.

VERTICALLY INTEGRATED COOPERATIVE FIRM MODELS

The theoretical model for a profit-maximizing vertically integrated cooperative firm can be developed through the use of marginal analysis. In the following analysis, the case of a firm that is integrated through the three stages of buying raw materials, processing, and wholesaling will be treated.

Short-run model

Figure 1, depicts the cost and demand curves for a firm vertically integrated through three successive economic stages. The X-axis measures units of quantities of products of the three stages. The Y-axis measures the prices for the three products of the three stages. AC_1 represents the average cost of the raw materials (farm product), plus services necessary to move the product in an acceptable form to the processing stage. MC_1 is the marginal cost associated with AC_1. AC_2 is the average of the combined costs of the first stage and the costs involved in the processing stage; MC_2 is the marginal cost associated with AC_2. AC_3 is the average of the combined costs of the first two stages plus the wholesaling stage; MC_3 is the marginal cost for the aggregate of the three stages.

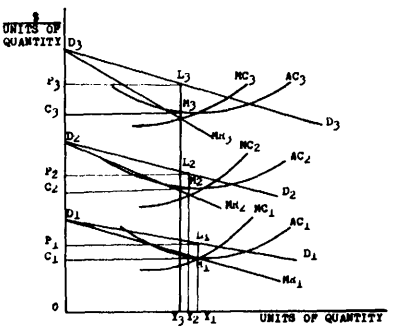

FIGURE 1. Short-run firm model.

D_3D_3 is the demand curve for the product of stage 3, faced by the firm; MR_3 is its respective marginal revenue. D_2D_2 is the derived demand (from D_3D_3) for the product of stage 2, and MR_2 is its respective marginal revenue. D_1D_1 is considered as the derived demand (from D_2D_2) for the product of stage 1 and MR_1 is its respective marginal revenue (4, p. 148).

The cooperative price maximizing output is equal to OY_3 units of stage 3 product. It is determined by the intersection of marginal cost and marginal revenue of

the final stage of the firm. The price per unit at the wholesale level is OP_3. The average cost of OY_3 units is depicted by OC_3.

The cooperative firm has an economic profit over costs represented by $C_3 P_3 L_3 M_3$. The cooperative operates on the cost-of-doing-business principle. All economic profits (savings) must be distributed to member-patrons on a patronage basis. The member would receive the going market price for the farm product, plus a patronage payment equal to $C_3 P_3$ per unit. Thus, the member gets above-existing price in marketing cooperatively.

Long-run model

The optimal structure of the firm may not be the same in the long run as in the short run. To determine how many economic stages are needed to maximize profits for the firm, a theoretical long-run model is developed under the following assumptions: (*a*) all production factors are variable; (*b*) all output of one stage is used as input in the next stage within the firm; (*c*) factor prices are held constant.

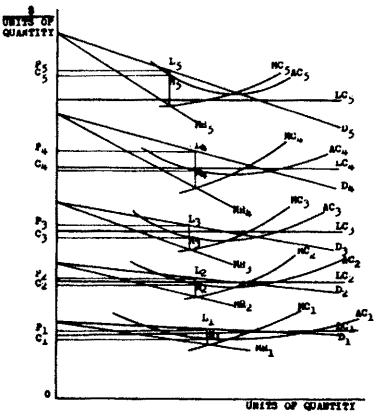

FIGURE 2. Long-run firm model.

Figure 2 shows the long-run average cost curves for the firm as it continues adding economic stages of production and marketing. The average cost (AC_1) is the long-run average cost of the first stage. The average cost (AC_2) is the long-run average combined cost of the first and the second stages. By adding more economic stages, the long-run average costs go up to AC_3, AC_4, and AC_5. LC_1, LC_2, . . . , LC_5 represents the levels of the combined lowest long-run average cost at which the successive stages can be operated when vertical integration does not exist. The vertical distance between LC_i and LC_{i-1} (where $i = 1, 2, \ldots, 5$) represents the lowest average cost of operating each stage without vertical integration.

The decreasing part of the long-run average costs reflects the economies of size. As the volume of business increases, more specialization can be achieved which tends to increase the production efficiency and decrease per unit cost. The rising part of the long-run average cost reflects the diseconomies of size. As the volume of business increases, limitations to the efficiency of management will be encountered. Per unit costs of production will increase.

If the output of one stage is an input in the next stage, the vertically integrated firm can obtain some inputs at a lower cost by eliminating the excess profits made by other firms in the industry. A vertically integrated firm producing at stage 3, for example, can obtain the product of stage 2 at a price equal to its cost. This will cause the long-run average cost to fall below the lowest nonintegrated level LC_3.

If vertical integration were carried to the point of adding stage 5 in Figure 2, the lowest attainable long-run average cost would lie above the lowest long-run average cost level LC_5. Diseconomies of vertical integration are caused by the complication of management and higher per unit costs. If LC_5 were the prevailing level set by competitive pressures, this firm would be forced to limit the number of vertically integrated stages for four. Thus, stage 4 would be the highest possible stage of vertical integration to be considered by this firm.

As additional vertically integrated processes are considered by the firm, the range of the volume of business that could be conducted by the firm would decrease (2, p. 1287). That is, management could operate a firm near LC_1 costs over a wide range of volumes. As more vertical integration is involved, the relatively flat portions of the relevant AC curves would be flatter the lower the level of integration.

The demand curve for each stage would help in determining the most profitable stage for the cooperative firm. In Figure 2, D_1 is the demand curve for the product of stage 1 and MR_1 is its respective marginal revenue. D_2, MR_2, D_3, MR_3, D_4, MR_4, D_5 and MR_5 are described in the same way. $MC_1, \ldots, MC_5$ are the long-run marginal costs of stage 1, ..., 5. The firm would equate MR_1 and MC_1 to determine the volume of business, price and profit. By comparing the profits on each stage, the firm would determine the most profitable stage (i.e. stage four has the largest economic profit $P_4C_4L_4M_4$, or P_4C_4 profit per unit) and limit its vertical integration to that stage.

EXAMPLE OF VERTICALLY INTEGRATED COTTON COOPERATIVES

Farmers have formed cooperative cotton gins and cottonseed oil mills to market their cotton and cottonseed through their own firms. Processing cottonseed and marketing the products, however, involves performance of many services not directly connected with the crushing operations, or marketing of products, but which are of real benefit to cooperative members. Such services include buying seed and paying transportation charges, grading, analyzing seed and product storing.

The benefits derived from cooperative cottonseed oil mill operations are shown by the recent growth in cooperative processing. As late as 1934, there were only three cooperative mills in the United States. Since that time, however, cotton producers have placed increasing importance on this phase of their cooperative activity and by 1960 approximately 50,000 cotton farmers were crushing their cottonseed through 19 farmer-owned mills, (3, p. 4).

The benefits member-patrons received from cooperative mills are indicated in Table I. Returns from cooperative mills and average farm prices paid by private (non-cooperative) firms in selected states during the 2-year period 1958-59 and 1959-60, as well as the price differential cooperative patrons received, are shown for comparative purposes.

The data in Table I show that the price the farmer received for cottonseed, including patronage payments, has been substantially higher than the average noncooperative farmer's return from cottonseed. The advantages to cooperative mill members were $12.77 per ton for Arkansas, $18.63 for California, $11.60 for Mississippi, $16.75 for Oklahoma and $13.99 for Texas in the 1959-60 season.

The mill's returns to the patron consisted of sales proceeds less costs incurred. There are variations among the firms with respect to the amount returned by years and between states as shown in Table I. Such factors as volume and quality of seed, crushing efficiency and location can materially affect the returns a firm is able to make. However, farmers have increased their net returns by integration through their own cooperative firms.

ECONOMIC EFFECTS OF VERTICAL INTEGRATION

Economies of vertical integration arise from at least two sources. First they may come from elimination of expenses of purchase-sale transactions to move products

TABLE 1. *Average farm prices, returns to patrons, and advantages to patrons of cooperative cottonseed oil mills in selected states, 1958-59 and 1959-60.*[a]

State	1958-59			1959-60		
	Returns to Cooperative Mill Patrons	Average Farm Price	Advantage to Cooperative Mill Patrons	Returns to Cooperative Mill Patrons	Average Farm Price	Advantage to Cooperative Mill Patrons
	Dollars Per Ton					
Arkansas	52.61	45.00	7.61	50.77	38.00	12.77
California	66.37	43.00	23.37	63.03	44.40	18.63
Mississippi	52.55	47.70	4.85	50.70	39.10	11.60
Oklahoma	58.14	41.40	16.74	54.35	37.60	16.75
Texas	54.62	42.40	12.22	52.14	38.20	13.94
Average	57.36	43.90	12.96	54.70	39.46	14.74

[a] Source: Perdue, *Crushing Cottonseed Cooperatively*, Farmer Cooperative Service, United Department of Agriculture, Circular 30, Washington, D. C., 1962, p. 3.

from one stage to the next. Second, they may follow from elimination of economic profits to private suppliers or customers (1, p. 156). The cooperative firm's economic profit is distributed on the patronage basis.

Diseconomies of vertical integration might take the form of higher cost of production, processing and marketing resulting from the necessity of producing for oneself what might be purchased more cheaply from other firms. The diseconomies of vertical integration comes as a result of the complication of managing many economic stages. Accordingly, the lowest attainable long-run average cost would be above the long-run average cost set by the efficient nonintegrated outside firms.

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