

## Chapter 21 – Production and Costs

- Short run** – quantities of some resources are fixed, such as technology, buildings, capital, management, or in short, the firm's plant is fixed
  - To increase output in the short run, firms usually increase labor
  - Short run decisions are easily reversed. It can increase or decrease labor/production easily
- Long Run** – quantities of all resources can be varied, when the firm can change its plant
  - To increase output, can buy new machines, acquire new technology, reorganize, etc.
  - Long run decisions are harder to reverse, and can have dramatic effects
  - Sunk Cost** – past cost of buying a plant that has no resale value
- Short Run Technology Constraint**
  - Total product – number of products produced
  - Marginal product – additional products per additional worker hired
  - Average product – average products per worker currently hired
- Total Product Curve** – graph of the total output on the Y, number of workers on the x. Everything under the curve is attainable. Almost like a mini PPF
- Marginal Product Curve** – graph of the marginal product on the Y, the number of workers on the x. Note that the points are BETWEEN the number of workers. Hence, if the marginal product w/ 0 workers is 4, then the point would be (0.5, 4). This is also the derivative of the Total Product Curve. Marginal returns increase originally, and decrease eventually. This is due to the operating limits of the factory
- Average product curve** – graph of the average product against labor. The maximum average product occurs where the average product curve hits the marginal 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 the average product, average product is decreasing. Note that the average product and the total product is NOT the same thing. Think marginal GPA and average GPA
- Total Cost** – cost of the productive resources it uses.  $TC = TFC + TVC$
- Total fixed cost** – cost of the firm's fixed inputs. Does not change as output changes
- Total variable cost** – cost of the firm's variable inputs. Changes as output changes
- Marginal Cost** – increase in total cost that results from a one unit increase on output. Also known as change in cost / change in output. Marginal costs get larger, known as the law of diminishing returns. The marginal costs is the derivative of the total cost.
- Average fixed cost** – total fixed cost per unit of output
- Average variable cost** – total variable cost per unit of output
- Average total cost** – total cost per unit output.  $ATC = AFC + AVC$ 
  - The Average total costs is U shaped due to the spreading of total fixed cost over a larger input, and eventually diminishing returns
  - The marginal costs curve intersects the ATC and AVC curves at their lowest points, just like the marginal product intersected the average product at it's highest point
- Product curves and cost curves** – when marginal Product is at a max, marginal cost is at a min. When average product is at a max( where it intersects the marginal product ), average cost is at a min
- Technology** - technology shifts the total product, average product, and marginal product curves upward. It shifts the cost curves(ATC, AVC, MC) downward. However, technological change often increases the cost of capital, so average/total fixed costs usually increase. This change in the mix of fixed cost and variable cost means that at low output levels, ATC might increase, but at high outputs ATC decreases
- Changes in fixed costs such as rent shift the fixed costs and total costs curves. Changes in wages shifts the variable cost and total costs curves.
- Long Run Production Function** – the relationship between the maximum output attainable and the quantities of both labor and capital.
  - As the number of workers increase, each marginal product drops, meaning the MC increases – law of diminishing returns
  - As the size of the plant grows, the marginal product drops, meaning the MC increases – law of diminishing returns
  - Each size of plant has it's own ATC curve. The lowest operating point and the size of the plant that should be used is the lowest cost ATC curve at the desired level of output
  - The minimum average total cost of a larger plant occurs at a greater output than it does for a smaller plant, since a larger plant has higher fixed cost and needs a larger output to cover the extra cost
- Average long run cost curve** - to use the lowest cost curve at ALL levels of output, changing the size of the plant as the output changes
- Economies of scale** – features of a firm's technology that lead to falling long run average cost as output increases. When economies of scale are present, the LRAC curve slopes downward. Economies of scale occur if the percentage increase in output exceeds the percentage increase in all inputs, and normally occurs only for certain outputs, while diseconomies of scale occur for other levels of output.

20. **Diseconomies of scale** – when the long run average cost rises as output increases, LRAC slopes downward, and the percentage increase in output is less than the percentage increase in inputs. Diseconomies of scale occur because eventually in a large firm complicated management schemes hinder production. It still may be profitable, but the cost is no longer at its lowest point
21. **Constant returns of scale** – LRAC has a slope of 0.
22. **Minimum efficient scale** – the smallest quantity of output at which the LRAC reaches its lowest level.