Lecture 2. Consumer Theory

BTM210, KAIST

Duksang Cho (KDI)

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Topics Covered in This Lecture

A Piece-of-Cake Problem

Consumer Preferences and Budget Constraints

Consumer Choices

A Piece-of-Cake Problem

- You have 10 pieces of cake. You can eat them between lunch(L) and dinner(D). What is the best way to maximize your satisfaction?
  - Suppose that your satisfaction can be captured by the following function:

$$U(L, D) = (L * D)^{1/2}.$$

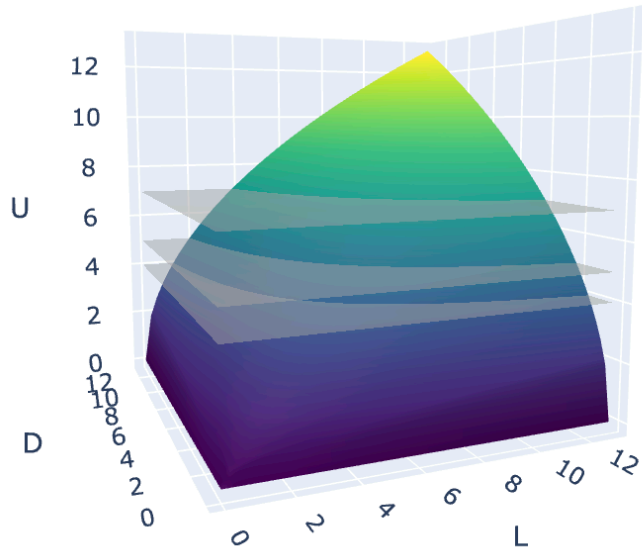
  - You can have up to 10 pieces of cake.:

$$L + D \leq 10.$$

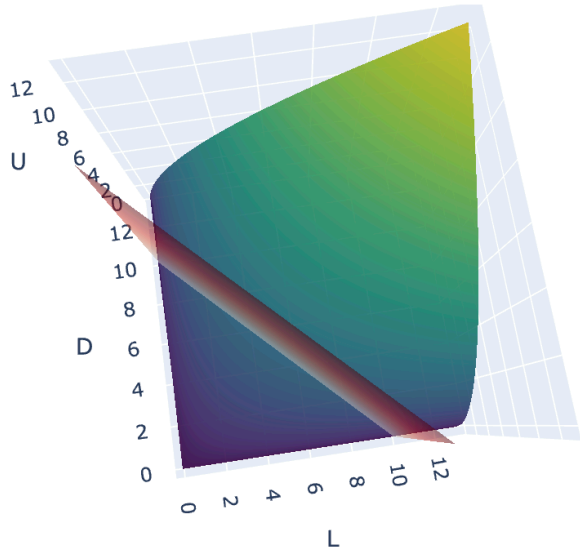
- Solution: The more, the better. Consume all pieces of cake: $L + D = 10$. Put $D = 10 - L$ into $U(L, D)$.

$$\max_L U = \sqrt{L * (10 - L)} \quad \rightarrow \quad L^* = D^* = 5, \; U(L^*, D^*) = 5$$

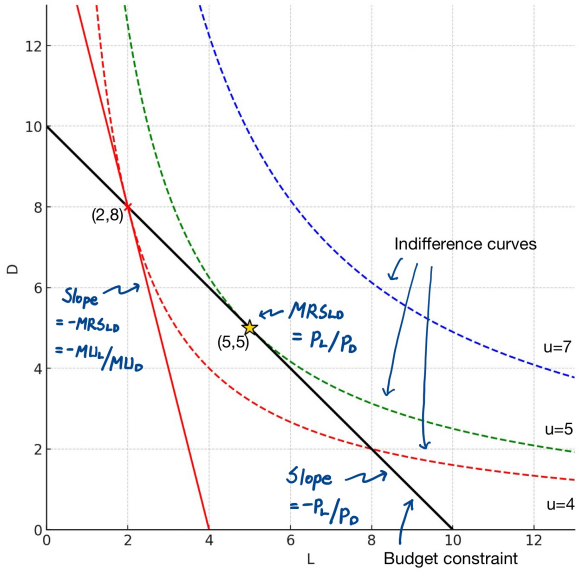
- 3-D plot of $U(L, D) = (L * D)^{1/2}$



- 3-D plot of the feasible cake constraint: $L + D = 10$



- Contour lines of $U(L, D)$ and the feasible cake constraint, $L + D \leq 10$



In This Lecture

- We ask:
  - What products do consumers buy?
  - How much do they purchase in the market?
- We find the answer by:
  - Examining the characteristics of consumers' preferences
  - Constructing utility functions that capture numerically the consumers' preferences
  - Determining the consumers' optimal choices given their budget constrains

A Piece-of-Cake Problem

Consumer Preferences and Budget Constraints

Consumer Choices

Market Baskets

- Market basket
  - Is a list with specific quantities of one or more goods.
  - Synonyms: consumption basket, market bundle, consumption bundle

TABLE 3.1 ALTERNATIVE MARKET BASKETS

MARKET BASKET	UNITS OF FOOD	UNITS OF CLOTHING
A	20	30
B	10	50
D	40	20
E	30	40
G	10	20
H	10	40

Note: We will avoid the use of the letters C and F to represent market baskets, whenever market baskets might be confused with the number of units of food and clothing.

Source: *Microeconomics, 9th ed.* (Pindyck and Rubinfeld, 2018), Table 3.1 Alternative Market Baskets

Preferences

- In microeconomics, a "rational" consumer is assumed to make decisions that maximize their utility (satisfaction) given their budget constraints.
- Several key assumptions are required for consumer "rationality":

1. Completeness
   - Consumers can compare and rank all possible consumption bundles.
   - For any two bundles A and B, the consumer can say
     - A is preferred to B ($A \succ B$),
     - B is preferred to A ($B \succ A$),
     - or they are indifferent ($A \sim B$) meaning that a consumer is equally satisfied with either A or B.
   - What you cannot say is "I don't know."

Preferences

2. Transitivity
   - If $A \succ B$ and $B \succ C$, then $A \succ C$.
   - This ensures consistency in choices.
3. Non-Satiation (More is Better)
   - Consumers always prefer more of a good rather than less.
   - In general, we assume "goods" rather than "bads."
4. Diminishing Marginal Rate of Substitution (Convexity)
   - As a consumer consumes more of one good, they are willing to give up less of another good to get additional units of the first good.
   - This leads to convex indifference curves.
   - e.g., French fries vs. Soda

Utility

- Utility
  - Refers to the numerical score representing the satisfaction that a consumer gets from a market basket.
  - Is a device used to simplify the "ranking" of market baskets.
- A utility function
  - Is a formula that assigns a level of utility to each market basket.
  - Is a way of "ranking" different market baskets.
- e.g., The utility function of food(F) and clothing(C), which tells us the level of satisfaction obtained from consuming F units of food and C units of clothing:

$$U(F, C) = F^{1/2} C^{1/2}$$

Marginal Utility

- Marginal utility
  - Measures the additional satisfaction obtained from consuming one additional unit of a good.

$$\text{e.g.,} \quad MU_F = \frac{\partial U(F, C)}{\partial F} = \frac{1}{2} F^{-1/2} C^{1/2}$$

- Diminishing marginal utility
  - Is the "principle" that the more a good is consumed, the less extra utility a consumer can achieve from each additional amount.

$$\text{e.g.,} \quad \frac{\partial MU_F}{\partial F} = -\frac{1}{4} F^{-3/2} C^{1/2} < 0$$

Indifference Curves

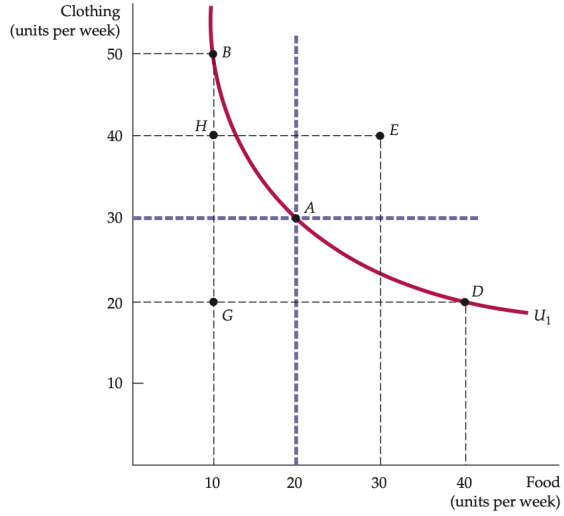
- An indifference curve
  - Represents all combinations of market baskets that provide a consumer with the same level of satisfaction.

$$\text{e.g.,} \quad U(F, C) = (F * C)^{1/2} = \overline{U}$$

  - Cannot intersect. (or violating the transitivity.)
  - Is downward sloping. (or violating the non-satiation.)
  - Is convex to the origin. (or violating the diminishing MRS.)
- Consumers prefer the higher indifference curves.

FIGURE 3.2
AN INDIFFERENCE CURVE

The indifference curve U_1 that passes through market basket A shows all baskets that give the consumer the same level of satisfaction as does market basket A; these include baskets B and D. Our consumer prefers basket E, which lies above U_1, to A, but prefers A to H or G, which lie below U_1.



Source: *Microeconomics, 9th ed.* (Pindyck and Rubinfeld, 2018), Figure 3.2 An Indifference Curve

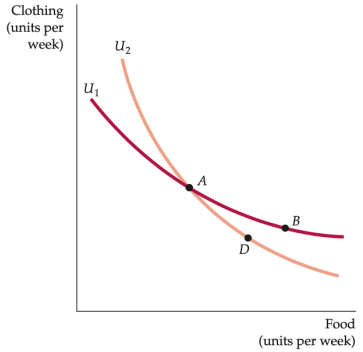


FIGURE 3.4
INDIFFERENCE CURVES CANNOT INTERSECT

If indifference curves U_1 and U_2 intersect, one of the assumptions of consumer theory is violated. According to this diagram, the consumer should be indifferent among market baskets *A*, *B*, and *D*. Yet *B* should be preferred to *D* because *B* has more of both goods.

Source: *Microeconomics*, *9th ed.* (Pindyck and Rubinfeld, 2018), Figure 3.4 Indifference Curves Cannot Intersect

The Marginal Rate of Substitution (MRS)

- The marginal rate of substitution (MRS)
  - Is equal in magnitude to the slope of the indifference curve.
  - Describes how a consumer is willing to substitute one good for another (by moving along the indifference curve).
  - Quantifies the amount of one good that a consumer will give up to obtain more of another (by moving along the indifference curve).
- e.g., The MRS of food(F) for clothing(C) is the maximum amount of clothing(C) that a person is willing to give up to obtain one additional unit of food(F).

$$\underbrace{dU(F,C) = \frac{\partial U}{\partial F}dF + \frac{\partial U}{\partial C}dC = 0}_{\text{Moving along the indifference curve}} \quad \Rightarrow \quad MRS_{FC} \equiv -\frac{dC}{dF} = \frac{\partial U/\partial F}{\partial U/\partial C} = \frac{MU_F}{MU_C}$$

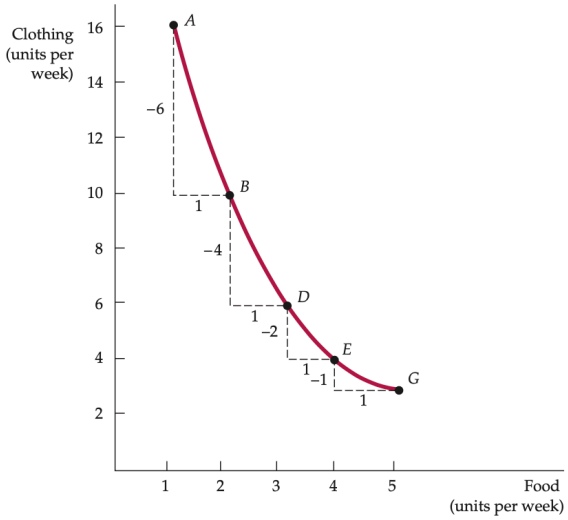


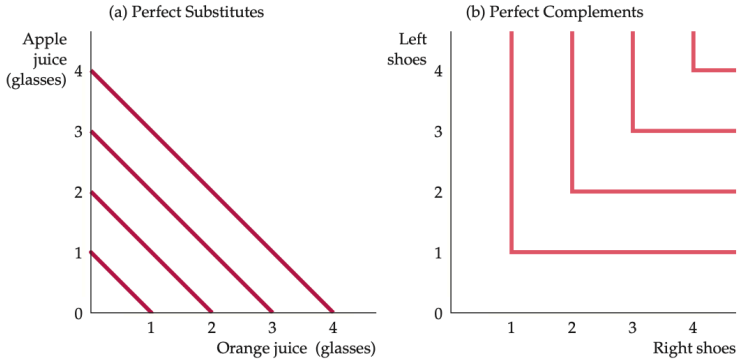
FIGURE 3.5
THE MARGINAL RATE OF SUBSTITUTION

The magnitude of the slope of an indifference curve measures the consumer's marginal rate of substitution (MRS) between two goods. In this figure, the MRS between clothing (*C*) and food (*F*) falls from 6 (between *A* and *B*) to 4 (between *B* and *D*) to 2 (between *D* and *E*) to 1 (between *E* and *G*). When the MRS diminishes along an indifference curve, the curve is convex.

Source: *Microeconomics, 9th ed.* (Pindyck and Rubinfeld, 2018), Figure 3.5 The Marginal Rate of Substitution

Unusual Cases: Perfect Substitutes and Perfect Complements

- Two goods are
  - Perfect substitutes if the MRS is a constant.
  - Perfect complements if the indifference curves are shaped as right angles.



Source: *Microeconomics, 9th ed.* (Pindyck and Rubinfeld, 2018), Figure 3.6 Perfect Substitutes and Perfect Complements

Budget Constraints

- A consumer cannot choose a market bundle that exceeds his or her budget constraint. On the budget line, all combinations of goods for which the total amount of money spent is equal to income.
- e.g., Let I, P_F and P_C are the income and the prices of food and clothing, respectively. Then, the budget constraint can be written as follows.

$$P_F F + P_C C \leq I$$

- Note that
  - Consumption baskets inside the budget line, $P_F F + P_C C \leq I$, are feasible.
  - Consumers, however, do not choose the market bundles inside the budget line because of the non-satiation assumption.

Marginal Rate of Transformation (MRT)

- The marginal rate of transformation (MRT)
  - Is equal in the magnitude to the slope of the budget line.
  - Describes the amount of one good that a consumer has to give up to buy more of another (by moving along the budget line).
  - Shows the opportunity costs.

$$C = \frac{I}{P_C} - \frac{P_F}{P_C}F \quad \Rightarrow \quad MRT_{FC} = P_F/P_C$$

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Consumer Choices

A Consumer's Problem

- What is the highest indifference curve the consumer can get given the budget constraint?
- We can determine the consumer's optimal consumption bundle, given his or her preference represented by a utility function and budget constraint.

$$\max_{F,C\geq 0} U(F,C) \quad \text{subject to} \quad P_F F + P_L L \leq I$$

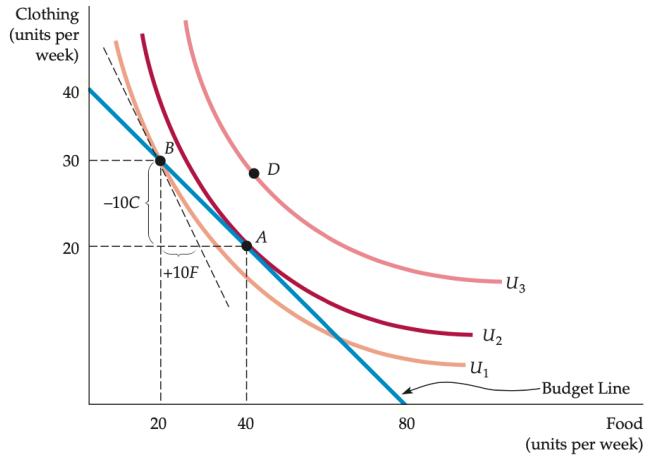
- The optimal consumption bundle (F^*, L^*) that maximizes the consumer's utility should be located on the highest indifference curve touching the budget line.

$$P_F F + P_C C = I \quad \text{and} \quad MRS_{FC} = \frac{P_F}{P_C}.$$

Interior Solutions

FIGURE 3.13 MAXIMIZING CONSUMER SATISFACTION

A consumer maximizes satisfaction by choosing market basket *A*. At this point, the budget line and indifference curve U_2 are tangent, and no higher level of satisfaction (e.g., market basket *D*) can be attained. At *A*, the point of maximization, the MRS between the two goods equals the price ratio. At *B*, however, because the MRS $[-(-10/10) = 1]$ is greater than the price ratio (1/2), satisfaction is not maximized.



Source: *Microeconomics, 9th ed.* (Pindyck and Rubinfeld, 2018), Figure 3.13 Maximizing Consumer Satisfaction

The Optimization Condition: $MRS_{FC} = P_F/P_C$

- At the optimization point, the marginal benefit is equal to the marginal cost.
  - The marginal benefit(MRS) is the slope of an indifference curve.

$$MRS_{FC} = \frac{MU_F}{MU_C}$$

  - The marginal cost(P_F/P_C) is the slope of the budget line.

$$C = -\frac{I}{P_C} - \frac{P_F}{P_C}F$$

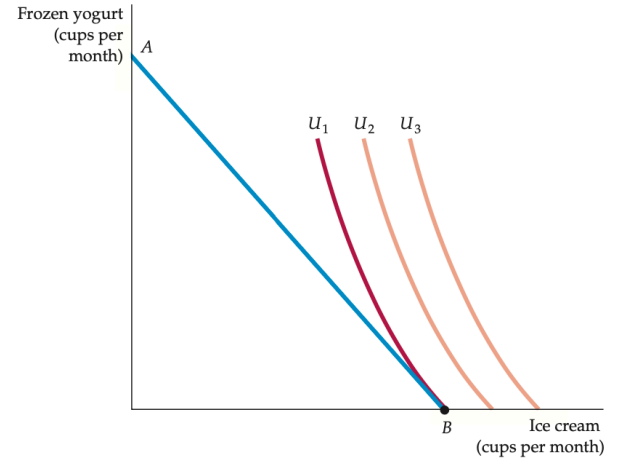
- If $MRS_{FC} = \frac{MU_F}{MU_C} > P_F/P_C$, the consumer can be better off by buying and consuming more food(F) and giving up clothing(C).

$$\underbrace{MU_F\left(\frac{1}{P_F}\right)}_{\text{Buying more F with \$1}} - \underbrace{MU_C\left(\frac{1}{P_C}\right)}_{\text{Spending \$1 less for C}} > 0$$

Corner Solutions: : Marginal Benefits $\neq$ Marginal Costs

FIGURE 3.15
A CORNER SOLUTION

When the consumer's marginal rate of substitution is not equal to the price ratio for all levels of consumption, a corner solution arises. The consumer maximizes satisfaction by consuming only one of the two goods. Given budget line *AB*, the highest level of satisfaction is achieved at *B* on indifference curve U_1, where the MRS (of ice cream for frozen yogurt) is greater than the ratio of the price of ice cream to the price of frozen yogurt.



Source: *Microeconomics, 9th ed.* (Pindyck and Rubinfeld, 2018), Figure 3.15 Corner Solutions

Exmaple: Karim's Optimal Time Allocation

- Karim, a business school graduate, is trying to decide how much to work and how much leisure to enjoy.
- If he works h hours a day, his daily income becomes $y = wh$.
  - He is concerned about income not for itself, but for what it enables him to spend on food, accommodation, and other goods and services including leisure activities—in other words, his consumption.
- Karim also cares about his free time.
- Karim faces a problem of scarcity:
  - He would like to enjoy both a high level of consumption and plenty of free time
  - But his choice is constrained by the relationship between hours and income.
  - Karim only has 24 hours a day.

Exmaple: Karim's Optimal Time Allocation

- Mapping Karim's preference(Figure 3.4)
- Question 3.4
- The budget constraint and the feasible set (Figure 3.6)
- How many hours does Karim decide to work? (Figure 3.7a)
- How Karim' s choice changes when the wage rises (Figure 3.9)