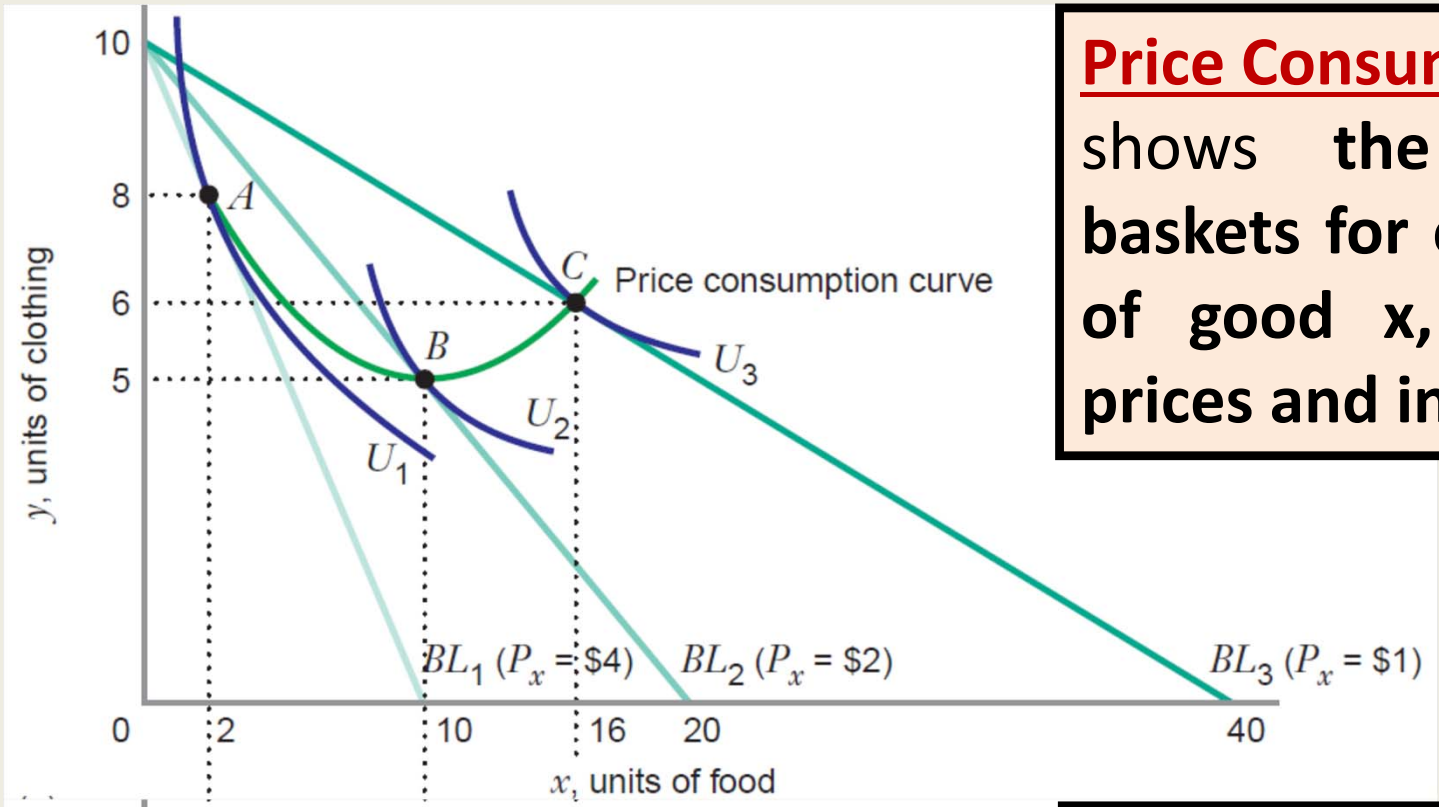
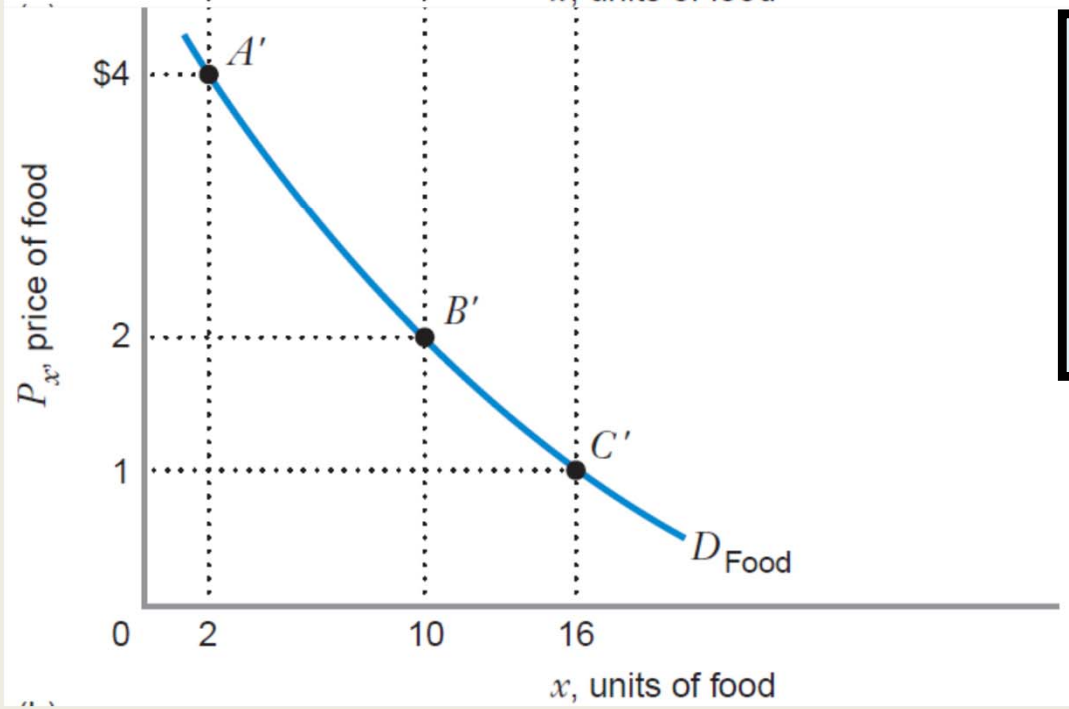
The Theory of Demand (Chapter 5)

Individual Demand Curve

- We have learnt how to find the optimal choice.
- Given income and prices of other goods, we know how much a consumer will demand of X for a given price of X, e.g. (X1, P1) and (X2, P2).
- Note that (X1, P1) and (X2, P2) are essentially points on a demand curve.
- Finding all points by varying the price of X allows us to draw the whole demand curve.



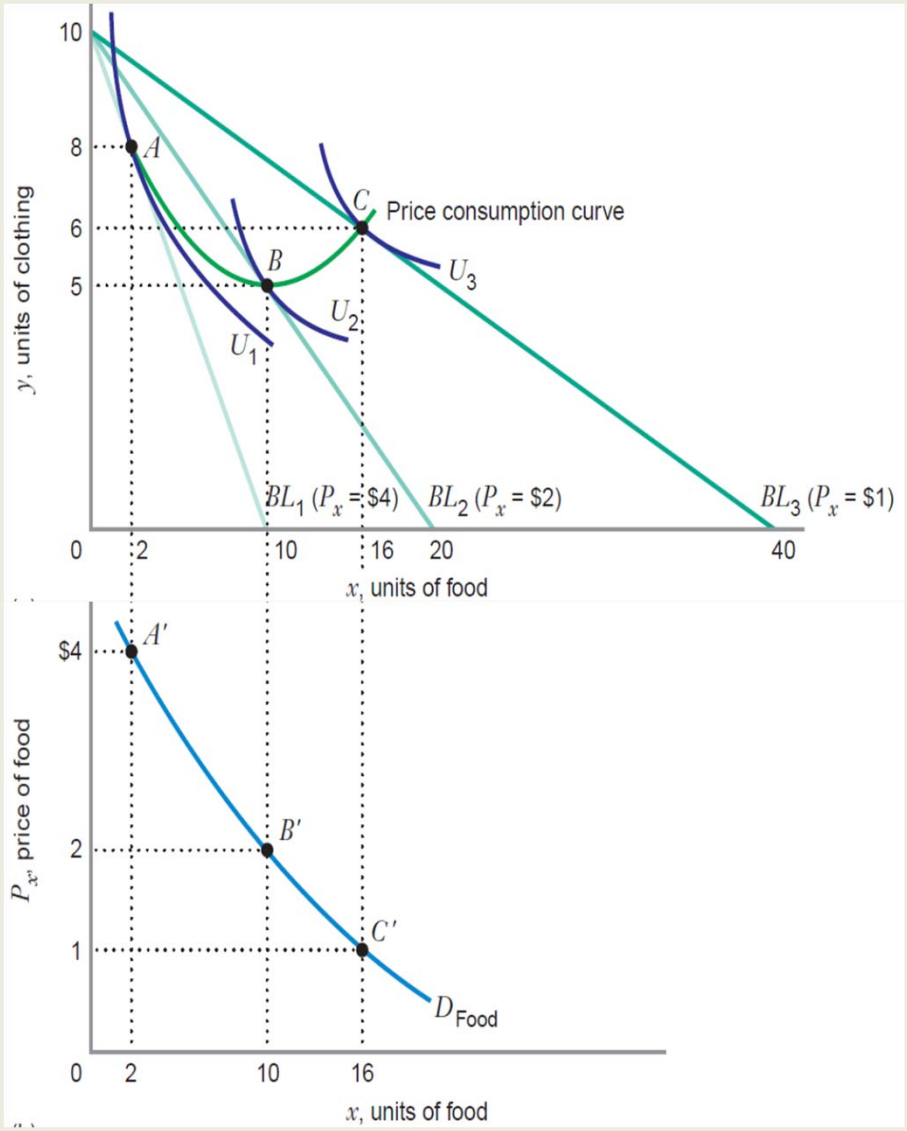


Price Consumption Curve (PCC)

shows **the set of optimal baskets for every possible price of good x, holding all other prices and income constant.**

Theory of consumer choice (IC&BL) can be used to derive a consumer's demand curve for good X.

Individual Demand Curve



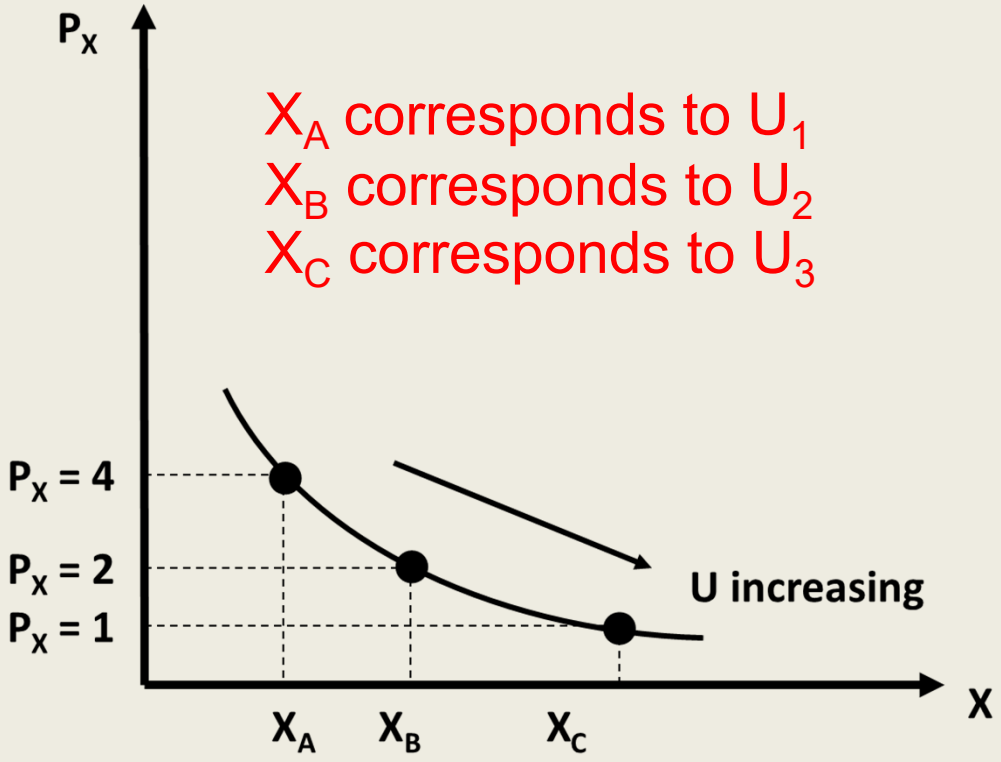
Key Points #1

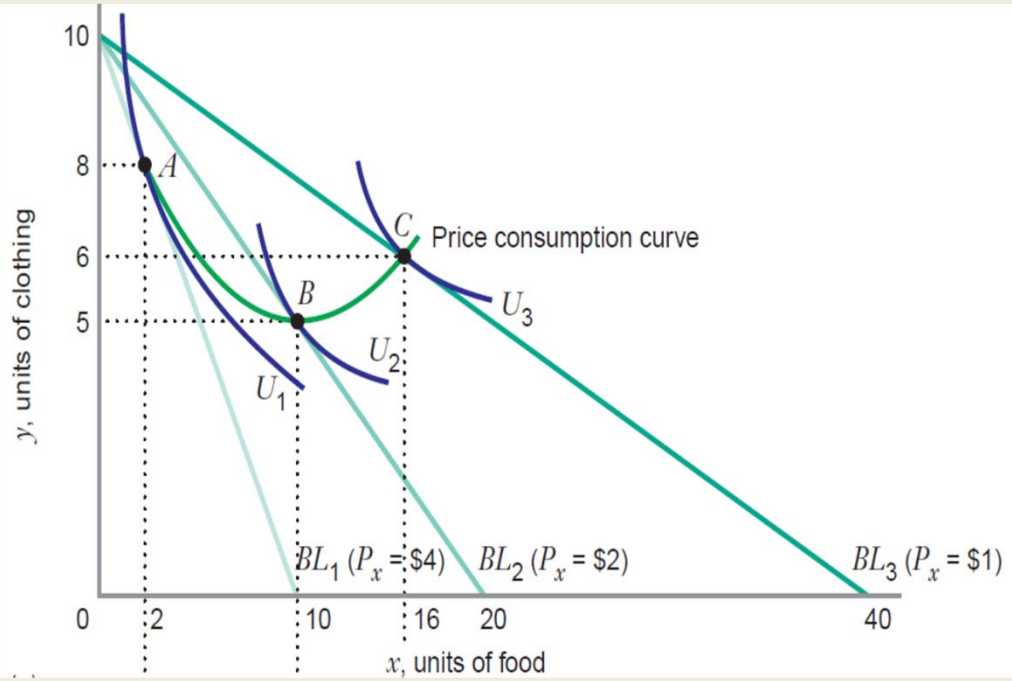
- The consumer is maximizing utility at every point on the demand curve.
- As P_x falls, it causes the consumer to move down and to the right along the demand curve as utility increases in that direction.
- The MRS_{xy} (= P_x/P_y) falls along the demand curve as the price of x falls (assuming an interior solution).

Individual Demand Curve

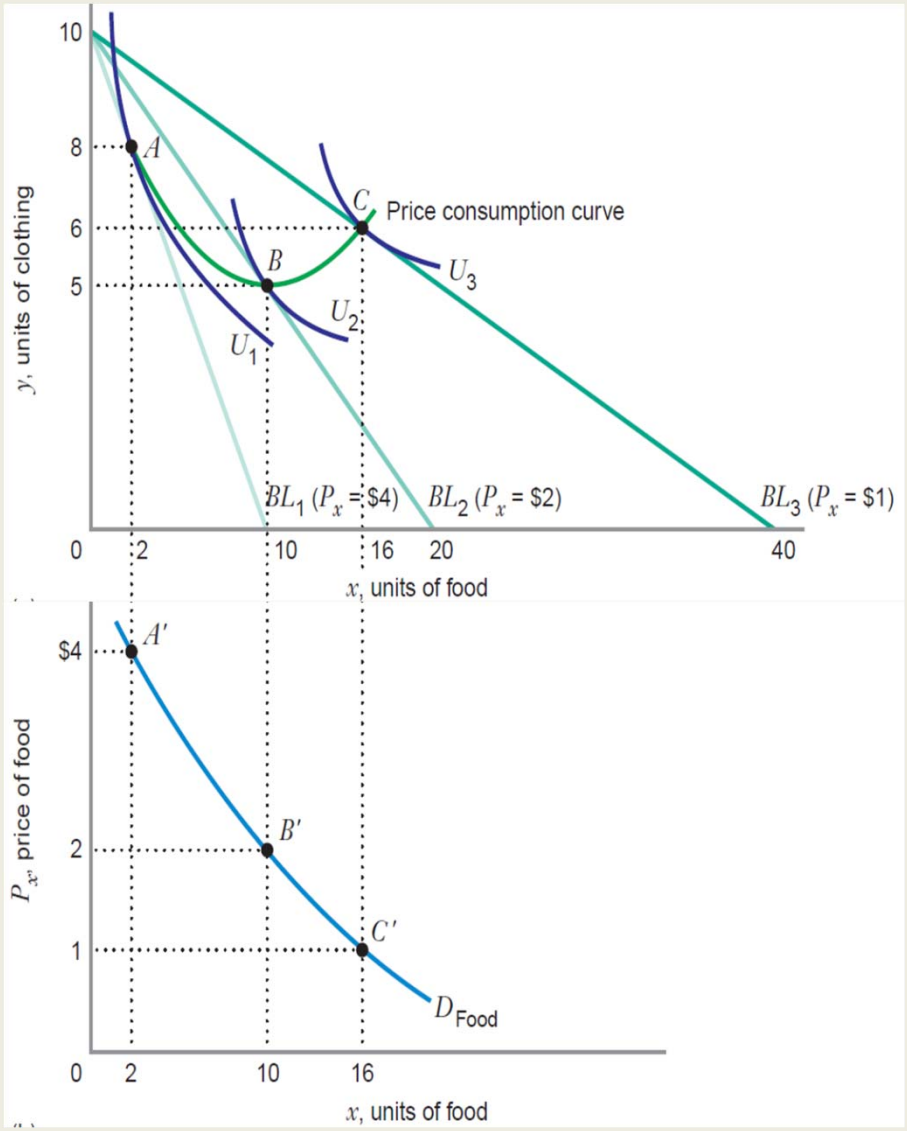
Key Points #1 (Explained)

➢ As P_x falls, it causes the consumer to move down and to the right along the demand curve as utility increases in that direction.





Individual Demand Curve



Key Points #2

- As MRS_{xy} falls, this means the consumer is willing to trade smaller Y in exchange for one more unit of X.
- The demand curve also shows the "willingness to pay", and willingness to pay for an additional unit of X falls as more X is consumed.
- When Px changes, we have a movement along the demand curve.

Price Consumption Curve (PCC)

- Price Consumption Curve can have different shapes.
  - Upward-Sloping Curve
  - Downward-Sloping Curve
  - Horizontal Straight Line
  - Backward-Bending Curve

- **Assuming a composite good on the Y-axis**, shapes of the PPC tell us two things:
  - Price Elasticity of Demand of the good on the X-axis.
  - How goods X and Y are related.

PCC and how goods X & Y are related

Consider the case where P_x falls.
Note: Y is a composite good with $P_y = 1$.

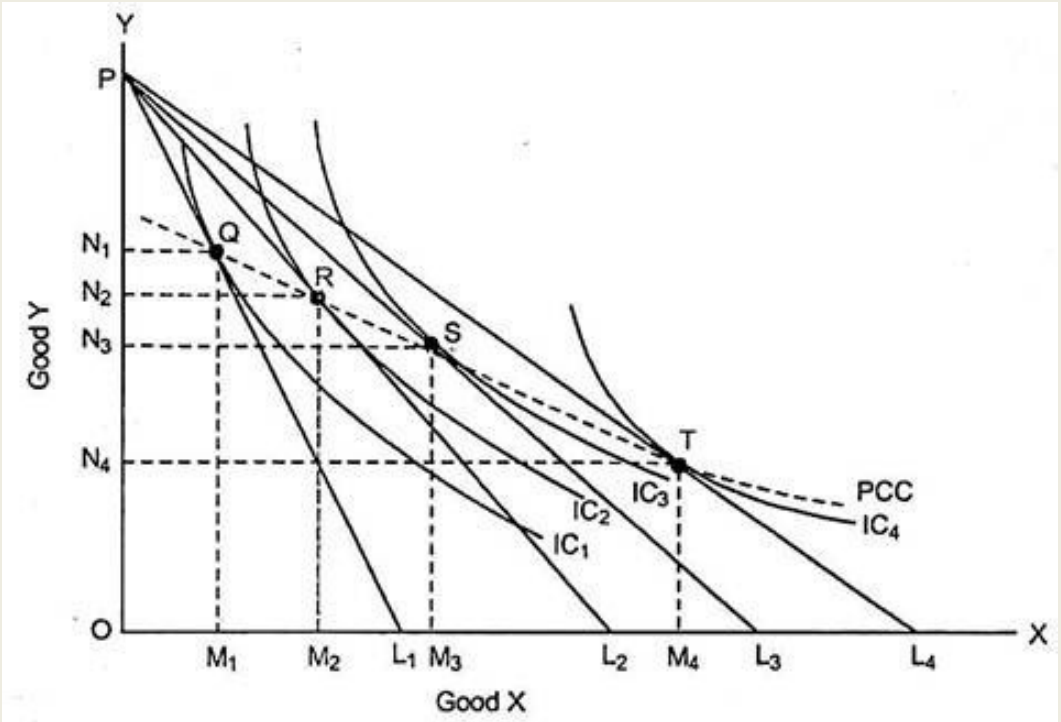


Fig. 8.31. Downward-Sloping Price Consumption Curve

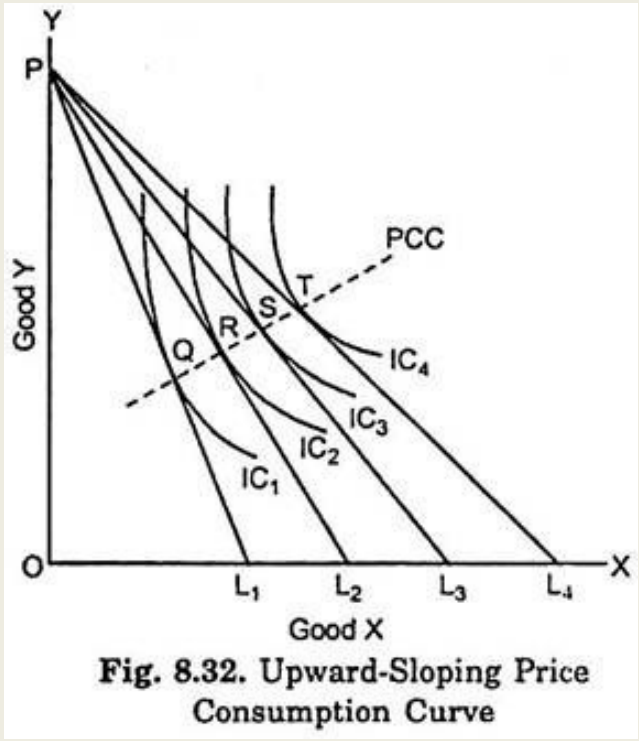


Fig. 8.32. Upward-Sloping Price Consumption Curve

PCC and how goods X & Y are related

Consider the case where P_x falls.
Note: Y is a composite good with $P_y = 1$.

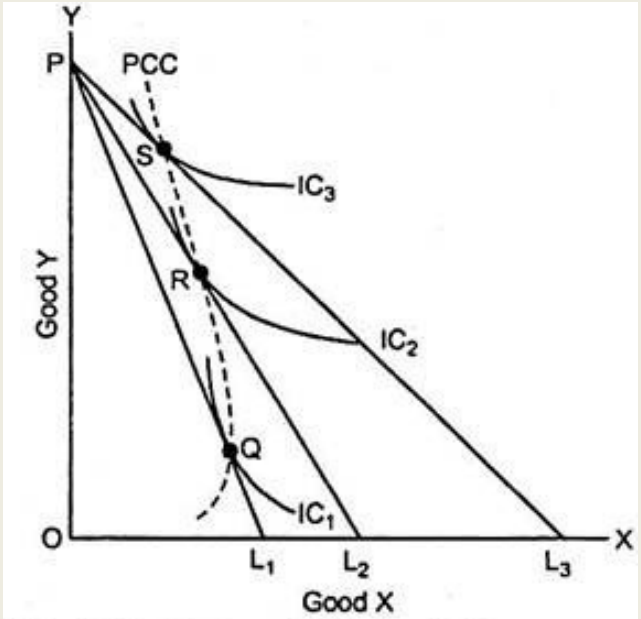


Fig. 8.33. Backward-Sloping Price Consumption Curve

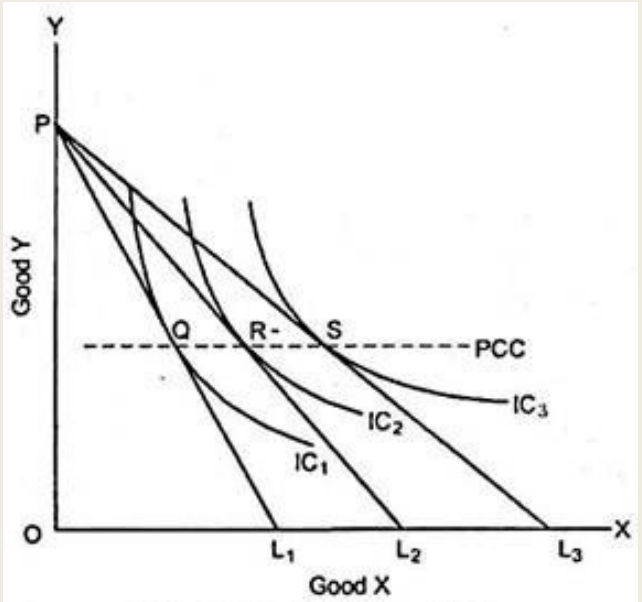
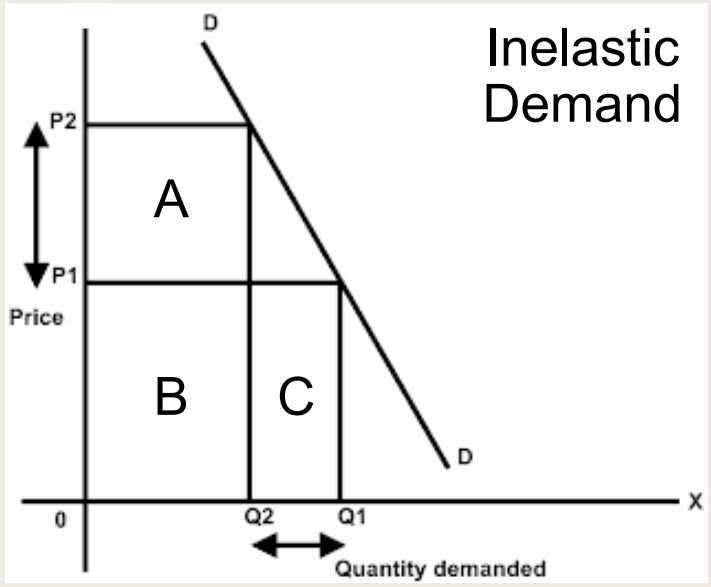


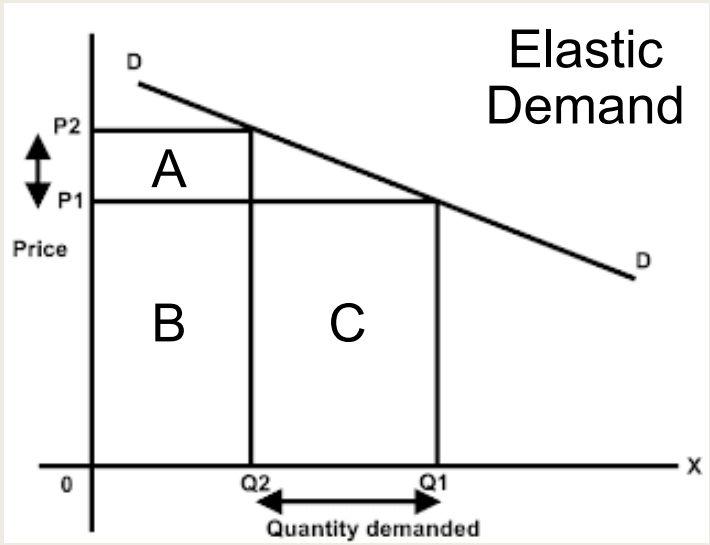
Fig. 8.34. Horizontal Price Consumption Curve

PCC and Price Elasticity of Demand (PED)

- To understand about PCC and PED, we must first understand the implications of PED.
- **Consider the case when Price falls** (i.e. from P_2 to P_1).



When Price falls, the expenditure on the good falls
i.e. A+B decreases to B+C
=>



When Price falls, the expenditure on the good rises.
i.e. A+B increases to B+C
=>

PCC and Price Elasticity of Demand (PED)

Consider the case where P_x falls.
Income = P, and Y is a composite good with P_y = 1.

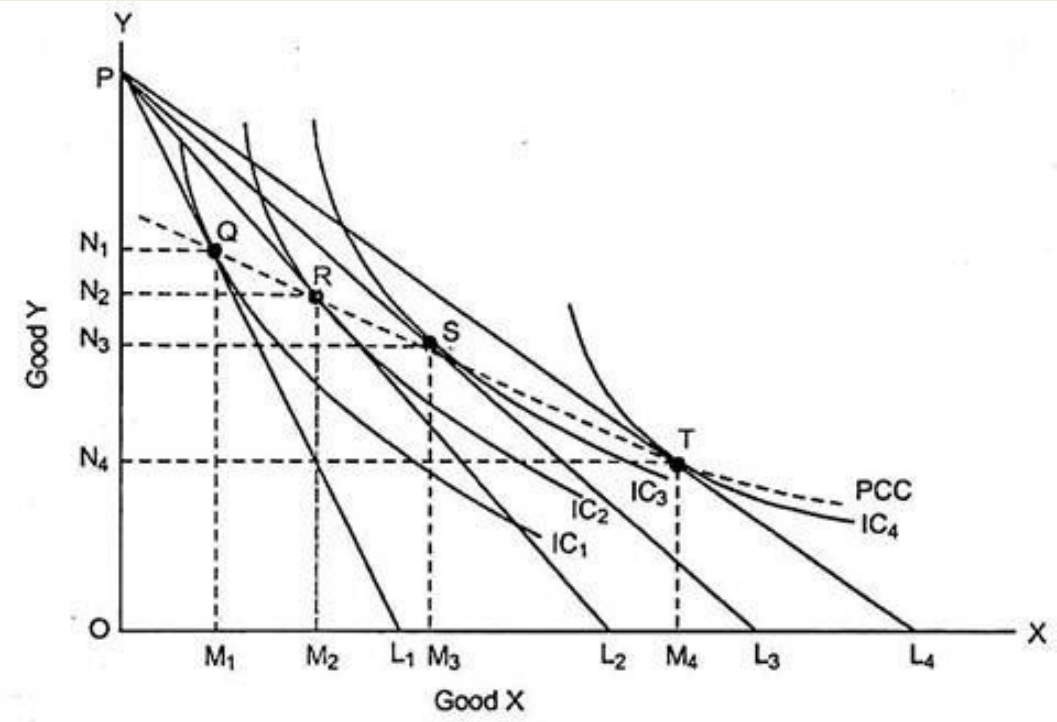


Fig. 8.31. Downward-Sloping Price Consumption Curve

For simplicity, we will consider Point Q (before P_x falls) and Point T (after P_x falls).

At Q, we spend N_1 on Y.
(At Q, there are N_1 units of Y, which costs P_y = \$1 per unit.)
Our income = P, and we spend the rest on X, so we spend ……on X.

At T, we spend N_4 on Y.
Our income = P, and we spend the rest on X, so we spend ……on X.

Here, after Px falls, our expenditure on X increases from …….. to ……..
Thus, the demand for X is ……

PCC and Price Elasticity of Demand (PED)

Consider the case where P_x falls.
Income = P, and Y is a composite good with P_y = 1.

Exp. on X after Px falls

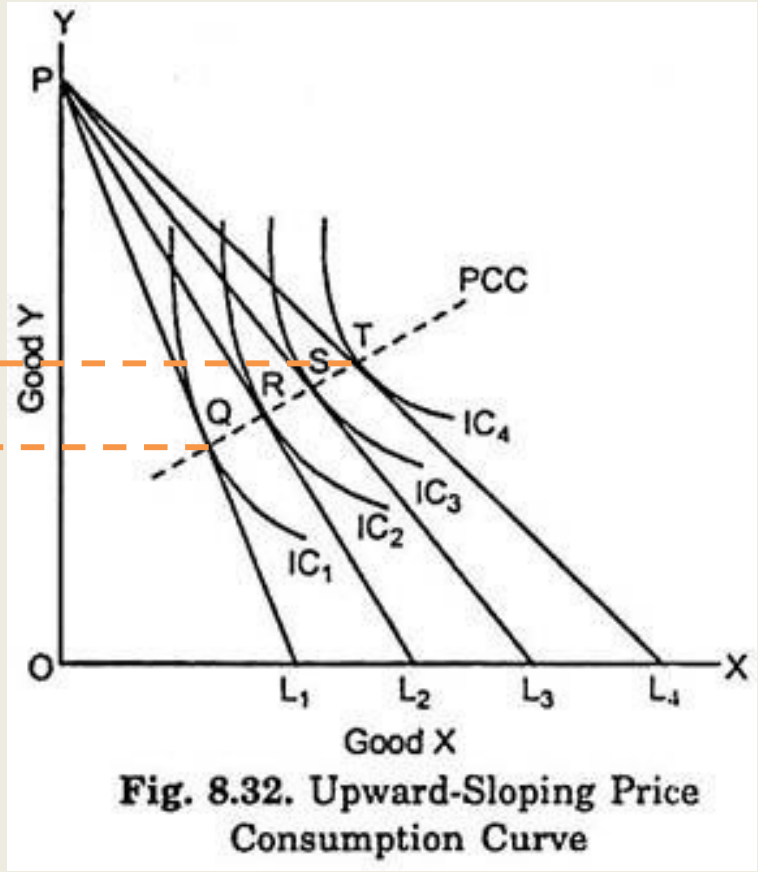


Fig. 8.32. Upward-Sloping Price Consumption Curve

For simplicity, we will consider Point Q (before P_x falls) and Point T (after Px falls).

At Q, we spend N on Y.
Our income = P, and we spend the rest on X, so we spend ……. on X.

At T, we spend M on Y.
Our income = P, and we spend the rest on X, so we spend……on X.

Here, after Px falls, our expenditure on X decreases from ……to ……
Thus, the demand for X is ……..

PCC and Price Elasticity of Demand (PED)

Consider the case where Px falls.
Income = P, and Y is a composite good with Py = 1.

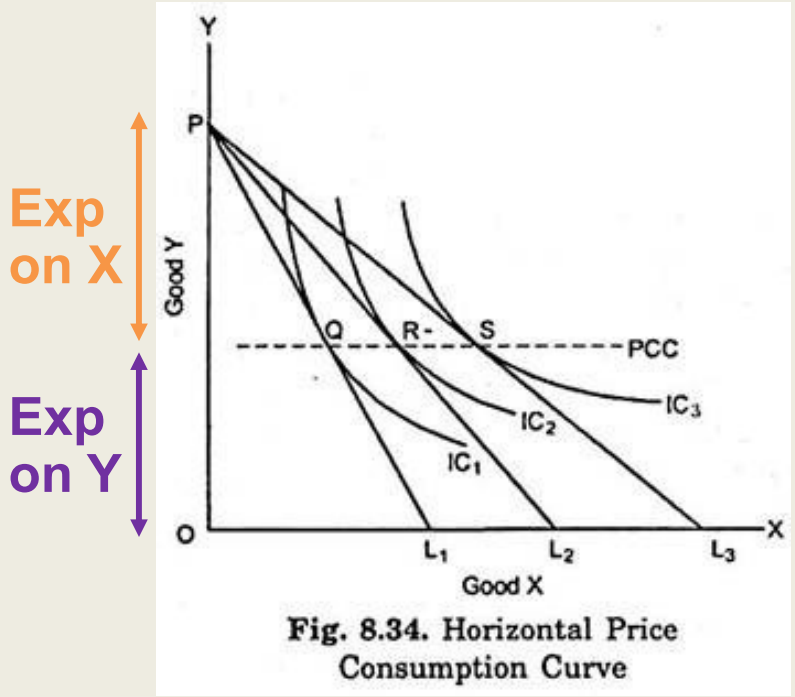
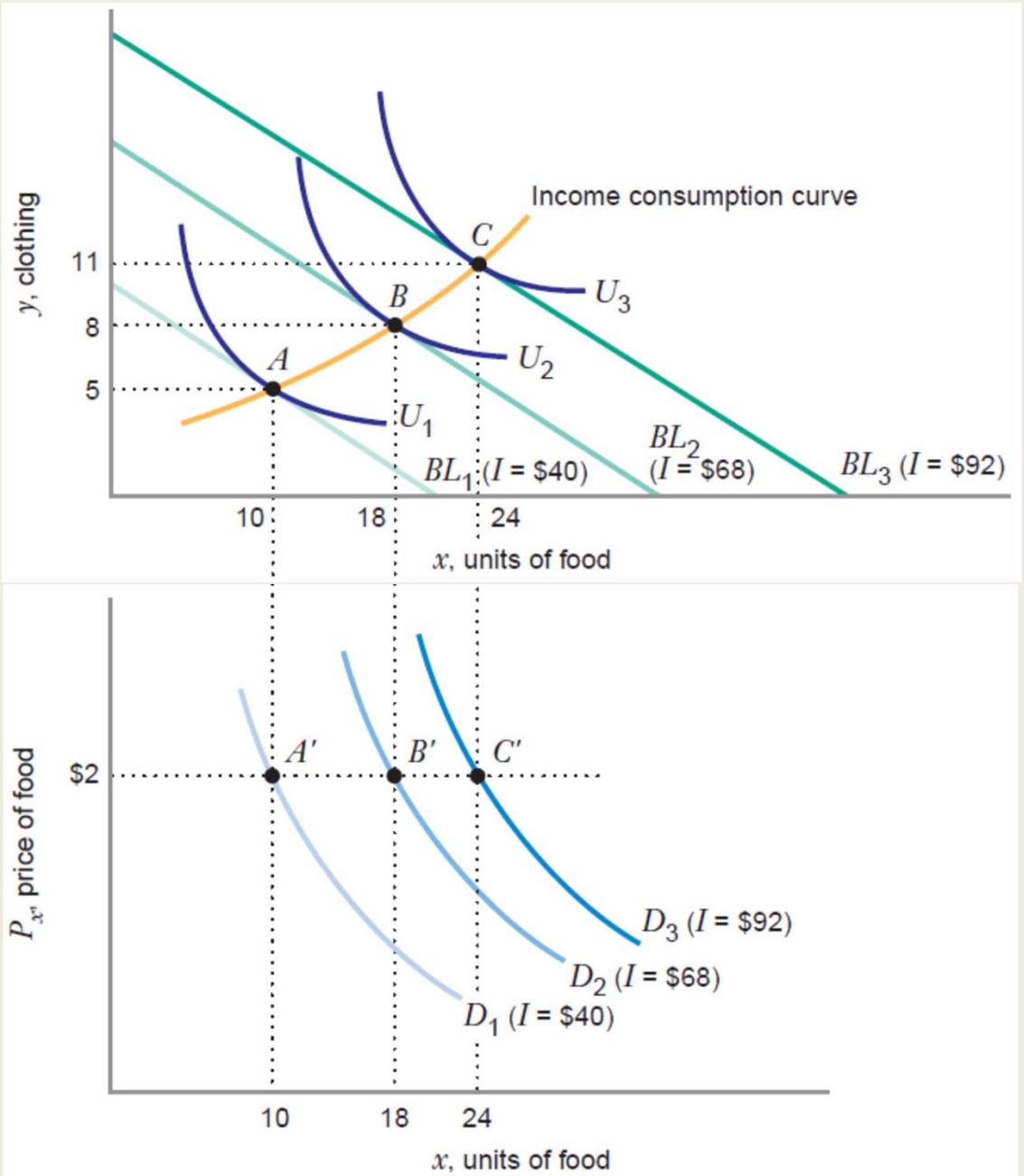


Fig. 8.34. Horizontal Price Consumption Curve

When Price changes, the expenditure on the good does not change.
i.e. A+B is still equal to B+C

Here, after P_x falls, we buy……. X, but our expenditure on X remains the same. Thus, demand is price unitary elastic.

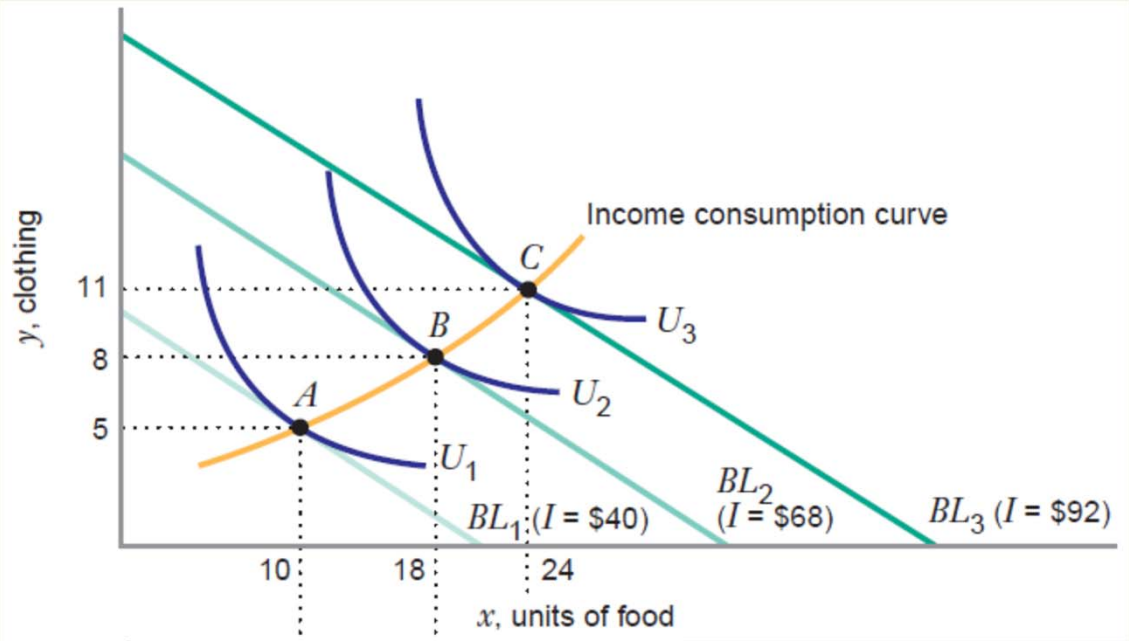
Income Consumption Curve (ICC)

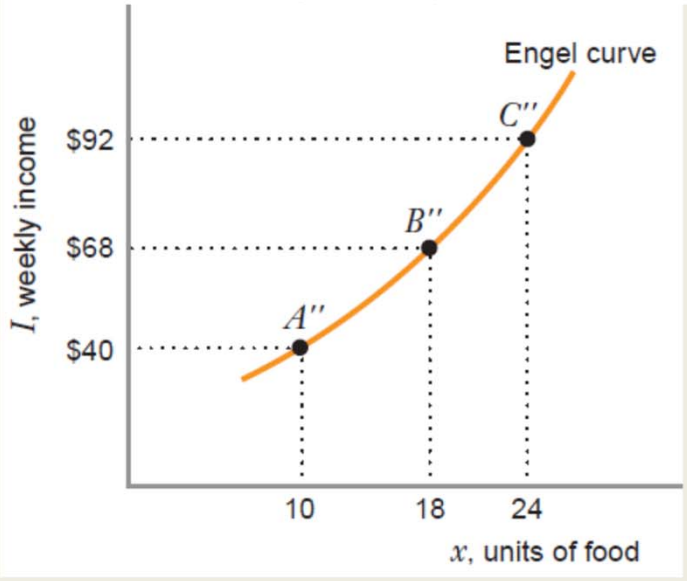


The ICC of good x is the set of optimal baskets for every possible level of income.

We can graph the points on the ICC as points from shifting the demand curve.

Engel Curve of a normal good





X is a normal good

The ICC for good x can be written as the quantity consumed of good x for any income level.

This is the **Engel Curve for good x**. When the income consumption curve is positively sloped, the slope of the Engel Curve is positive.

Engel Curve of an inferior good

X is an inferior good

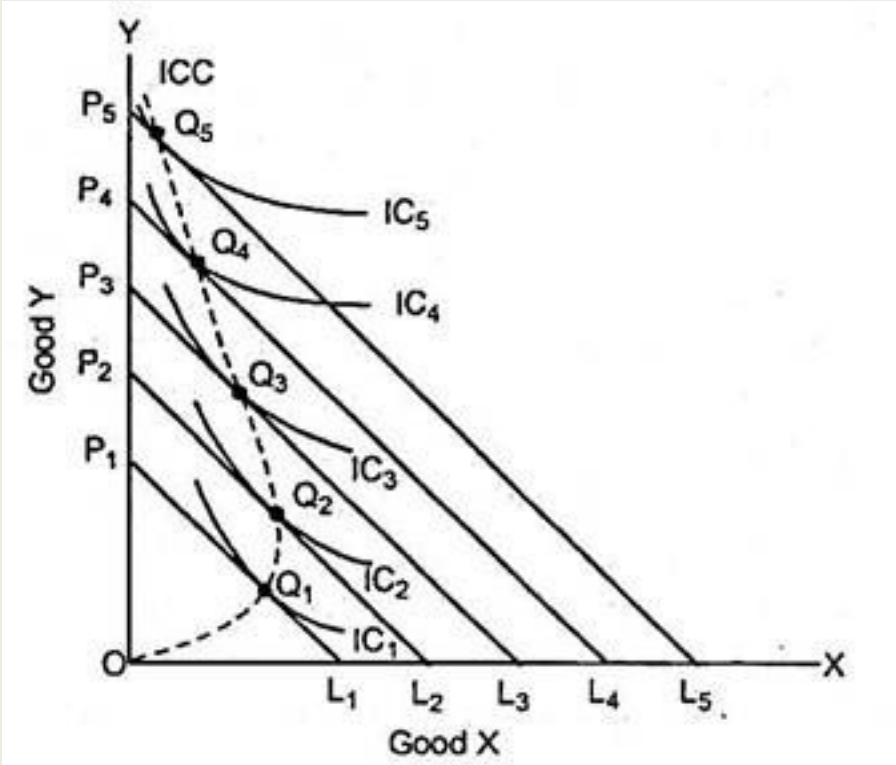


Fig. 8.22. Income Consumption Curve in Case of Good X being Inferior Good

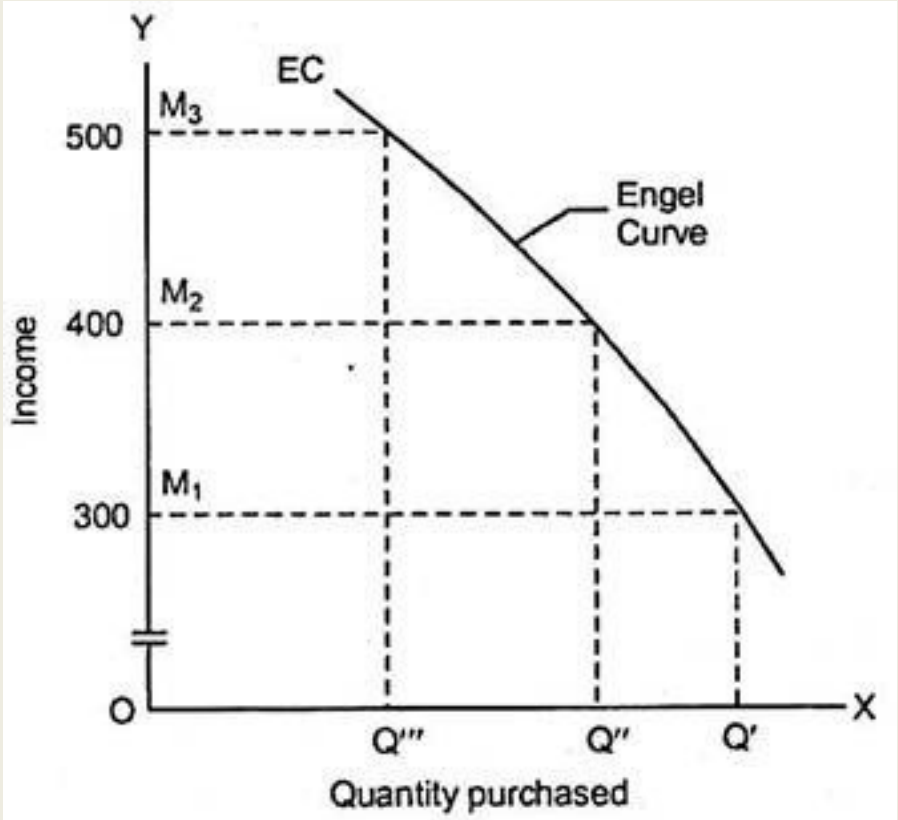


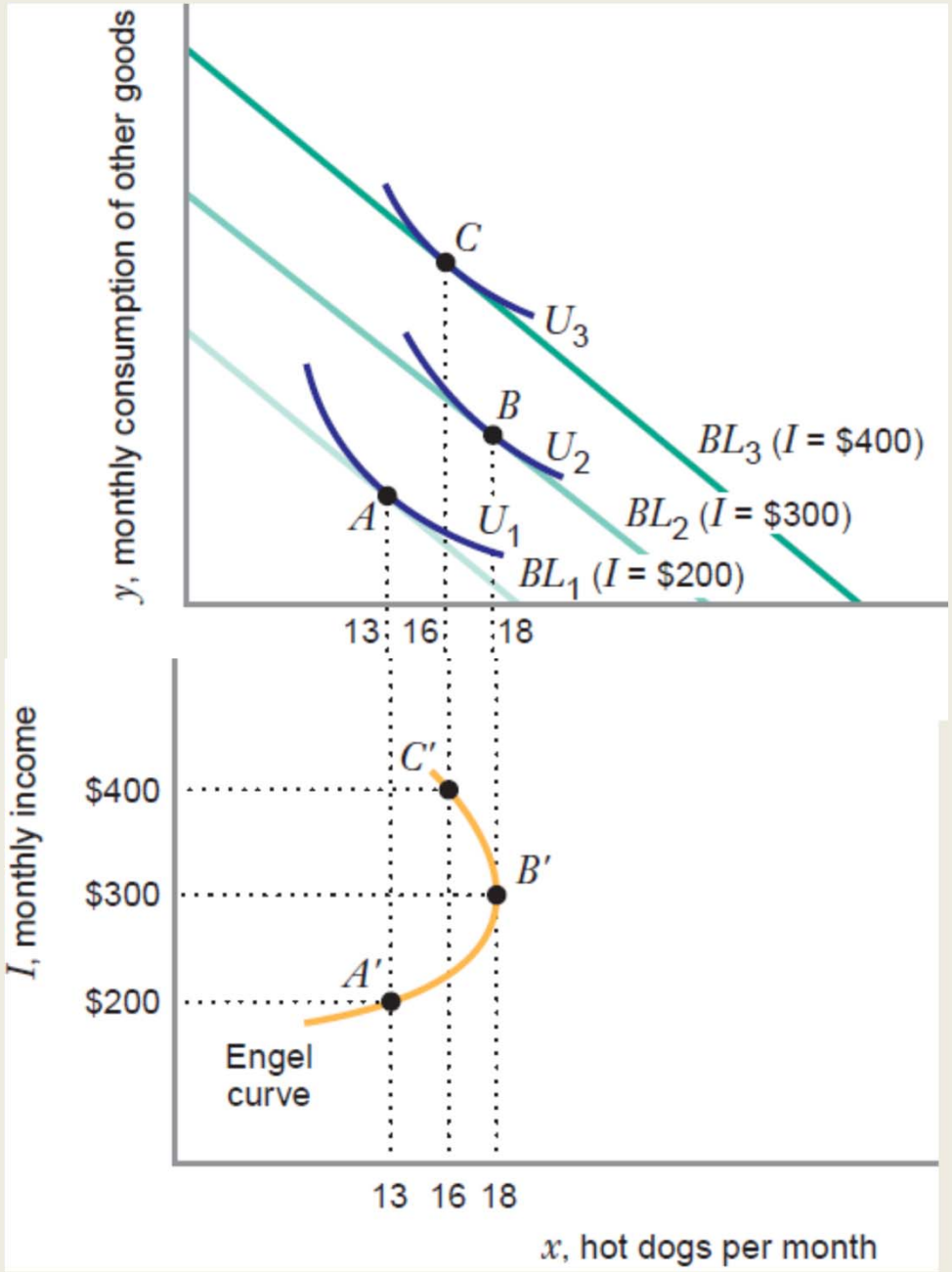
Fig. 8.28. Engel Curve of an Inferior Good

Summary: ICC, Engel Curve, and Types of Goods

- If the ICC shows that the consumer purchases more of good x as her income rises, good x is **……**
- Equivalently, if the slope of the Engel curve is positive, the good is a normal good.

- If the ICC shows that the consumer purchases less of good x as her income rises, good x is ……
- Equivalently, if the slope of the Engel curve is negative, the good is an inferior good.

Backward-Bending Engel Curve



Backward-Bending Engel Curve

A good can be normal over some ranges and inferior over others.

(a) As income rises from $200 to $300, the consumer's weekly consumption of hot dogs increases from 13 (basket *A*) to 18 (basket *B*). However, as income rises from $300 to $400, the consumer's weekly consumption of hot dogs decreases from 18 to 16 (basket *C*).

(b) Hot dogs are a normal good between points *A′* and *B′* (i.e., over the income range $200 to $300), where the Engel curve has a positive slope. But between points *B′* and *C′* (i.e., over the income range $300 to $400), hot dogs are an inferior good, and the Engel curve has a negative slope.

LEARNING-BY-DOING EXERCISE 5.2

Finding a Demand Curve (No Corner Points)

A consumer purchases two goods, food and clothing. The utility function is $U(x, y) = xy$, where x denotes the amount of food consumed and y the amount of clothing. The marginal utilities are $MU_x = y$ and $MU_y = x$. The price of food is P_x, the price of clothing is P_y, and income is I.

Problem

(a) Show that the equation for the demand curve for food is $x = I/(2P_x)$.

(b) Is food a normal good? Draw D_1, the consumer's demand curve for food when the level of income is $I =$ \$120. Draw D_2, the demand curve when $I =$ \$200.

LEARNING-BY-DOING EXERCISE 5.3

Finding a Demand Curve (with a Corner Point Solution)

A consumer purchases two goods, food and clothing. He has the utility function $U(x, y) = xy + 10x$, where x denotes the amount of food consumed and y the amount of clothing. The marginal utilities are $MU_x = y + 10$ and $MU_y = x$. The consumer's income is \$100, and the price of food is \$1. The price of clothing is P_y.

Problem Show that the equation for the consumer's demand curve for clothing is

$$y = \frac{100 - 10P_y}{2P_y}, \quad \text{when } P_y < 10$$

$$y = 0, \quad \text{when } P_y \geq 10$$

Use this equation to fill in the following table to show how much clothing he will purchase at each price of clothing (these are points on his demand curve):

P_y	2	4	5	10	12
y					

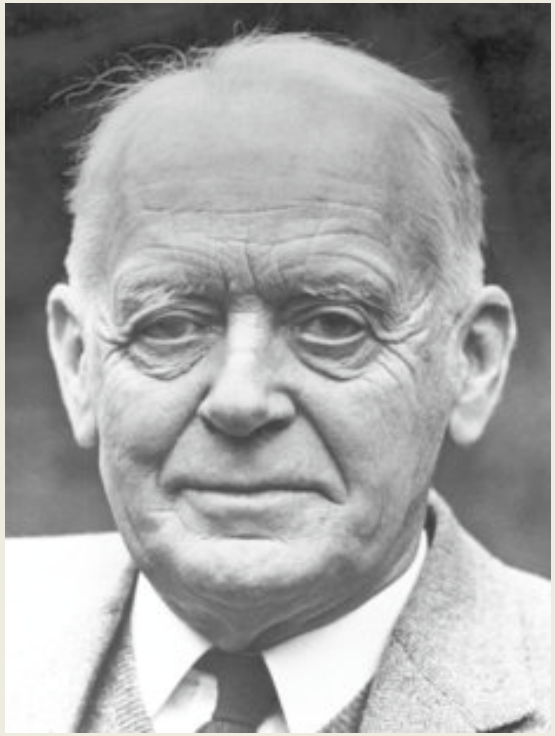
Decomposition of the Total Effect

- When the price of a good changes, its quantity demanded changes.

- Economists believe that **this change in quantity demanded for a good** is due to **mixture of two effects**:
  - Substitution Effect (SE)
  - Income Effect (IE)
- That is, **TE = SE + IE**.

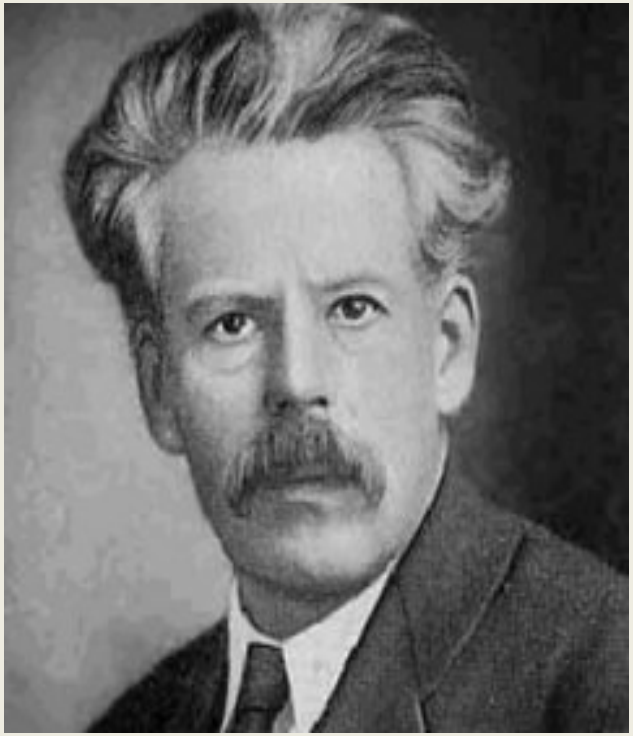
- TE refers to Total Effect of the price change. (or Price effect)

HICKS Approach Vs. Slutsky Approach



Sir John R. Hicks (1904-1989)

The Sveriges Riksbank Prize in Economic Sciences in Memory of Alfred Nobel 1972
(with Kenneth J. Arrow)



Eugen Slutsky (1880-1948)

On the Theory of
the Budget of the Consumer, 1915

Hicks vs Slutsky Method

- The Hicksian Method of eliminating the I.E.
  After the price change, to undo the I.E., we must compensate the consumer such that he/she can obtain (or resume) the old utility level

  In other words, Hicks Method virtually gives the consumer compensated income to get back to **his original IC**.

- The Slutskian Method of eliminating the I.E.
  After the price change, to undo the I.E., we must compensate the consumer such that he/she can obtain (or resume) the old basket at the old IC.
- In other words, Slutsky Method virtually gives the consumer compensated income to be able to afford **his original bundle** on his original IC.

Decomposition of the Total Effect

CASE 1: When X is a normal good

Example – Income and Substitution Effects

Example:

Suppose $U(x,y) = xy$ ➔ MU_x = ……., MU_y = …….
P_y = \$1/unit and I = \$72

Suppose that P_{x1} = \$9/unit. What is the (initial) optimal consumption basket?

Tangency Condition: $MU_x/MU_y = P_x/P_y$ ➔ ……..
Constraint: $P_xx + P_yy = I$ ➔ ……..

Solving: x = …… and y = ……..

Example – Income and Substitution Effects

Find the decomposition basket B.

1. It must lie on the *original* indifference curve U_1 along with basket A ➔ $U_1 = XY = 4(36) = 144$.
2. It must lie at the point where the decomposition budget line is tangent to the indifference curve.
3. Price of X (P_X) on the decomposition budget line is final price of $4.

Tangency Condition: $MU_x/MU_y = P_x/P_y$ ➔ .....

Combined with XY = 144 ➔ x = ..., y = ...

Substitution Effect: .....units of X

Income Effect: ..... units of X

Decomposition of the Total Effect

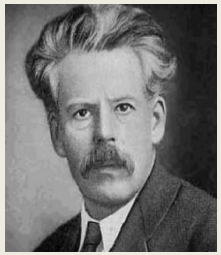
CASE 2: When X is an inferior good

Decomposition of the Total Effect

CASE 3: When X is a Giffen Good

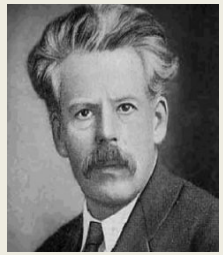
Decomposition of the Total Effect

CASE 1: When X is a normal good



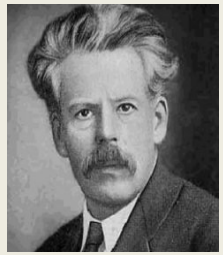
Decomposition of the Total Effect

CASE 2: When X is an inferior good



Decomposition of the Total Effect

CASE 3: When X is a Giffen Good



Hicksian Demand Curve Vs. Marshallian Demand Curve

Let's use Hicksian Method

Other Key Points

- We refer the Hicksian demand curve as **"compensated"** demand curve, whereas the Marshallian demand curve is referred as "**uncompensated**" demand.
- The Hicksian demand curve is always downward-sloping because **it ignores the IE**.
- For the same reason, the Hicksian demand for a normal good is steeper than the Marshallian demand.

Slutsky's Equation

Consumer's Duality Problem

Fixed budget & utility maximisation

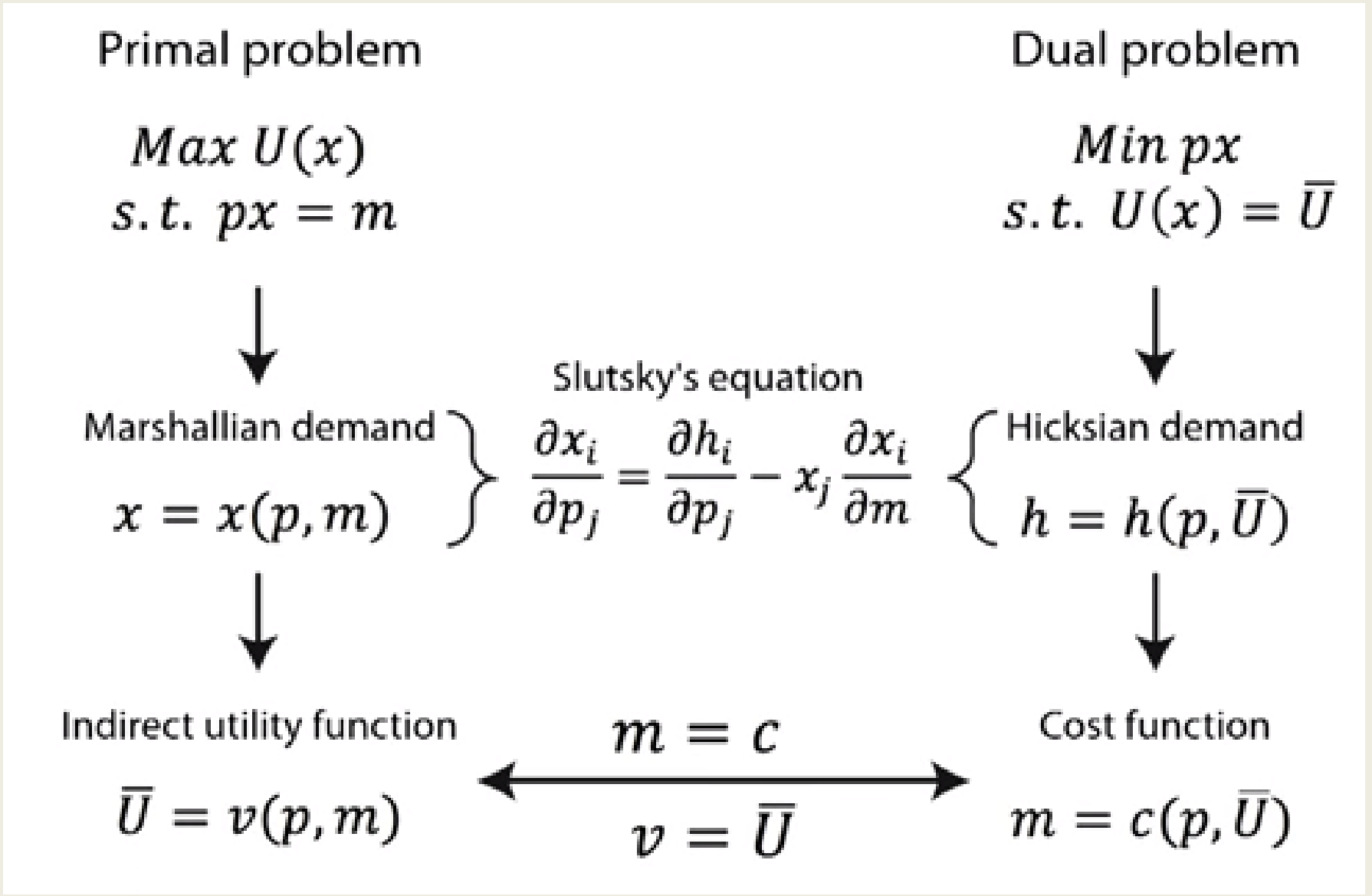
PRIMAL PROBLEM

Fixed utility & cost minimisation

DUAL PROBLEM

Fixed budget & utility maximisation
PRIMAL PROBLEM

Fixed utility & cost minimisation
DUAL PROBLEM


Primal problem
Dual problem
$Max\ U(x)$
$s.t.\ px = m$
$Min\ px$
$s.t.\ U(x) = \overline{U}$
Slutsky's equation
$\frac{\partial x_i}{\partial p_j} = \frac{\partial h_i}{\partial p_j} - x_j \frac{\partial x_i}{\partial m}$
Marshallian demand
$x = x(p, m)$
Hicksian demand
$h = h(p, \overline{U})$
Indirect utility function
$\overline{U} = v(p, m)$
$m = c$
$v = \overline{U}$
Cost function
$m = c(p, \overline{U})$

Consumer Surplus, Compensating Variation, Equivalent Variation

compensating variation
A measure of how much money a consumer would be willing to give up after a reduction in the price of a good to be just as well off as before the price decrease.

equivalent variation
A measure of how much additional money a consumer would need before a price reduction to be as well off as after the price decrease.

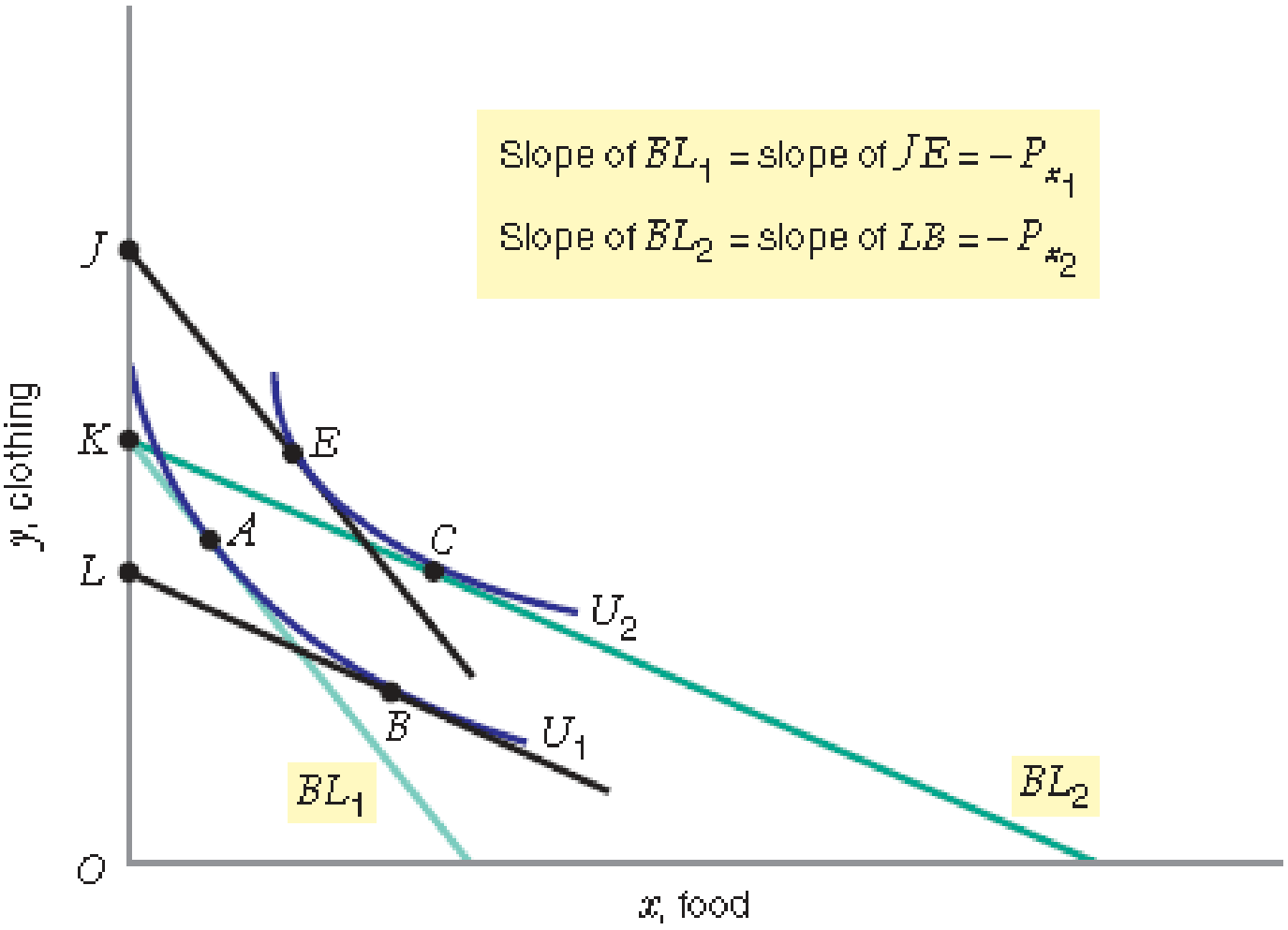


FIGURE 5.15 Compensating and Equivalent Variations with a Positive Income Effect

The price change from P_{x_1} to P_{x_2} has a positive income effect, so the compensating variation (the length of the segment KL) and the equivalent variation (the length of the segment JK) are not equal. In this case, $JK > KL$.

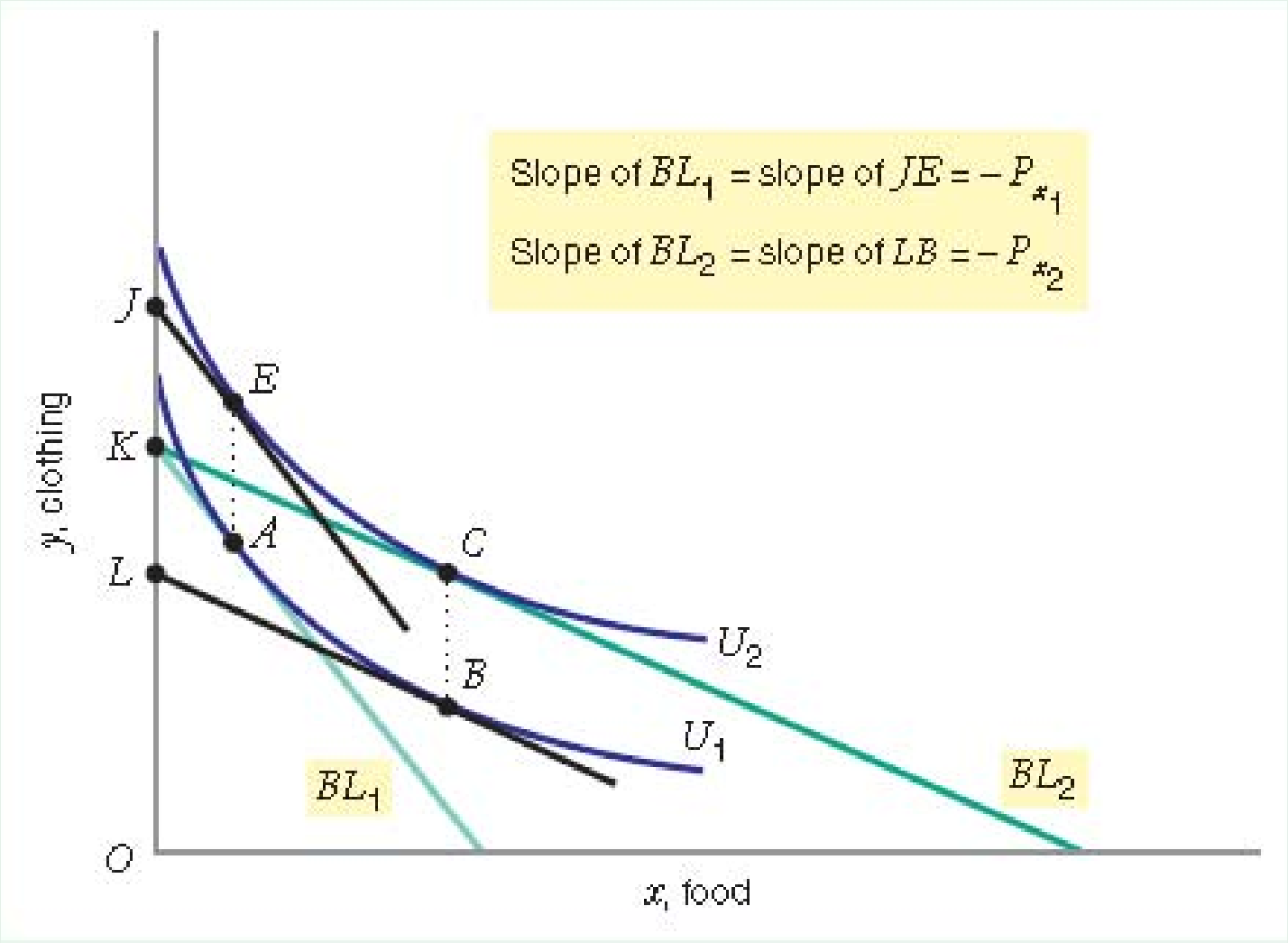


FIGURE 5.16 Compensating and Equivalent Variations with No Income Effect (Utility Function Is Quasilinear)
The utility function is quasilinear, so indifference curves U_1 and U_2 are parallel, and there is no income effect (C lies directly above B, and E lies directly above A). The compensating variation (KL) and equivalent variation (JK) are equal.

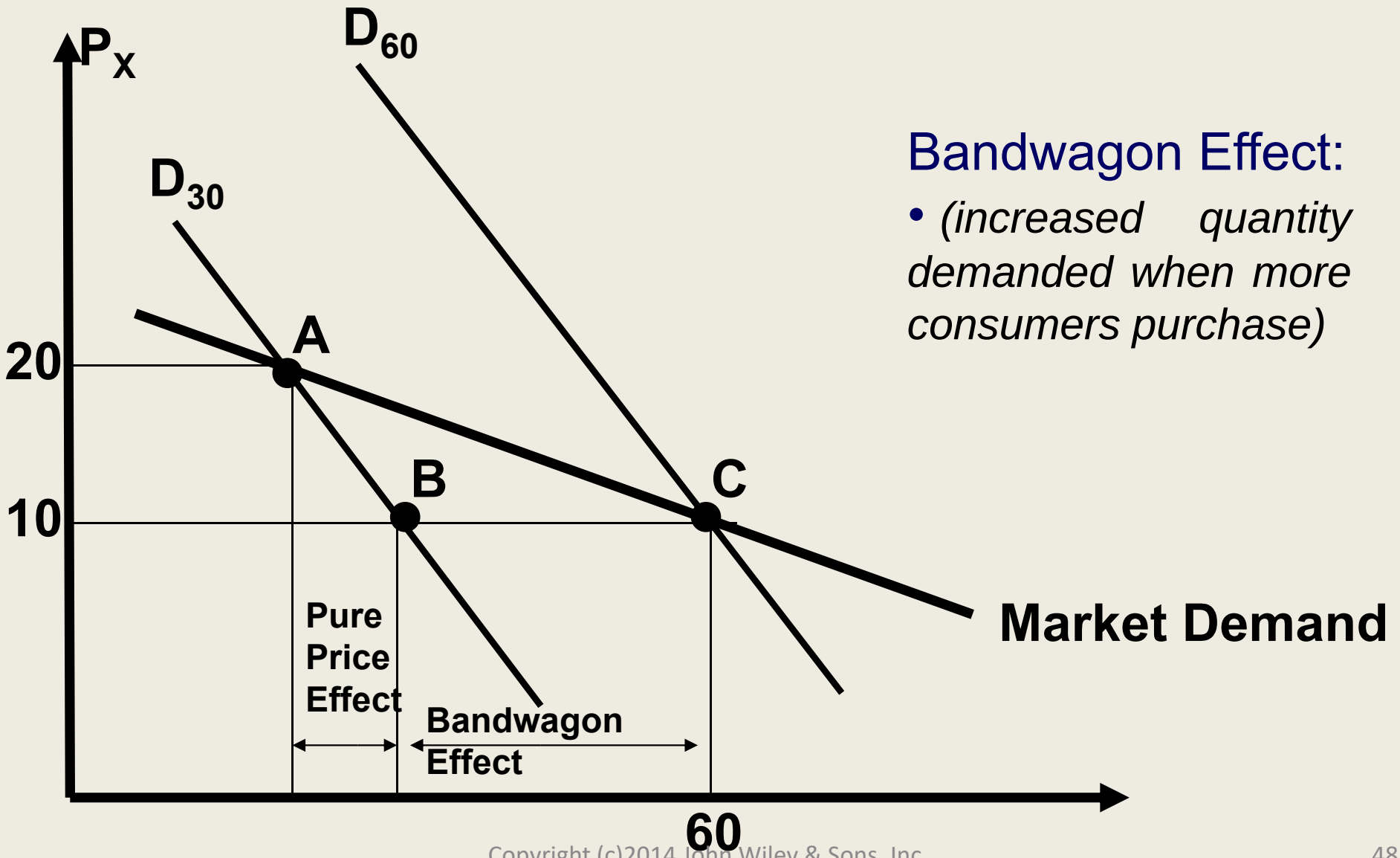
Network Externalities

- If one consumer's demand for a good changes with the number of other consumers who buy the good, there are network externalities.

Network Externalities

- Bandwagon effect: A positive network externality that refers to the increase in each consumer's demand for a good as more consumers buy the good

Network Externalities



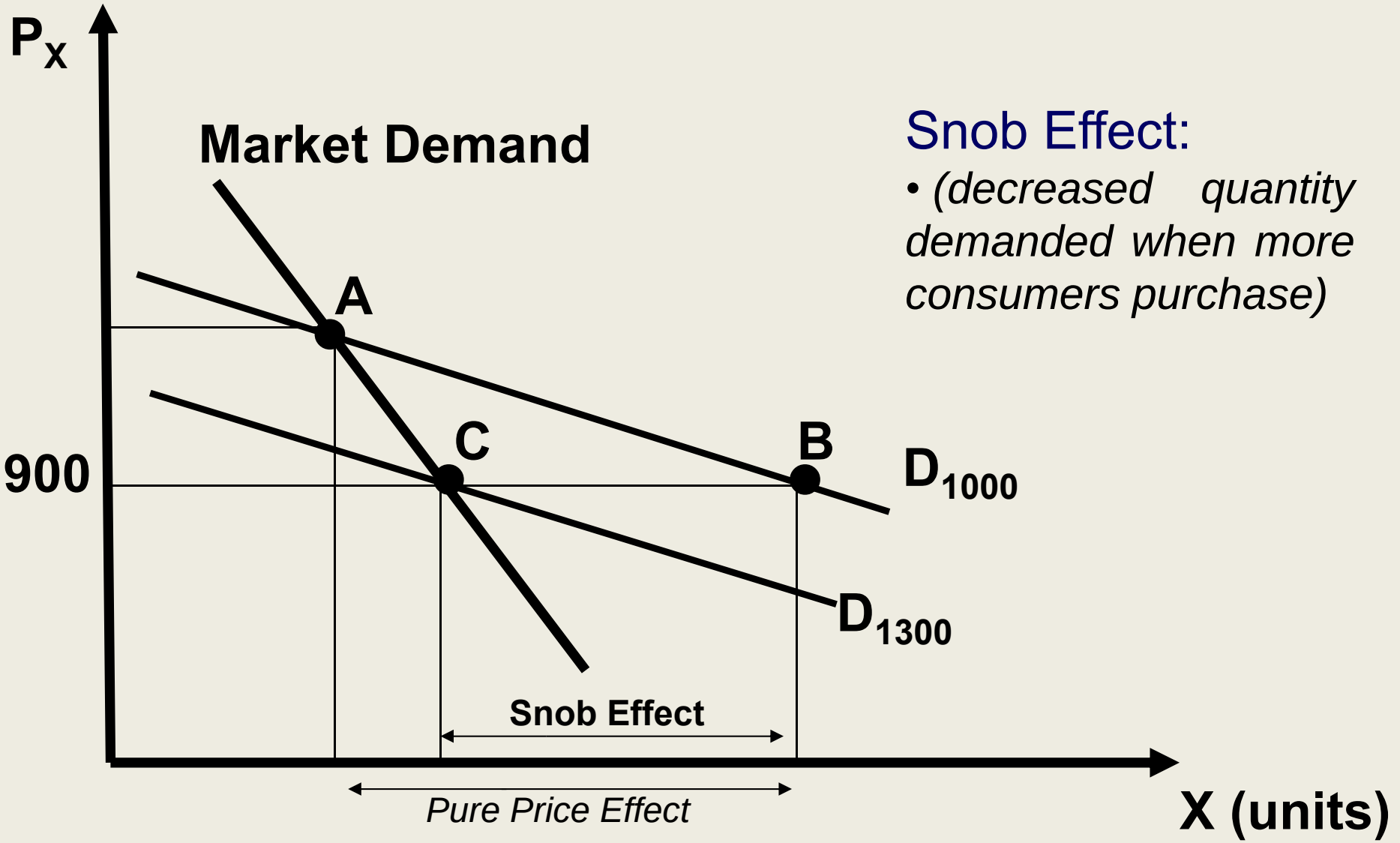
Bandwagon Effect:

- *(increased quantity demanded when more consumers purchase)*

Network Externalities

- Snob effect: A negative network externality that refers to the decrease in each consumer's demand as more consumers buy the good

Network Externalities



Snob Effect:

- *(decreased quantity demanded when more consumers purchase)*

Labor-Leisure Trade-off

- Divide the day into two parts: Work hours and leisure (non work) hours.
- Earns income during work hours and uses the income to pay for activities he enjoys in his leisure time.

Defining Labor Supply

- Total Daily income:
- *w(24-L)*

  where w is the hourly wage rate

L is the leisure hours

24 is the 24 hours in a day

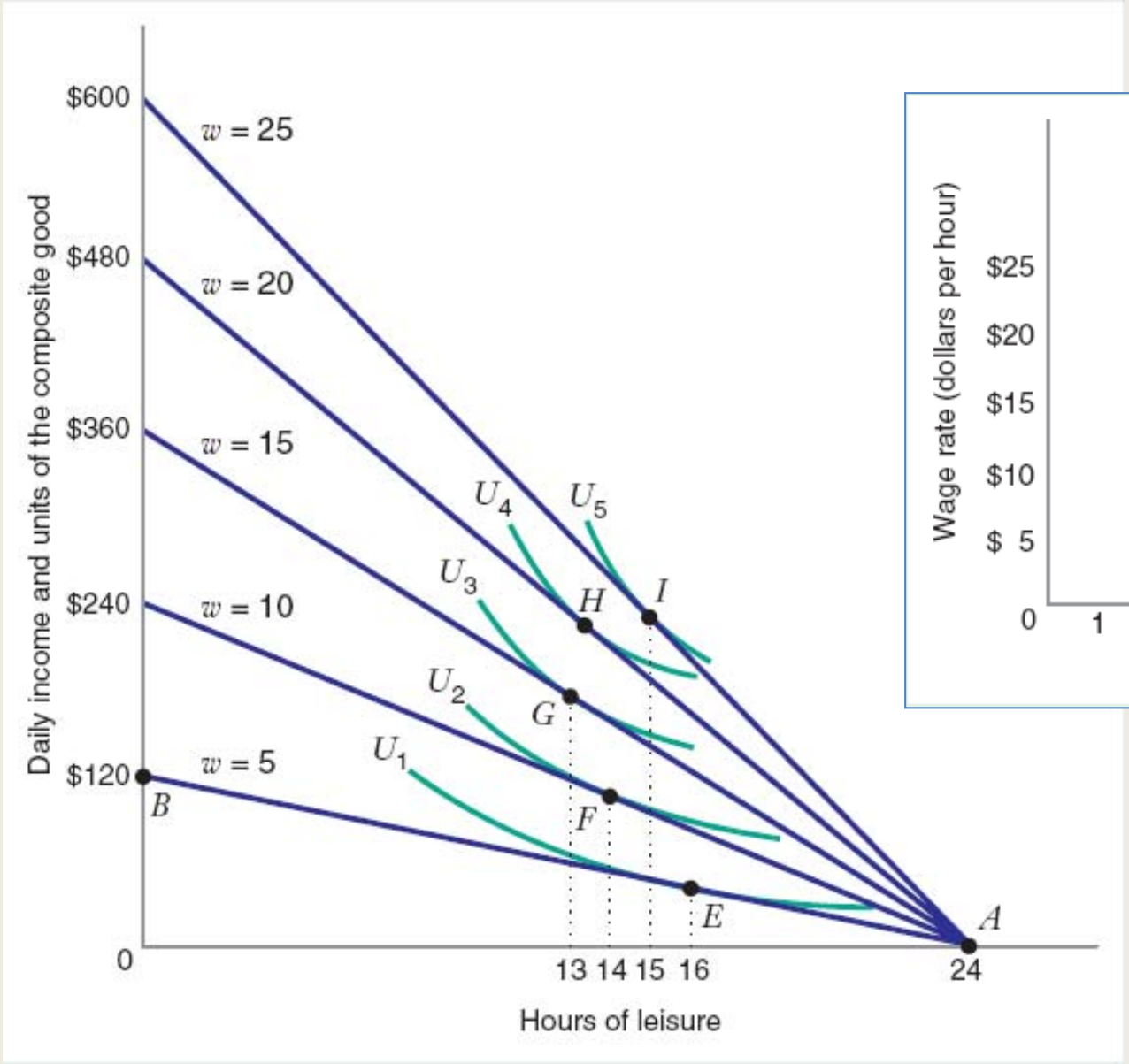
Supply of Labor

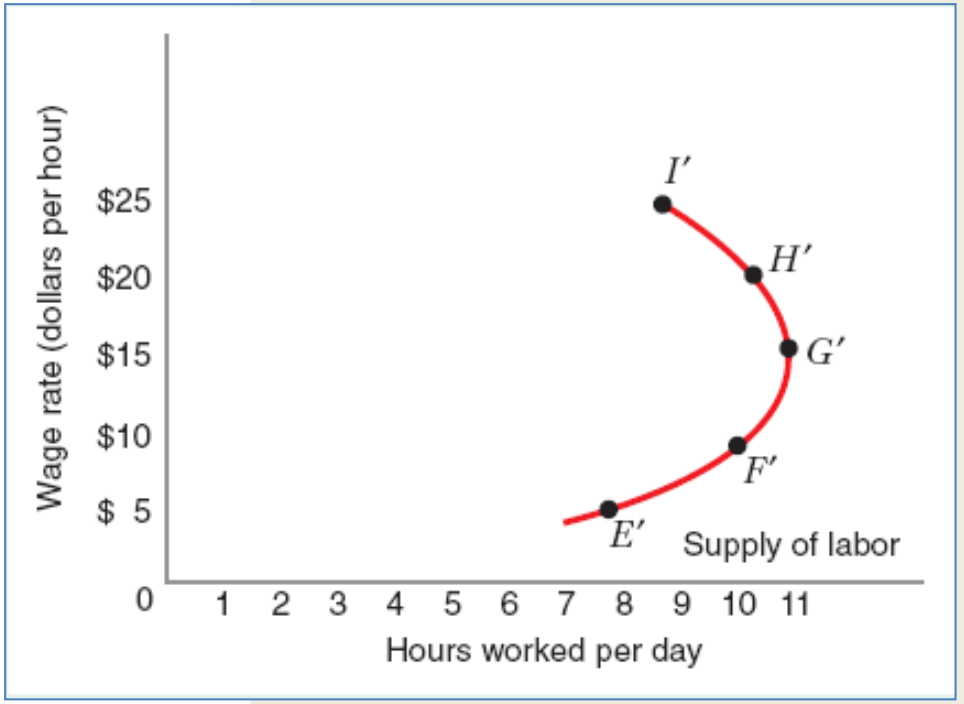
- An increase in wage rate reduces the amount of labor required to buy a unit of the composite good
- This leads to both a Substitution effect and Income effect.

Labor Supply Curve

- The labor supply curve slopes upward over the region where the substitution effect associated with the wage increase outweighs the income effect, but bends backward over the region where the income effect outweighs the substitution effect.

Labor Supply Curve





Consumer Price Indices

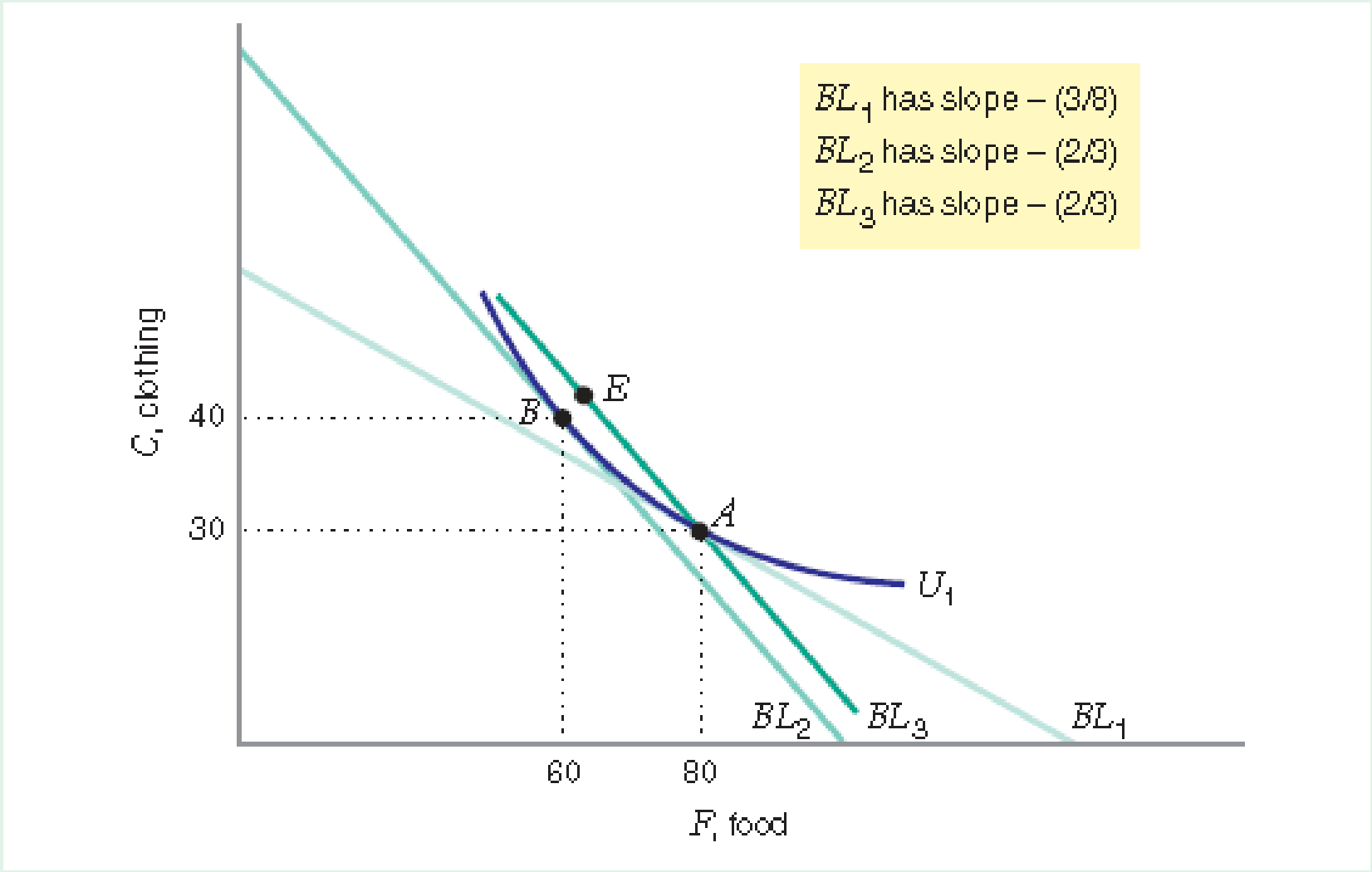


FIGURE 5.27 **Substitution Bias in the Consumer Price Index**