MARYLAND COOPERATIVE EXTENSION
UNIVERSITY OF MARYLAND
COLLEGE PARK•EASTERN SHORE

Fact Sheet

Fact Sheet 546

Cost and Revenue Considerations in Farm Management Decisionmaking

Most productive agricultural resources are scarce. Consequently, to obtain the use of these productive resources, one has to pay a price for them. This fact sheet discusses the concepts of input pricing, time periods, major categories of costs, calculation of costs and cost applications as they relate to the decision-making process used by managers as they face everyday economic problems on the farm.

Pricing Inputs

By definition, the cost of producing a product means the expenses incurred to produce a particular amount of a product for a particular time period. An important economic consideration is what price or cost to use in valuing the resources used in the production process. Farmers can easily price some resources or inputs, such as seed, fertilizer, lime, fuel and hired labor. Farmers generally use a market price to determine the cost of these resources. Other inputs, such as land, operator labor and family labor, are not as easy to price. Farmers may have to rely on the opportunity cost for pricing these resources.

The opportunity cost of a resource is the value of the product not produced or activity not carried out. In other words, the return forgone by not using a resource in a certain way (usually the most profitable or best alternative use) is the opportunity cost. For example, if a farmer produces corn, the lost income from not producing barley, wheat, oats, dairy products or hogs is the opportunity cost. The opportunity cost of land may be the land value multiplied by an acceptable rate of return (interest rate) or some alternative rental rate (cash, share or flexible cash). The opportunity cost of labor is the income foregone by not working off of the farm or by not using farm labor in some alternative enterprise on the farm.

Resources often are limited in quantity and farmers must decide the best use for them. A farmer in this predicament would allocate the limited resource among alternative uses in such a way that he or she places the resource in the most profitable enterprise first, the next most profitable second, and so forth. This ensures the marginal value products (added-value products) of the last unit are equal in all uses. As the farmer adds resources, marginal value productivity of the resources will eventually decrease in the enterprises receiving more and more of the resources, and a point will be reached where the marginal value productivity will be equal for the last unit of the resource used in all of the enterprises.

Time Periods

Only the shortrun and longrun time periods that are important in classifying costs will be considered here. The short run permits desired changes in outputs without altering the size of the existing farm and usually involves one production period. In the short run, at least one input has to be fixed. In the long

run, outputs can be changed by varying all inputs including the size of the operation.

Major Categories of Costs

Major categories of costs include fixed, variable, marginal, cash and noncash.

Fixed Costs

Fixed costs are costs incurred even if no output is produced. They arise because a quantity of fixed resources is used during the production period even if there is no production.

There are several examples of fixed costs, such as **D**epreciation, **I**nterest, **R**ent and Repairs, **T**axes and **I**nsurance. Many people refer to these as the DIRTI-5. Depreciation (**D**) may result from use or passage of time. However, only time depreciation (obsolescence) is a fixed cost, use depreciation is a variable cost. If a farmer purchased a farm and paid an annual interest (**I**), this amount would be a fixed cost since the payment (including interest) would have to be made regardless of the amount of output produced. If the farmer were self-financed, an opportunity cost of interest (I) on average investment could be calculated and included as a fixed cost since the investment in the farm could not be used somewhere else. Rent (**R**) would be a fixed cost if it had to be paid regardless of the amount of product produced. Some farmers place repairs (**R**), or at least part of repairs and maintenance expenses for a machine or building, as the (**R**) portion of the DIRTI-5. Many farmers insure (I) their buildings and equipment against hazards and must make premium payments independent of the amount of crops or livestock produced. In addition to the DIRTI-5, some farmers include housing costs for machinery storage as a fixed cost.

In summary, fixed costs are

- incurred even though no output is produced,
- fixed only after the expense has been incurred,
- primarily a function of time and not output,
- not the relevant costs in determining the optimum level of input use, and
- associated with at least one fixed resource in the short run.

Variable Costs

Variable costs are costs of adding variable inputs to the production process and are incurred only if production takes place. The level of costs depends on the quantity and price of these inputs. These costs increase as output increases and decrease as output decreases. Examples of variable cost items include seed, fertilizer, lime, gasoline, diesel fuel, oil, lubricants and herbicides. These inputs can be changed during the production process to bring about changes in output. However, once a variable cost is incurred, it becomes fixed for that production period.

Variable costs are primarily a function of output level produced and are the costs used in determining the optimum level of input use. (See Fact Sheet 548 "Using Economic Principles To Manage Your Farm".)

Cash and Noncash Costs

Cash costs require current cash outlays. Noncash costs can be deferred to later periods for payment. Because noncash costs can be deferred, often they are overlooked in the decisionmaking process. This can be an error.

What are some cash and noncash costs? Depreciation is a noncash cost. That is, farmers prorate the

investment's cost over the life of the asset and do not make annual cash payments for the fixed cost. Interest on the investment can be cash or noncash. When an individual borrows money, the interest payment is a cash expense. If he or she uses owned capital, an opportunity cost of the capital is a noncash cost. Property taxes are cash costs. In general, repairs are cash costs. However, if a farmer uses his or her own labor, this could be considered a noncash cost. Insurance can be a cash or noncash cost. That is, if a farmer is self-insured, it is a noncash cost. If the farmer purchases commercial insurance, the premium would be paid as a cash cost. In general, outlays for seed, fertilizer, lime, fuel, oil, lubricants, rented land or hired labor are cash costs.

It is important to remember that both cash and noncash costs must be considered when making farm financial decisions. In the short run, and if a large proportion of the costs are noncash, less cash is needed to operate the business. However, in the long run, all cash and noncash costs must be covered.

Marginal Cost

Marginal cost is the addition to total cost associated with producing one more unit of output. Marginal cost is important in farm management decisionmaking because it must be compared to the revenue earned by selling the additional unit of output. If the additional unit of output covers more than the marginal cost, it is economical to produce it.

Cost Calculations

The seven cost concepts in farm management decisionmaking are total fixed cost, total variable cost, total cost, average fixed cost, average variable cost, average total cost and marginal cost (Table 1).

Table 1: Cost and revenue calculations for selected input-output relationships[1]

Input (X_1) (unit)	Output (Y) (Bushel)	Total fixed cost (TFC)	Total variable cost (TVC)	Total cost (TC)	Average fixed cost (AFC)	Average variable cost (AVC)	Average total cost (ATC)	Marginal cost (MC)	Marginal revenue (MR)	Total revenue (TR)	Net revenu (NR) (TR-TC)
0	0	$100	$ 0	$100	$--	$--	$--			$ 0	$-10
								0.75	3.00		
1	20	100	15	115	5.00	0.75	5.75			60	-5
								0.50	3.00		
2	50	100	30	130	2.00	0.60	2.60			150	2
								0.75	3.00		
3	70	100	45	145	1.43	0.64	2.07			210	6
								1.50	3.00		
4	80	100	60	160	1.25	0.75	2.00			240	8
								3.00	3.00		
5	85	100	75	175	1.18	0.88	2.06			255	8
								7.50	3.00		
6	87	100	90	190	1.15	1.03	2.18			261	7

[1] Fixed cost is $100. Price of input ($X_1$) is $15 per unit. Price (MR) of output (Y) is $3 per

bushel.

Total fixed cost (TFC) is the sum of all fixed input costs. Total variable cost (TVC) is the sum of all variable input costs. Total cost (TC) is the sum of total variable and total fixed costs.

$$TC = TFC + TVC$$

Average fixed cost (AFC) is total fixed cost divided by the level of output (Y). In short, AFC is a fixed cost per unit of output that will decline as long as output increases. This is true because TFC is constant regardless of level of output produced (Figure 1 and Table 1).

$$AFC = \frac{TFC}{Y}$$

Average variable cost (AVC) is the total variable cost divided by the level of output.

$$AVC = \frac{TVC}{Y}$$

Total variable cost is the price of the input (P,) multiplied by the amount of the input (X). AVC for a single variable input can be expressed as

$$AVC = \frac{P_x X}{Y}$$

$$AVC = P_x\left(\frac{X}{Y}\right)$$

$$AVC = \frac{P_x}{Y/X}$$

where Y/X =Average Physical Product (APP).

$$\text{Then, } AVC = \frac{P_x}{APP}$$

P_x remains constant in a purely competitive market (where a farmer can buy all of the input desired at the given price). Therefore, there is an inverse relationship between average physical product

$$\left(\frac{Y}{X}\right)$$

and AVC. If APP is at a maximum, AVC is at a minimum. If APP is increasing, AVC is decreasing and vice versa.

Average total cost (ATC) is total cost divided by output or the sum of average fixed and average variable costs.

$$\frac{TC}{}$$

$$ATC = \frac{}{Y}$$

or

$$ATC=AFC+AVC$$

Marginal Cost

Marginal cost is calculated by dividing the change in cost ($\triangle$ cost) by the change in output ($\triangle Y$).

$$MC=\frac{\triangle Cost}{\triangle Y}$$

If there is only one variable input, marginal cost per unit of output for that input can be represented as

$$MC=\frac{\triangle Cost}{\triangle Y}$$

where $\triangle Cost=P_x\triangle X$.

Then,

$$MC=P_x\left(\frac{\triangle X}{\triangle Y}\right)$$

$$MC=\frac{P_x}{\triangle Y/\triangle X}$$

where $\frac{\triangle Y}{\triangle X}$ = Marginal Physical Product.

Then,

$$MC=\frac{P_x}{\text{Marginal Physical Product (MPP)}}$$

An inverse relationship exists between marginal cost (addition to cost for each additional unit of output) and marginal physical product (addition to output for each additional unit of input used). Since marginal cost is the addition to the total cost for producing another unit of output, MC is related to AVC and ATC. When MC is less than AVC or ATC, AVC and ATC will decrease. If MC is greater than AVC or ATC, AVC and ATC will increase. Consequently, MC crosses the AVC and ATC at their minimum points (Figure 1).

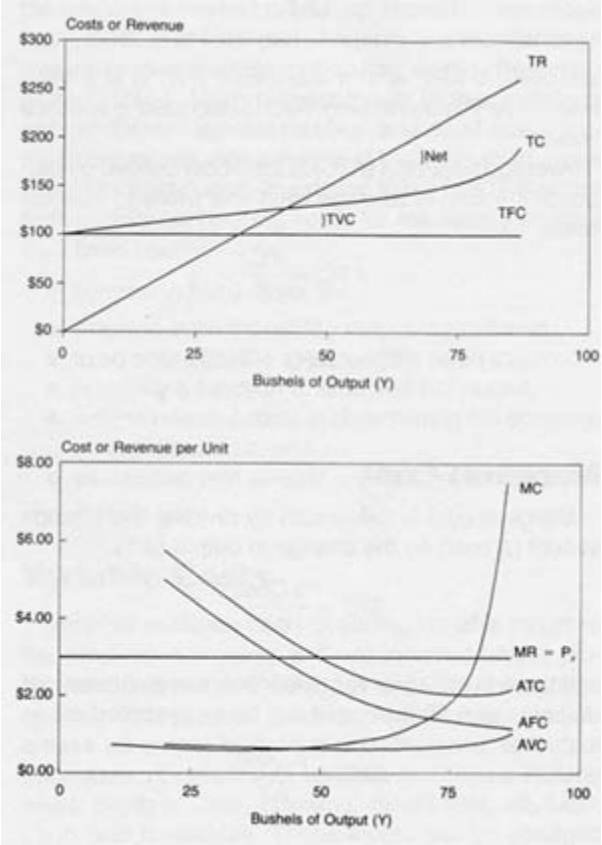

Figure 1. Shortrun costs, revenue and optimal level of output.

Cost and Revenue Applications

Table 1 and Figure 1 present cost and revenue calculations for selected input-output relationships and prices. As pointed out, AFC declines as output increases. Also, AVC or ATC declines when MC is less than each respective cost and increases when MC is greater than AVC or ATC. The MC column (Table 1) shows the cost of producing an additional bushel of output, and the marginal revenue (MR) column shows the additional revenue from selling an additional bushel of output. MR is constant and equal to the price of the output because the farmer in a purely competitive market can sell all the product desired at the given price. It is economical to increase output as long as added income (MR) is greater than the added cost (MC). The first input adds 20 bushels to output, each of which adds $3 to revenue (MR) and costs only 750 each (MC). The second unit of input adds 30 bushels of output, each of which adds $3 (MR) and 500 (MC); the third, $3 versus 750 (MC); the fourth, $3 versus $1.50 (MC); the fifth, $3 versus $3 (MC). This is as far as the farmer should increase output. If he or she adds the sixth input, additional cost (MC) is $7.50 per bushel of corn, which greatly exceeds the (MR) of $3 per bushel. This is not economical. This type of analysis is called marginal analysis; it compares additional revenue per bushel to additional cost per bushel.

According to the last column, net revenue (NR) increases as long as the marginal return (MR) from selling one more unit of output exceeds the cost of producing that additional unit of output. Since MR equals MC as output increases from 80 to 85 bushels, both output levels yield the same NR. This will always be true when MR is equal to MC. In practice, the farmer usually gets MR and MC close, without letting MR become less than MC.

Summary and Conclusions

This fact sheet emphasizes cost and revenue considerations in farm management decisionmaking and is useful in helping farmers to analyze practical problems they face about alternative enterprises that could

be produced on the farm.

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