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Enterprise Budgeting And Marginal Analysis

The development of budgets for individual crop and livestock enterprises may at first seem rather unrelated to the marginal principles developed in earlier chapters of this text, but these economic principles play an important role in determining how budgets for farm enterprises should be constructed. A number of questions arise. (1) What level of output should be chosen? (2) Upon what level of input use should the farm budget be based? (3) How should inputs that last for more than one season be handled? (4) What about potential economies and diseconomies of size for the enterprise? (5) what about uncertainty with respect to prices and output levels? Answers to these questions form the basis for this chapter.

Key terms and definitions:

Enterprise Budget
Decision Rule
Pecuniary Economies of Size
Non ! pecuniary Economies of Size
Fixed Input Allocation

19.1 The Development of an Enterprise Budget

Budgets for individual farm enterprises are widely used by farmers and others as planning devices for determining both what crops should be grown and livestock should be raised, and for determining how inputs should be allocated between enterprises. A farmer who does little other planning might devote considerable time to the development of individual enterprise budgets for each of the crop and livestock activities being considered.

Table 19.1 provides an example of a commonly used format for an enterprise budget. The example used here is corn. The enterprise budget is constructed on the basis of an acre. Output is listed first. A price for the output is assumed. The variable costs are listed. An assumption is made with regard to the amount to be used of each variable input. In the case of corn, the list includes inputs such as insecticides and herbicides, nitrogen, phosphate and potash fertilizer, and seed. Assumptions are made with regard to the price of each variable input item, and the corresponding cost of that item per acre is calculated. Labor to be used per acre is calculated, and a wage rate for that labor specified. Costs for fuel and repairs required to run the machinery needed to produce the crop are listed. Estimates of the amount of fuel to be used are made as well as its price per gallon.

Repair costs are frequently very difficult to estimate. It is difficult to know how much will need to be spent for the repair of a machine on a per acre basis before it is used, and implicit assumptions need to be made about the price of machinery repairs. These numbers are usually nothing more than guesses based on the farmer's past experiences with the machines used in conjunction with the enterprise. Engineering data may also be available for estimating repair costs.

The fixed costs are listed. A major fixed cost item is the depreciation on the machinery, buildings, and equipment. Fixed costs should represent the costs associated with the wearing out of the inputs that are used in the enterprise for more than one season, but tax laws enter. Farmers are probably more aware of the concept of depreciation as defined by what is allowed as an expense under current federal tax law than they are of the true costs associated with the wearing out of the machine over a number of years of operation. Farmers are concerned with maximizing profit after taxes, so the number to be entered for depreciation becomes unclear. Taxes are also included here, and are usually relatively easy to determine on a per acre basis for the budget.

Another major fixed-cost item is the interest charge on borrowed money, or the opportunity cost of the farmer's own money invested in the farm. If the farmer uses entirely borrowed funds, the cost to be listed here is easy to determine, but if the farmer uses some of his or her own money, the money that is used should have an imputed value or shadow price attached to it based on the returns available in a risk ! free alternative. For example, if the farmer could have earned 8 percent interest at the local bank, that represents a shadow price for the farmer's own money used in the corn enterprise. Another alternative for tenants is to show the cash, or cash equivalent rent.

Table 19.1. An Enterprise Budget for an Acre of Corn.

Gross returns:		
Sale of grain	$3.00 x 110 bu	$330.00
Total returns		330.00
Variable costs of production:		
Nitrogen	$ 0.25 x 125.00 lb	31.25
Phosphate	0.23 x 60.00 lb	13.80
Potash	0.13 x 60.00 lb	7.80
Lime	8.50 x .50 tons	4.25
Seed	1.00 x 16.00 lb	16.00
Chemicals	17.00 x 1.00 acres	17.00
Insurance	.015 x 600.00 dollars	9.00
Repairs	.015 x 600.00 dollars	9.00
Machinery Operation	5.00 x 5.00 hr	25.00
Hauling	0.18 x 110.00 bu	19.80
Labor	3.50 x 5.00 hr	17.50
Total variable costs		170.40
Fixed costs of production		
Machinery depreciation	10.0% x $ 300	30.00
Building depreciation	5.0% x 300	15.00
Interest on machinery	8.0% x 300	24.00
Interest on buildings	8.0% x 300	24.00
Interest on land	8.0% x 1500	120.00
Taxes	0.6% x 1800	10.80
Total fixed costs		223.80
Total fixed and variable costs		394.20
Net returns over all costs (Return to management)		! 64.20

Farmers usually respond by saying that their money invested in farmland, due to an appreciation in farmland values, in most years yields a return greater than what would have been received by putting the money in a bank account. This return would have occurred whether or not the farmer produced corn, but would not have occurred if the farmer had sold the farmland and exited from farming.

Fixed- and variable-cost items are summed and subtracted from gross returns obtained from the sale of the crop to determine profit on a per acre basis. Even here there are difficulties. Ideally, the profit should be representative of what is left over after every factor of production other than management has been paid, but problems occur. Farmers usually do

not deduct an opportunity cost for their own money invested in the enterprise. Moreover, they usually do not charge on the budget for their own or family labor that is not a cash expense. The profit figure that often appears on an enterprise budget is actually a return to management and entrepreneurial skill as well as a return to the farmer's own money invested and to nonwage farm family labor.

The farm enterprise budget is a document based on a very comprehensive and complicated series of economic assumptions. The marginal principles outlined in earlier chapters can play a role in dealing with some of the issues associated with the development of a budget for a farm enterprise.

19.2 The Level of Output to Be Produced

One of the first questions a farmer must face is to determine the level of output to be produced and represented in the budget. The farm enterprise budget is usually developed on a per acre or per animal basis. However, a salient theme running through much of this text is that the cost per unit of output produced is not constant, but varies depending on the output level chosen. An enterprise budget, even if constructed on a per acre or per animal basis, must be based on a specific assumption with regard to the amount of the output that is to be produced. The basic problem here is that the level of output of a particular enterprise is one of the key pieces of information that the farmer desires as an outcome of the budgeting process. However, to develop the budget, the farmer must make an assumption about the level of output to be produced, particularly if fixed costs are to be determined on a per acre basis.

A production economist would argue that if the entrepreneur is interested in maximizing profits, the level of output to be chosen is that output level where

marginal cost = marginal revenue = product price

Figure 19.1 illustrates a set of cost functions on the output side for corn production. The enterprise budget can at best represent only a single point in this series of cost functions. If the farmer produced but one commodity, the level of output for the enterprise budget should be equal to the profit-maximizing level where marginal cost and marginal revenue are the same.

However, farmers usually produce more than one product and have limitations on the availability of funds to purchase inputs for each enterprise. The equation marginal cost equals marginal revenue implies that no limitations exist in the availability of money needed to purchase inputs. Under this assumption, the farmer would produce at a level that maximizes profits in each enterprise. It is unlikely that a farmer would have all the money needed for the purchase of inputs, and will globally maximize profits.

The product-product model provides a better set of decision!making rules for determining the allocation of dollars for the purchase of inputs when the farmer produces many different outputs and faces constraints. The basic decision rule for the product-product model is

†19.1 $$VMP_{xy_1}/v = \ldots = VMP_{xy_i}/v = \ldots = VMP_{xy_m}/v = R$$

where the notation is the same as defined in Chapter 16.

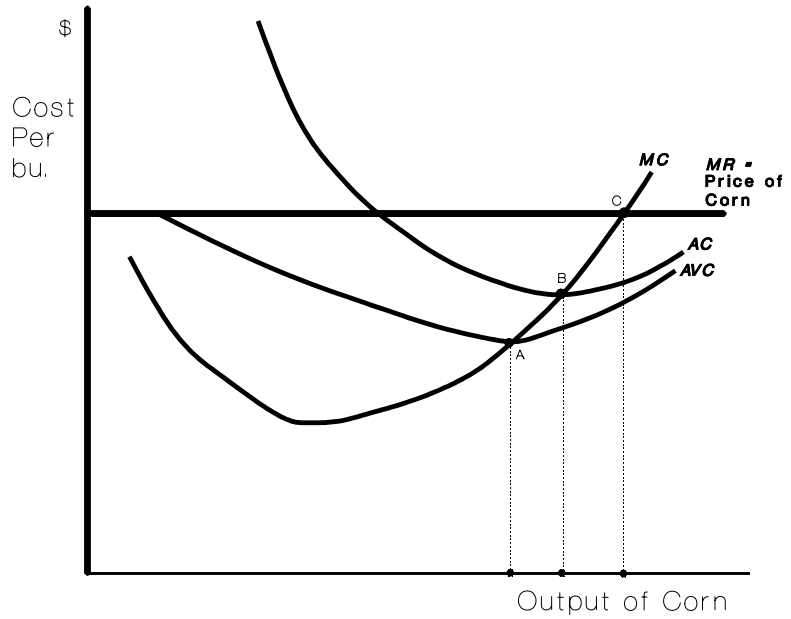

Figure 19.1 Output of Corn and Per Bushel Cost of Production

Equation †19.1 is the familiar equimarginal return principle on the output side. The rule implies that the farmer would attempt to make equal the ratio of returns to costs for all enterprises. Equation †19.1 also implies that the output level to appear on the farm budget for each enterprise would probably be less than that associated with the point where marginal revenue and marginal cost are the same.

19.3 The Variable-Input Levels

A second decision the farmer must make is to determine the level of the variable inputs to be used. The marginal cost equals marginal revenue rule generates an output level that maximizes profits. The output level that maximizes profits uses the amounts and combinations of inputs defined by the intersection of the pseudo scale lines.

The farmer interested in maximizing profits can either equate marginal cost to marginal revenue or can determine where the *VMP* for each input divided by its respective price equals 1. The first approach gives the solution in terms of output, while the second provides the solution in terms of the optimal quantities of each input to be used, but the two solutions are consistent. If each input is used at its profit maximizing level by the (*VMP* = *MFC*) decision rule on the input side, the profit maximizing level of output will be produced by the (*MR* = *MC*) decision rule on the output side.

If there are constraints or limitations in the availability of funds for the purchase of inputs, marginal analysis also provides a clear set of rules both with regard to how dollars should be allocated for the purchase of inputs as well as how the inputs should be allocated among enterprises:

$$\dagger 19.2 \quad p_1 MPP_{x_i y_1}/v_1 = \ldots = p_i MPP_{x_i y_i}/v_1 = \ldots = p_m MPP_{x_i y_m}/v_1$$

$$\vdots \qquad\qquad \vdots \qquad\qquad \vdots$$

$$= p_1 MPP_{x_j y_1}/v_j = \ldots = p_i MPP_{x_j y_i}/v_j = \ldots = p_m MPP_{x_j y_m}/v_j$$

$$\vdots \qquad\qquad \vdots \qquad\qquad \vdots$$

$$= p_1 MPP_{x_n y_1}/v_n = \ldots = p_i MPP_{x_n y_i}/v_n = \ldots = p_m MPP_{x_n y_m}/v_n \quad 8$$

Constrained maximization indicates that inputs should be allocated to each output in such a way that the last dollar spent for each input returns the same amount for every farm enterprise. The input levels selected should be consistent both with this rule and with the output level specified for each enterprise budget.

However, farmers often have but partial knowledge of the *VMP*'s associated with each input to be used in the production of each output. Information is frequently obtained on a trial ! and- error basis, which can be both expensive and time consuming for the farmer. There is little question as to the proper amount and allocation of each input, but the information needed to do this is often unavailable.

19.4 The Fixed-Input Allocation

A farm budget is frequently used as a planning device for the coming production season. Fixed inputs would thus include only those factors of production the farmer did not intend to change or control over the coming season. Conversely, variable inputs are factors of production which the farmer planned to control or alter during the upcoming season. Variable inputs are usually readily allocable to specific enterprises. In many instances, fixed inputs cannot readily be allocated to an enterprise.

Inputs not allocable to a specific enterprise have very little to do with marginal analysis. If fixed inputs cannot easily be allocated to a particular enterprise, they should not play a role in determining whether or not that enterprise should be pursued. If the ultimate goal of enterprise budgeting is to determine the output levels for each enterprise, perhaps those inputs that cannot easily be allocated to a particular enterprise should better be left out of the enterprise budget entirely.

The cost of fixed inputs does become important when the farmer determines the net farm income at the end of the growing season. In the long run, the farmer must cover all costs, fixed and variable, in order to survive, but in the long run, all costs are variable. The budget for an enterprise should not be looked upon as a document for determining the net farm income from

that enterprise, but rather as a planning tool useful in managing the farm. Fixed inputs enter in only if the farmer is considering the purchase or the sale of the item at the time the enterprise budget is made, and then the input is more properly treated as a variable cost allocable to the enterprise.

For the purpose of enterprise budgeting, inputs allocable to the specific enterprise might better be categorized as durable or nondurable. Durable inputs are those that normally last more than one production season. Nondurable inputs are used up during the production season. The process of determining the cost per year of a specific durable input to appear in the enterprise budget is much easier once the farmer has determined that the durable input should be allocated to a specific enterprise.

19.5 The Economies of Size and Farm Budgets

As noted earlier, a farm budget assumes a specific level of output to be produced. However, costs per unit of output can vary substantially depending on the size of the operation. The assumed size of the operation can have a great deal to do with the specific numbers that appear in the budget.

As indicated in Chapter 9, economies of size usually arise from two sources. Pecuniary economies of size occur because the farm manager is able to purchase an input at a lower price per unit in large quantities than in small quantities.

Non pecuniary economies of size occur because by expanding the level of output, the farmer can spread fixed costs and thus reduce average fixed costs per unit of output. But if fixed costs cannot be allocated to specific enterprises, the pecuniary economies of size issue is more properly dealt with as part of the total plan for the farm, outside the budget for a specific enterprise. Moreover, in the long run there are no fixed costs.

Nonpecuniary economies of size can also occur due to the possible specialization of inputs. As the size of the enterprise increases, the farmer can purchase input that are better suited to low ! cost production.

Enterprise budgets can reflect pecuniary economies of size. Prices for variable inputs might be based on approximations of how much of each input will be purchased by the farm in total. In providing quantity discounts to the farmer, the fertilizer dealer does not care how much of the fertilizer is to be allocated specifically to the wheat, corn, and soybean enterprise.

19.6 Price and Output Uncertainty

To develop an enterprise budget, specific assumptions need to be made with respect to prices and outputs. If an enterprise budget is developed as a planning document, neither prices nor outputs will be known with certainty. If the farmer makes budgets at the start of the season, the farmer will be nearly certain of the prices for inputs needed and purchased at the start of the production season. For inputs purchased during the production season, there may be a degree of variability relative to budgeted amounts.

A decision must be made with regard to the price of the output or outputs produced by the enterprise. There will normally be a good deal of variability in output prices during the

production season, but the farmer has tools available for dealing with this source of variability. For example, the futures market might be used to determine a specific price for the output at the end of the production season. If the output or commodity is affected by a government program, the price of the commodity may be supported at some specific level. Therefore, the problem of attaching a specific price to an output in an enterprise budget may not be as difficult as it initially seems.

Output uncertainty presents other problems. Despite a farmer's keen awareness of the *VMP*'s associated with each input in the production of each output in a normal production season, because of nature, the outcomes suggested by the enterprise budget may not become reality. Farmers usually make output predictions based on past experience with the enterprise in an average year, adjusted for any changes in the use of inputs as proposed in the budget. Ideally, this is the output level where marginal revenue and marginal cost are equal, or as an alternative, an output level such that the rates of product transformation for the output from each pair of enterprises equals the corresponding output price ratio.

19.7 Concluding Comments

Enterprise budgets are the planning tools perhaps most commonly used by farmers. Marginal analysis can provide a useful basis for the development of the appropriate numbers for an enterprise budget. Marginal analysis can be used to determine (1) the proper output level, (2) the amounts and combinations of inputs that will produce at greatest profit or least cost for a given output level, and (3) the proper size of the operation.

An enterprise budget is a planning document that specifies what might happen and also what almost surely will not always take place. It is not an accounting document designed to determine the overall profitability of the farm. The marginal rules developed in this text can play a key role in making the enterprise budget a more effective aid to farm planning.

Problems and Exercises

1. In an enterprise budget, how are variable costs distinguished from fixed costs?

2. Upon what basis might a farmer determine potential selling prices for the commodity or commodities produced by the enterprise?

3. In determining costs, what level of output should be chosen as the basis for making the enterprise budget?

4. Suppose that the farmer has available quantity discounts in the purchase of fertilizer and chemicals. How should such discounts be handled within the enterprise budget framework?