Biggest decision that an entrepreneur makes is in what industry to establish a firm

There are two decision time frames:

- The short run
    - Short run – a time frame in which the quantity of at least one factor of production is fixed
        - Usually, capital, land, and entrepreneurship are fixed factors of production
        - Plant – the fixed factors of production
    - Short-run decisions are easily reversed
        - The firm can increase or decrease its output in the short run by increasing or decreasing the amount of labor it hires
- The long run
    - Long run – a time frame in which the quantities of *all* factors of production can be varied
    - To increase output in the long run, a firm can change its plant as well as the quantity of labor it hires
    - Long-run decisions are not easily reversed
        - Sunk cost – the past expenditure on a plant that has no resale value

Short-run technology constraint

There are three concepts that describe the relationship between output and the quantity of labor:

- Total output
    - The maximum output that a given quantity of labor can produce
- Marginal output
    - The increase in total output that results from a one-unit increase in the quantity of labor employed (input) , with all other inputs remaining the same
    - Measured by slope of total product curve
    - Change in total output/change in total input: $\Delta TP/\Delta L$ L = labor
- Average output
    - Equal to total product (output)divided by the input (labor, machinery, etc)
    - Tells how productive workers are on average
    - Upside down u-shape curve

Product curves – graphs of the relationships between employment and the three product concepts

Similar to the PPF, it separated the attainable from the unattainable

Shapes of product curves are similar because almost every production process has two features:

- Increasing marginal returns initially
    - Occurs when the marginally product of an additionally workers exceeds the marginal product of the previous worker

- Diminishing marginal returns eventually
    - Occurs when the marginal product of an additional worker is less than the marginal product of the previous worker
    - Law of diminishing returns – "as a firm uses more of a variable factor of production with a given quantity of the fixed factor of production, the marginal product of the variable factor eventually diminishes"

Average product curve

- For the number of workers at which marginal product *exceeds* average product, average product is *increasing*
- For the number of workers at which marginal product is *less than* average product, average product is *decreasing*

Total Cost in the short run

- Total cost (TC) – the cost of all the factors of production a firm uses
    - Total fixed cost (TFC) – the cost of the firm's fixed factors
        - Total fixed cost is the same at all outputs
        - Does not depend on quantity produced
    - Total variable cost (TVC) – the cost of the firm's variable factors
        - Total variable cost changes as output changes
    - Total fixed cost = vertical distance between the TVC and TC curves
- Total cost = TFC + TVC

Marginal Cost in the short run

- Marginal Cost – the increase in total cost that results from a one-unit increase in output
    - MC = ΔTotal Cost/ΔQuanity (check mark shape)
- At small outputs, marginal cost decreases as output increases because of greater specialization and the division of labor
- Marginal cost tells us how total cost changes as output increases
- When marginal product is at its maximum, marginal cost is at a minimum

Average Cost in the short run

- Average fixed cost (AFC) (downward slope)
    - Total fixed cost per unit of output
- Average variable cost (AVC) (u-shaped)
    - Total variable cost per unit of output
- Average total cost (ATC) (u-shaped)
    - Total cost per unit of output
- TC/Q = TFC/Q + TVC/Q (Q= quantity produced) or ATC = AFC + AVC

- The vertical distance between the average total cost and average variable cost curves is equal to average fixed cost
    - Distance shrinks as output increases because average fixed cost declines with increasing output

Marginal Cost and Average Cost

- Marginal cost curve (MC) intersects the average variable cost curve and the average total cost curve ***at their minimum points***.
    - When marginal cost is less than average cost, average cost is decreasing
    - When marginal cost exceeds average cost, average cost is increasing

Average Total Cost Curve

- Average total cost is the sum of average fixed cost and average variable cost, so the shape of the ATC curve combines the shapes of the AFC and the AVC curves
- U shape of the ATC curve comes from two influences:
    - Spreading total fixed cost over a larger output
        - When output increases, the firm spreads its total fixed cost over a larger output; its average fixed cost decreases so the AFC curve slopes downward
    - Eventually diminishing returns
        - As output increases, ever-larger amounts of labor are needed to produce an additional unit of output; as output increases, AVC decreases initially, but eventually increases
        - AVC is U shaped

Cost Curves and Product Curves

- At the point of maximum marginal product, marginal cost is at a minimum
- At the point of maximum average product, average variable cost is at a minimum

Shifts in the Cost Curves

- Technology
    - With better technology, the same factors of production can produce more output
    - Lowers the costs of production and shifts the cost curves downward
- Prices of factors of production
    - Increases the firm's costs and shifts cost curves (depends on which factor price changes)
        - Increase in fixed cost shifts the TFC and AFC curves upward and shifts the TC curve upward but leaves the AVC and TVC curves and the MC curve unchanged
        - Increase in variable cost shifts the TVC and AVC curves upward and shifts the MC curve upward but leaves the AFC and TFC curves unchanged

Term	Symbol	Definition	Equation