

AAE101: Intro to Ag. & Applied Econ.

Discussion Section 7

Professor: Siwan Song

TA: Erick F Molina *

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Dept. of Agricultural & Applied Economics
Taylor Hall 520, 427 Lorch St, Madison, WI 53706

✉ molinaperez@wisc.edu

Today's goal

- To characterize the utility maximization problem.
- Learn about economic costs of production.

Utility Maximization

Total Utility: Total utility is the total amount of satisfaction or pleasure a person derives from consuming some specific quantity of a good or service. Example: How much utility from eating 3 slices of pizza for lunch?

Marginal Utility: Marginal utility is the extra satisfaction from an additional unit of a good or service. Example: How much utility from each slice?

Law of diminishing marginal utility: As the consumption of a good or service increases, the marginal utility obtained from each additional unit of a good or service decreases.

Indifference Curve: Curve showing combinations of two products that yield the same amount of total utility, so that the consumer is indifferent as to which combination to purchase.

*This handout is based on the corresponding handouts from previous years by Felipe Parra Escobar, Matt McKetty & Talita Silva. Modifications and additions in this version by Erick.

Indifference Map: Series of indifference curves where each curve reflects different amounts of utility.

Marginal Rate of Substitution is represented by the slope of the indifference curve at a particular point.

Equivalency at equilibrium: In equilibrium, we get that the MRS is equal to the ratio of prices.

$$\frac{MU_A}{MU_B} = \frac{P_A}{P_B}$$

Businesses and the Costs of Production

Economic Costs

Economic Costs: The payment that must be made to obtain and retain the services of a resource. They are the sum of explicit and implicit costs.

- **Explicit Costs:** The monetary payments a firm makes to those from whom it must purchase resources.
- **Implicit Costs:** The opportunity costs of using the resources that the firms already own.

Accounting Profit: Only considers revenue and explicit costs like wages, the cost of land and capital, etc.

Economic Profit: Considers revenue, explicit costs and implicit costs like wages, the cost of land and capital, and implicit costs, like foregone wages.

Short Run: The period of time in the future in which at least one input to production is fixed. That is, it cannot be adjusted or changed. For example, a fixed plant.

Long Run: The period of time in the future in which all inputs are variable. Firms can adjust plant size as well as enter and exit industry.

Short-Run Production Relationship

Total Product: The total quantity, or total output, of a particular good or service.

Marginal Product: Additional product from one more unit of labor.

$$MP = \frac{\text{Change in TP}}{\text{Change in labor input}}$$

Average Product: Or labor productivity, it is the output per unit of labor input.

$$AP = \frac{TP}{\text{Units of labor}}$$

Law of Diminishing Returns: As variable resources (labor) are added to fixed resources (equipment machinery) the marginal product of the variable resource will fall. We will get less and less product from each additional worker.

Short Run Production Costs

We divide a businesses's **total costs** in the short run into *fixed costs* and *variable costs*.

We use fixed and variable costs to yield Average Costs and Marginal Costs.

Total Fixed Costs (TFC): Sum of costs that do not vary with input use. Examples can be rent, or insurance.

Total Variable Costs (TVC): Sum of costs that vary with input use.

Average costs: They are found by dividint the total costs over the amount of output Q . For example, the average total costs are given by:

$$ATC = \frac{TC}{Q}$$

Long-Run Production Costs

Economies of Scale: When as a firm increases production, the long-run average total costs decline, up to a certain level of production.

Diseconomies of scale: Where long run average total costs increase after a certain level of production.

Constant Returns to Scale: Average total costs remain the same as a firm increases its level of production.

Practice Questions

1. **Marginal Utility and Total Utility Calculation:** Consider a consumer who derives utility from consuming pizza slices. The marginal utility from consuming each slice is as follows:

- Slice 1: 15 utils
- Slice 2: 10 utils
- Slice 3: 6 utils
- Slice 4: 2 utils

- a) Calculate the total utility after consuming 3 slices.

The total utility after consuming 3 slices is the sum of the marginal utilities:

$$\text{Total Utility} = 15 \text{ utils} + 10 \text{ utils} + 6 \text{ utils} = 31 \text{ utils}$$

- b) What is the marginal utility of consuming the 4th slice?

The marginal utility of consuming the 4th slice is 2 utils.

- c) Does this follow the law of diminishing marginal utility? Why or why not?

Yes, this follows the law of diminishing marginal utility. The marginal utility decreases as more slices are consumed: 15 utils for the first slice, 10 for the second, 6 for the third, and 2 for the fourth. This shows that the additional satisfaction from each slice diminishes as consumption increases.

2. **Indifference Curves and Marginal Rate of Substitution (MRS):** Suppose a consumer is choosing between two goods: apples (A) and bananas (B). The following table shows combinations of apples and bananas that provide the same level of utility:

Apples (A)	Bananas (B)
2	10
3	6
4	4

- a) Plot the indifference curve based on the table.

The indifference curve is plotted by taking the combinations of apples and bananas from the table: (2,10), (3,6), and (4,4). Plot these points on a graph where the x-axis represents apples (A) and the y-axis represents bananas (B), and connect them to form the indifference curve.

- b) What is the Marginal Rate of Substitution (MRS) between apples and bananas as the consumer moves from consuming 2 apples and 10 bananas to 3 apples and 6 bananas?

The Marginal Rate of Substitution (MRS) is the rate at which the consumer is willing to substitute apples for bananas. To calculate the MRS as the consumer moves from consuming 2 apples and 10 bananas to 3 apples and 6 bananas:

$$MRS = \frac{\Delta B}{\Delta A} = \frac{6 - 10}{3 - 2} = -4$$

The consumer is willing to give up 4 bananas to gain 1 more apple.

- c) At equilibrium, the price of apples is \$2 per apple and the price of bananas is \$1 per banana. Does the MRS equal the ratio of prices? Why is this important? At equilibrium, the price ratio is: $\frac{P_A}{P_B} = \frac{2}{1} = 2$ The MRS should equal the price ratio at equilibrium. Since the calculated MRS is 4 (in absolute value), it does not equal the price ratio, indicating the consumer may not be at equilibrium. This is important because, in equilibrium, the rate at which the consumer is willing to substitute between goods should equal the price ratio, ensuring they are maximizing utility given their budget.

3. **Calculating Accounting and Economic Profit:** A small business makes \$100,000 in revenue. The explicit costs (rent, wages, and materials) are \$60,000. The implicit costs (foregone salary from a previous job) are \$20,000.

- a) Calculate the accounting profit.

Accounting profit only considers explicit costs: Accounting Profit = Revenue – Explicit Costs = 100,000 – 60,000 = 40,000

- b) Calculate the economic profit.

Economic profit considers both explicit and implicit costs: Economic Profit = Revenue – (Explicit Costs + Implicit Costs) = 100,000 – (60,000 + 20,000) = 20,000

- c) Based on the economic profit, is this business making a "real" profit when considering opportunity costs?

The business is making a positive accounting profit of \$40,000, but when considering opportunity costs, the economic profit is only \$20,000. This means that while the business is profitable on paper, it is less profitable when considering the foregone earnings from other opportunities.

4. **Short-Run Production Costs:** A firm has the following cost structure for producing widgets:

- Total Fixed Costs (TFC): \$500
- Total Variable Costs (TVC): \$800 when producing 100 widgets

a) Calculate the Average Total Costs (ATC) and Average Variable Costs (AVC) for producing 100 widgets.

$$\text{For 100 widgets: } ATC = \frac{TFC+TVC}{Q} = \frac{500+800}{100} = \frac{1300}{100} = 13 \quad AVC = \frac{TVC}{Q} = \frac{800}{100} = 8$$

b) If the firm produces 200 widgets and total variable costs increase to \$1,400, calculate the new ATC and AVC.

$$\text{For 200 widgets, if the total variable costs increase to \$1,400: } ATC = \frac{TFC+TVC}{Q} = \frac{500+1400}{200} = \frac{1900}{200} = 9.5$$

$$AVC = \frac{TVC}{Q} = \frac{1400}{200} = 7$$

c) Discuss how variable costs change with output and what that means for the firm's decision to increase production.

The variable costs (TVC) increase as output increases, but the average costs (ATC and AVC) decrease when output rises from 100 to 200 widgets. This suggests that the firm is experiencing economies of scale, where increasing production leads to lower average costs, making it more efficient to increase production in the short run.