

Microeconomics, Module 6, "Production and Costs" (Chapter 6)

(Overview and important relations)

(The attached PDF file has better formatting.)

### *Fixed and Variable Costs*

To produce goods, a firm must buy inputs. A winery buys grapes and bottles, and hires labor to ferment the wine. It needs to buy or rent a factory to produce the wine.

A change in consumers' tastes may prompt the firm to produce more or less wine.

- Some inputs can be changed quickly: it can easily buy more glass bottles.
- Some inputs change slower: it may take several weeks to hire more workers.
- Some inputs are difficult to change quickly: building a new factory may take over a year.

A *fixed* factor of production cannot be changed in the time period being considered. For a time period of one quarter, the factory is a fixed factor, and the other inputs are variable factors. The *short run* is a period too short for all the factors to be variable. There are many short runs: 1 week, 1 month, 1 quarter, etc.

Costs can be split into *fixed costs* (costs of fixed factors of production) and *variable costs* (costs of variable factors).

$$\text{Total Costs (TC)} = \text{Fixed Costs (FC)} + \text{Variable Costs (VC)}$$

If the firm produces a quantity  $Q$ ,

$$\text{Average cost (AC)} = \text{Total Costs (TC)} \div \text{Quantity produced (Q)}$$

and

$$\text{Average Variable Cost (AVC)} = \text{Variable Cost (VC)} \div \text{Quantity produced (Q)}$$

Marginal cost is the cost of the last unit produced:  $MC = \partial TC / \partial Q$ .

Total costs are variable costs plus fixed costs. Fixed costs do not vary with quantity, so the derivative of fixed costs with respect to quantity is zero. Hence:

$$MC = \partial TC / \partial Q = \partial (FC + VC) / \partial Q = \partial VC / \partial Q$$

*Revenue* is the income before expenses and other costs. If the firm sells a quantity  $Q$  at a price  $P$ , Total Revenue =  $TR = P \times Q$ .

## Cost Curves

Module 6 discusses three types of cost curves:

- Average total cost (usually called just average cost)
- Average variable cost
- Marginal cost

Each curve shows the costs as a function of the quantity produced.

The marginal cost curve intersects both the average total cost curve and the average variable cost curve at the minimum points of those curves. (The text derives this relation).

Long-run cost curves: in the long run, all costs are variable, so total costs = variable costs. The relevant curves are the long-run average cost and the long-run marginal cost.

### Returns to Scale

In the long run, all inputs are variable. But if a firm doubles all its inputs, it may get more or less than double the output. The change in the output resulting from a change in all the inputs is the *return to scale*.

- If a firm has *constant* returns to scale, then changing all the inputs by the same proportion leads to a proportional change in the output. Doubling the inputs doubles the output.
- If a firm has *increasing* returns to scale, then changing all the inputs by the same proportion leads to a more-than-proportional change in the output. Doubling the inputs more than doubles the output.
- If a firm has *decreasing* returns to scale, then changing all the inputs by the same proportion leads to a less-than-proportional change in the output. Doubling the inputs less than doubles the output.

Returns to scale correspond to the slope of the long-run average cost curve:

- With constant returns to scale, average costs stay constant, so the long-run average cost curve is *horizontal*.
- With increasing returns to scale, average costs drop, so the long-run average cost curve is *downward sloping*.
- With decreasing returns to scale, average costs rise, so the long-run average cost curve is *upward sloping*.