



Fixed and Variable Cost Principles for Financial Planning

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The crop and livestock budgets in the *Kansas Farm Management and Marketing 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 when deciding whether to continue production, both in the short run and long run. Almost all agricultural producers face the prospect of not covering all their costs at least once, 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, like livestock feed, can be varied day by day, while others like land or buildings may take months to either acquire or sell.

In the short run, the amounts of some inputs can be changed while others cannot. In agricultural production, inputs like seed, fertilizer, fuel, labor, and livestock feed are viewed as being variable in the short run. Inputs like land, machinery, buildings, and breeding livestock are typically seen as fixed in the short run. The long run, then, is 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 runs. Variable costs are costs of 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 things like 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 payments must be made even if a crop never gets planted.

Rules for Production Decisions

Should a producer continue in 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 and the long run.

Rule for the short run: the producer should stay in production if it appears sales revenue will at least cover variable costs. Thus, by continuing with production, all the variable costs and at least some of the fixed costs are paid.

However, if even the 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, a producer 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 payments.

Rule for the long run: produce only 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 examples are useful in illustrating these principles. Consider first the wheat operation for northeast Kansas described in Table 1. Using budget figures similar to those in the KSU Farm Management Guides, the expected revenue per acre of \$149.34 easily covers all variable costs. However, after adding the fixed costs associated with land and machinery, this producer loses \$26.75 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 most of the fixed costs (all but \$26.75 per acre) are covered. Planting no crop would have saved variable costs but still would have resulted in a loss equal to total fixed costs, \$83.86 per acre, because land and machinery payments would have to be made whether a crop was grown or not.

In the long run, however, some changes need to be made since the business cannot continue to lose \$26.75 per acre every year. One option is to determine how much marketing and production performance must be improved to cover all costs. Line L indicates that \$5.04 per bushel is needed to cover all costs at the current yield level. 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 M indicates yield would have to rise by 6.69 bushels per acre (about 19.1 percent) without increasing costs in order to break even. Such a yield increase may also be difficult without more costly inputs.

Another option is to reduce costs without reducing yields, which may be difficult. However, fixed costs may be reduced several ways, such as through the use of less expensive machinery, or through refinancing arrangements that lengthen loan maturity and reduce annual payments.

If all of these efforts are still unsuccessful in covering all costs, the producer faces the unpleasant alternative of leaving the farming business. To otherwise remain in business means a loss in net worth every year. If the producer in this example farmed 1,000 acres, \$26,750 would be lost each year on average. Postponing the decision to leave 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 a feeder pig operation. Using budget figures similar to those in the KSU Farm Management Guides, we find the expected gross return per head is \$55.55. This gross return per head is large enough to cover both variable and fixed costs of production. Thus, the producer will produce in the short and long runs.

When preparing budgets, it is important to calculate expected costs, returns, and break-even prices using various price assumptions. Expected returns and break-even 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 \$49.33 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 \$40 per hundredweight, losses from variable and total costs are \$-0.70 and \$-8.68 per head, respectively. In this case, a feeder pig finisher would not cover either variable or fixed costs. A producer would be better off not finishing hogs given the costs in Table 2 and a market price of \$40 per hundredweight. If a producer finished hogs, the expected loss would be \$8.68 per head. If a producer did not finish hogs, the loss would be \$7.98 per head.

Table 1. Per Acre Production Costs, Expected Returns, and Cost-Return Comparisons for Wheat, Northeast.

COSTS OF PRODUCTION:	
A. Total variable costs	\$ 92.33
B. Total fixed costs	83.86
C. Total costs (A + B)	176.09
RETURN PER HEAD:	
D. Yield per acre	35 bushels
E. Price per bushel	\$ 4.00
F. Net government payment	9.34
G. Total returns per acre [(D × E) + F]	149.34
COST-RETURN COMPARISONS:	
H. Returns over variable costs (G-A)	\$ 57.11
I. Return over total costs (G-C)	-26.75
J. Variable costs/bushel (A ÷ D)	2.64
K. Fixed costs/bushel (B ÷ D)	2.40
L. Total costs/bushel (C ÷ D)	5.04
M. Additional yield per acre needed to cover revenue shortfall, at \$4.00/bushel (I ÷ \$4.00)	6.69 bushels

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

COSTS OF PRODUCTION:	
A. Total variable costs	\$47.49
B. Total fixed costs	7.98
C. Total costs (A + B)	55.47
RETURN PER HEAD:	
D. Market hog (245 lbs × \$43.65/cwt)	\$106.94
E. Less cost of feeder pig	-49.25
F. Less death loss (2.00% of D)	-2.14
G. Gross return per head (D - E - F)	55.55
COST-RETURN COMPARISONS:	
H. Returns over variable costs (G - A)	\$8.06
I. Return over total costs (G - C)	0.08
J. Variable and feeder pig costs per hundredweight sold	40.36
K. Total and feeder pig costs per hundredweight sold	43.62
L. Maximum price that can be paid for feeder pigs and still cover all costs	49.33
M. Return over variable costs given an expected market hog price of \$40/cwt	-0.70
N. Return over total costs given an expected market hog price of \$40/cwt	-8.68