Fixed and Variable Cost Principles for Financial Planning

Department of Agricultural Economics

Kansas State University Agricultural Experiment Station and Cooperative Extension Service

Kevin C. Dhuyvetter
Extension Agricultural Economist
Farm Management

The crop and livestock budgets in the *Kansas Farm Management Handbook* and those in other agricultural finance publications include sections for "variable costs" and "fixed costs." The purpose of this guide is to explain how fixed and variable costs should be used in the production decision-making process, both in the short and long run. Most agricultural producers face the prospect of not covering all of their costs at some point, and at these times it is important to consider whether future production makes financial sense.

Definitions

"Short run" and "long run" are not defined in terms of a specific number of days, weeks, or months. Rather, they are defined in terms of how quickly different types of inputs can be varied in the production process. Some inputs, such as livestock feed, can be varied day by day, while other inputs – land and buildings, for example may take months or even years to either acquire or sell.

In the short run, the amounts of some inputs can be changed while others cannot. In agricultural production, inputs such as seed, fertilizer, fuel, labor, and livestock feed are generally viewed as being variable in the short run. However, it is important to realize that once a cost has been incurred it is no longer variable (e.g., seed is a fixed cost after planting). Such inputs as land, machinery, and buildings are typically viewed as being fixed in the short run. Breeding livestock may be considered either fixed or variable, depending on the nature of the business. For example, dairy cows and sows are relatively variable compared to buildings and equipment because they turnover fairly rapidly; however, beef cows are often more fixed because they tend to stay in the herd for longer time periods. The long run is generally defined to be the length of time in which all inputs can be varied, including land.

The definitions of variable and fixed costs follow from the definitions of the short and long run. Variable costs are those inputs that can be varied in the short run. Varying these inputs also changes the level of output in the short run, so the costs of fertilizer, fuel, labor, and livestock feed are variable costs. In turn, fixed costs are the costs of those inputs that do not change in the short run. These costs must be paid whether anything is produced or not. For example, land and machinery costs (either principal and interest payments or opportunity costs) are incurred regardless of whether a crop is planted.

Rules for Production Decisions

Should a producer continue production if expected sales do not cover either variable costs or fixed costs? There are separate decision rules used to answer this question for the short run versus the long run.

Rule for the short run: Producers should stay in production if projected revenue will cover variable costs. Thus, by continuing with production, all variable costs and at least some of the fixed costs are paid. If variable costs cannot be covered, continued production, even in the short run, only makes things worse. An example of this is the case of a crop so poor that the value of the grain in the field is not worth the cost of harvesting it.

Because fixed costs are paid in the short run regardless of whether anything is produced, producers should stay in production if at least some of those costs can be paid. For example, a below-average crop yield might allow for all variable costs to be covered but perhaps not all machinery and land costs.

Rule for the long run: Producers should stay in production if all costs can be covered. A producer cannot stay in business indefinitely if income does not cover costs of long-lived assets such as land, buildings, or machinery. Each additional year of production in this case reduces net worth by the amount that revenue falls below total costs.

Crop Production Example

Some simplified examples are useful in illustrating these principles. Consider first a wheat operation for north central Kansas described in Table 1. Using budget figures found in Farm Management Guide MF-2158, the expected revenue per acre of $144.32 easily covers the $93.56 per acre variable costs. However, after adding the fixed costs associated with land and machinery, this producer loses $24.52 per acre.

What should this producer do in the short run and the long run? In the short run, the producer is better off going ahead with production because all variable costs and a portion of fixed costs are covered. Planting no crop would save variable costs but there would still be a loss equal to total fixed costs, $75.28 per acre, because land and machinery costs are incurred whether or not a crop is produced.

In the long run, however, some changes need to be made, since the business cannot continue to lose $24.52 per acre every year. One option is to determine how much marketing and production performance must be improved to cover all costs. Line K indicates that $3.47 per bushel is needed to cover all costs at the current yield and cost levels. While this price

may be achieved in some years, it seems unlikely this price could be achieved on average unless market conditions change drastically. Line L indicates that yield would have to rise by about 8 bushels per acre (about 18 percent) without increasing costs at the current price level in order to breakeven. Such a yield increase is most likely not possible without increasing inputs.

Another option is to reduce costs without reducing yields, which may be difficult. Fixed costs may be reduced several ways, such as through the use of less expensive machinery, or through more efficient use of machinery (i.e., cover more acres with same machinery).

If all of these efforts are still unsuccessful in covering total costs, the producer faces the decision of leaving the farming business or finding a more profitable crop to plant. To remain in business at the status quo means a loss in net worth every year. In this example, a producer farming 800 acres of wheat would lose $19,616 each year on average at the given yields, costs, and prices. Postponing the decision to change crops or quit farming only makes this producer worse off.

Livestock Production Example

Another example using the fixed and variable cost principles is presented in Table 2. This budget is for an operation finishing feeder pigs and is based on KSU Farm Management Guide MF-2152. The expected gross revenue of $44.71 per head almost covers the variable costs, but is not sufficient to cover fixed costs.

When preparing budgets, it is important to calculate expected costs, returns, and breakeven prices using various price assumptions. Expected returns and breakeven prices are sensitive to changes in the cost of feeder pigs. When purchasing feeder pigs, many producers want to know what they can afford to pay. Table 2 presents the maximum price that can be paid for feeder pigs and still cover all costs. Given the assumptions in Table 2, a producer could pay up to $30.50 per head for feeder pigs and still cover all costs.

Returns over variable and total costs are also sensitive to changes in the expected market hog price. For an expected market hog price of $30/cwt, losses from variable and total costs are –10.48 and –19.39 dollars per head, respectively. In this case, a feeder pig finisher would not cover either variable or fixed costs. A producer would be considerably better off not finishing hogs given the costs in Table 2 and a market price of $30/cwt. If a producer finished hogs, the expected loss would be $19.39 per head, whereas, if a producer did not buy feeder pigs, the loss would be equal to the $8.91 per head fixed costs.

Table 1. *Per Acre Production Costs, Expected Returns, and Cost-Return Comparison for Wheat, North Central, Kansas.*

COSTS OF PRODUCTION	
A. Total variable costs	$ 93.56
B. Total fixed costs	75.28
C. Total costs (A + B)	168.84
RETURN PER ACRE:	
D. Yield, bushels	46.00
E. Price, $/bushel	$ 2.94
F. Government payment	9.08
G. Total returns [(D x E) + F]	144.32
COST-RETURN COMPARISON:	
H. Returns over variable costs (G – A)	$ 50.76
I. Returns over total costs (G – C)	-24.52
J. Variable cost/bushel (A ÷ D)*	1.84
K. Total cost/bushel (C ÷ D)*	3.47
L. Additional yield per acre needed to cover revenue shortfall at $2.94/bushel (I ÷ $2.94)	8.34

** Government payment has been factored in.*

Table 2. *Per Head Production Costs, Expected Returns, and Cost-Return Comparison for Finishing Feeder Pigs.*

COSTS OF PRODUCTION	
A. Total variable costs	$ 45.33
B. Total fixed costs	8.91
C. Total costs (A + B)	54.24
RETURN PER HEAD:	
D. Market hog (260 lbs x $33.95/cwt)	88.27
E. Less cost of feeder pig	$ 40.03
F. Less death loss (4% x D)	3.53
G. Gross return per head (D – E – F)	44.71
COST-RETURN COMPARISON:	
H. Returns over variable costs (G – A)	$ -0.62
I. Returns over total costs (G – C)	-9.53
J. Variable and feeder pig cost/cwt sold [(A + E + F) ÷ 260 x 100]	34.19
K. Total and feeder pig costs/cwt sold [(C + E + F) ÷ 260 x 100]	37.62
L. Maximum price that can be paid for feeder pigs and still cover all costs	30.50
M. Return over variable costs given an expected market hog price of $30/cwt	-10.48
N. Return over total costs given an expected market hog price of $30/cwt	-19.39

Publications from Kansas State University are available on the World Wide Web at: http://www.oznet.ksu.edu

Kansas State University Agricultural Experiment Station and Cooperative Extension Service

MF-1006 October 2001