Topic 1 Part 1

Consumer Preferences and the Concept of Utility (Chapter 3)

Motivation

- To study of how consumers with limited resources choose goods and services
- To derive the demand curve
- Businesses care about demand curves
- Government can use this to determine how to help and whom to help its people

Consumer Preferences

Consumer Preferences tell us how the consumer would rank (that is, compare the desirability of) any two combinations or baskets of goods, assuming these baskets were available to the consumer at no cost.

** The actual choice will depend on other factors, such as income and prices of goods. **

Consumer Preferences

Assumptions

Completeness

Preferences are **complete** if the consumer can rank any two baskets of goods, according to one of the following possibilities:

- A preferred to B
- B preferred to A
- indifferent between A and B

Consumer Preferences

Assumptions

Transitivity

Preferences are **transitive** if a consumer who prefers basket A to basket B, and basket B to basket C also prefers basket A to basket C.

That is, if A > B and B > C, transitivity requires A > C.

Consumer Preferences

Assumptions

Monotonicity

Preferences are **monotonic** if a basket with more of *at least one* good and no less of any good is preferred to the original basket.

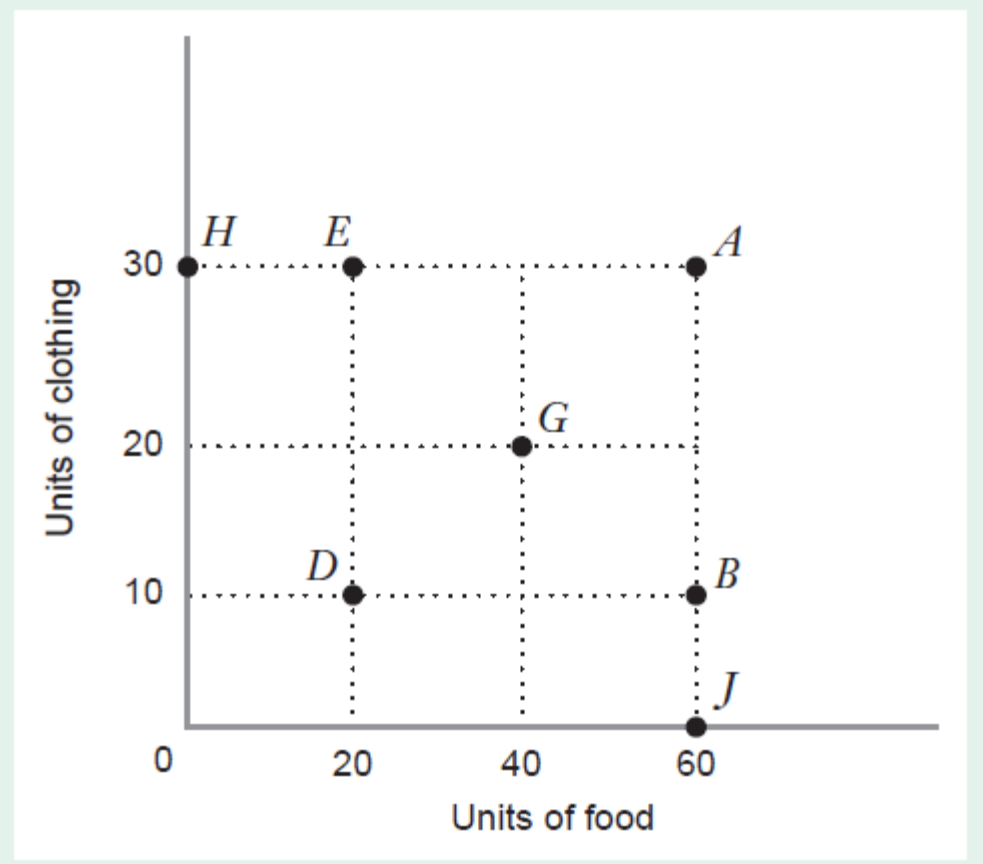
That is, more is better.

Completeness e.g. D > G, A = E, etc.

Transitivity e.g. if E > H and H > D, then E > D

Monotonicity e.g. E > H, A > B, etc.

Ex: Give 2 sets of any 3 baskets where the 3 assumptions hold.



Types of Ranking

Ordinal Ranking gives info about the Order in which a consumer ranks baskets.

Cardinal Ranking gives info about the Order and Intensity of a consumer's preference.

Example: Students are ranked according to their exam marks.

An ordinal ranking lists the students in order of their marks (i.e., Harry did best, Joe did second best, and so on).
A cardinal ranking gives the mark of the exam, (i.e., Harry got 80, Joe got 75, and so on).

The Utility Function

The three assumptions about preferences allow us to represent preferences with a utility function.

Utility function, U(x)

– a function that measures the level of satisfaction a consumer receives from any basket of goods and services.

– It assigns a number to each basket so that more preferred baskets get a higher number than less preferred baskets.

– e.g. if A is preferred to B, then U(A) > U(B).

The Utility Function

Let U(y) = $\sqrt{y}$ represent utility from consuming y units of food.

Note that this utility function represents the preference that satisfies the three assumptions.

Complete: U(y) assigns a specific utility value to each level of y.

Transitive: e.g. U(5) > U(4) > U(3).

Monotonic: more y gives more utility.

Marginal Utility

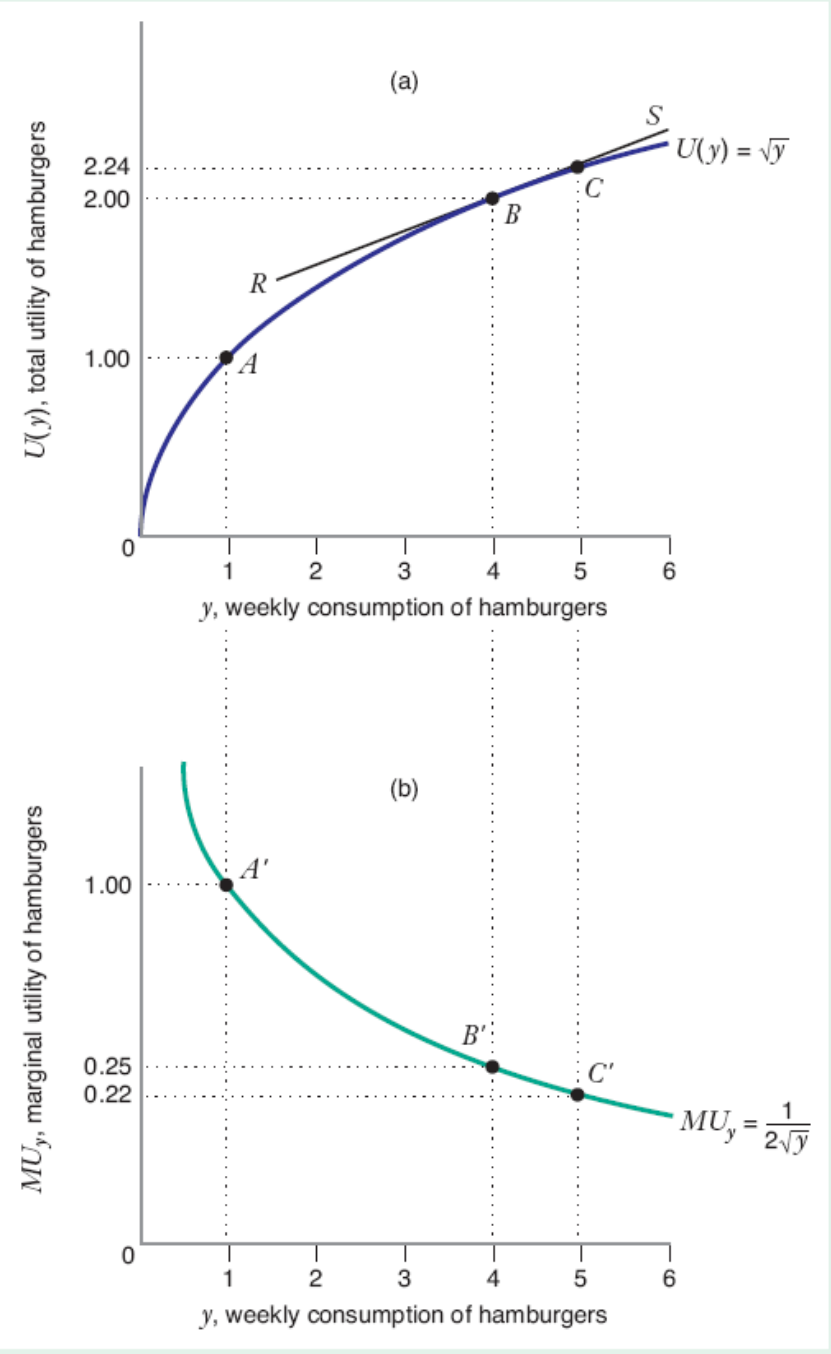
Marginal Utility of a good y is

- additional utility that the consumer gets from consuming one more unit of y
- the rate at which total utility changes as the level of consumption of good y rises
- $MU_y = \Delta U/\Delta y$
- the slope of the utility function with respect to y

Diminishing Marginal Utility

The principle of diminishing marginal utility states that the marginal utility falls as the consumer consumes more of a good.

It reflects a human trait. The more we consume, the fuller we get, and the less satisfaction we gain from additional consumption.



Diminishing Marginal Utility

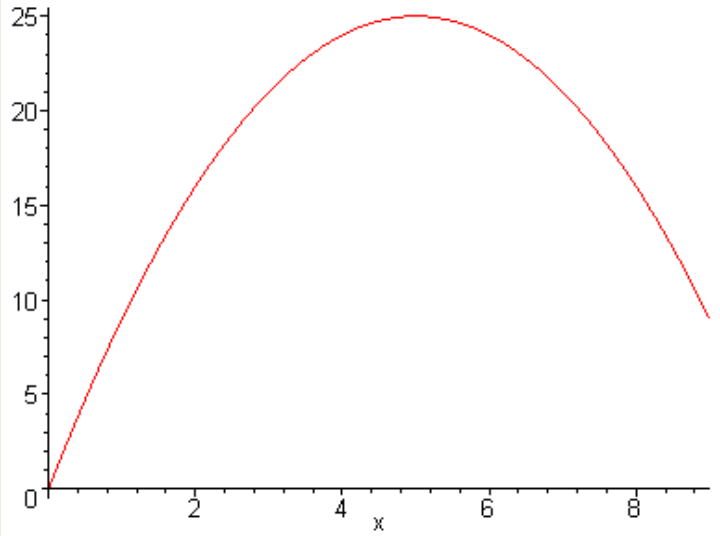
Diminishing Marginal Utility

Is more always better?

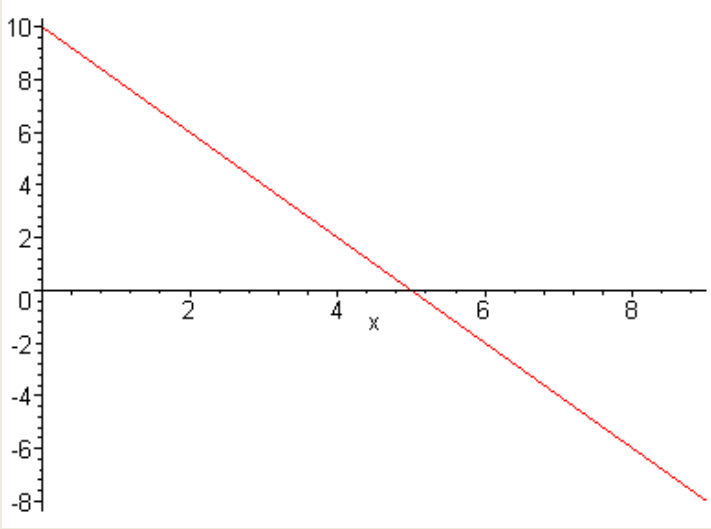
Monotonicity (more is better) implies that MU must always be positive. That is, the utility graph is always upward-sloping, e.g. higher y → higher U(y).

In reality, Monotonicity is not always true, and MU can be negative. e.g. consuming too much food can cause stomachache and hence reduce utility!

Marginal Utility

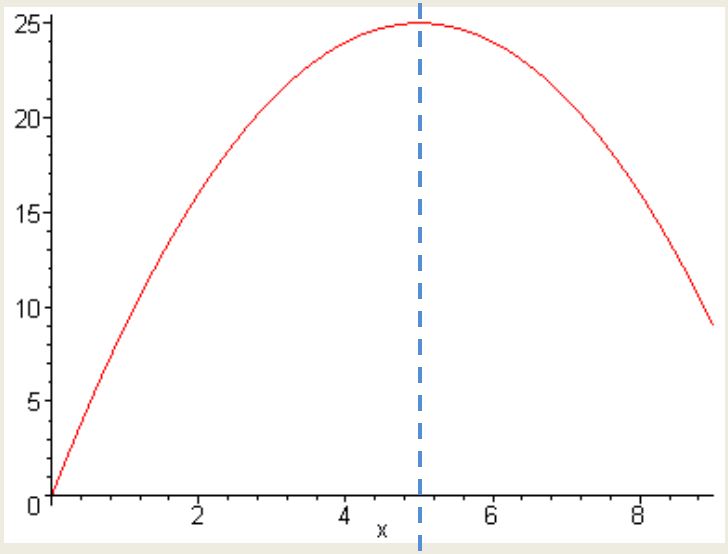


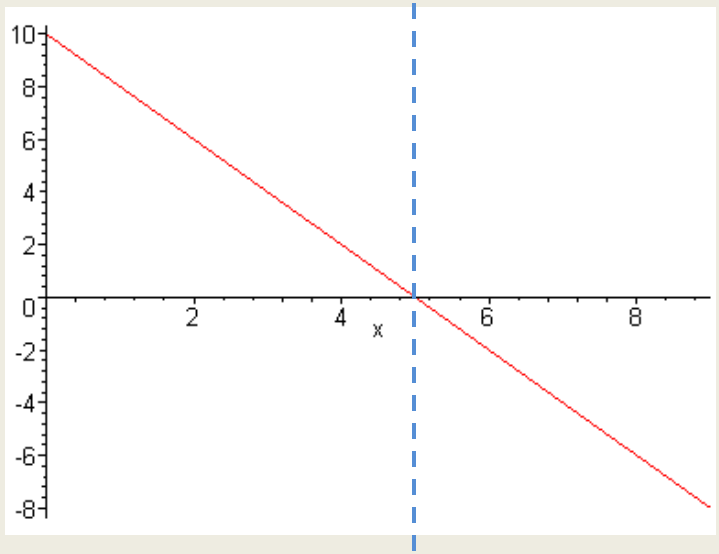
$$U(H) = 10H - H^2$$



$$MU_H = 10 - 2H$$

Marginal Utility





More may not always be better.

BUT it is reasonable to assume that the consumer will not buy too much.

It makes no sense for anyone to pay money to reduce his/her happiness.

Here, the consumer would not buy more than 5 units, and we only need to draw the graph up to such point.

Marginal Utility

Example of $U(H)$ and MU_H

$$U(H) = 10H - H^2$$
$$MU_H = 10 - 2H$$

H	H^2	U(H)	MU_H
2	4	16	6
4	16	24	2
6	36	24	-2
8	64	16	-6
10	100	0	-10

MU = 0 at H = 5.

U(H) is maximized at H = 5. U(5) = 25.

The Utility Function

We will assume that our utility function U(x) has two properties to reflect the two human traits.

1. More is better $U'(x) > 0$
2. Diminishing MU $U''(x) < 0$

That is, the utility is **a concave function**.

These properties also hold in the case of multiples goods.

Marginal Utility – multiple goods

In reality, people consume more than one good.

e.g. $U(x, y) = x + y$

The marginal utility of a good, x, is the additional utility that the consumer gets from consuming a little more of x when the consumption of all the other goods in the consumer's basket remain constant.

- $\Delta U/\Delta x$ (y held constant) = MU_x
- $\Delta U/\Delta y$ (x held constant) = MU_y

Marginal Utility – multiple goods

Consider the consumer choosing to buy goods x and y. The consumer's utility function is $\mathrm{U}(\mathrm{x},\mathrm{y}) = \sqrt{xy}$.

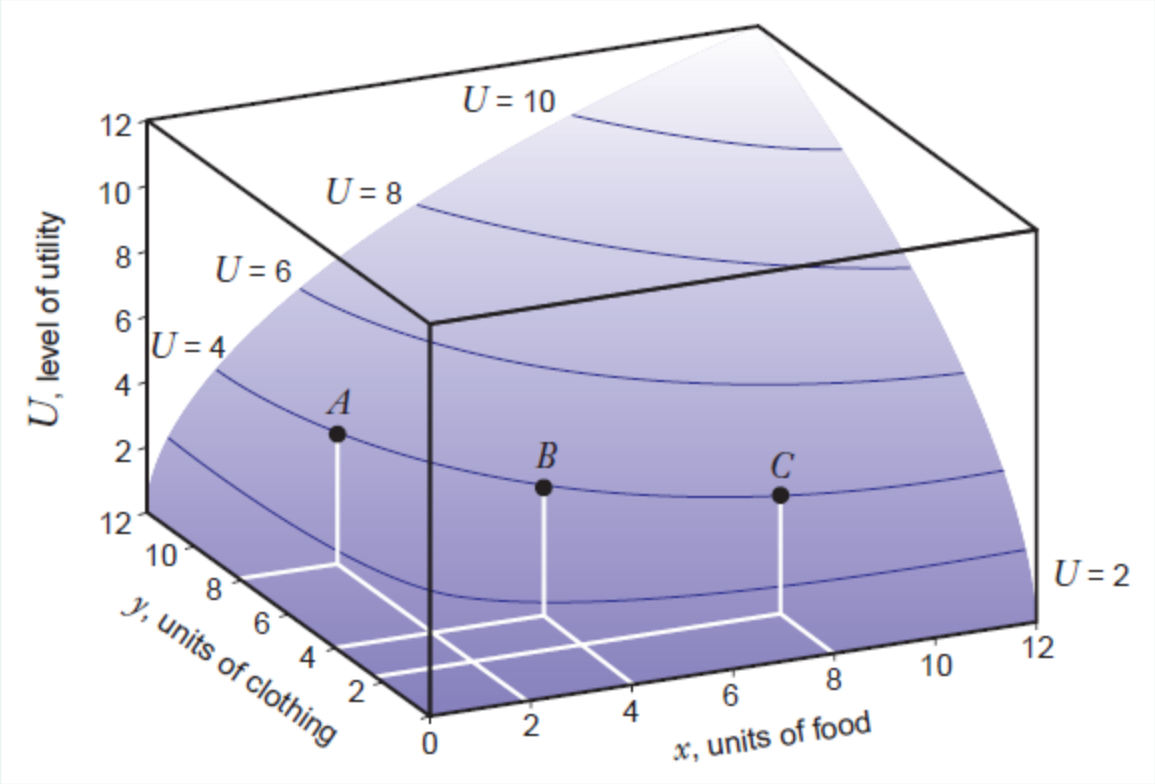


FIGURE 3.4 Graph of the Utility Function $U = \sqrt{xy}$
The level of utility is shown on the vertical axis, and the amounts of food (x) and clothing (y) are shown, respectively, on the right and left axes. Contours representing lines of constant utility are also shown. For example, the consumer is indifferent between baskets A, B, and C because they all yield the same level of utility ($U = 4$).

Marginal Utility – multiple goods

Example: Consider $U(x, y) = \sqrt{xy}$; find MUx and MUy.

$\Delta U/\Delta x$ (y held constant) = $MUx = \frac{\sqrt{y}}{2\sqrt{x}}$

which is decreasing in x.

$\Delta U/\Delta y$ (x held constant) = $MUy = \frac{\sqrt{x}}{2\sqrt{y}}$

which is decreasing in y.

The function has diminishing MU in x and y.
It is also increasing in x and y.

Marginal Utility – multiple goods

LEARNING-BY-DOING EXERCISE 3.1

Marginal Utility

Let's look at a utility function that satisfies the assumptions that more is better and that marginal utilities are diminishing. Suppose a consumer's preferences between food and clothing can be represented by the utility function $U = \sqrt{xy}$, where x measures the number of units of food and y the number of units of clothing, and the marginal utilities for x and y are expressed by the following equations: $MU_x = \sqrt{y}/(2\sqrt{x})$ and $MU_y = \sqrt{x}/(2\sqrt{y})$.

Problem

(a) Show that a consumer with this utility function believes that more is better for each good.

(b) Show that the marginal utility of food is diminishing and that the marginal utility of clothing is diminishing.

Marginal Utility – multiple goods

LEARNING-BY-DOING EXERCISE 3.2

Marginal Utility That Is Not Diminishing

Some utility functions satisfy the assumption that more is better, but with a marginal utility that is not diminishing. Suppose a consumer's preferences for hamburgers and root beer can be represented by the utility function $U = \sqrt{H} + R$, where H measures the number of hamburgers consumed and R the number of root beers. The marginal utilities are

$$MU_H = \frac{1}{2\sqrt{H}}$$

$$MU_R = 1$$

Problem

(a) Does the consumer believe that more is better for each good?

(b) Does the consumer have a diminishing marginal utility of hamburgers? Is the marginal utility of root beer diminishing?

Indifference Curves

When making choices, people face trade-offs.

To illustrate the trade-offs involved in consumer choice, we introduce an indifference curve.

An **Indifference Curve** or **Indifference Set:** is the set of all baskets for which the consumer is indifferent

An **Indifference Map** : Illustrates a set of indifference curves for a consumer

Indifference Curves

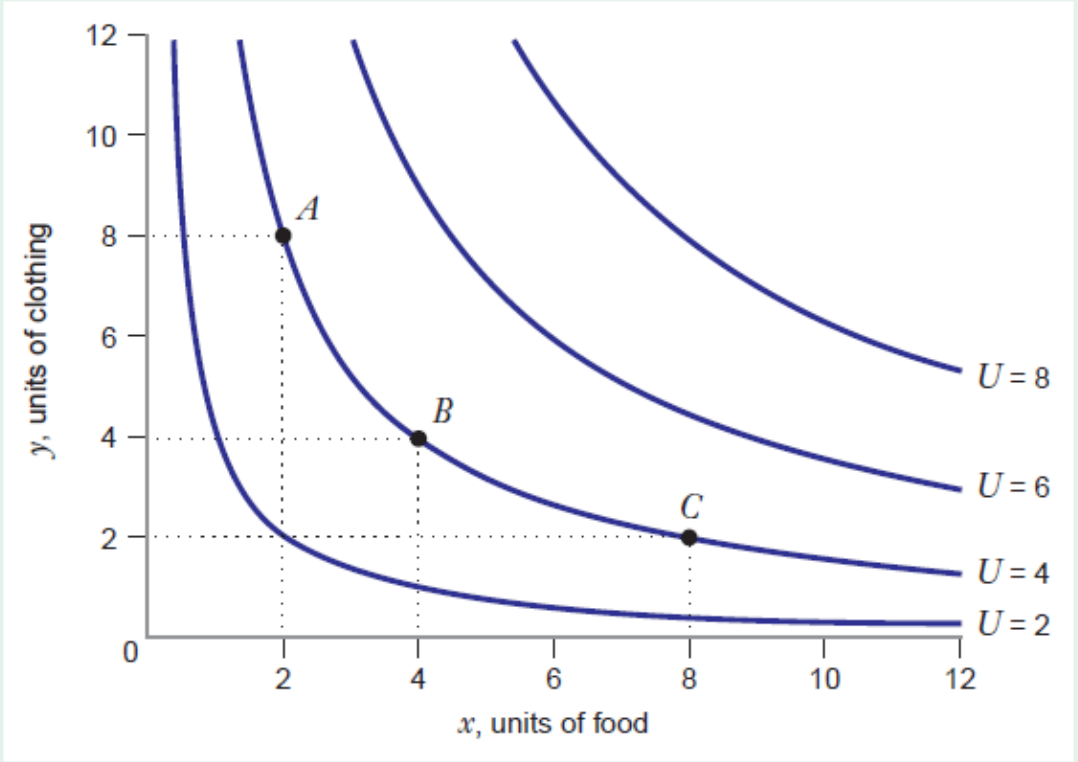
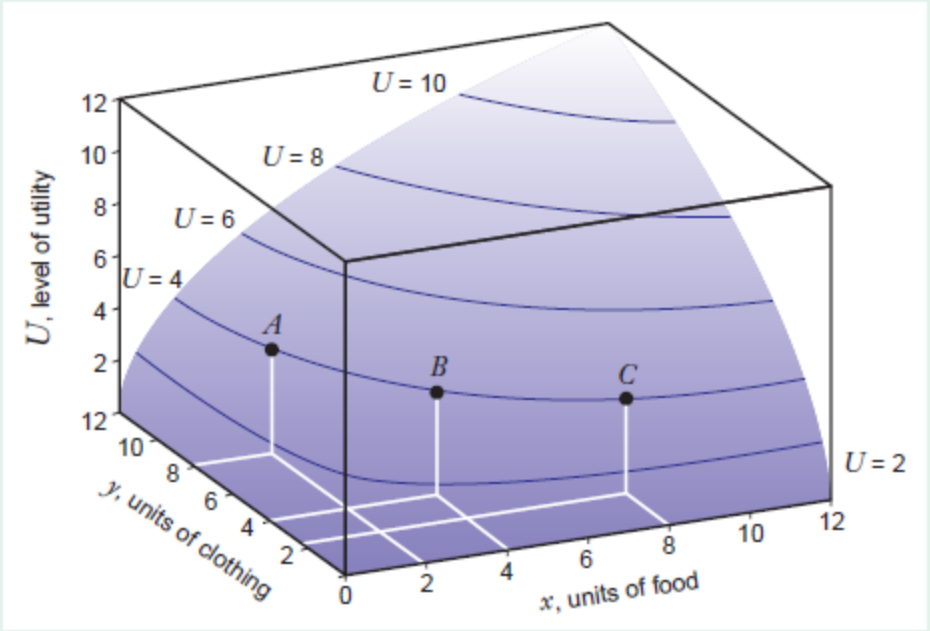
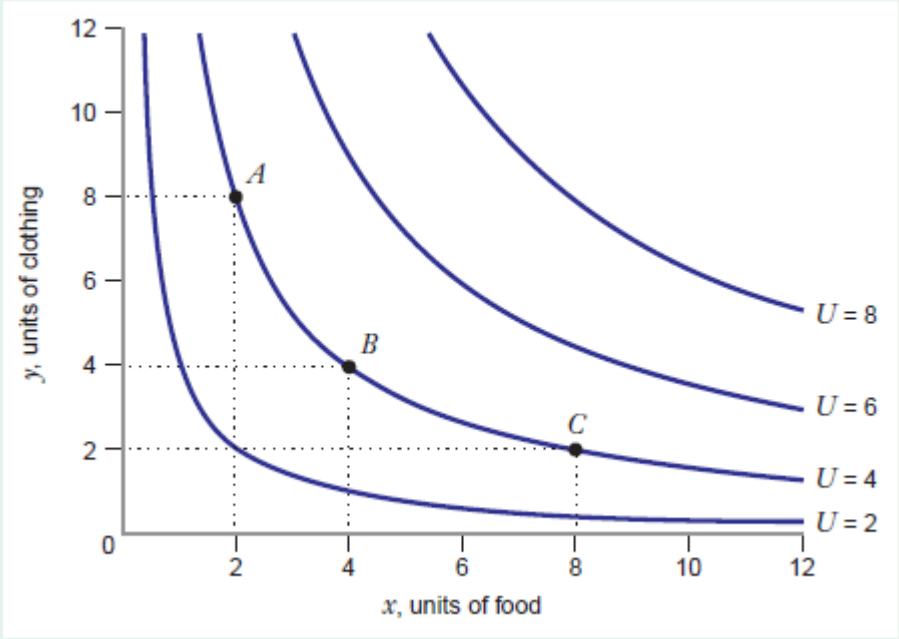


FIGURE 3.5 Indifference Curves for the Utility Function $U = \sqrt{xy}$
The utility is the same for all baskets on a given indifference curve. For example, the consumer is indifferent between baskets *A*, *B*, and *C* in the graph because they all yield the same level of utility ($U = 4$).


U = 10
U = 8
U = 6
U = 4
U = 2
A
B
C
U, level of utility
y, units of clothing
x, units of food
0
2
4
6
8
10
12


A
B
C
U = 8
U = 6
U = 4
U = 2
y, units of clothing
x, units of food
0
2
4
6
8
10
12

Indifference Curves

Key Properties

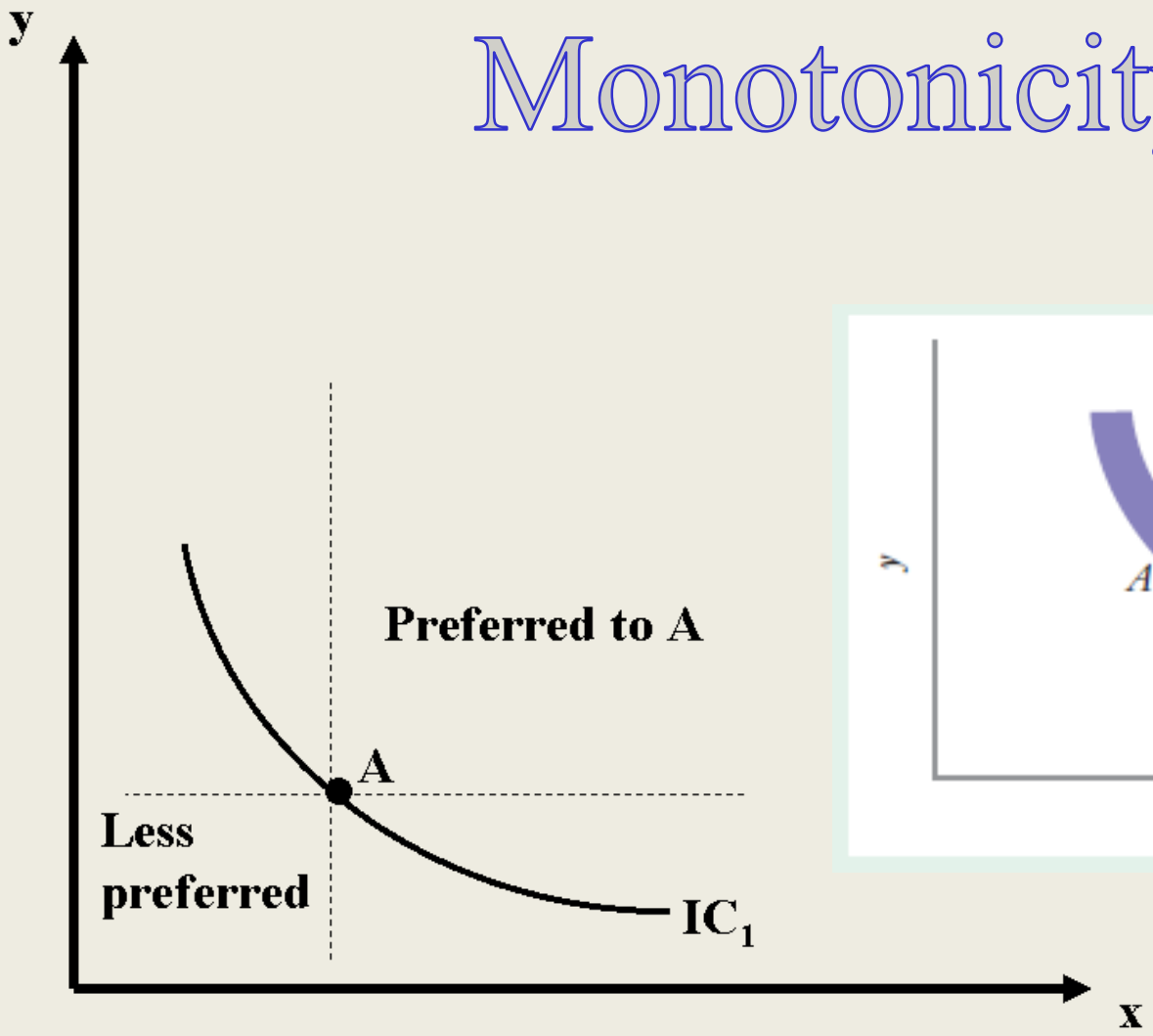
1) **Monotonicity =>** indifference curves have negative slope – and indifference curves are not “thick”

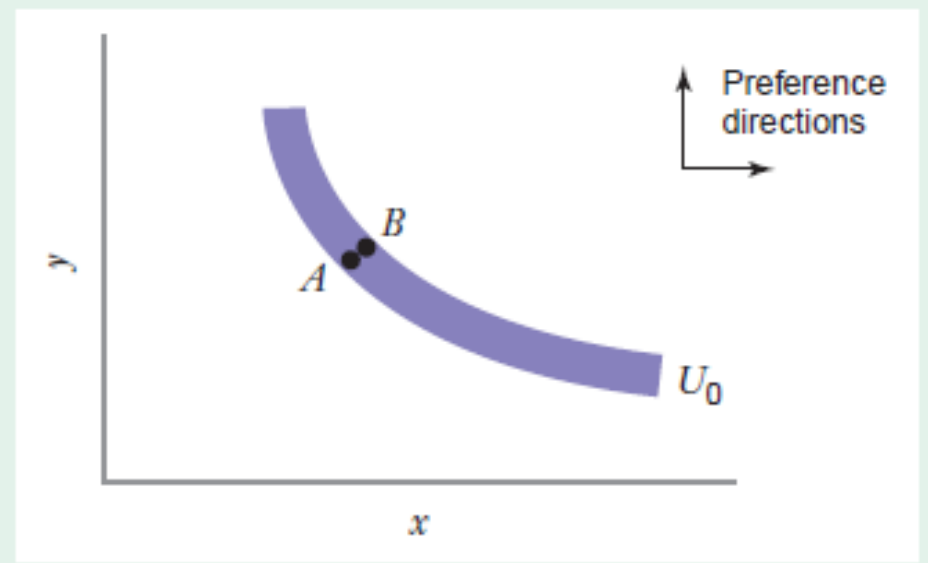
2) **Transitivity =>** indifference curves do not cross

3) **Completeness =>** each basket lies on only one indifference curve

Indifference Curves

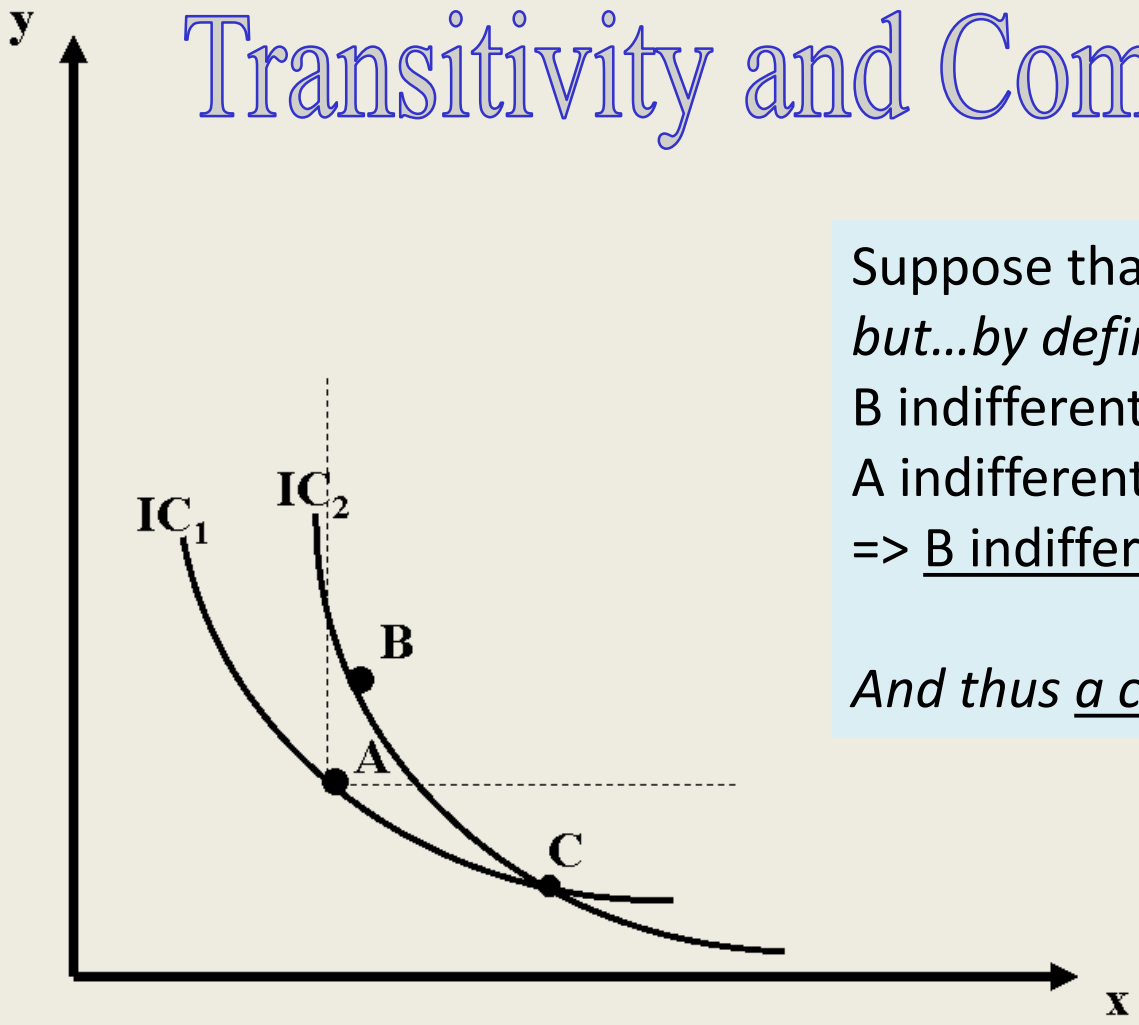
Monotonicity





Indifference Curves

Transitivity and Completeness



Suppose that B preferred to A.
but…by definition of IC,
B indifferent to C
A indifferent to C
=> B indifferent to A by transitivity.

And thus a contradiction.

Indifference Curves

Example

$$U = xy^2$$

Check that underlying preferences are complete, transitive, and monotonic.

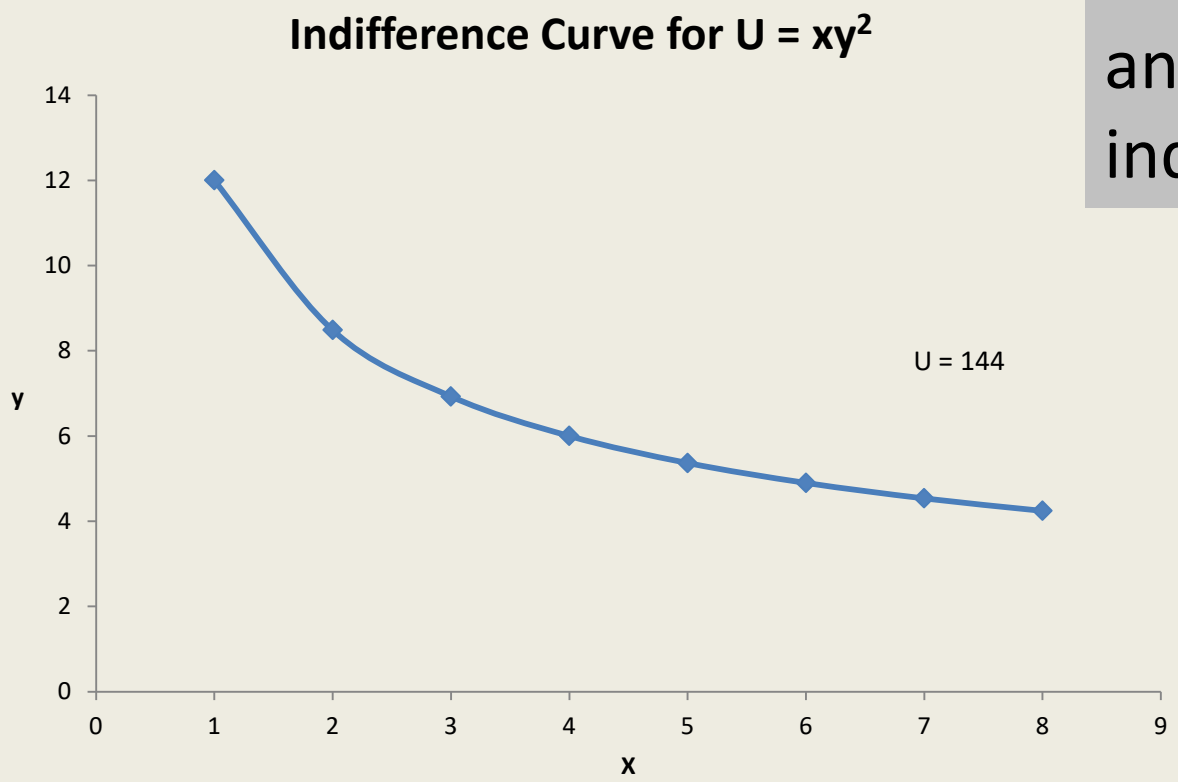
$$MU_x = y^2$$

$$MU_y = 2xy$$

$$for \quad U = 144$$

x	y	xy^2
8	4.24	143.8
4	6	144
3	6.93	144.07
1	12	144

Indifference Curves



Example: Utility and the single indifference curve.