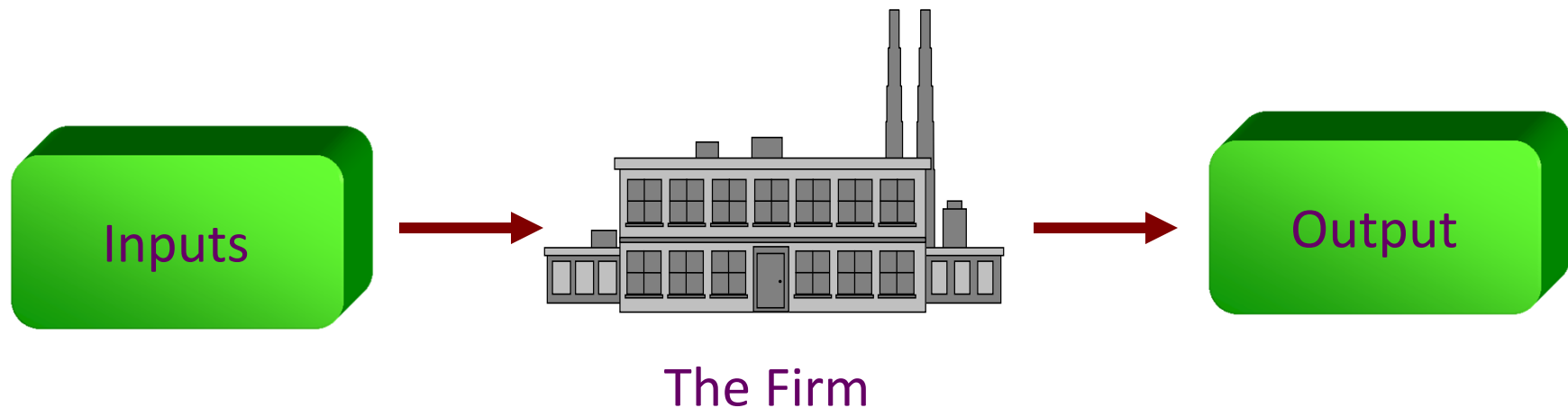


Microeconomics Review: Costs

Reference: any intermediate microeconomics text

The Neoclassical View of the Firm

- We (and almost everyone else) use a neoclassical view of the firm
 - the firm is an organization that *transforms* inputs into outputs with the goal of maximizing profits



Cost function

- **production function**: how inputs are transformed into output. The production function is written:

$$q = f(x_1, x_2, \dots, x_k)$$

- One way to look at the firm's profit maximization problem: firm chooses inputs $\mathbf{x}_1, \mathbf{x}_2, \dots, \mathbf{x}_k$ to maximize profit

$$\max_{x_1, \dots, x_k} pf(x_1, x_2, \dots, x_k) - w_1 x_1 - \dots - w_k x_k$$

- Another way: break the firm's problem into two parts:
 - first, figure out the lowest cost of producing any given level of output
→ cost function
 - second, find the output that is profit-maximizing

Cost function

- **cost function**: relationship between output choice and production costs. It is derived by finding the input combination that minimizes cost:

$$C(q) = \min_{x_1, \dots, x_k} \sum_{i=1}^k w_i x_i \quad \text{subject to} \quad f(x_1, x_2, \dots, x_k) = q$$

- now the firm's problem can be written:

$$\max_q \quad pq - C(q)$$

revenue cost producing the units in the most efficient way

Types of Costs

- **Fixed costs, F :** costs that do not vary with output (e.g., rent)
- **Sunk costs:** portion of F that is **not recoverable** (e.g., doctor's license)
- **Avoidable costs:** portion of F that **can be recovered** (e.g., machinery)
- **Variable costs, $VC(q)$:** costs that vary with output
- **Total costs, $C(q)$:** $C(q) = F + VC(q)$
 - **Marginal cost, $MC(q)$:** change in total costs that results from producing one more unit of output:

$$MC(q) = \frac{\partial C(q)}{\partial q}$$

Types of Costs

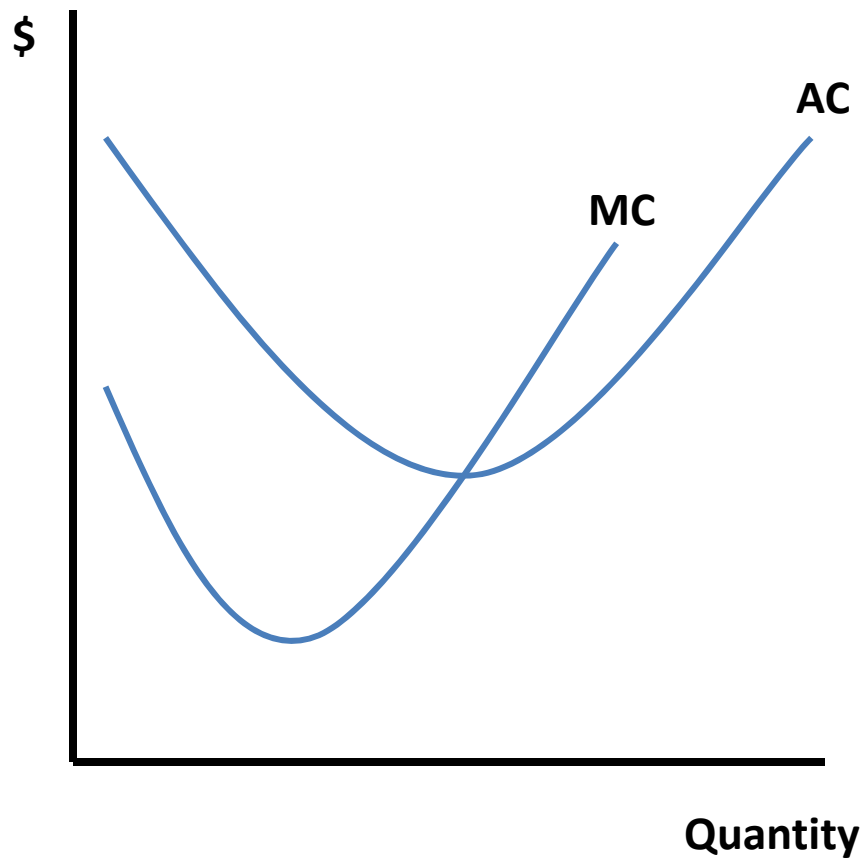
- **Average Cost:** $AC(q) = \frac{C(q)}{q}$

- **Average Variable Cost:** $AVC(q) = \frac{VC(q)}{q}$

- **Average Fixed Cost:** $AFC(q) = \frac{F}{q}$

- **Note:**
$$\begin{aligned} AC(q) &= \frac{C(q)}{q} = \frac{VC(q) + F}{q} = \frac{VC(q)}{q} + \frac{F}{q} \\ &= AVC(q) + AFC(q) \end{aligned}$$

Cost curves



Typical U-shaped AC and MC curves

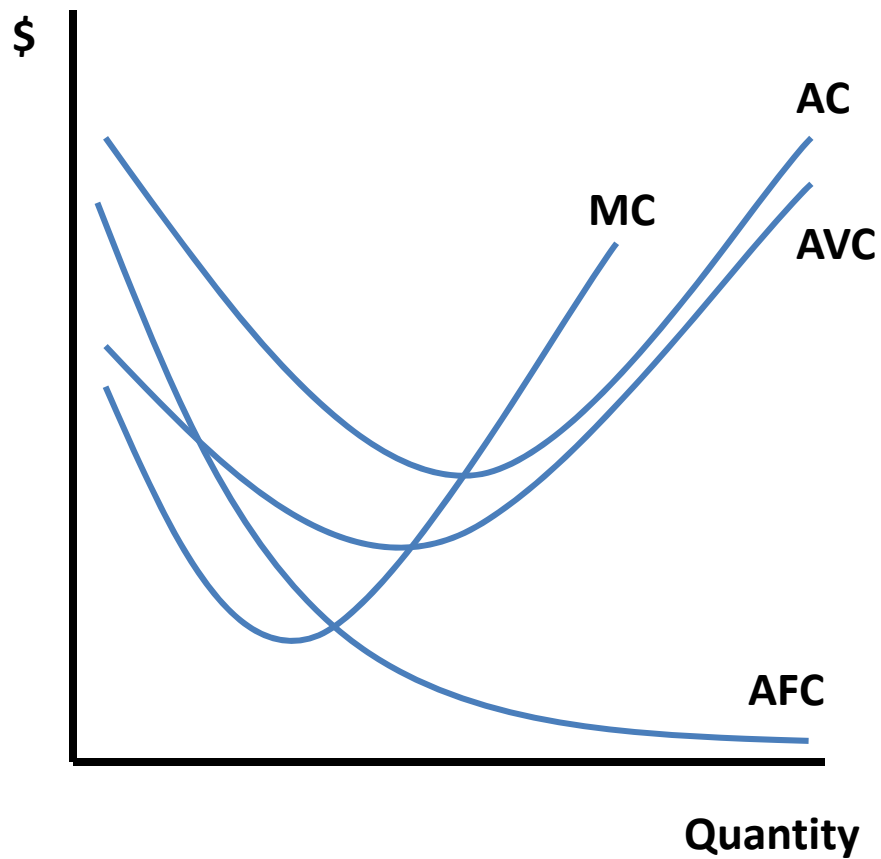
Relationship between AC and MC:

- * If $MC < AC$, then AC falls.
- * If $MC > AC$, then AC increases.
- * $MC = AC$ at the min of AC curve.

Why? Specialization and managerial talent

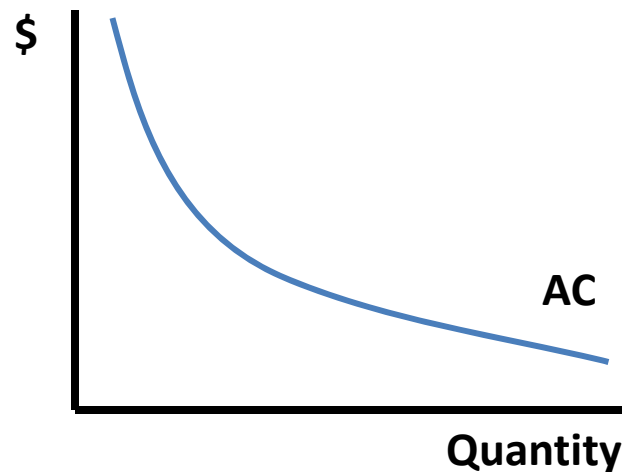
Cost curves

$$AC(q) = AVC(q) + AFC(q)$$



Economies of Scale

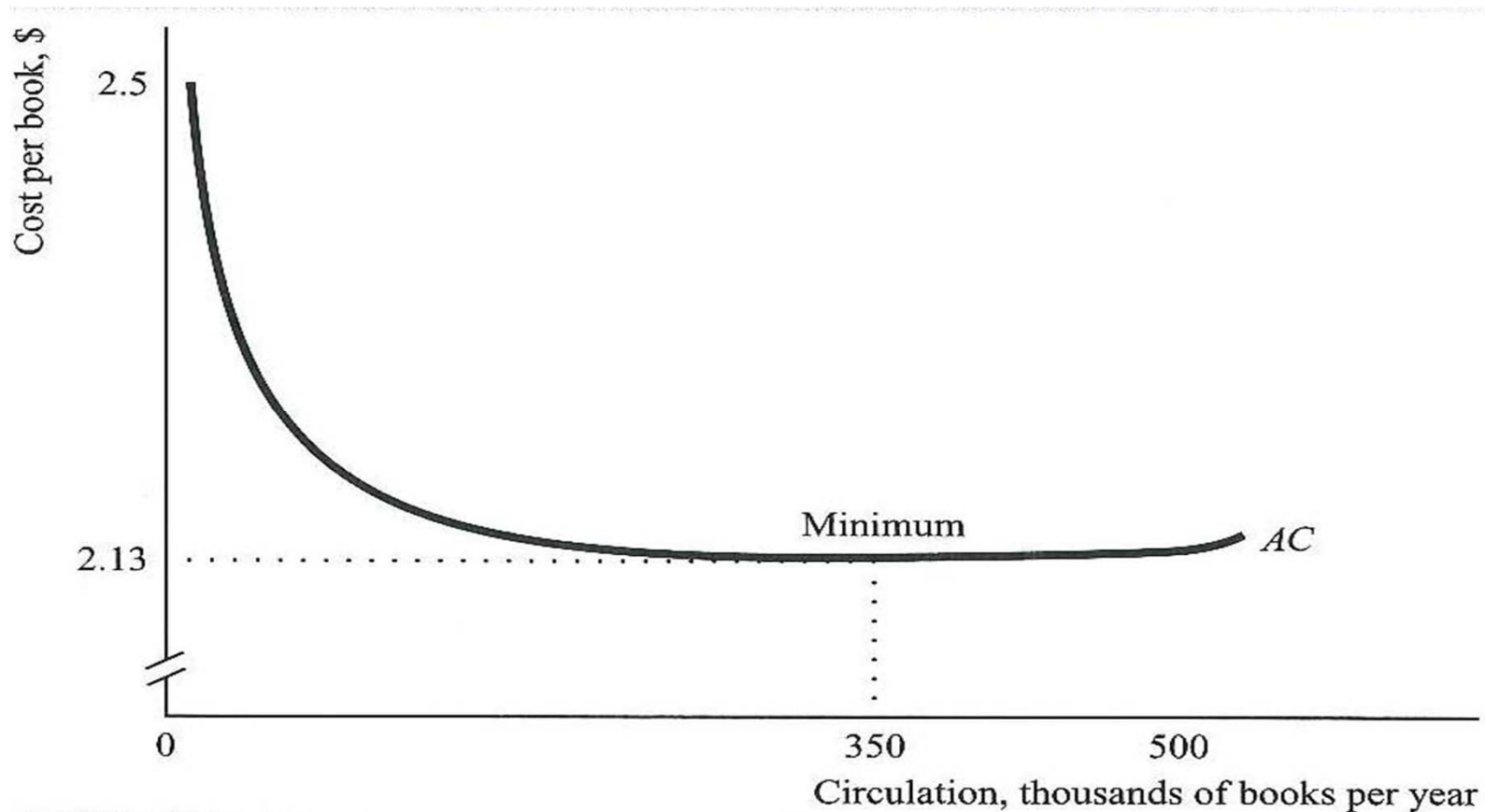
- **Economies of scale/increasing returns to scale:** average cost (AC) **falls** as output increases
- **Constant returns to scale:** average cost does not vary with output
- **Diseconomies of scale/decreasing returns to scale:** average costs **risers** as output increases
- If a firm enjoys **economies of scale at all output levels**, then it is efficient for one firm to produce the entire market output → natural monopoly



Empirical Example

Due to the higher fixed cost, thus more efficient to have a big library than a small library

- DeBoer estimated average cost curves of Indiana libraries using book circulation as the measure of output



Empirical Example

- He found average costs to be \$3.62 for a small library with a circulation of 2,000 books per year, \$2.59 at a circulation of 10,000 books and the minimum AC of \$2.13 at 350,000 books. Beyond 350,000 books AC rises slightly
- He also found that most libraries operate on the strictly decreasing part of the AC curve – i.e., they are too small from a cost perspective
- **Policy implication:**
 - The government can use this information to conclude that operating a larger library is less costly than operating several small libraries
 - E.g., the AC is 5.5% higher with four libraries with a 50,000-book circulation than a library with a 200,000-book circulation

Economies of Scope

- Most firms produce/sell more than one product:
 - OSS sell computers, paper, furniture
 - Microsoft produces Windows operating system and MS Office
 - Disney produces animated movies and a TV channel, runs a theme park, sells toys and merchandise
- A technology exhibits economies of scope if the costs of supplying 2 products jointly is lower than supplying them separately

$$C(q_1, q_2) < C(q_1, 0) + C(0, q_2)$$

Sources of Economies of Scope

- **Source of economies of scope: marketing**

- When consumers are unsure about a product's quality, they make inferences based on the product's brand
- Established firms don't have to advertise as much to persuade consumers to buy a new product
- Companies with well-established brands in one product line can introduce additional products at a lower cost than a stand-alone or new company can

marketing as a form of signaling, to convince consumers that they have a good quality product.

Empirical Example

- Yatchew studies economies of scale and economics of scope in electricity distribution in Canada
- He found the minimum average cost was achieved at about 20,000 customers
- Since most Canadian utilities serve more than 20,000 customers he concluded that utility mergers would not produce cost savings due to scale economies
- He also found that utilities that delivered both electricity and other municipal services had costs that were 7 to 10% lower than those that delivered only electricity indicating economies of scope
- **Policy implication:**
 - Do not allow mergers between electricity utilities
 - Allow mergers between different types of utilities and services