**PROFIT MAXIMIZATION**

PROFIT = TOTAL REVENUE – TOTAL COST
PROFIT = (PRICE x QUANTITY) – (AVERAGE TOTAL COST x QUANTITY)
PROFIT = (PRICE – AVERAGE TOTAL COST) x QUANTITY

**LONG-RUN PROFIT MAXIMIZATION**

During the long run, when ALL inputs can be varied, firms maximize profit by combining inputs in quantities such that the productivity per dollar is the same for all inputs. This ensures that the firm uses the most economically efficient method of production for any rate of output.

\[
\frac{MP(x)}{P(x)} = \frac{MP(y)}{P(y)} = \frac{MP(z)}{P(z)}
\]

Firms are willing to pay 5 times as much for Input X as they pay for Input Y…. **IF** Input X is 5 times as productive as Input Y, at the margin.

In the long run, a firm that produces no output will hire no inputs, and total revenue and total cost will both be zero.

**SHORT-RUN PROFIT MAXIMIZATION**

\[
\text{PROFIT} = (\text{PRICE} – \text{AVERAGE TOTAL COST}) \times \text{QUANTITY}
\]

Price minus average total cost is the profit per unit of output. Profit-maximizing firms do **NOT** try to maximize “profit per unit of output”. Total profit may be greater if many more units of output are sold, even if “profit per unit of output” is less than maximum. For example, you could earn $10 profit per unit of output on 100 units of output sold (profit = $1000) or $8 profit per unit of output on 150 units of output sold (profit = $1200).

Firms facing a downward-sloping demand curve for their product will maximize total revenue where price elasticity of demand is unit elastic. Profit-maximizing firms do **NOT** try to maximize “total revenue”. For example, you could maximize your total revenue at $1000 with total cost of $900 (profit = $100) or by producing less you might have total revenue of $800 with total cost of $600 (profit = $200).

In the short run, firms have fixed inputs whose quantities cannot be changed. Firms must pay for these inputs, whether or not they are used. Thus, a firm that shuts down and produces no output in the short run will have zero total revenue but total cost will be equal to total fixed cost. Short-run economic profit is not zero for a firm that shuts down (produces no output). Short-run economic profit for a firm that shuts down is equal to **NEGATIVE** total fixed cost (an economic loss).
PROFIT MAXIMIZATION

PROFIT = TOTAL REVENUE – TOTAL COST
SHUTDOWN TOTAL REVENUE = 0
SHUTDOWN TOTAL COST = TOTAL FIXED COST
SHORT-RUN SHUT-DOWN PROFIT = 0 – TOTAL FIXED COST = -TOTAL FIXED COST

A firm will produce output in the short run if producing is more profitable than shutting down. By producing, the firm will incur variable costs in addition to its fixed costs. It will also earn positive total revenue. If the total revenue from selling output exceeds the total variable costs of production the firm should produce output in the short run, even if it has negative economic profit. If the economic loss from producing is less than the total fixed cost, the firm should not shut down. For example, you could shut down and lose $100 per day (your total fixed cost). By producing, you generate $50 in variable costs and $80 in total revenue (losing only $70 per day instead of $100 per day). Notice that your total revenue need not exceed total fixed cost to make production more profitable than shutting down. If total revenue exceeds total variable cost in the short run, the firm should not shut down.

If the firm decides to produce output in the short run (instead of shutting down), how much output should it produce each time period? Marginal cost is the change in total cost from producing one additional unit of output. Marginal revenue is the change in total revenue from selling one additional unit of output. If an additional unit of output adds more to total revenue than to total cost, it will increase economic profit and should be produced. If an additional unit of output adds more to total cost than to total revenue, it will reduce economic profit and should not be produced.

THREE RULES FOR SHORT-RUN PROFIT MAXIMATION IN ANY MARKET STRUCTURE:

1) SHUT DOWN IF TOTAL REVENUE < TOTAL VARIABLE COST
   SHUT DOWN IF AVERAGE REVENUE (PRICE) < AVERAGE VARIABLE COST

   PRODUCE IF TOTAL REVENUE > TOTAL VARIABLE COST
   PRODUCE IF AVERAGE REVENUE (PRICE) > AVERAGE VARIABLE COST

   IF TR = TVC AND AR (= P) = AVC, THE FIRM LOSES EXACTLY THE SAME AMOUNT BY PRODUCING OR SHUTTING DOWN, AND ITS DECISION WILL DEPEND ON ITS EXPECTATIONS OF FUTURE SALES, PRICES, AND REVENUE.

2) A FIRM THAT DOES NOT SHUT DOWN SHOULD PRODUCE AT THE RATE OF OUTPUT WHERE MARGINAL REVENUE EQUALS MARGINAL COST

3) MARGINAL COST IS ALWAYS INCREASING AT THE PROFIT-MAXIMIZING RATE OF OUTPUT
THREE RULES FOR SHORT-RUN PROFIT MAXIMIZATION IN PERFECT COMPETITION:

Perfectly competitive firms face perfectly price elastic (horizontal) demand curves. **ONLY** in this market structure is it true that \[ \text{PRICE} = \text{AVERAGE REVENUE} = \text{MARGINAL REVENUE} \]

For perfectly competitive firms the second short-run profit maximization rule becomes

\[ \text{PRODUCE WHERE \text{PRICE} = \text{MARGINAL COST (ONLY BECAUSE \text{PRICE} EQUALS \text{MARGINAL REVENUE)}}. \]

RELATING PROFIT-MAXIMIZATION RULES TO GRAPHS

Price (on the demand curve) equals average revenue (total revenue divided by quantity of output) as long as all units of output are sold at the same price (there is no price-discrimination).

You can easily determine from a graph whether a firm should shut down in the short run, by comparing the demand curve and the average variable cost curve. It makes no difference whether the demand curve is downward-sloping or horizontal when you make this comparison. If the average variable cost curve lies below the demand curve at **any rate of output**, the firm should NOT shut down. If the average variable cost curve lies entirely above the demand curve, shut down.

You can easily determine from a graph whether a firm is making positive, zero, or negative economic profit, by comparing the demand curve and the average total cost curve. It makes no difference whether the demand curve is downward-sloping or horizontal when you make this comparison. If the average total cost curve lies below the demand curve at **any rate of output**, the firm can earn positive economic profit. If the average total cost curve lies entirely above the demand curve, economic profit will be negative. If the average total cost curve just touches the demand curve at one point but never drops below it (if they are tangent), the firm can “break even” (earn zero economic profit) at that one rate of output (it will incur economic loss if it produces at any other rate of output). The “economic profit rectangle” (or “economic loss rectangle”) comes from the equation \[ \text{PROFIT} = (\text{PRICE} - \text{AVERAGE TOTAL COST}) \times \text{QUANTITY}. \]

REMEMBER:

**COMPARE AVERAGE VARIABLE COST TO THE DEMAND CURVE** to determine whether or not a firm should shut down in the short run.

**COMPARE AVERAGE TOTAL COST TO THE DEMAND CURVE** to visualize positive, negative, or zero economic profit in the short run.

**COMPARE MARGINAL COST TO MARGINAL REVENUE** to determine the profit-maximizing rate of output for a firm that does not shut down in the short run. [Price is then found on the demand curve for that rate of output.]