# Consumer Behavior

# EE311

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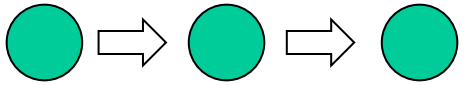
# Outline

- How are consumer preferences used to determine demand?
- How do consumers allocate income to the purchase of different goods?
- How do consumers with limited income decide what to buy?
- How to derive an individual demand?
- Income and Substitution Effects
- Applications

# Consumer Preferences – Basic Assumptions

1. Preferences are *complete*.
   - Consumers can rank market baskets; i.e., either prefer A to B, B to A, or indifferent
2. Preferences are *transitive*.

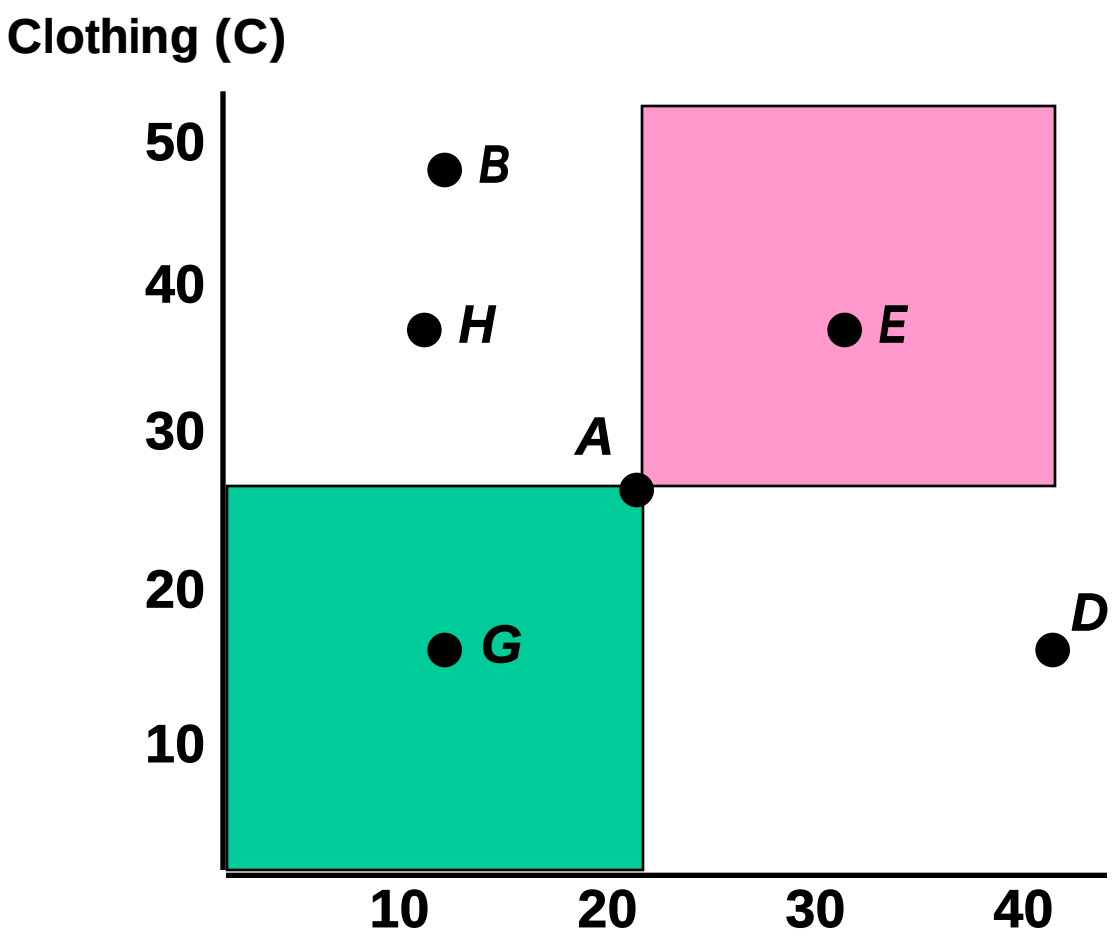


   - If prefer A to B, and B to C, the must prefer A to C
3. Consumers *always prefer more* of any good to less.
   - More is better --> rule out "Bads". This assumption can be relaxed.
4. Variety is preferred to extreme


# Consumer Preferences

- Consumer preferences can be represented graphically using *indifference curves or ICs*
- Indifference curves represent all combinations of market baskets that the person is *indifferent to*
  - A person will be equally satisfied with either choice or attain the same utility level

# Indifference Curves: An Example



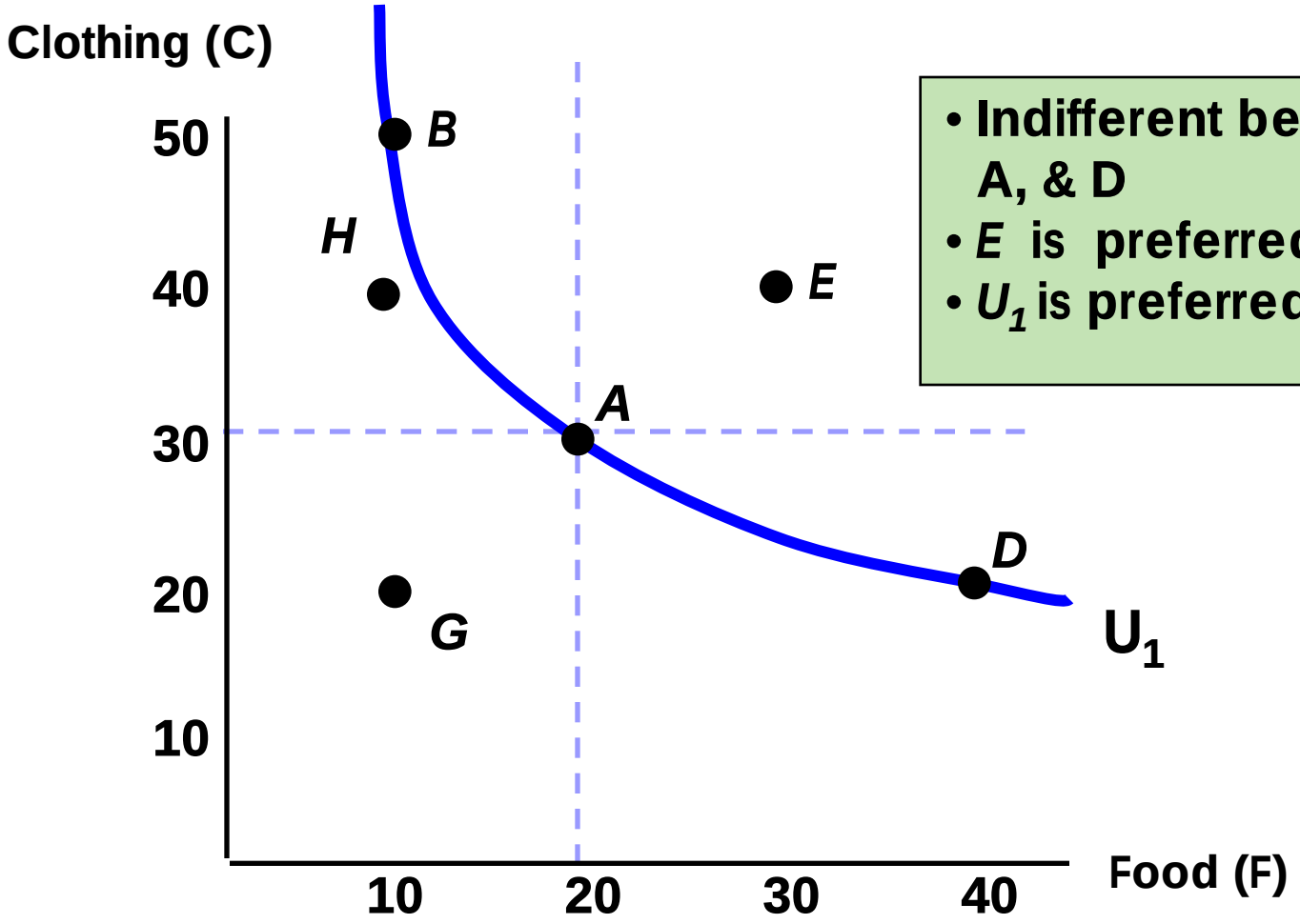

The consumer prefers *A* to all combinations in the blue box, while all those in the pink box are preferred to *A*.

The Indifferent curve for A cannot lie in those two areas.

# Indifference Curves: An Example

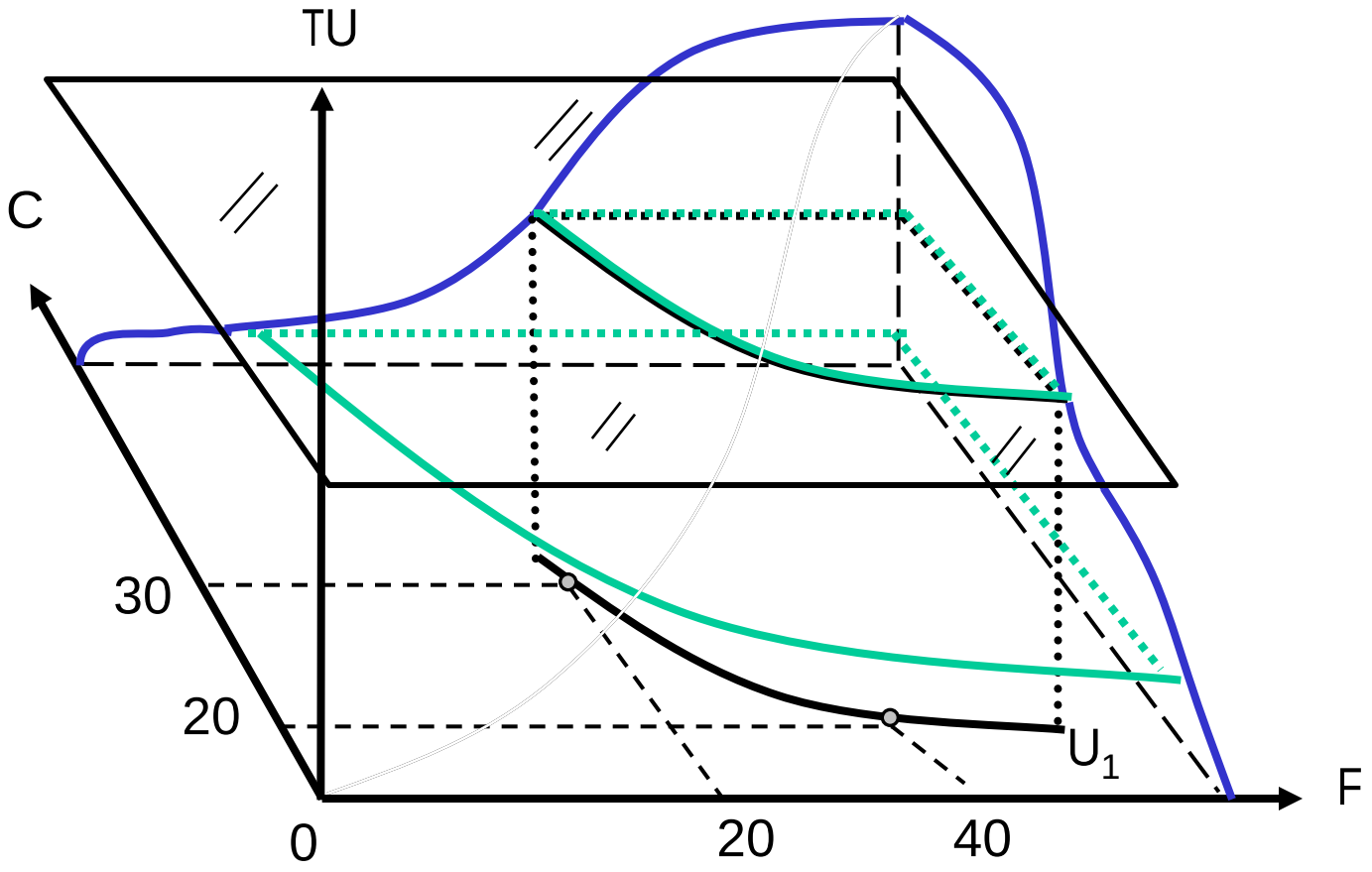
- Points such as B & D have more of one good but less of another compared to A
  - Need more information about consumer ranking
- Consumer may decide they are indifference between B, A and D
  - We can then connect those points with an indifference curve

# Indifference Curves: An Example




- Indifferent between B, A, & D
- *E* is preferred to $U_1$
- $U_1$ is preferred to *H* & *G*

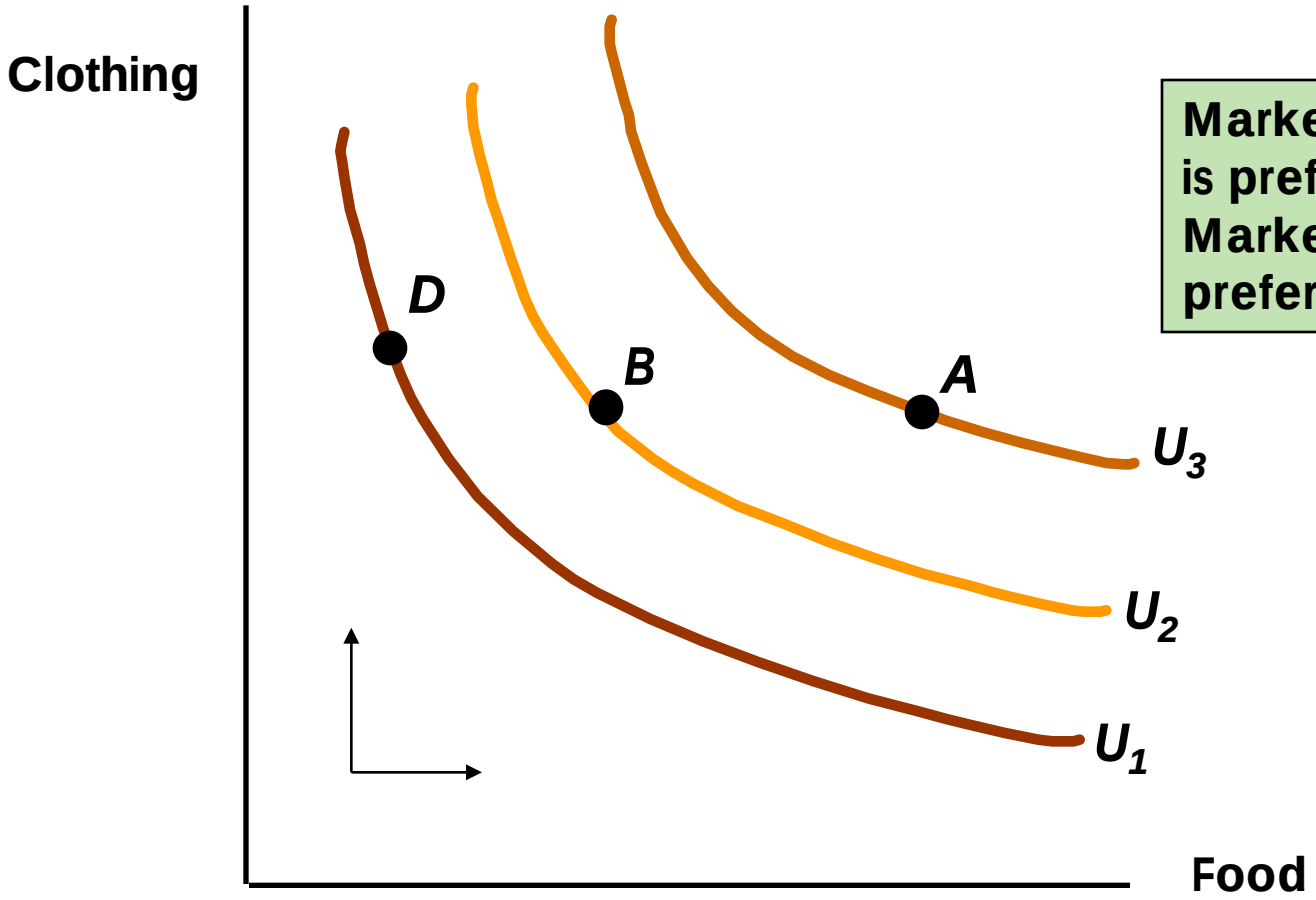
# Indifference curves are the contour on the utility hill



# Indifference Curves: Properties

- They slope downward to the right.
  - Goods are substitutable
  - If F rises, C must fall to maintain the same $U_1$.
- Any basket lying northeast of an IC is preferred to any on the IC
- Convex to the origin
  - Variety is preferred to extreme
- Indifference curves can not cross
- Continuous:  no gaps

# Indifference Map



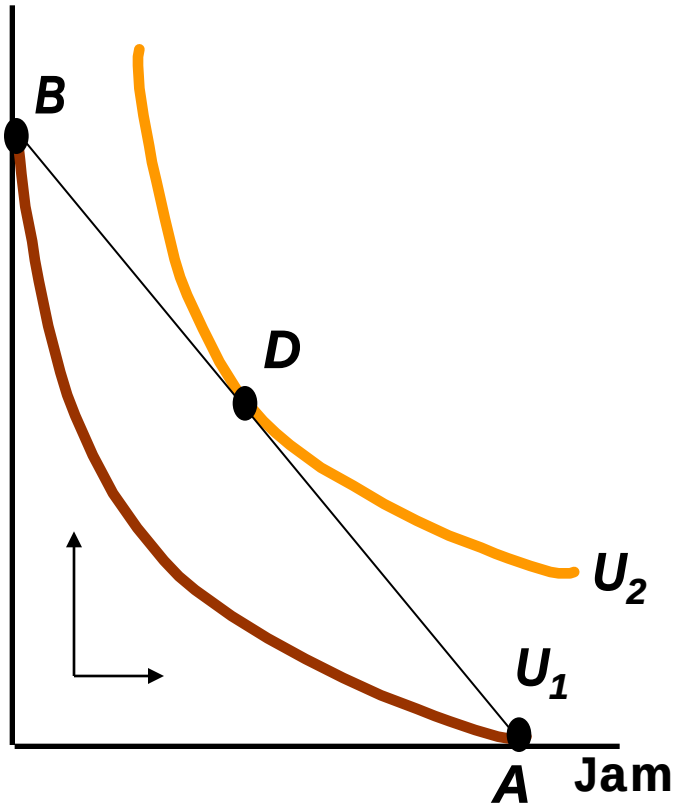

**Market basket *A* is preferred to *B*. Market basket *B* is preferred to *D*.**

# Indifference Map

Convex to the origin

Prefer varieties

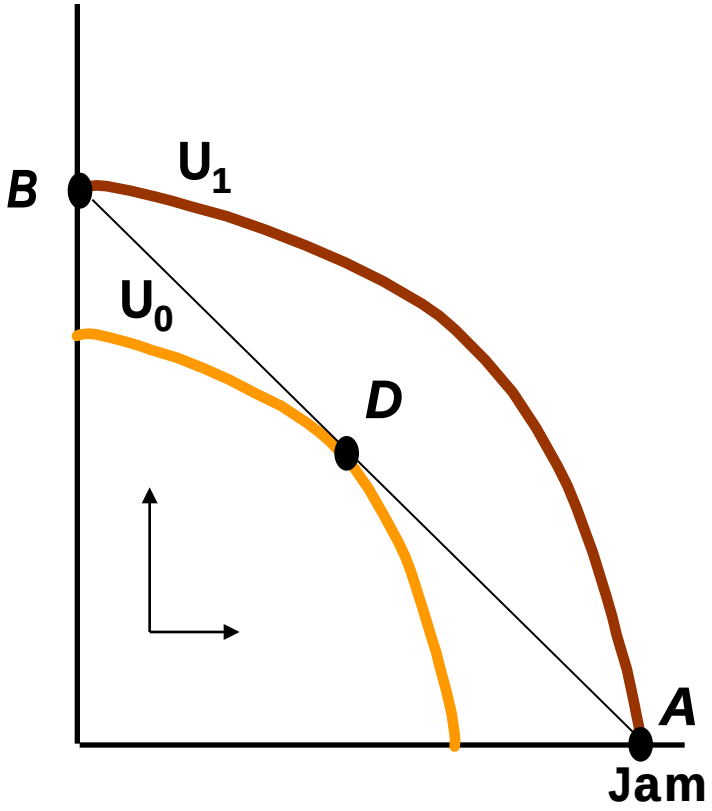
Butter



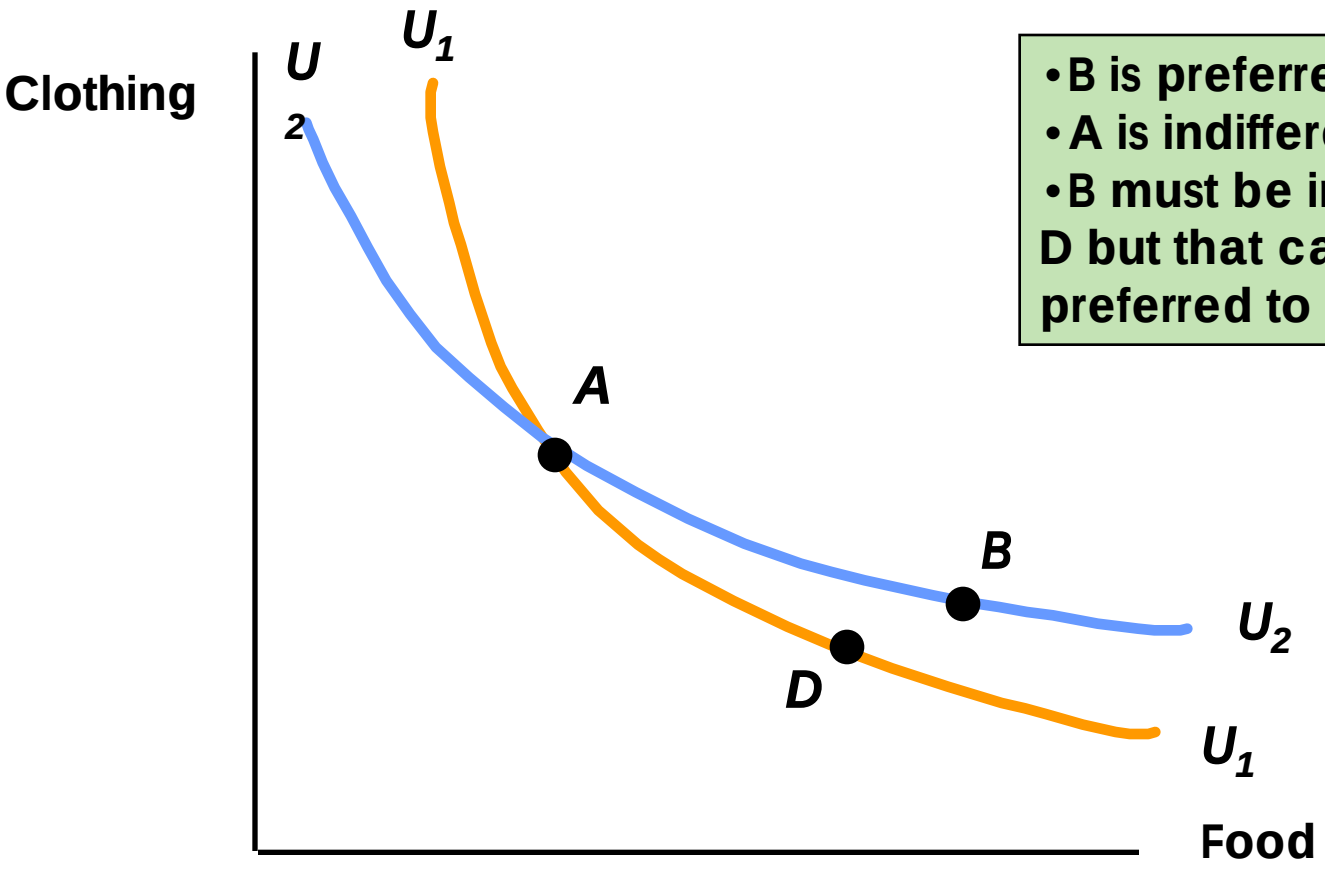

Concave to the origin

Prefer extreme

Chili Paste

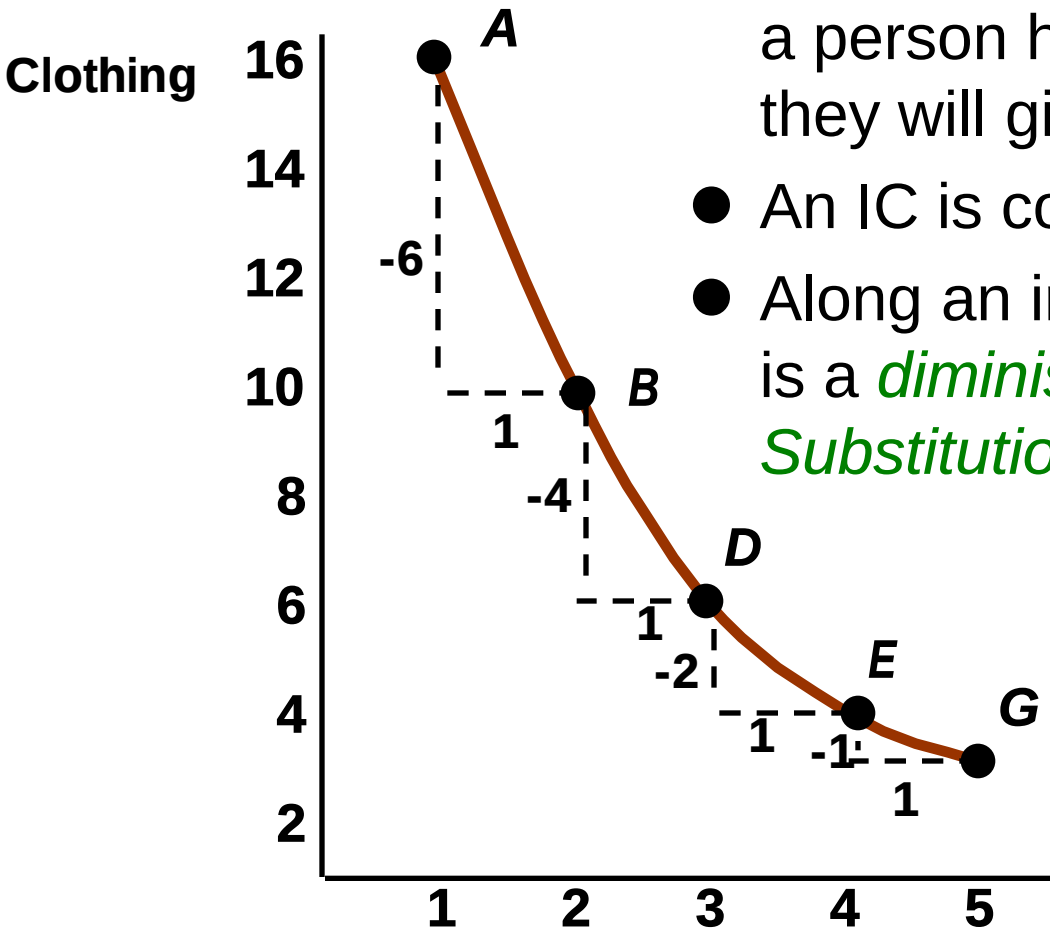


# Crossing Indifference Curves




- B is preferred to D
- A is indifferent to B & D
- B must be indifferent to D but that can't be if B is preferred to D

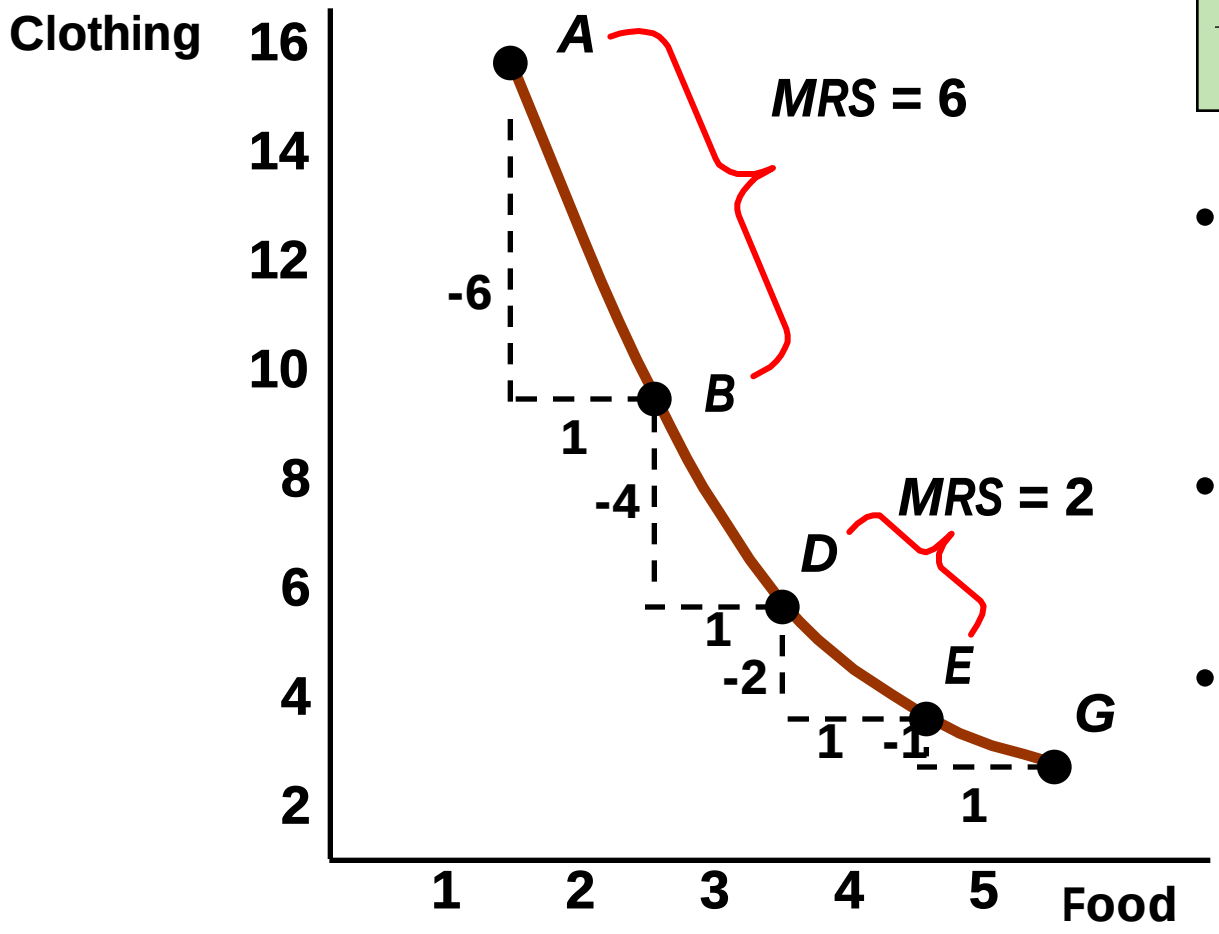
# Indifference Curves




- The more clothing and less food a person has, the more clothing they will give up to get more food
- An IC is convex to the origin
- Along an indifference curve there is a *diminishing Marginal Rate of Substitution (MRS)*

**Observation: The amount of clothing given up for 1 unit of food decreases from 6 to 1**

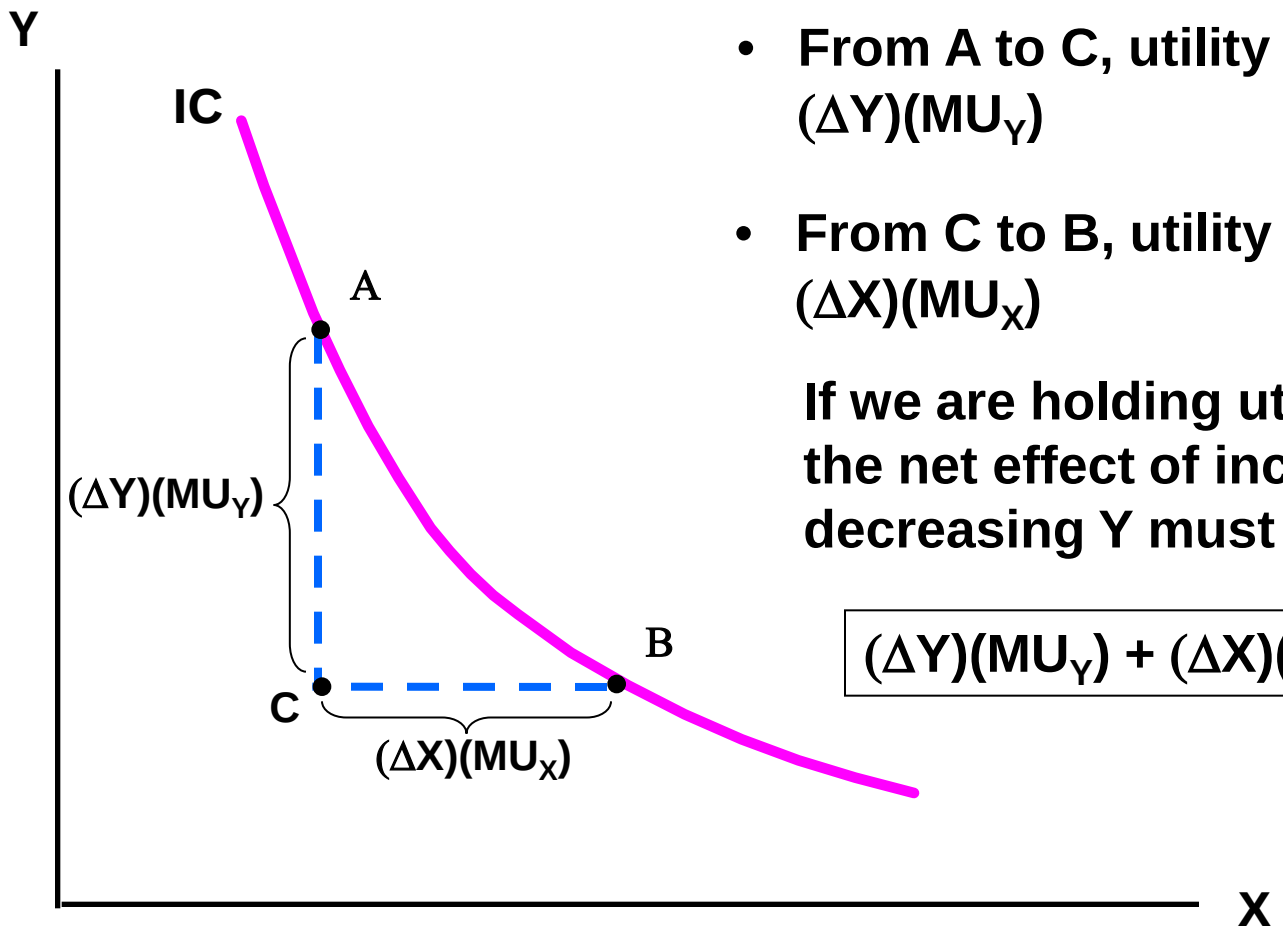
# Marginal Rate of Substitution




$$MRS = \frac{\Delta C}{\Delta F}$$

- MRS measures how a person trades one good for another
- It is the slope of the IC
- The willingness to substitute is less as we consume more of one good.

# Marginal Rate of Substitution




- From A to C, utility decreases by $(\Delta Y)(MU_Y)$
- From C to B, utility increases by $(\Delta X)(MU_X)$

If we are holding utility constant, the net effect of increasing X and decreasing Y must be zero

$$(\Delta Y)(MU_Y) + (\Delta X)(MU_X) = 0$$

# Marginal Rate of Substitution

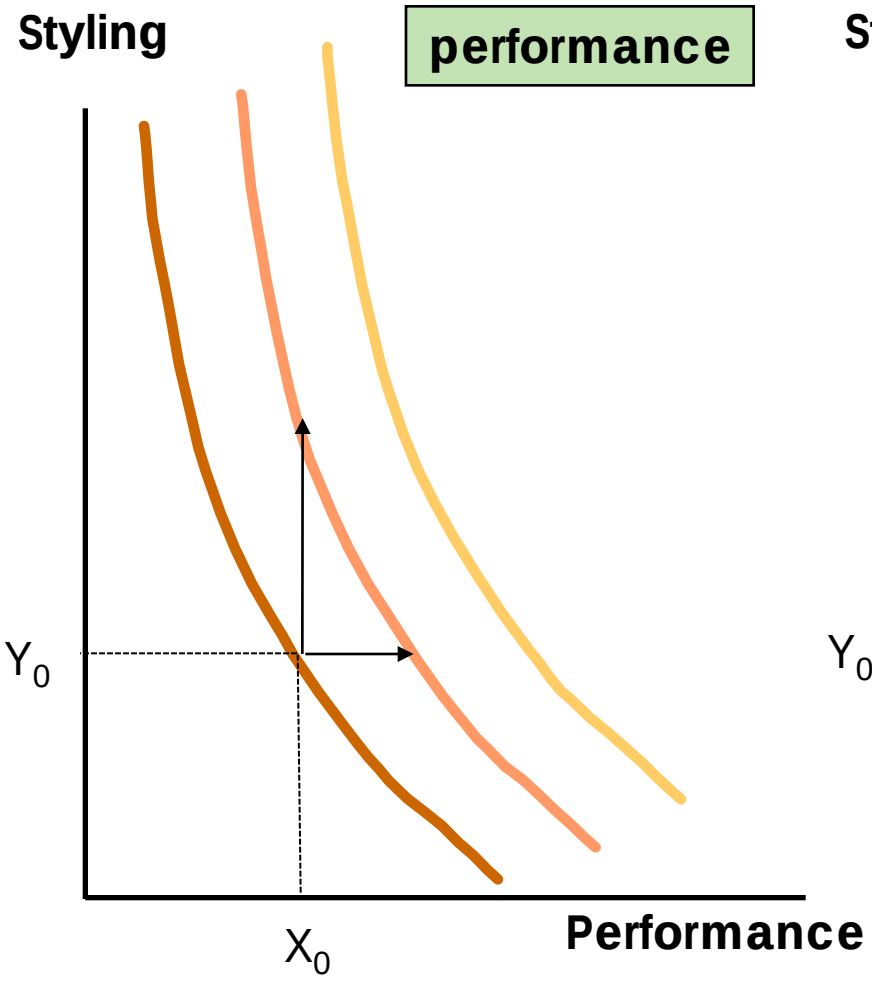
- Rearranging equation, we can see the relationship between MRS and MUs

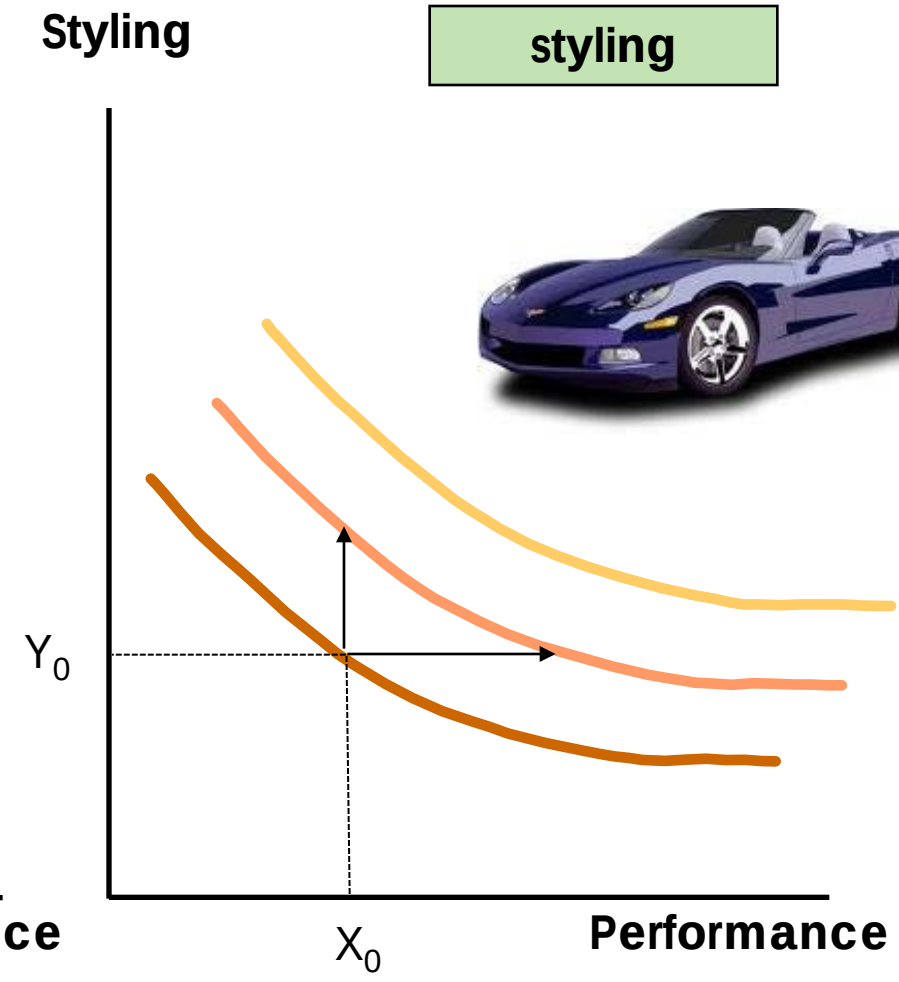
$$(\Delta Y)(MU_Y) + (\Delta X)(MU_X) = 0$$

$$(\Delta Y)(MU_Y) = -(\Delta X)(MU_X)$$

$$\frac{\Delta Y}{\Delta X} = -\frac{(MU_X)}{(MU_Y)} = MRS$$

# MRS and Preferences

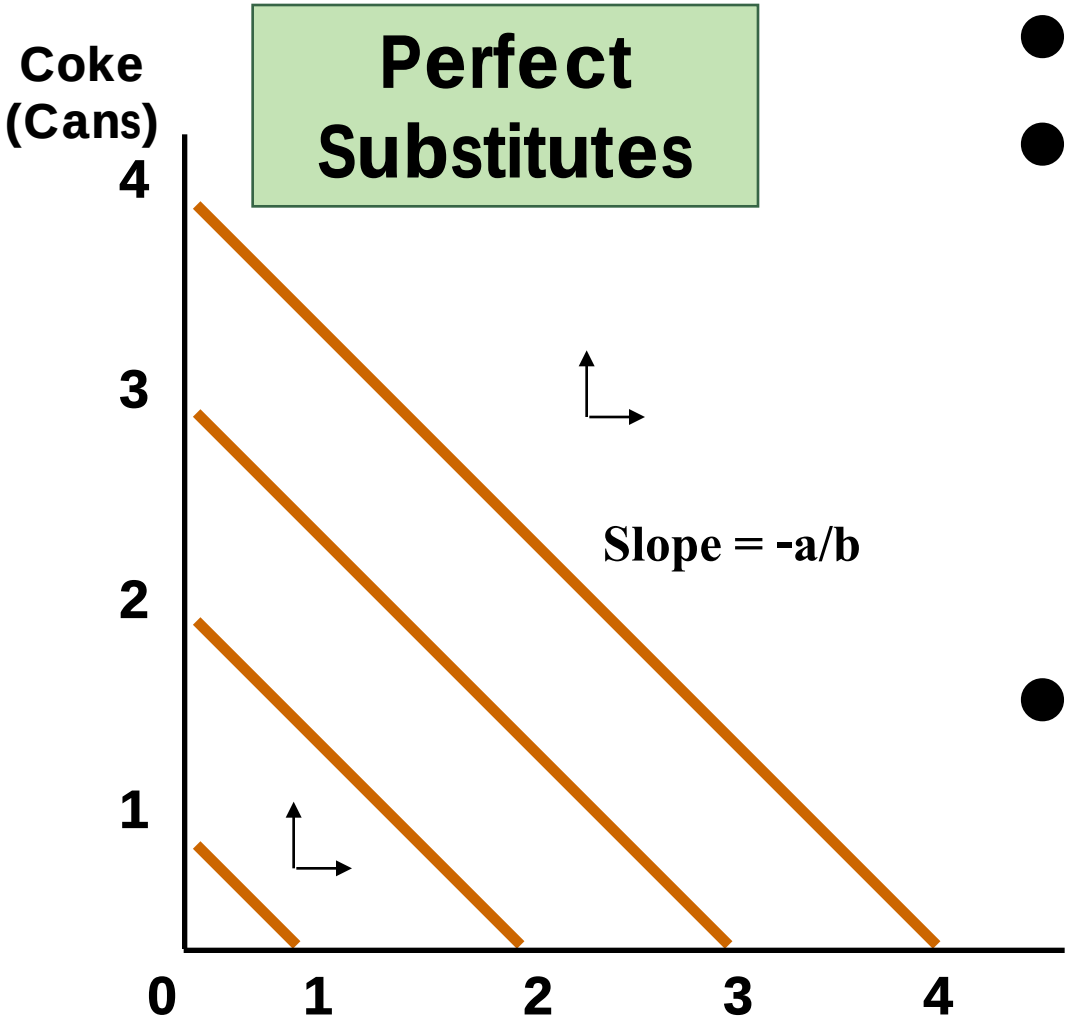


# Shapes of the IC and types of goods

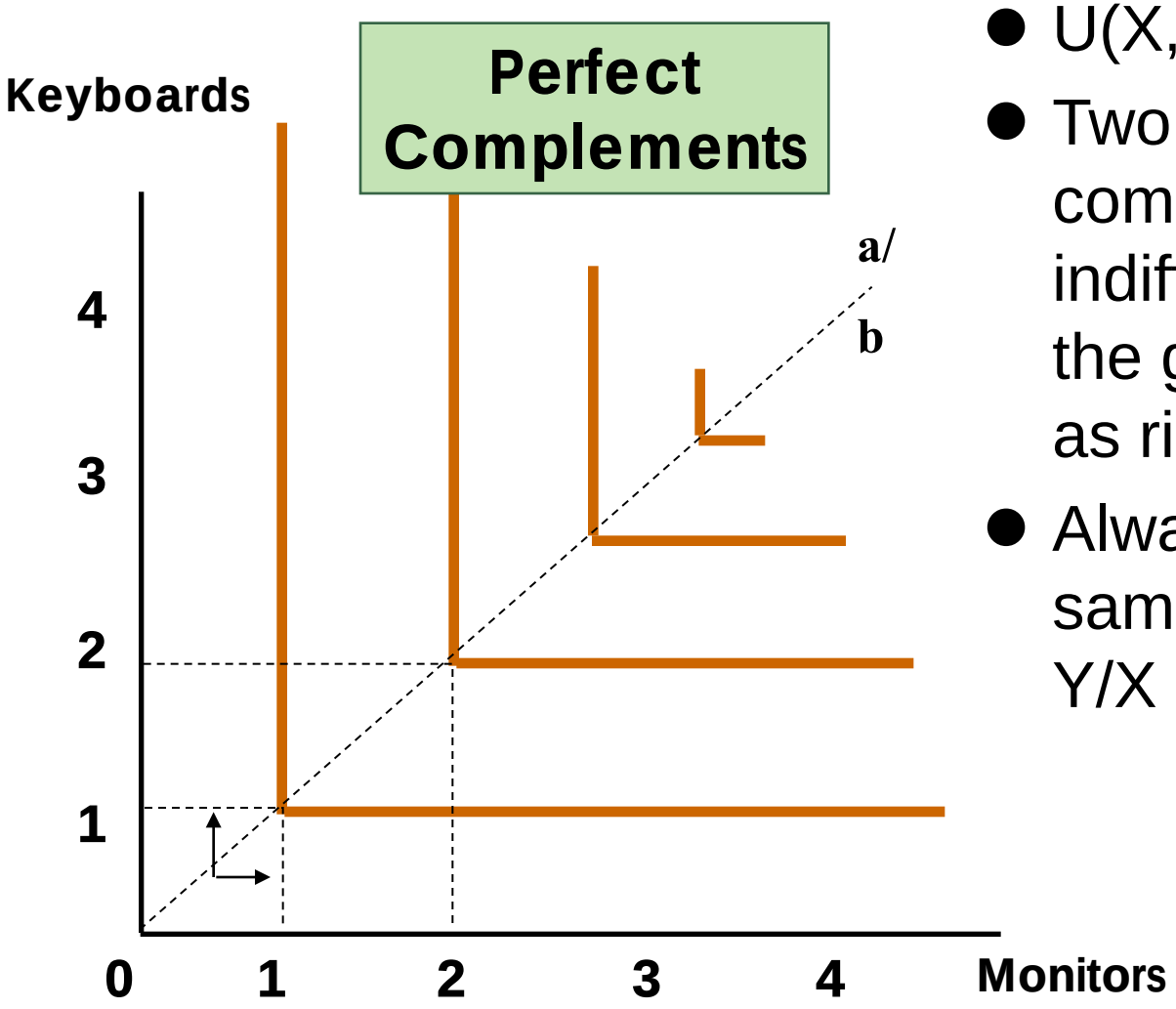
- Indifference curves with different shapes imply a different willingness to substitute
- Two polar cases are of interest
  - Perfect substitutes
  - Perfect complements
- Other types
  - Neuters
  - Bads

# Consumer Preferences



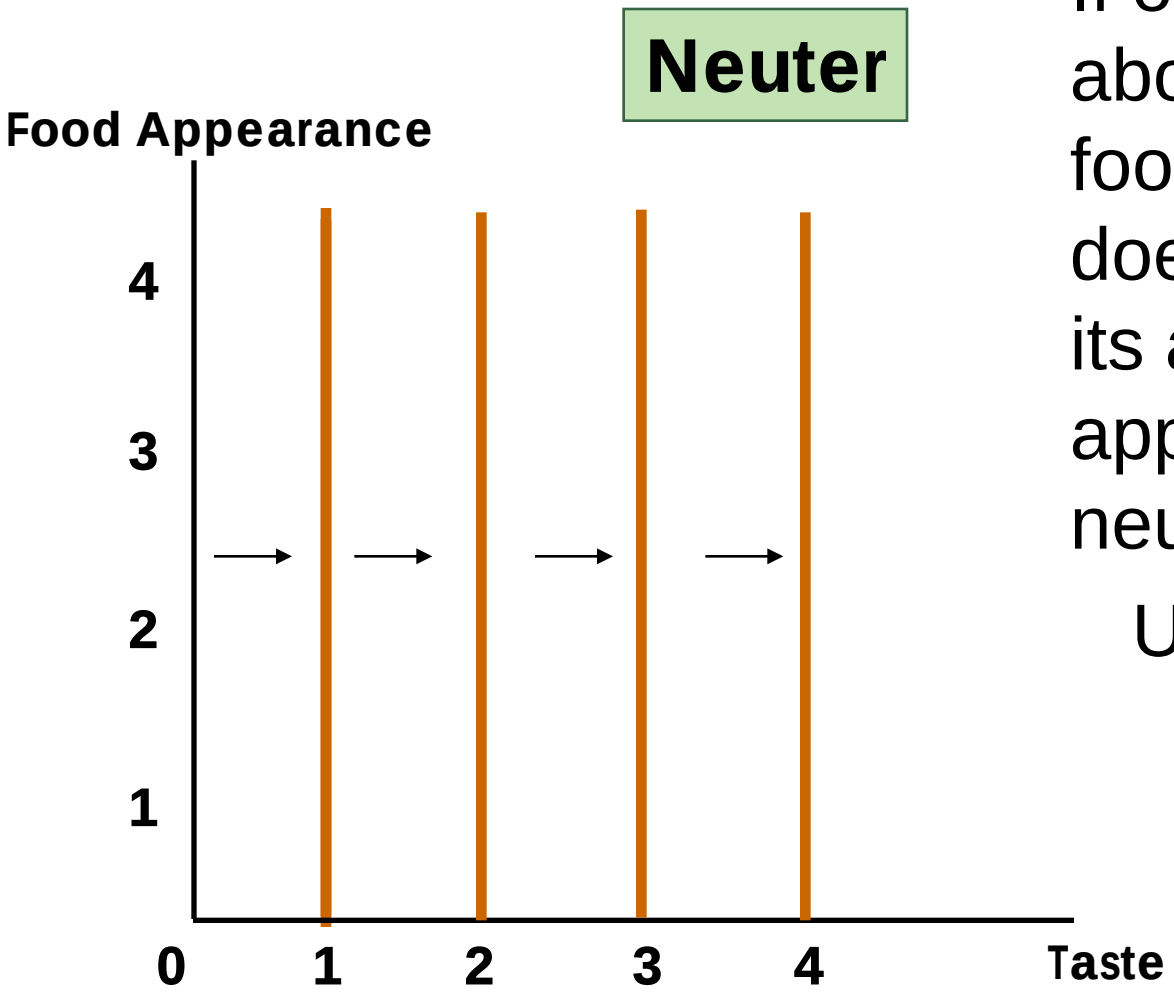

- U(X, Y) = aX + bY
- Two goods are perfect substitutes when the marginal rate of substitution of one good for the other is constant.
- Note: MRS needs not to be 1.

# Consumer Preferences




- U(X, Y) = Min {aX, bY}
- Two goods are perfect complements when the indifference curves for the goods are shaped as right angles.
- Always consume in the same proportion Y/X = a/b.

# Consumer Preferences

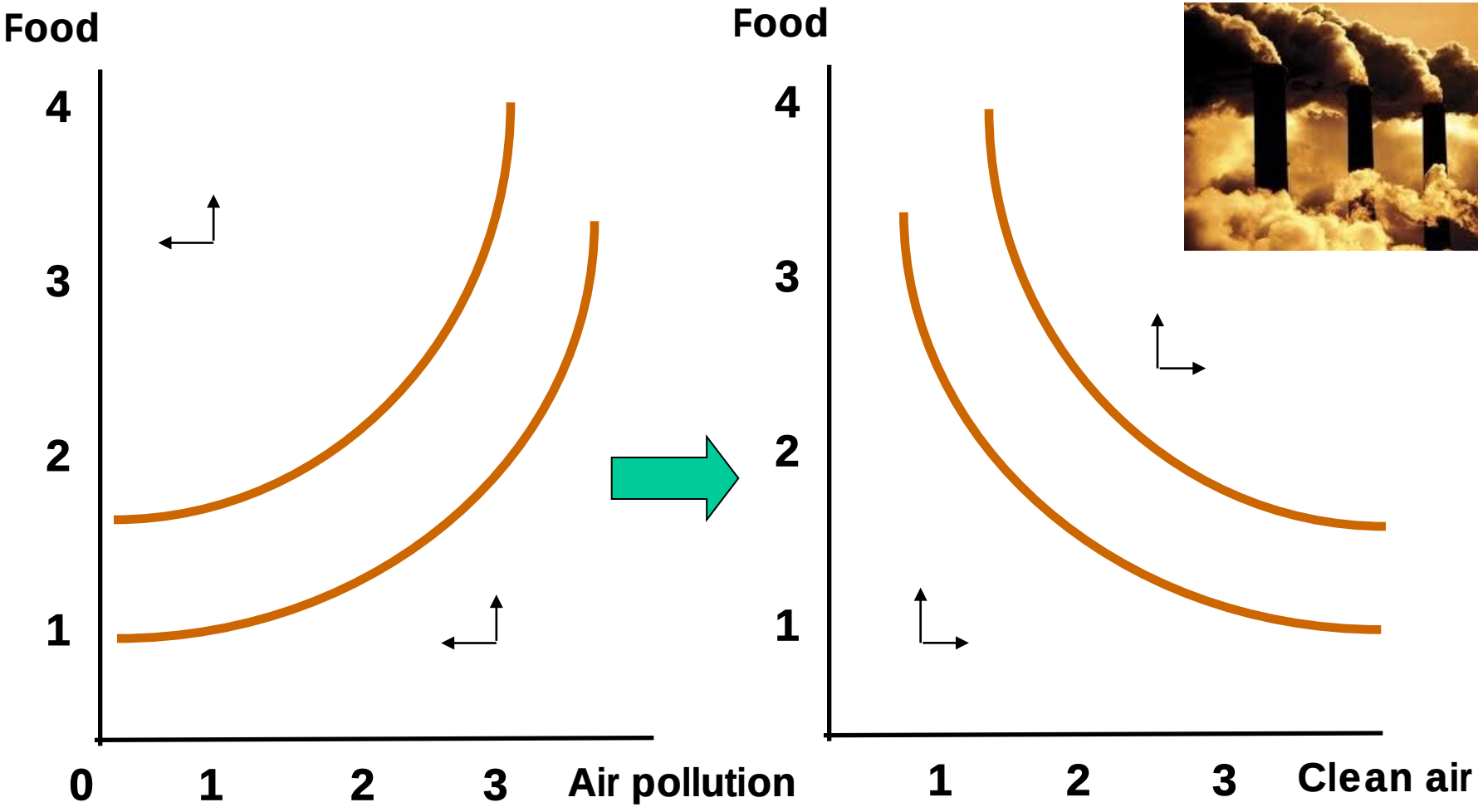


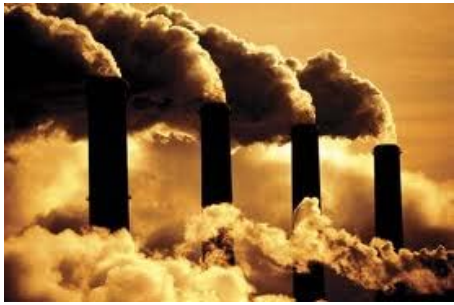

If one care only about the taste of the food he eats, but does not care about its appearance, the appearance is a neuter to him.

$$U(X,Y) = aX$$

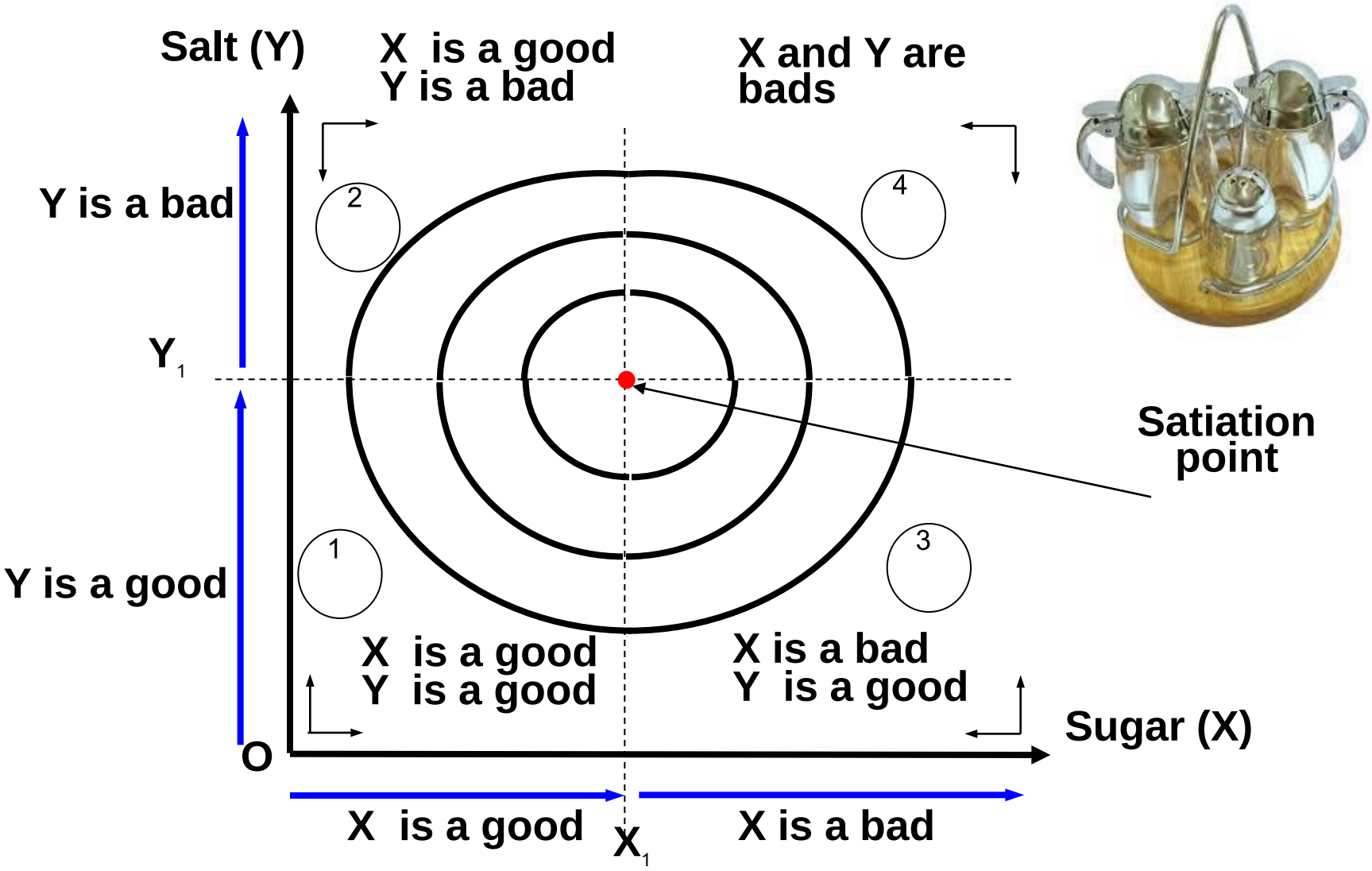
# Bads are commodities we don't want more of;

# e.g., air pollution, stress



# Satiation or Bliss point



# Cardinal versus Ordinal Preferences

- The theory of consumer behavior does not required assigning a numerical value to the level of satisfaction
- Although ranking of market baskets are good, sometimes numerical value are useful
- Utility: A numerical score representing the satisfaction that a consumer gets from a given market basket.

# Utility

- *Utility function*
  - Formula that assigns a level of utility to individual market baskets
  - If the utility function is

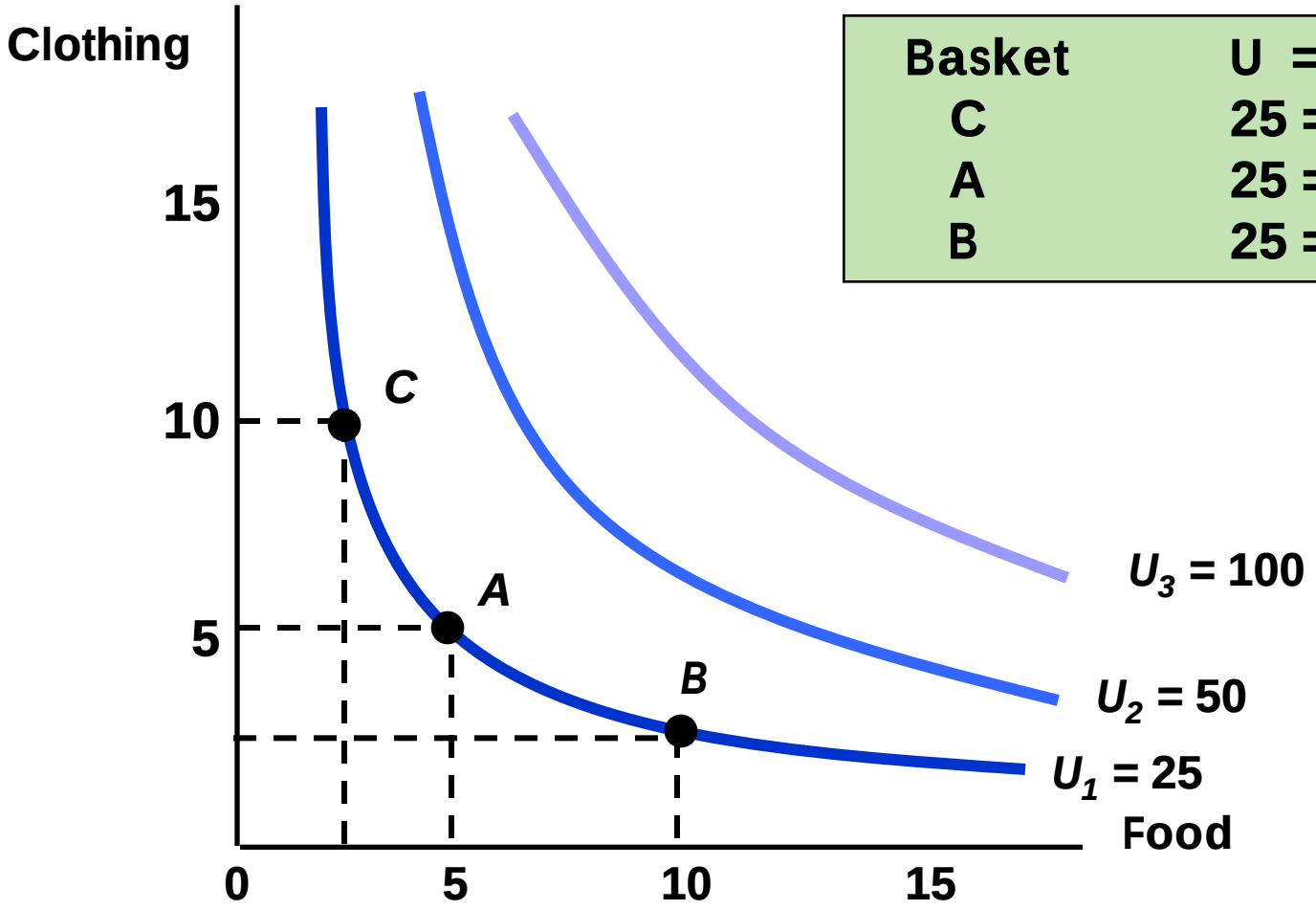
$$U(F,C) = F + 2C$$

A market basket with 8 units of food and 3 units of clothing gives a utility of

$$14 = 8 + 2(3)$$

F and C are perfect substitutes

# Utility - Example: Cobb-Douglas




| Basket | U = FC |
|---|---|
| C | 25 = 2.5(10) |
| A | 25 = 5(5) |
| B | 25 = 10(2.5) |

# Utility

- Although we numerically rank baskets and indifference curves, numbers are ONLY for ranking
- A utility of 4 is not necessarily twice as good as utility of 2
- The actual unit of measurement for utility is not important.
- An ordinal ranking is sufficient to explain how most individual decisions are made.

# Budget Constraints

- The Budget Line
  - Indicates all combinations of two commodities for which total money spent equals total income.
  - We assume only 2 goods are consumed, so we do not consider savings for the time being

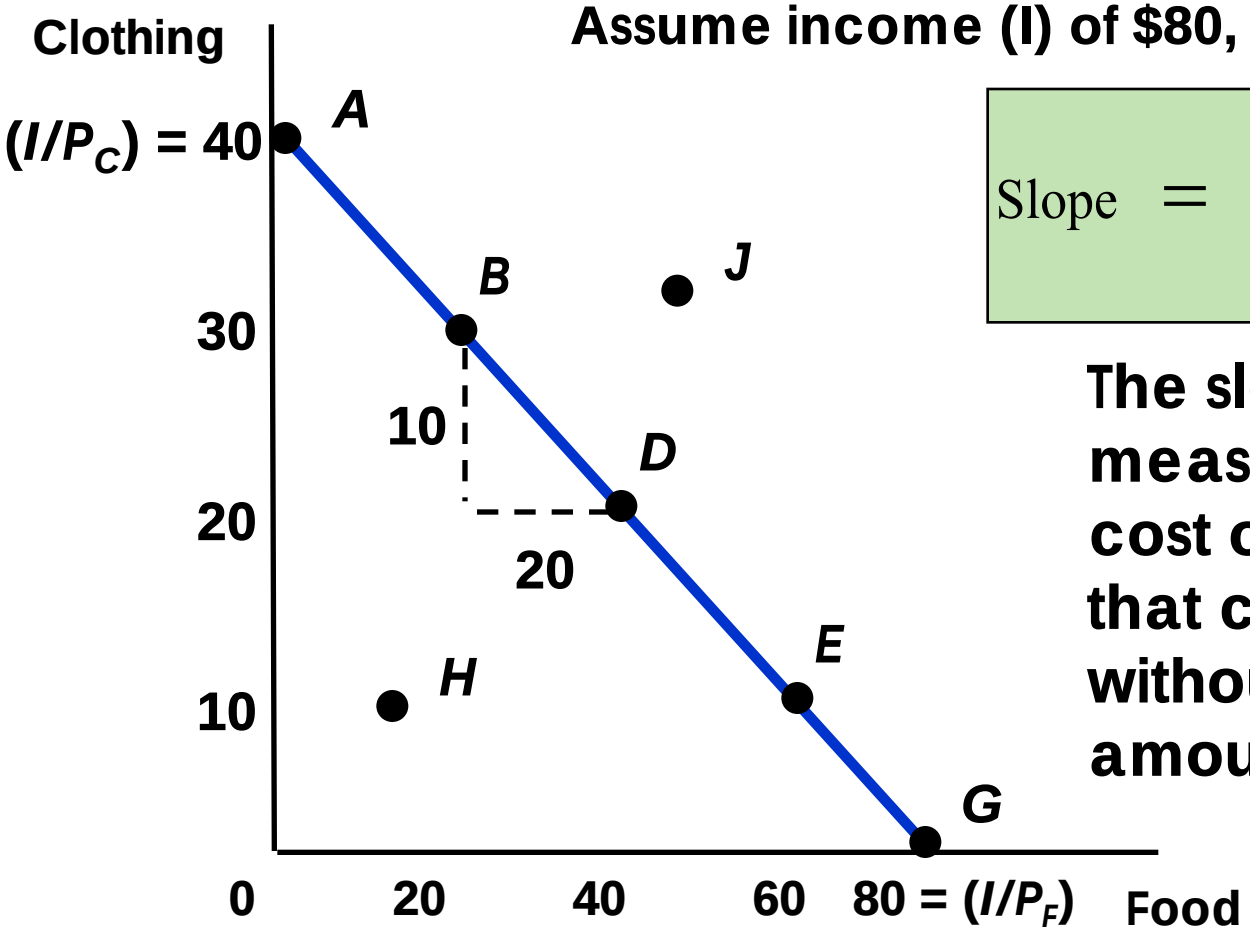
# The Budget Line

- A consumer chooses food (F) and Clothing (C)
- Price of food = PF and price of clothing = PC
- The budget line then can be written:

$$P_F F + P_C C = I$$

All income is allocated to food (F) and/or clothing (C)

# The Budget Line




**Assume income (I) of \$80, $P_F$ = \$1 and $P_C$ = \$2**

$$\text{Slope} = \frac{\Delta C}{\Delta F} = -\frac{1}{2} = -\frac{P_F}{P_C}$$

**The slope of the line measures the relative cost of food and clothing that can be substituted without changing the amount of money spent.**

# The Budget Line

$$I = P_F F + P_C C$$

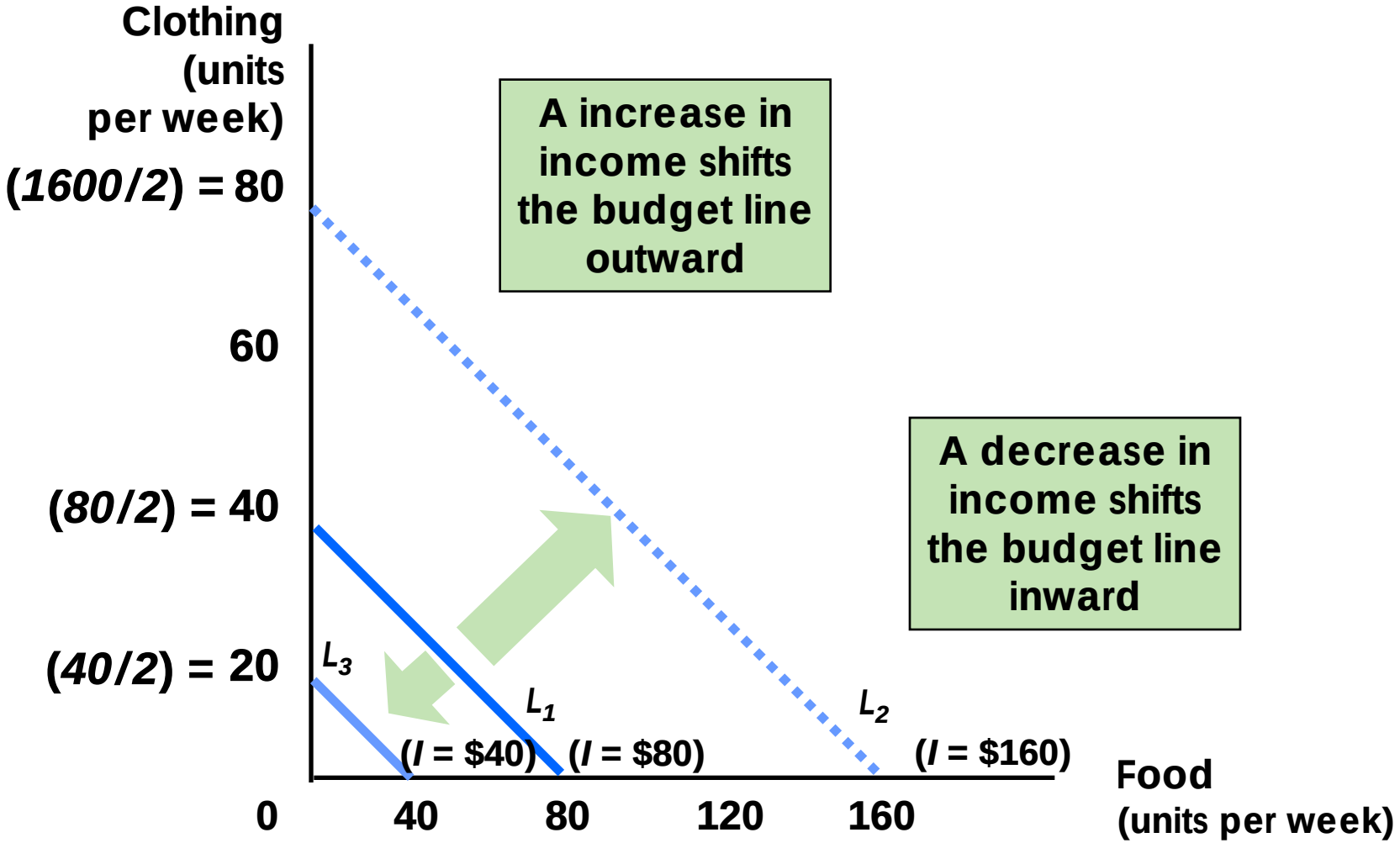
$$P_C C = I - P_F F$$

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

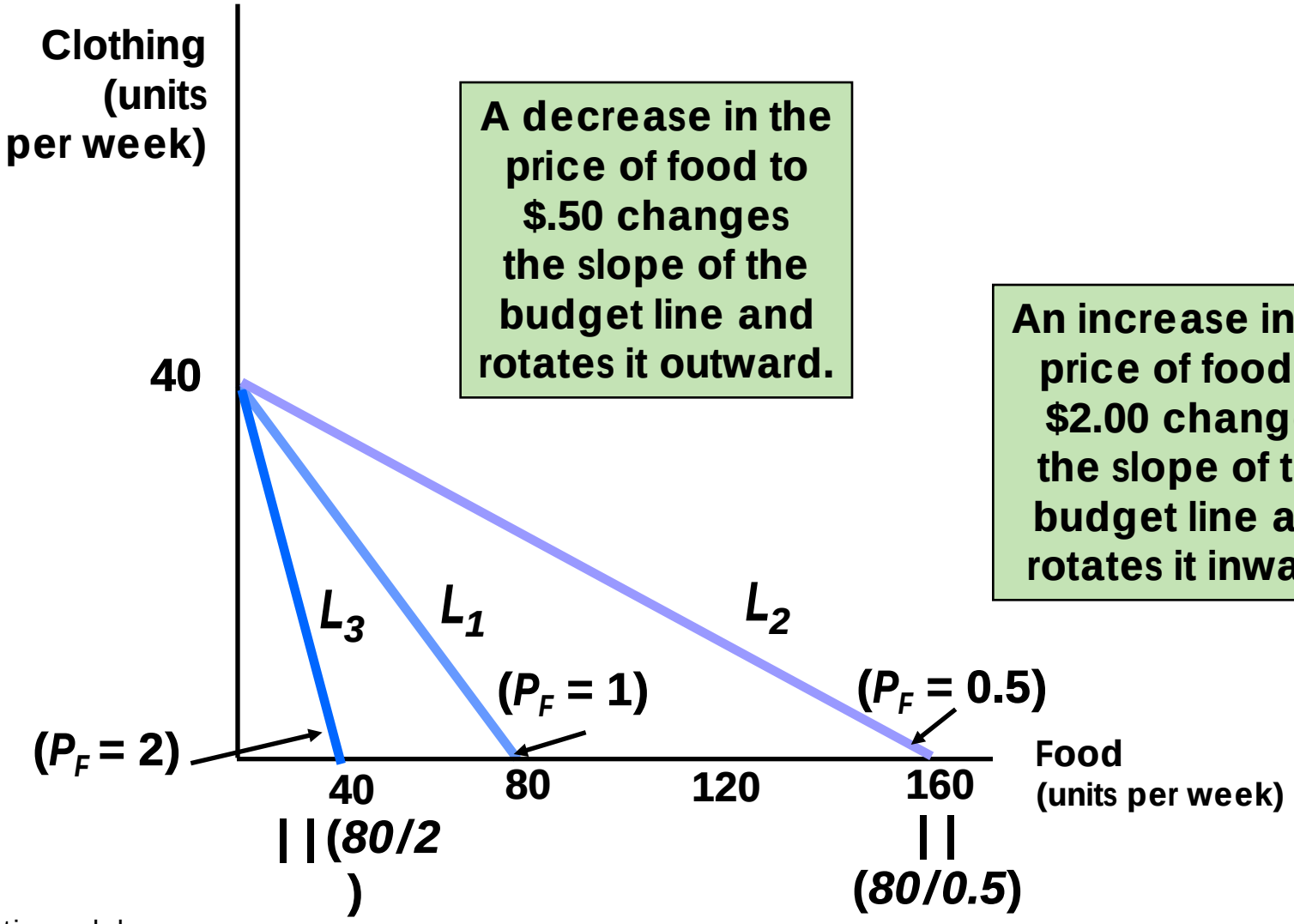
Y intercept

slope

# The Budget Line: Changes in income



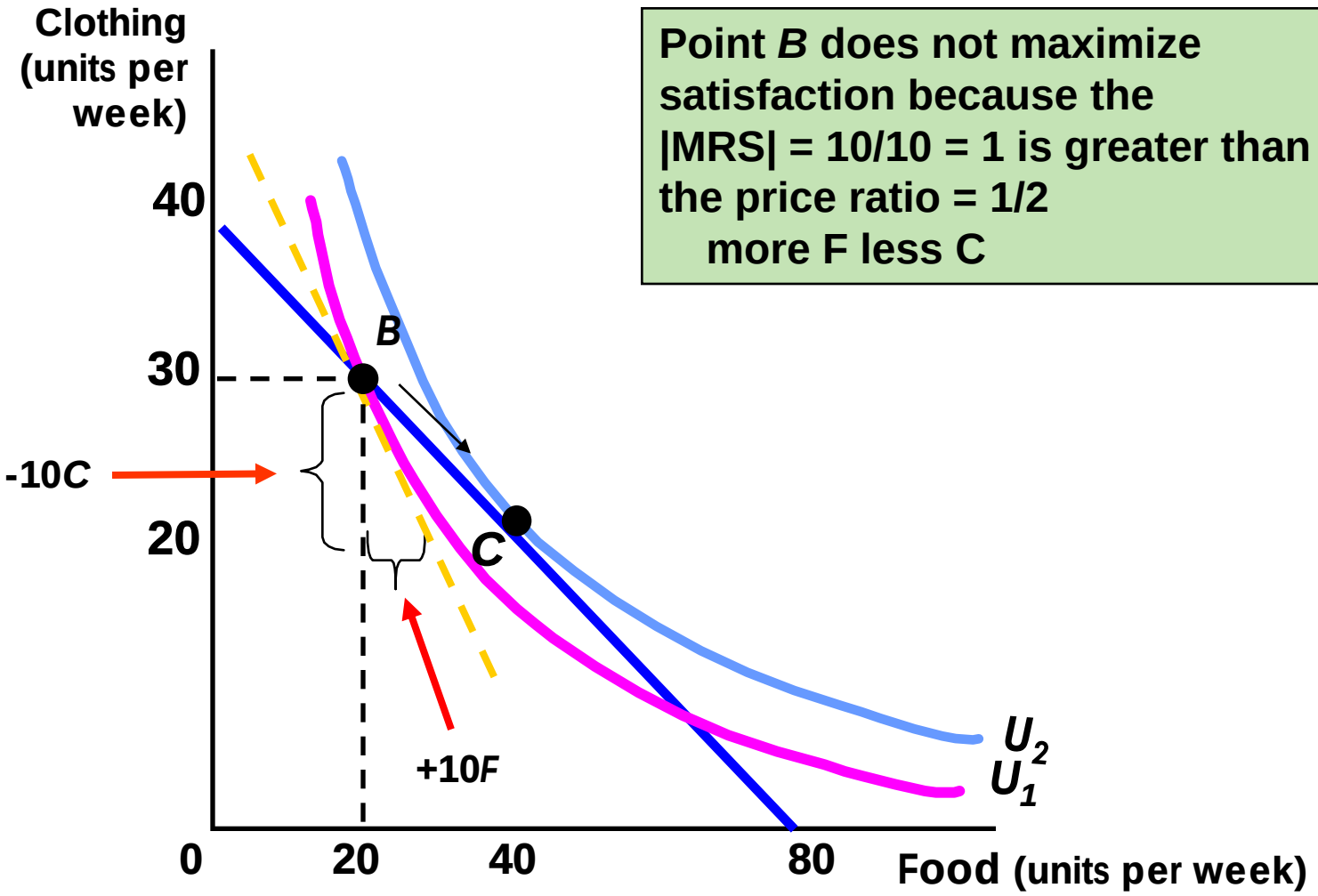
# The Budget Line: Changes in a price



# Consumer Choice

- Optimal consumption point is where MRS = the relative prices
- MRS = the rate that the consumer is willing to sacrifice some clothing to get 1 unit of food
- $P_F/P_C$ = cost of additional unit of food in terms of clothing

# Consumer Choice




**Point *B* does not maximize satisfaction because the |MRS| = 10/10 = 1 is greater than the price ratio = 1/2**
**more F less C**

# Consumer Choice

- If $|MRS| \neq P_F/P_C$ then individuals can reallocate basket to increase utility
- If $|MRS| > P_F/P_C$ -> Consumer is willing to give up clothing for food more than what the market requires
  - Will increase food and decrease clothing until $|MRS| = P_F/P_C$
- If $|MRS| < P_F/P_C$
  - Will increase clothing and decrease food until $|MRS| = P_F/P_C$

# Optimal condition

Max $U(X,Y)$ such that $I = P_X X + P_Y Y$

Since $I = P_X X + P_Y Y$ implies

$Y = I/P_Y - XP_X/P_Y$.

Substituting this gives

Max $U(X, I/P_Y - XP_X/P_Y)$

$MU_X - MU_Y P_X/P_Y = 0$

$$MRS = \frac{MU_X}{MU_Y} = \frac{P_X}{P_Y}$$

# Optimal condition: Lagrange approach

Max $U(X,Y)$ such that $I = P_X X + P_Y Y$

$$L = U(X,Y) + \lambda(I - P_X X - P_Y Y)$$

$$\left.\begin{aligned} dL/dX &= MU_X - \lambda P_X = 0 \\ dL/dY &= MU_Y - \lambda P_Y = 0 \end{aligned}\right\} \Longrightarrow MRS = \frac{MU_X}{MU_Y} = \frac{P_X}{P_Y}$$

$$dL/d\lambda = I - P_X X - P_Y Y = 0$$

$\lambda = MU_X/P_X = MU_Y/P_Y$ It is the marginal utility per baht. It is also equal to the shadow price of money or the marginal utility of money

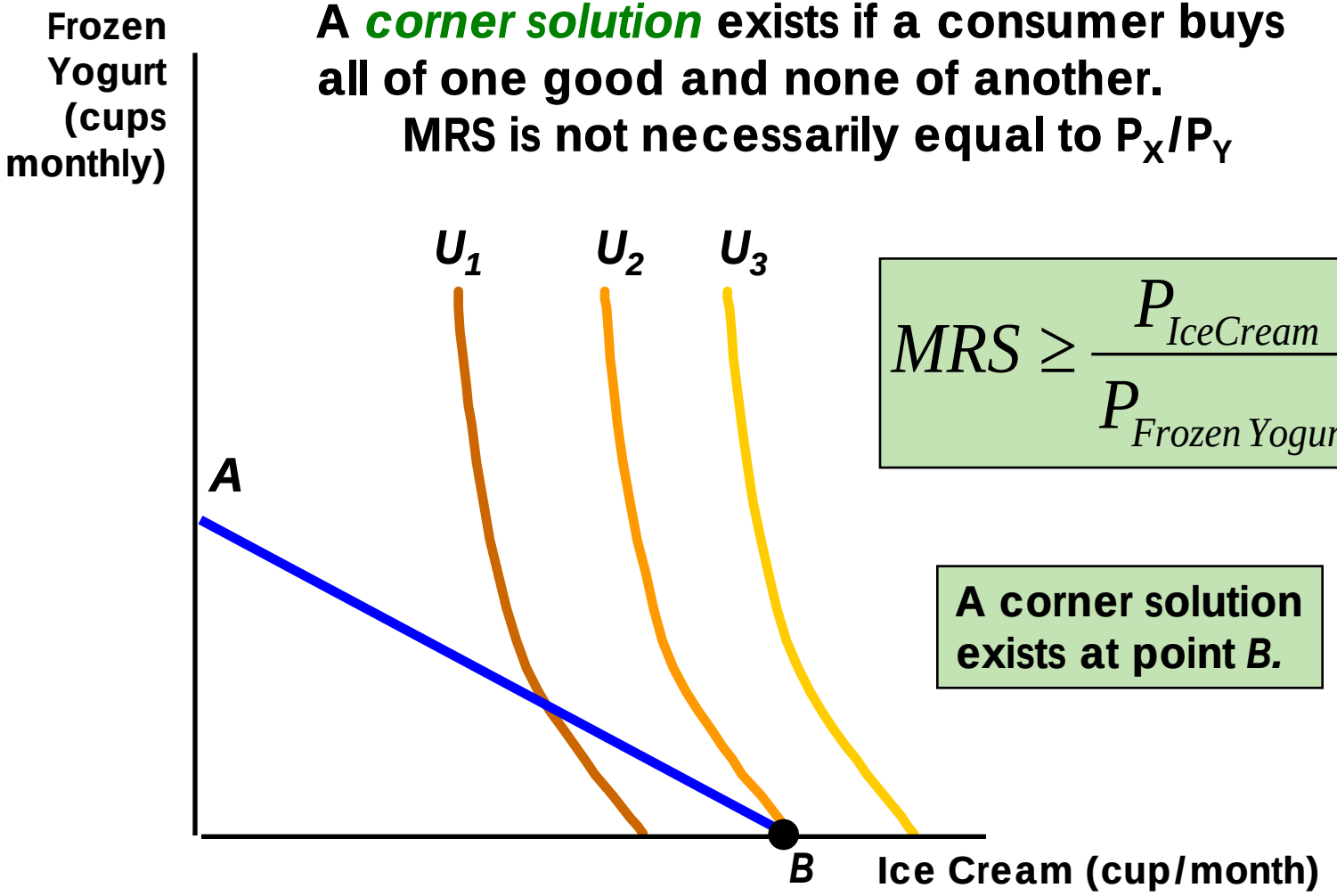
# Consumer Choice

- Normally MRS should equal $P_X/P_Y$ and the equilibrium is call an interior solution
- A *corner solution* exists if a consumer buys in extremes, and buys all of one category of good and none of another.
  - MRS is **not** necessarily equal to $P_X/P_Y$

# A Corner Solution

A *corner solution* exists if a consumer buys all of one good and none of another.

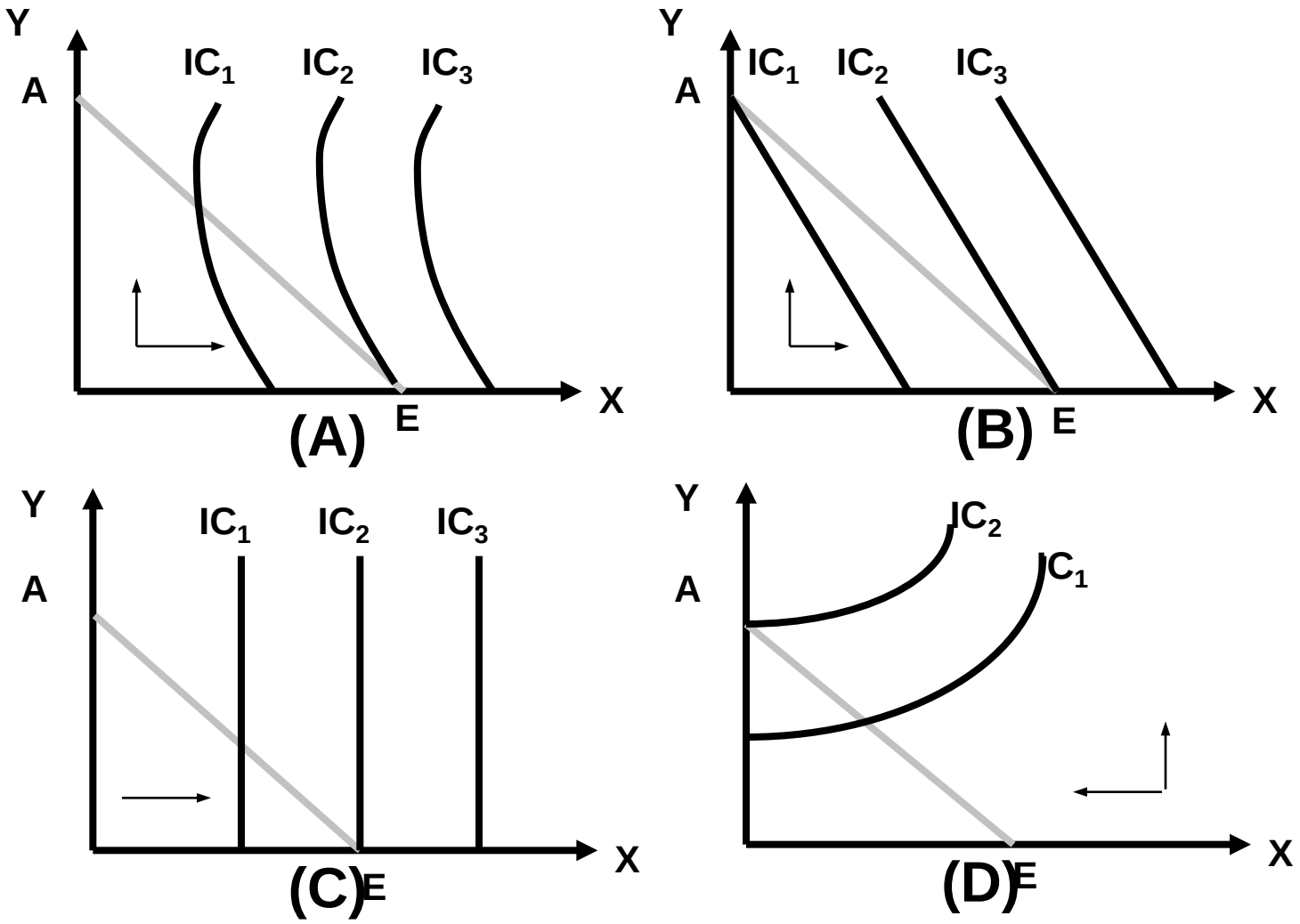
MRS is not necessarily equal to $P_X/P_Y$



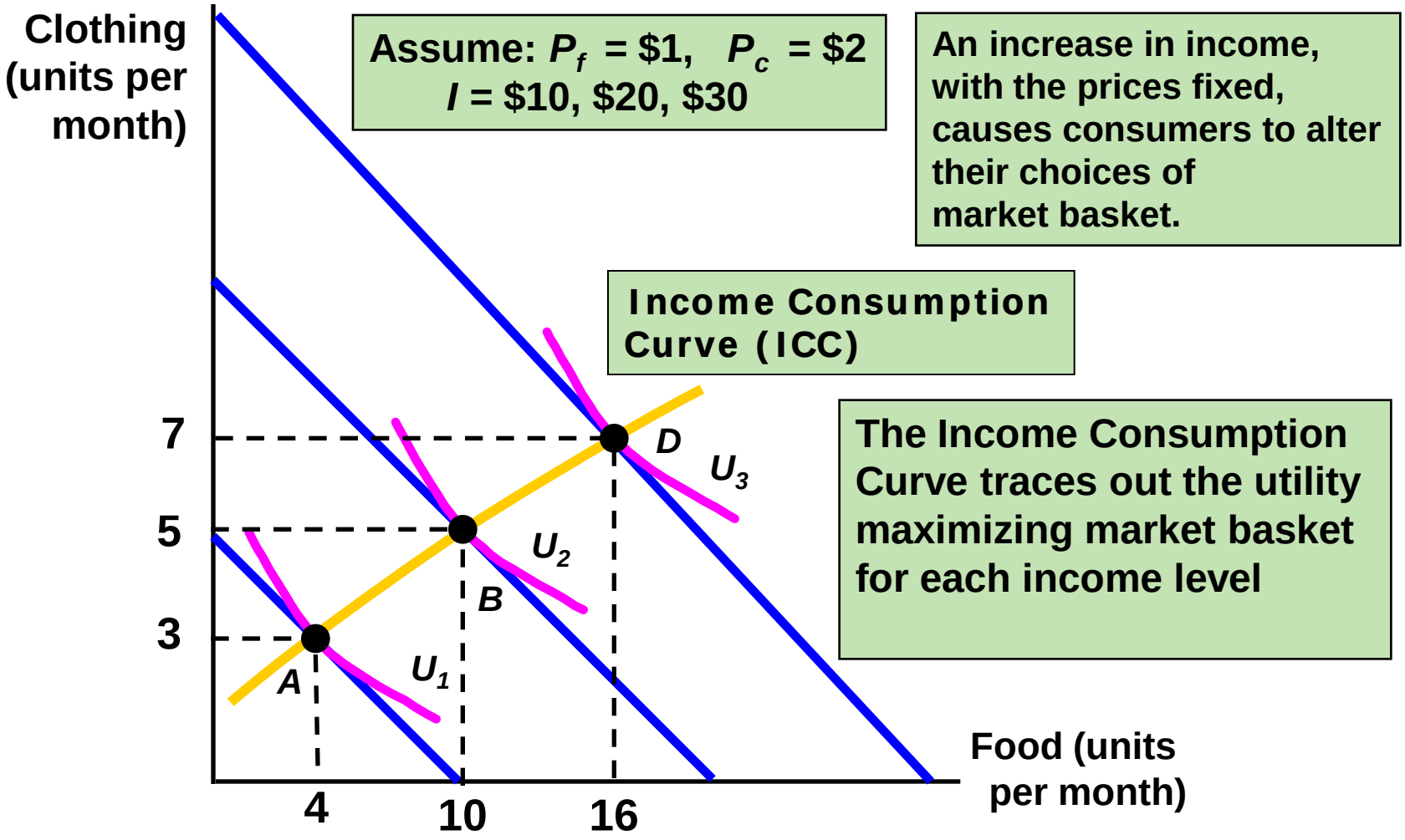

$$MRS \geq \frac{P_{IceCream}}{P_{Frozen\ Yogurt}}$$

A corner solution exists at point *B*.

# Corner Solutions



# Effects of Income Changes



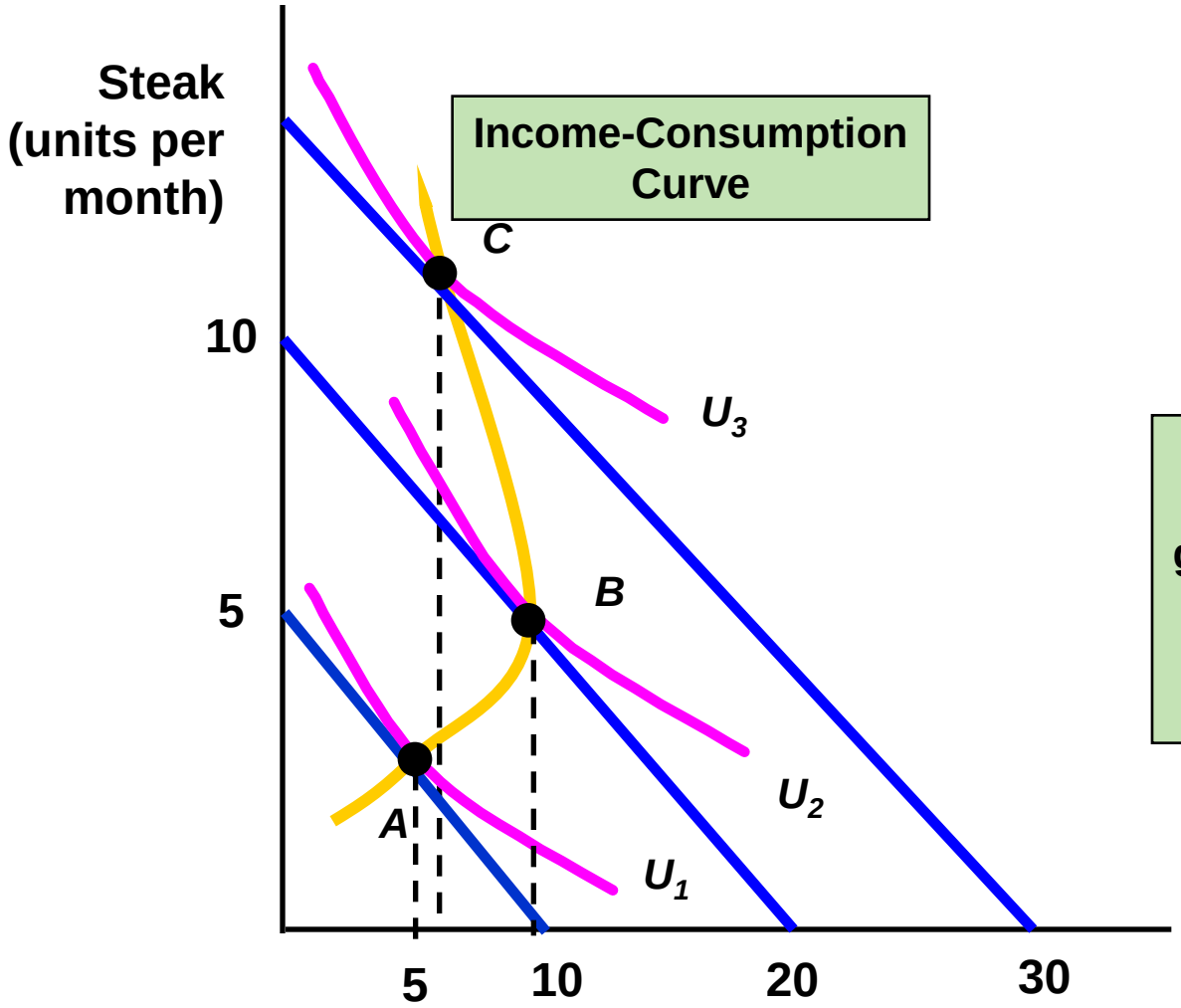
# Individual Demand

- Income Changes
  - When the income-consumption curve moves from left to right as income increases:
    - The quantity demanded increases with income.
    - The income elasticity of demand is positive.
    - The good on the X axis is a **normal good**.

# Individual Demand

- Income Changes
  - When the income-consumption curve move from right to left as income increases:
    - The quantity demanded decreases with income.
    - The income elasticity of demand is negative.
    - The good on the X axis is an **inferior good**.

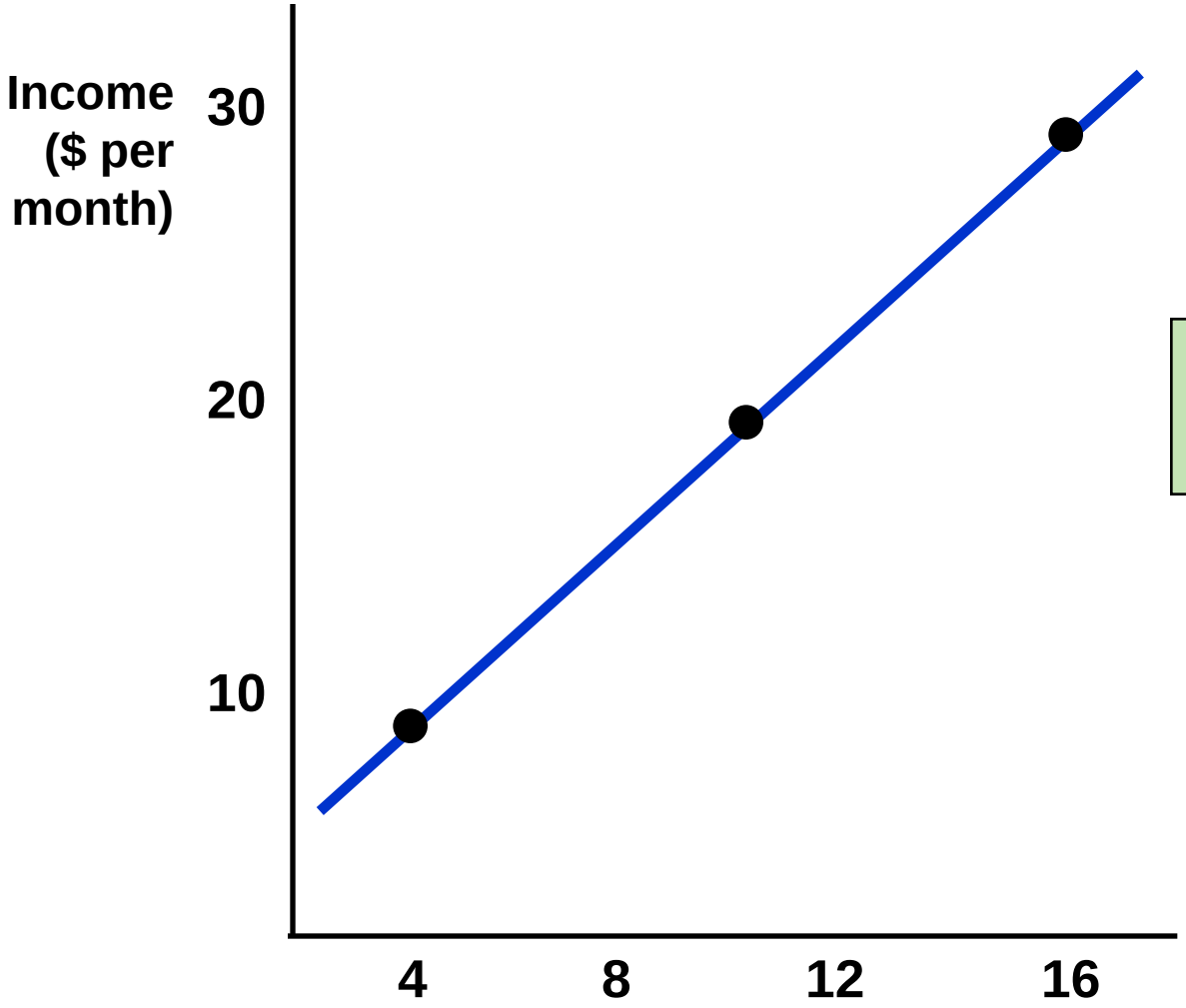
# An Inferior Good




Both noodle and steak behave as a normal good, between *A* and *B*...

...but noodle becomes an inferior good when the income consumption curve bends backward between *B* and *C*.

# Engel Curves

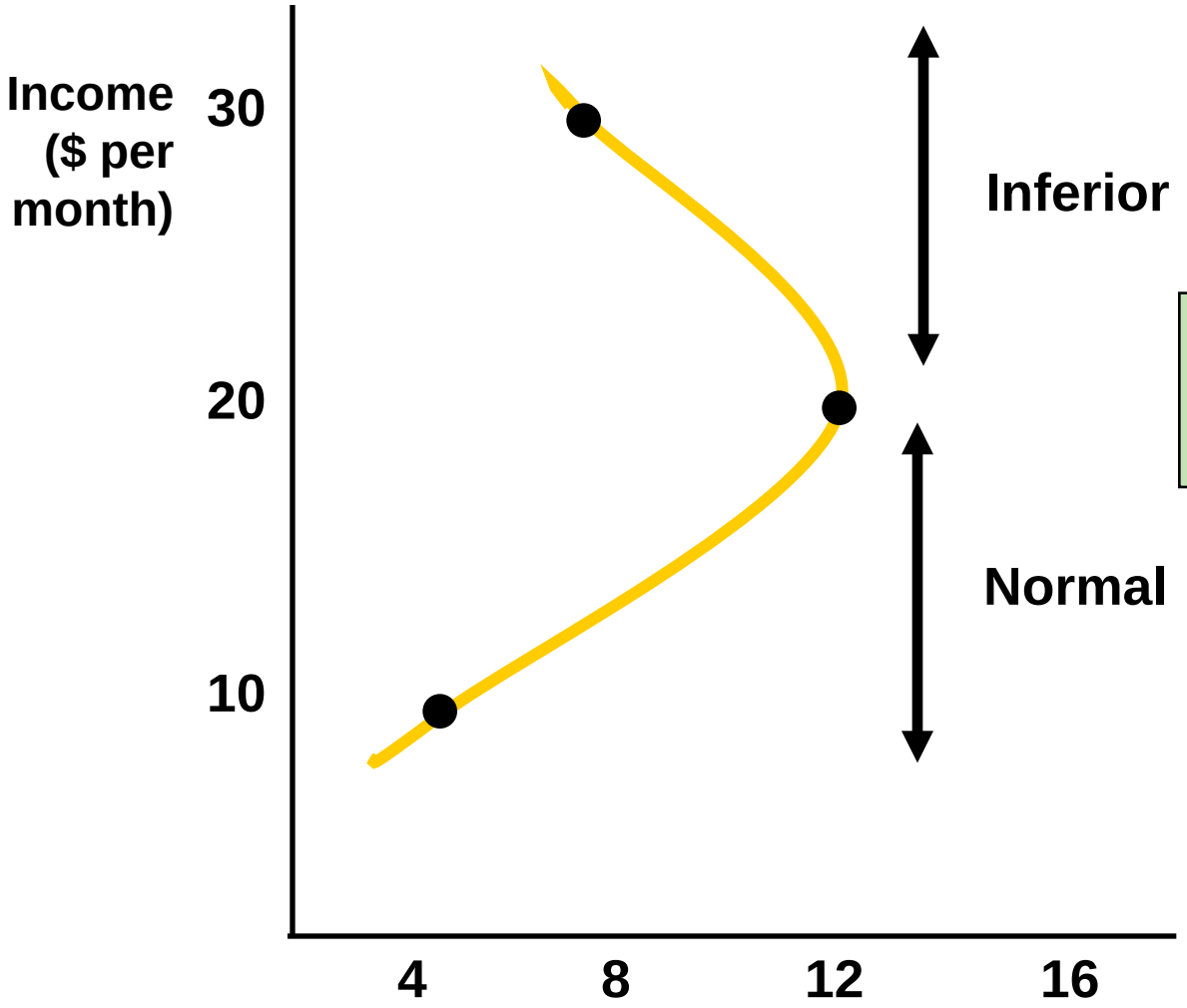



Engel curves slope upward for normal goods.

# Individual Demand

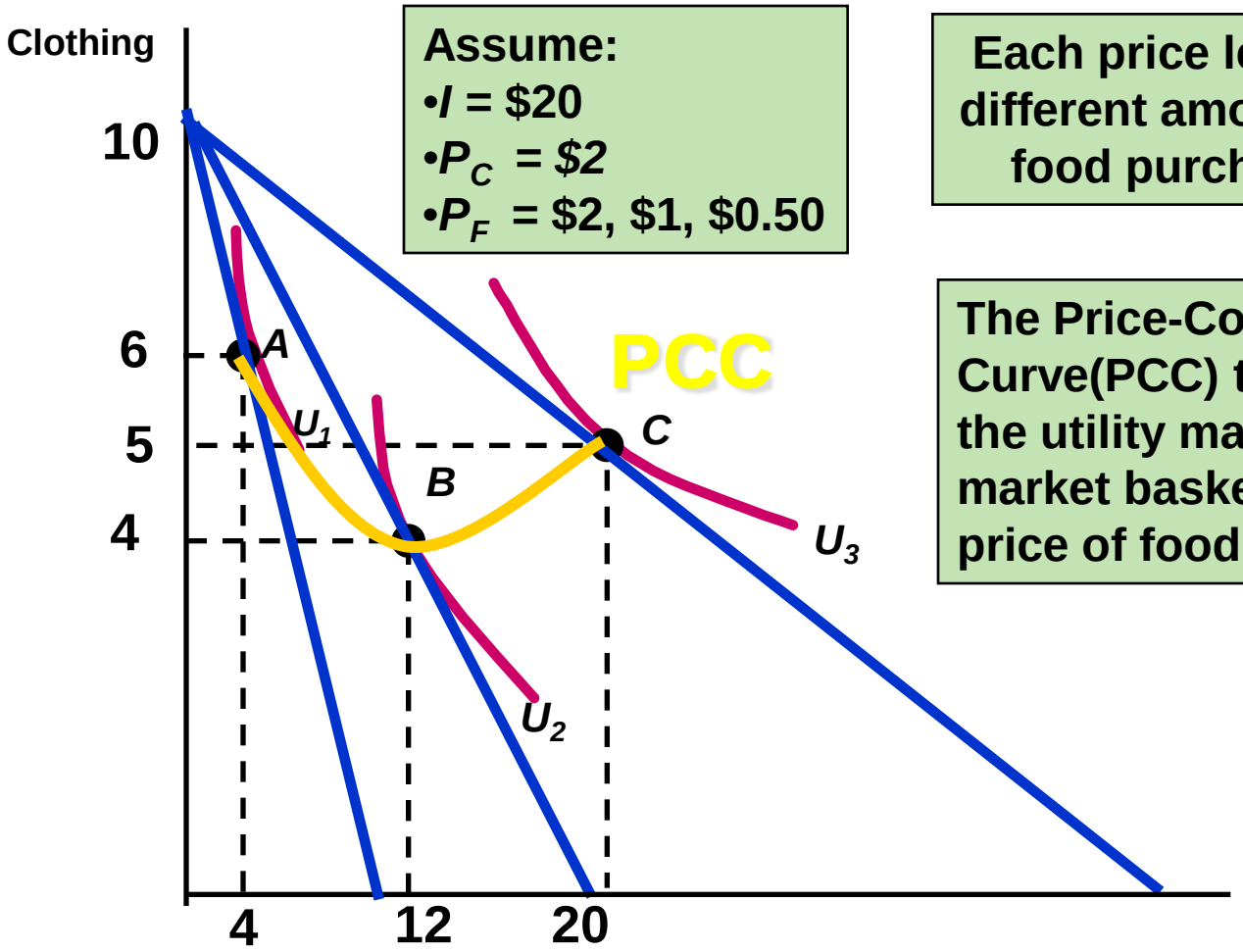
- Engel Curves
  - Engel curves relate the quantity of good consumed to income.
  - If the good is a normal good, the Engel curve is upward sloping.
  - If the good is an inferior good, the Engel curve is downward sloping.

# Engel Curves




Engel curves are backward bending for inferior goods.

# Effect of a Price Change

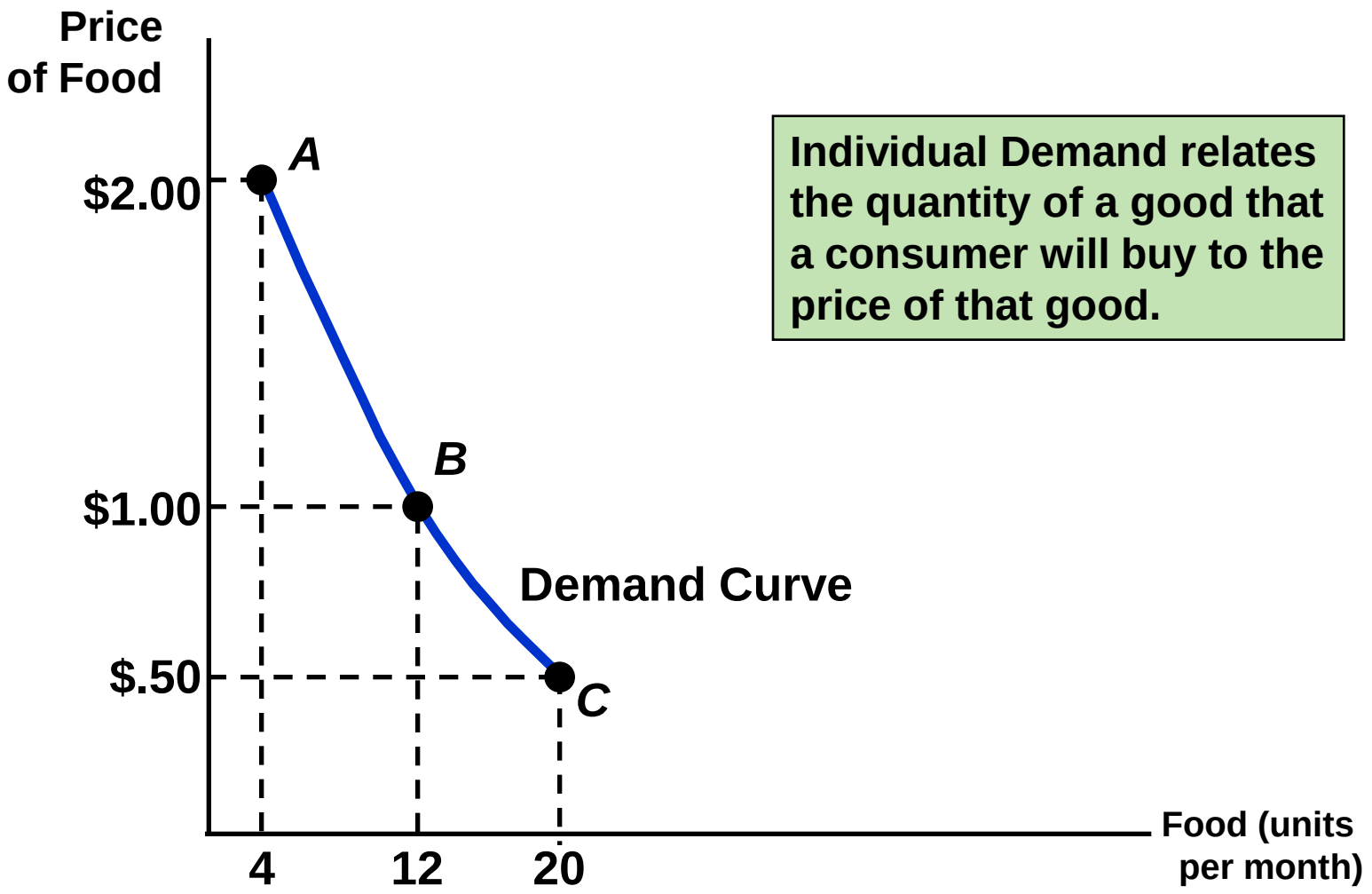



**Assume:**
- $I$ = \$20
- $P_C$ = \$2
- $P_F$ = \$2, \$1, \$0.50

**Each price leads to different amounts of food purchased**

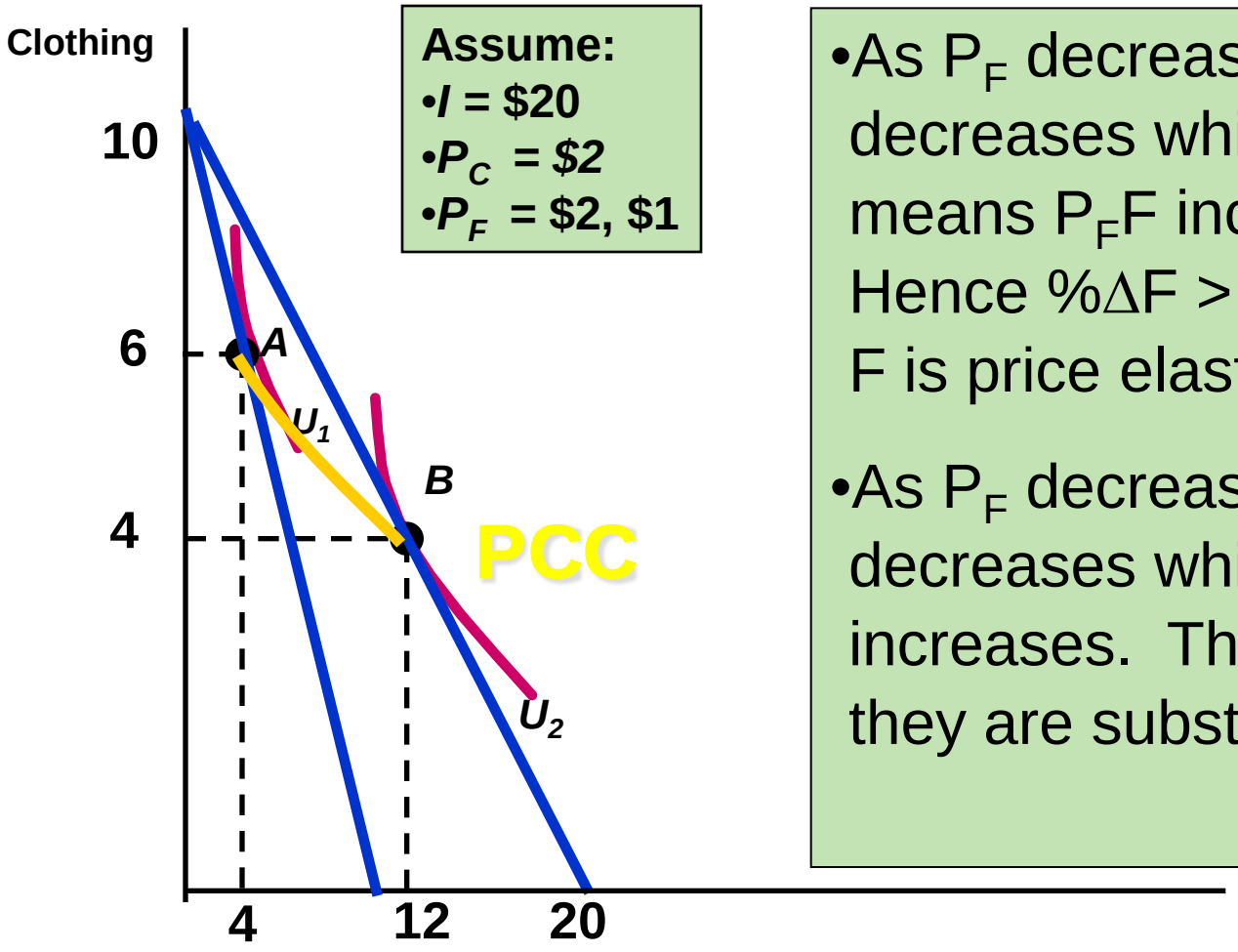
**The Price-Consumption Curve(PCC) traces out the utility maximizing market basket for each price of food**

# Effect of a Price Change



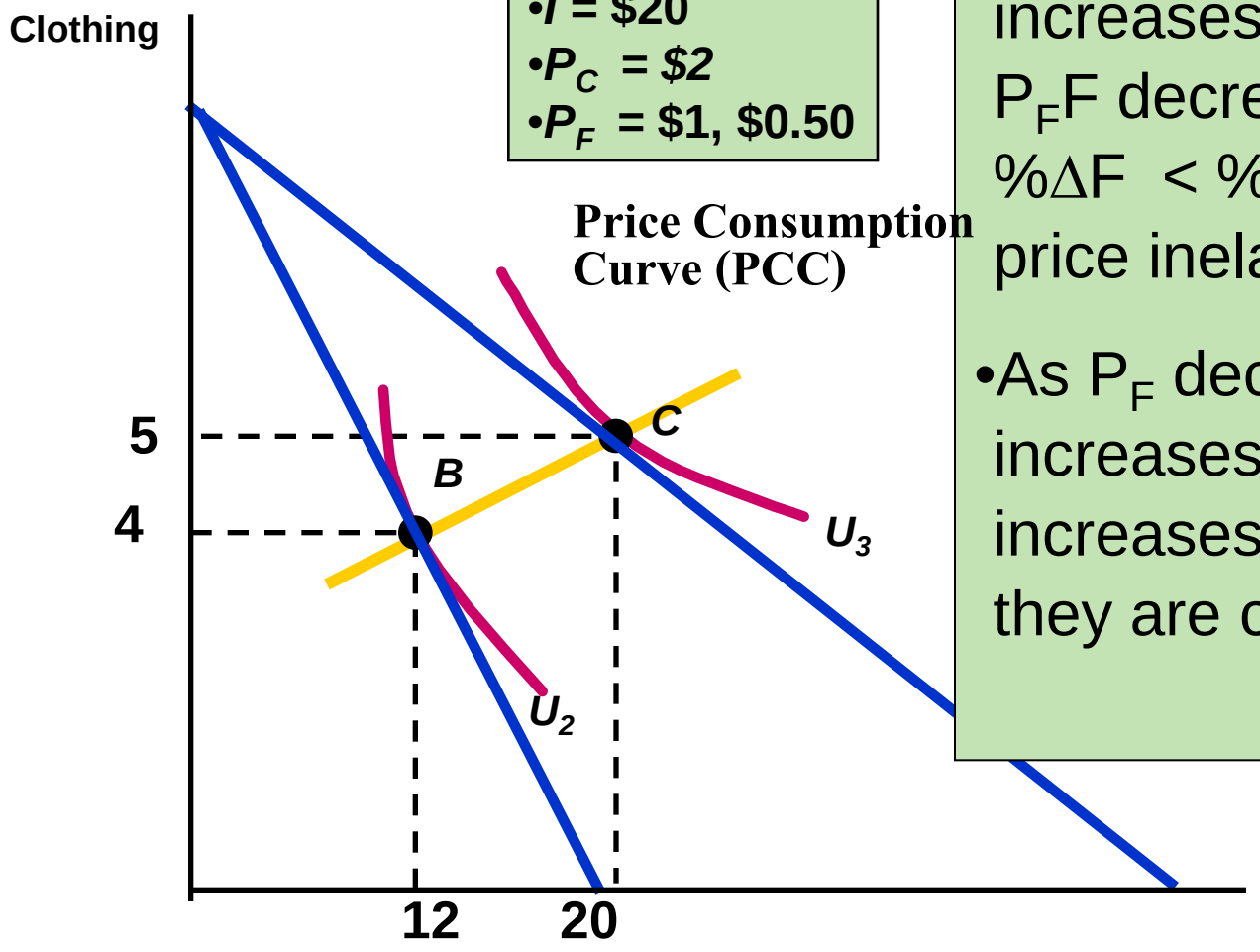

**Individual Demand relates the quantity of a good that a consumer will buy to the price of that good.**

# Decreasing PCC




- As $P_F$ decreases, $P_C C$ decreases which means $P_F F$ increases. Hence $\%\Delta F > \%\Delta P_F$ or F is price elastic.
- As $P_F$ decreases, C decreases while F increases. That means they are substitutes.

# Effect of a Price Change




- As $P_F$ decreases, $P_C C$ increases which means $P_F F$ decreases. Hence $\%\Delta F < \%\Delta P_F$ or F is price inelastic.
- As $P_F$ decreases, C increases while F increases. That means they are complements.

# Substitutes & Complements

- If the price consumption curve is downward-sloping, the two goods are considered substitutes.
- If the price consumption curve is upward-sloping, the two goods are considered complements.
- They could be both.

# Income and Substitution Effects

- Substitution Effect
  - Relative price of a good changes when price changes
  - Consumers will tend to buy more of the good that has become relatively cheaper, and less of the good that is relatively more expensive.
- Income Effect
  - Consumers experience an increase in real purchasing power when the price of one good falls.

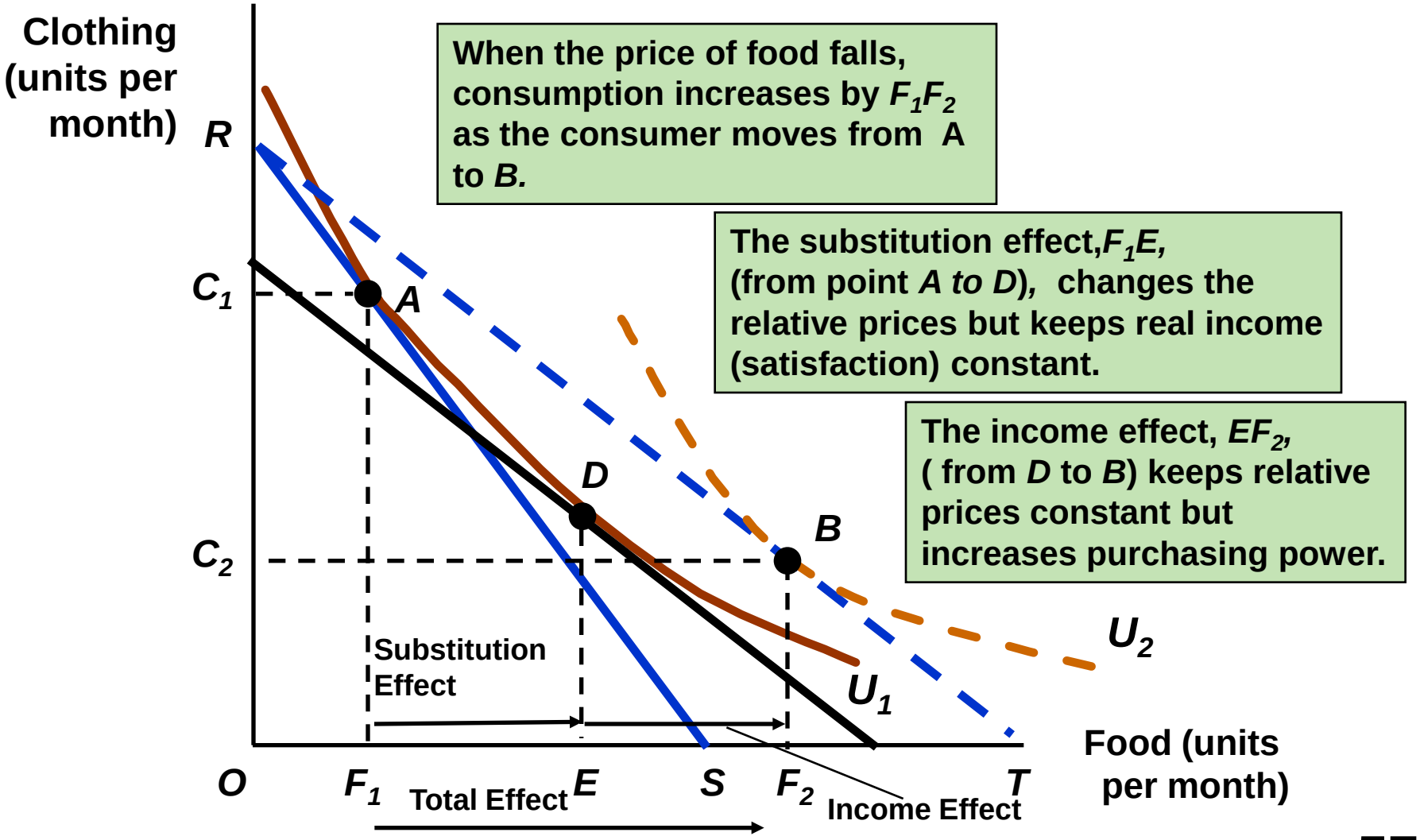
# Income and Substitution Effects

- Substitution Effect
  - The substitution effect is the change in an item's consumption associated with a change in the price of the item, with **the level of utility held constant**.
  - When the price of an item declines, the substitution effect always leads to an increase in the quantity demanded of the good.

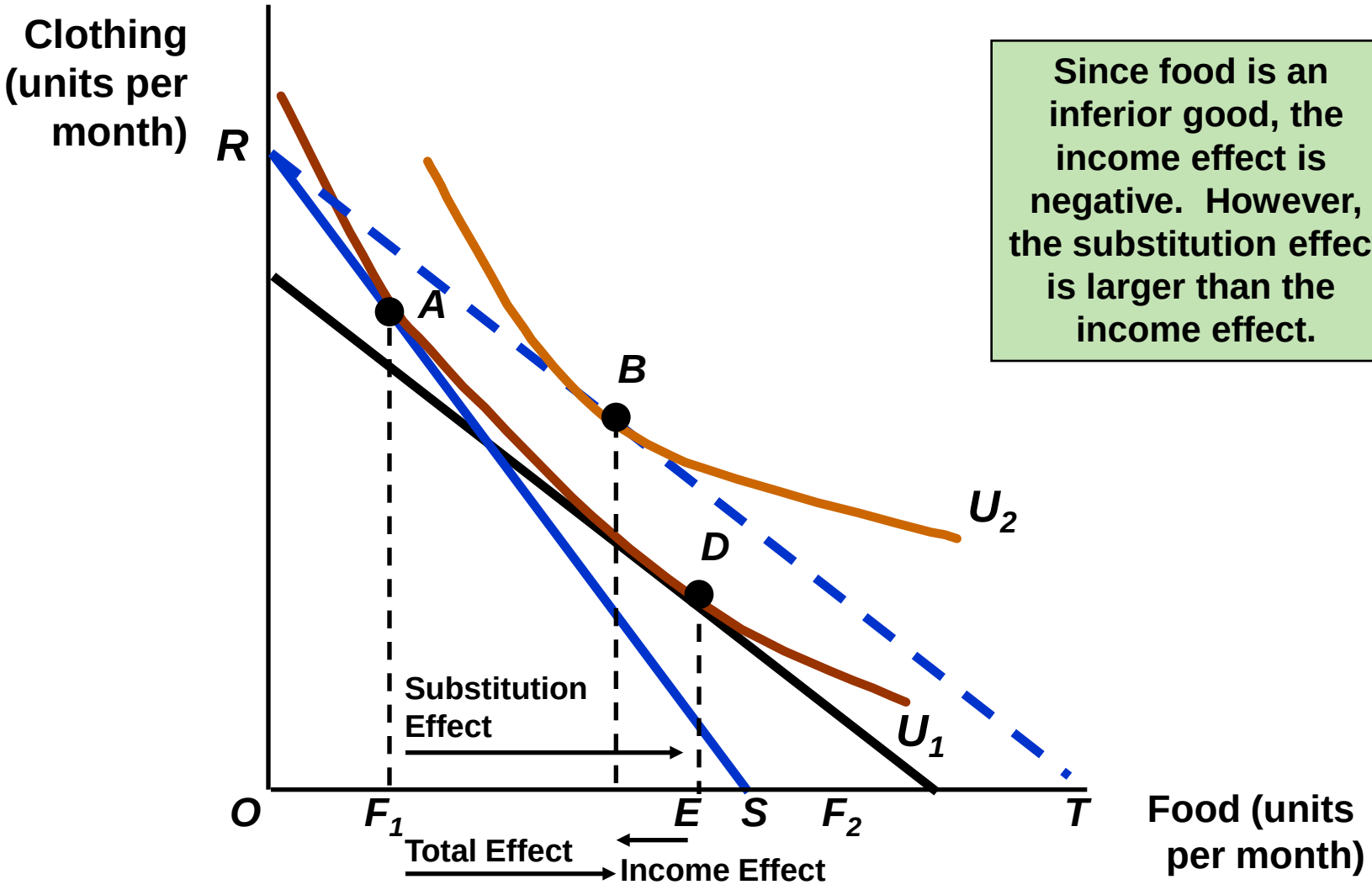
# Income and Substitution Effects

- Income Effect
  - The income effect is the change in an item's consumption brought about by the change in purchasing power, with the **price of the item held constant**.
  - When a person's income increases, the quantity demanded for the product may increase or decrease.
  - Even with inferior goods, the income effect is rarely large enough to outweigh the substitution effect.

# Income and Substitution Effects: Normal Good



# Income and Substitution Effects: Inferior Good

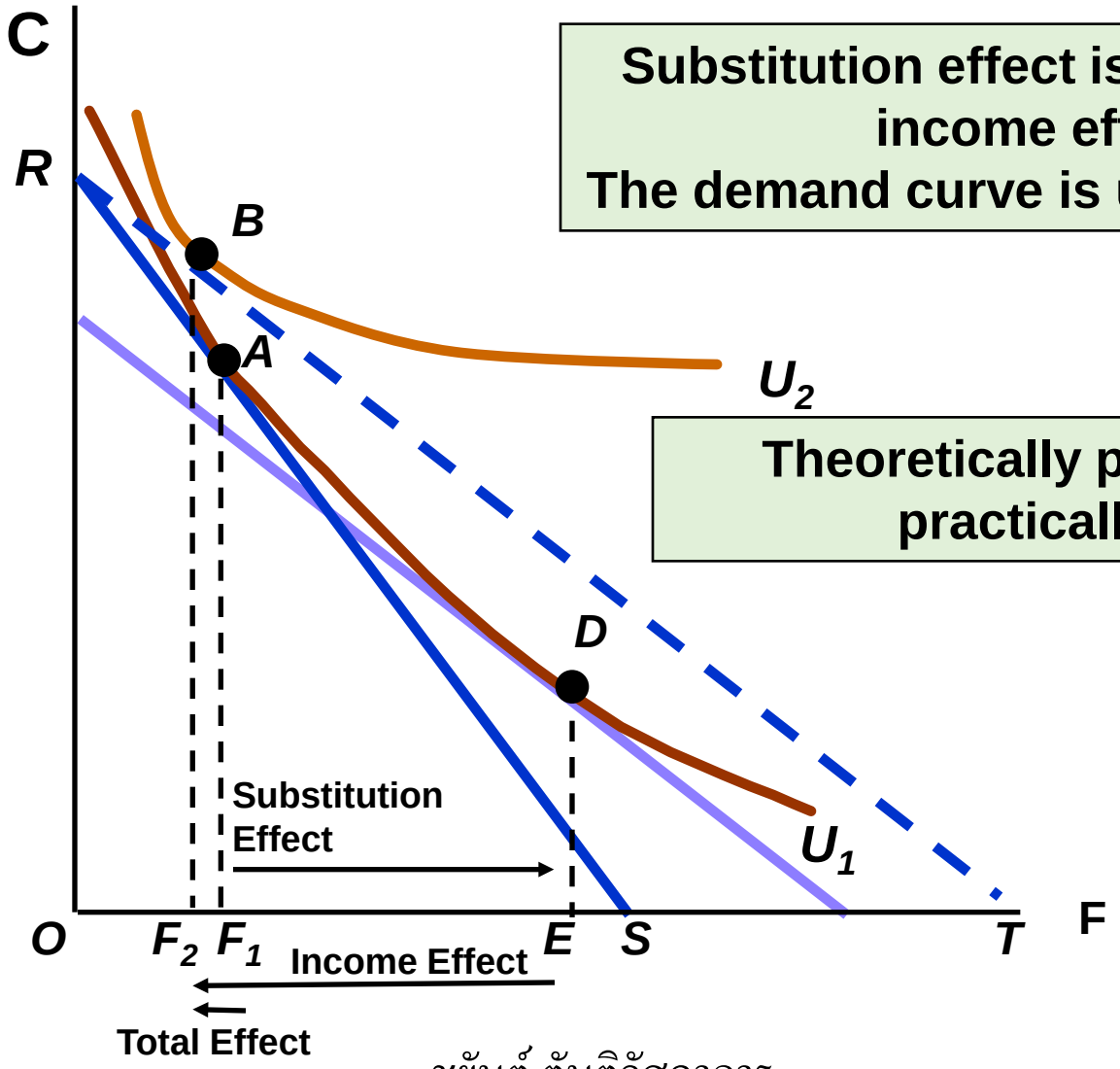



Since food is an inferior good, the income effect is negative. However, the substitution effect is larger than the income effect.

# Income and Substitution Effects

- A Special Case--The Giffen Good
  - The income effect may theoretically be large enough to cause the demand curve for a good to slope upward.
  - This rarely occurs and is of little practical interest.

# Income and Substitution Effects: Giffen Good



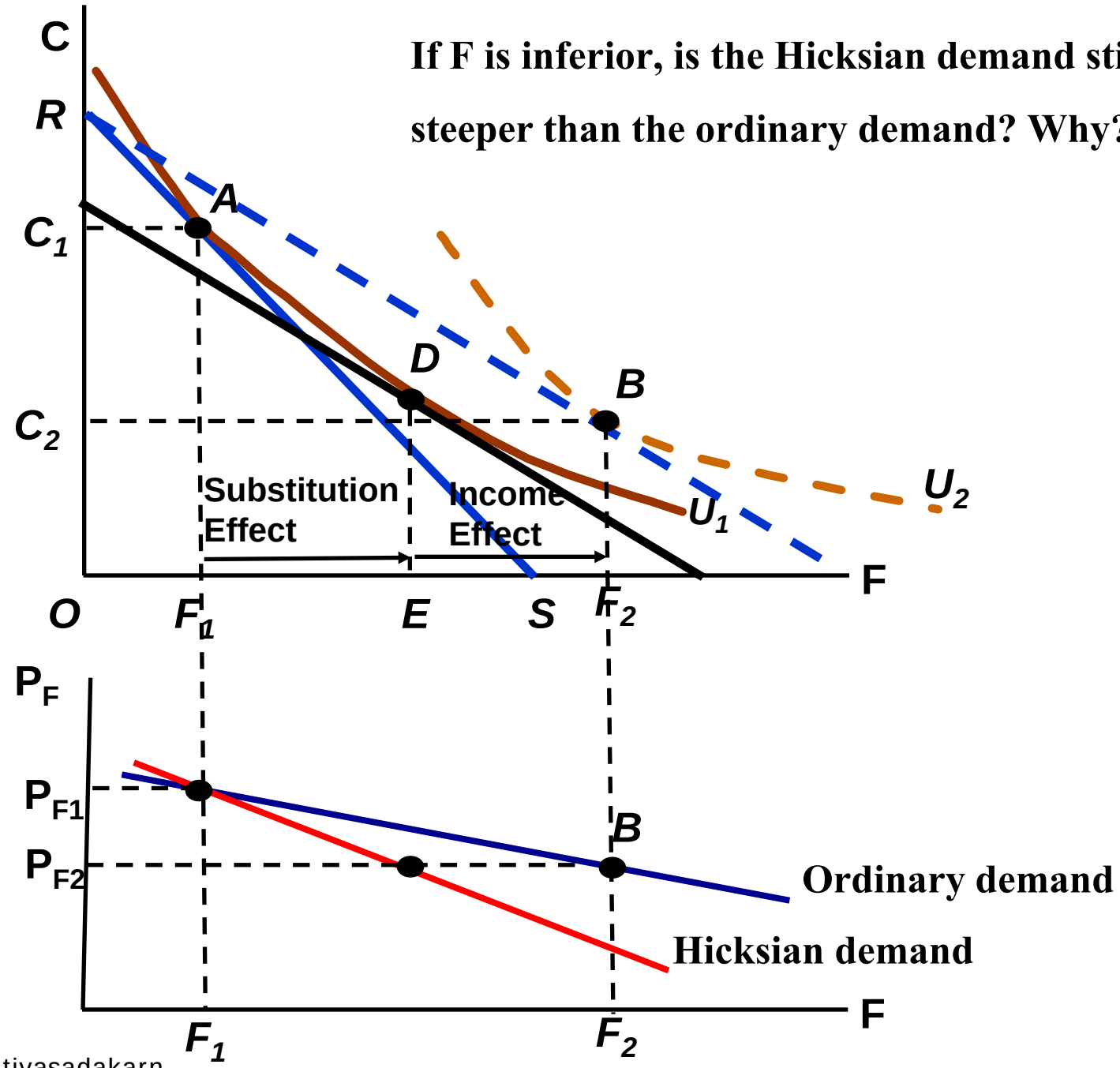

**Substitution effect is less than the income effect**
**The demand curve is upward sloping**

**Theoretically possible, but practically rare.**

# Compensated demand curve

- Ordinary demand or Marshallian demand always has income effect
  - Derive by fixing income.
  - It may slope upward if it is a Giffen good.
- Compensated demand of Hicksian demand excludes income effect or compensated for income
  - Derive by fixing utility
  - It always slopes downward.
  - It is used for calculating welfare change.

If F is inferior, is the Hicksian demand still steeper than the ordinary demand? Why?

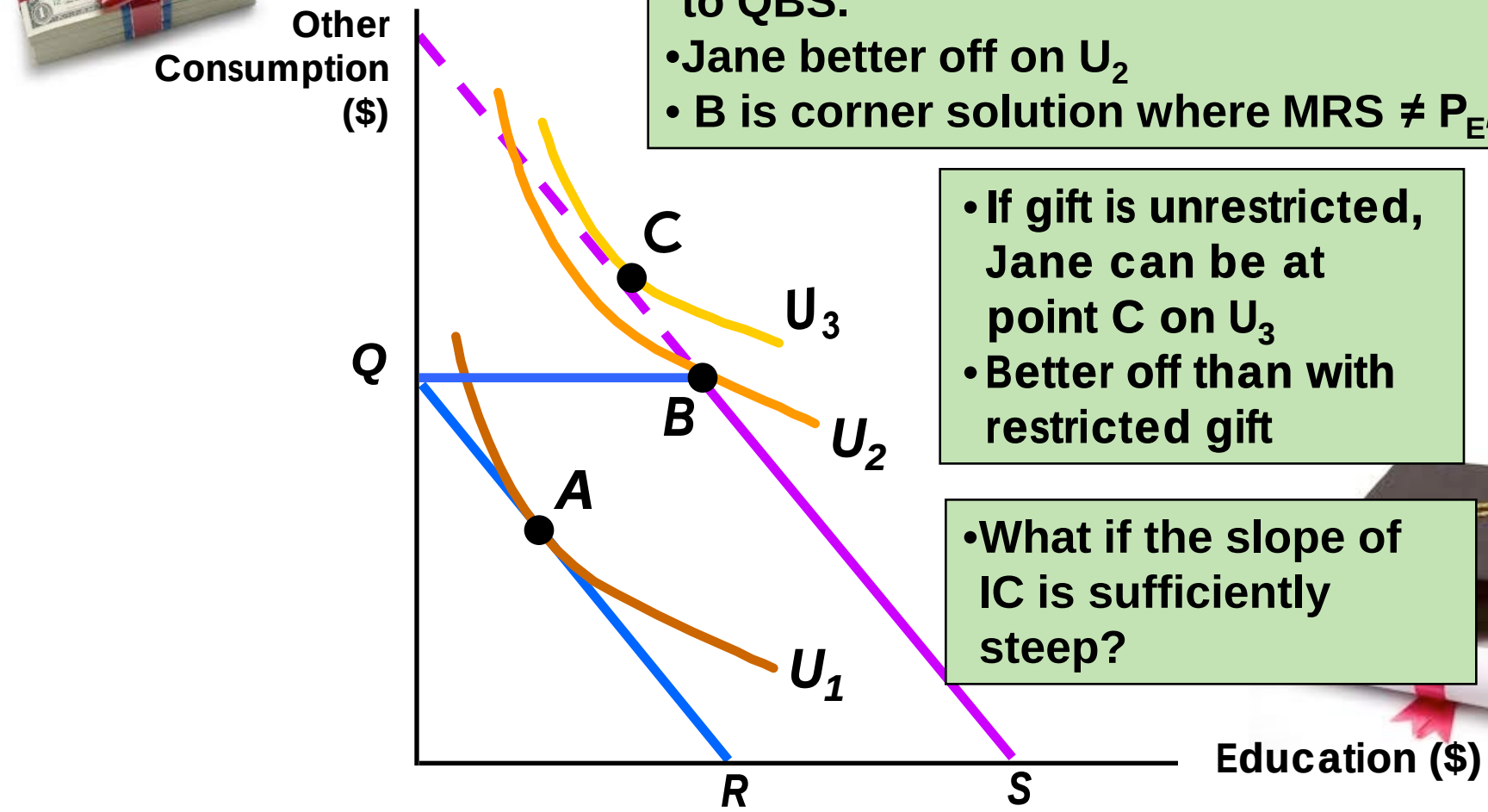


# Application: Cash or Gifts

- Suppose Jane Doe's parents set up a trust fund for her college education.
- The money must be used only for education.
- Original budget line, QR, with a market basket, A, of education and other goods
- Trust fund shifts out the budget line as long as trust fund, QB, spent on education
- Jane increases satisfaction moving to higher indifference curve, $U_2$
- Although a welcome gift, an unrestricted gift might be better since she can get $U_3$

# Application: Cash or Gifts

- The gift changes the budget line from QR to QBS.
- Jane better off on $U_2$
- B is corner solution where MRS ≠ $P_E/P_{OG}$

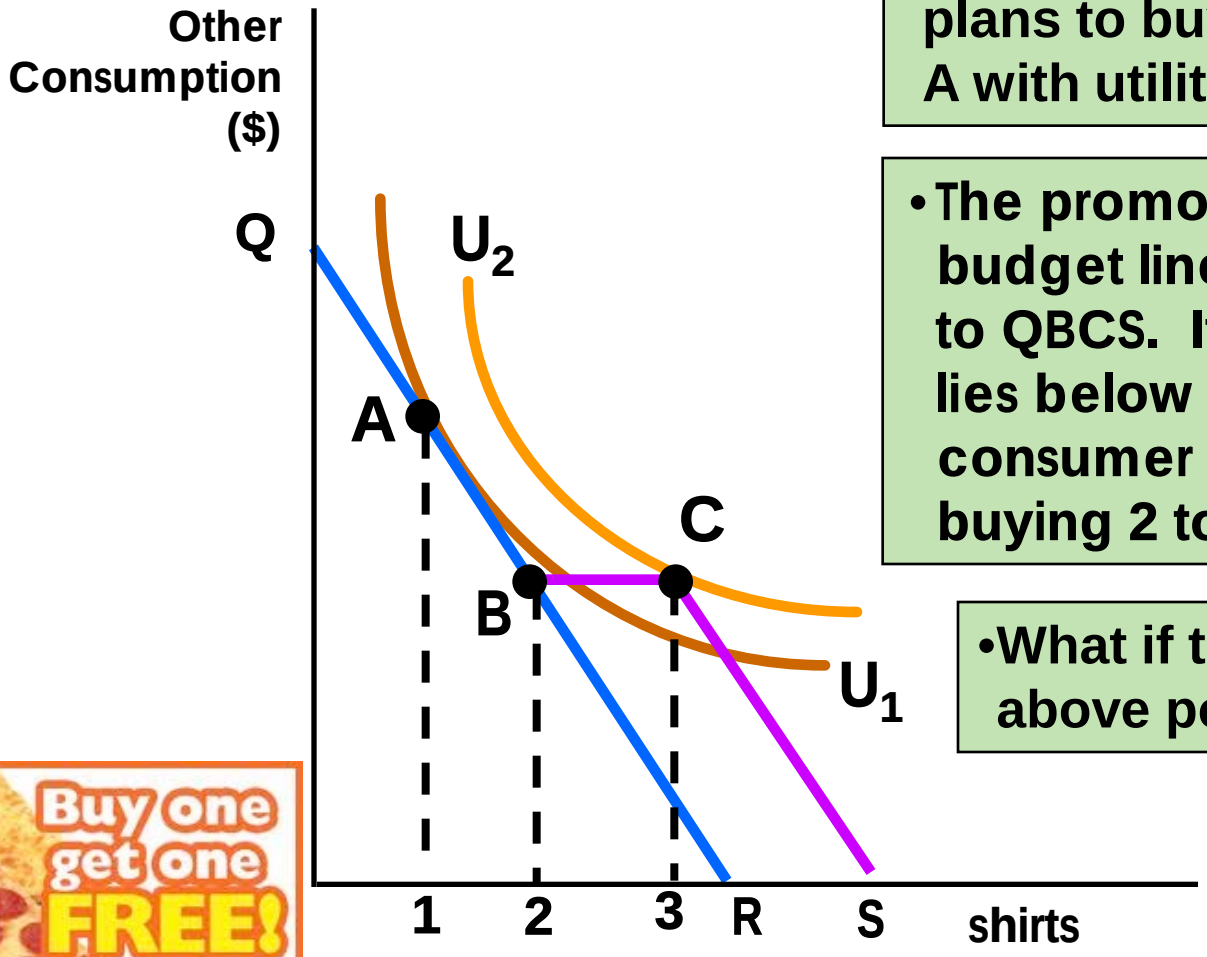



- If gift is unrestricted, Jane can be at point C on $U_3$
- Better off than with restricted gift

- What if the slope of IC is sufficiently steep?

- What if education becomes bad before he graduates?

# Application: Buy two, get one free



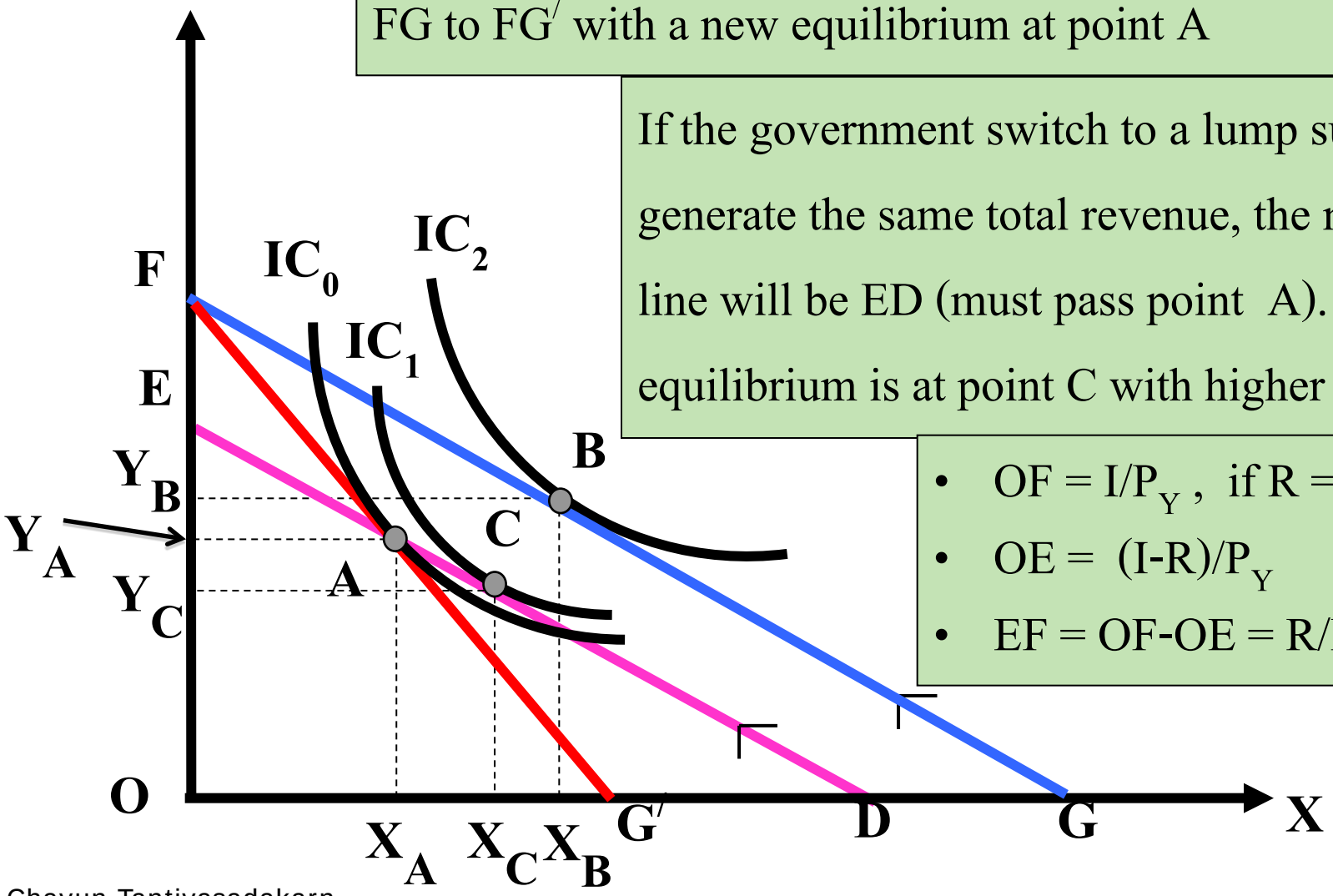

- Originally, this consumer plans to buy 1 shirt at point A with utility $U_1$.
- The promotion causes the budget line QR to change to QBCS. If the original IC lies below point C, this consumer is better off buying 2 to get 1 more shirt.
- What if the original IC is above point C?

# Lump sum versus ad valorem tax

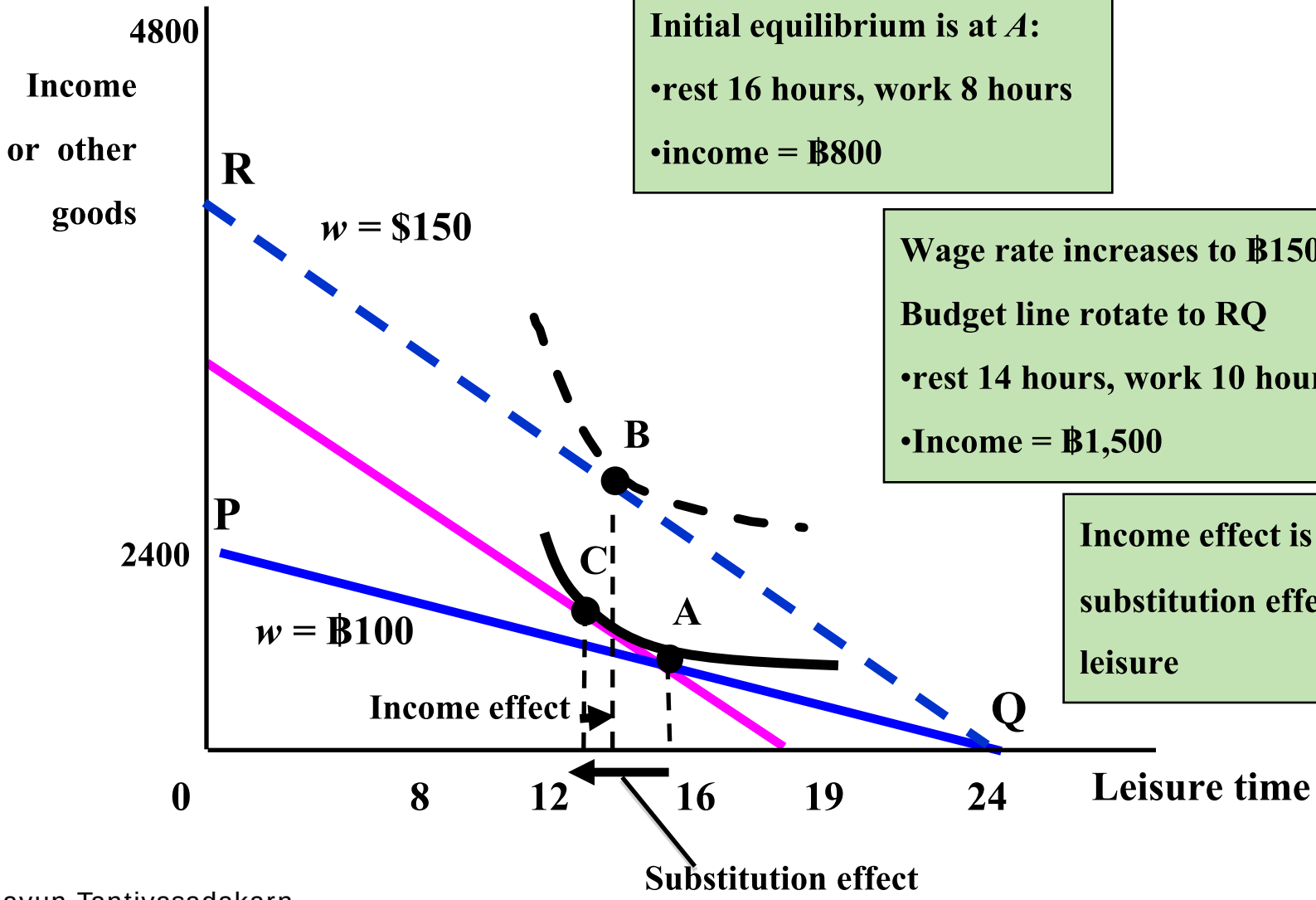
An ad valorem tax (%) on X will rotates the budget line from FG to FG/ with a new equilibrium at point A

If the government switch to a lump sum tax that generate the same total revenue, the new budget line will be ED (must pass point A). A new equilibrium is at point C with higher utility

- $OF = I/P_Y$ , if R = tax revenue
- $OE = (I-R)/P_Y$
- $EF = OF-OE = R/P_Y$



# Substitution and income effect of the change in wage rate




Initial equilibrium is at *A*:

- rest 16 hours, work 8 hours
- income = ฿800

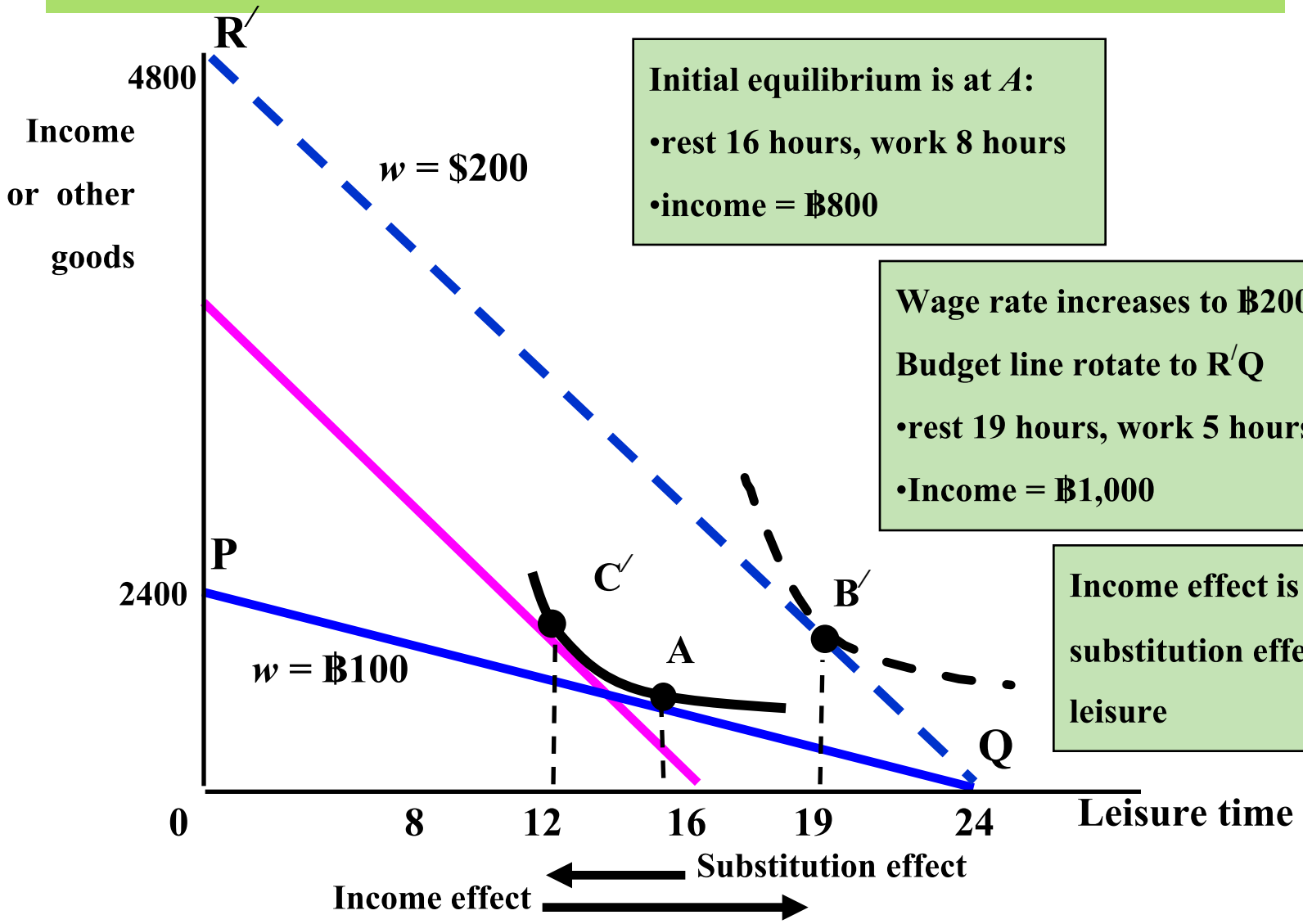
Wage rate increases to ฿150

Budget line rotate to RQ

- rest 14 hours, work 10 hours
- Income = ฿1,500

Income effect is less than substitution effect → less leisure

# Substitution and income effect of the change in wage rate




Initial equilibrium is at *A*:
- rest 16 hours, work 8 hours
- income = ฿800

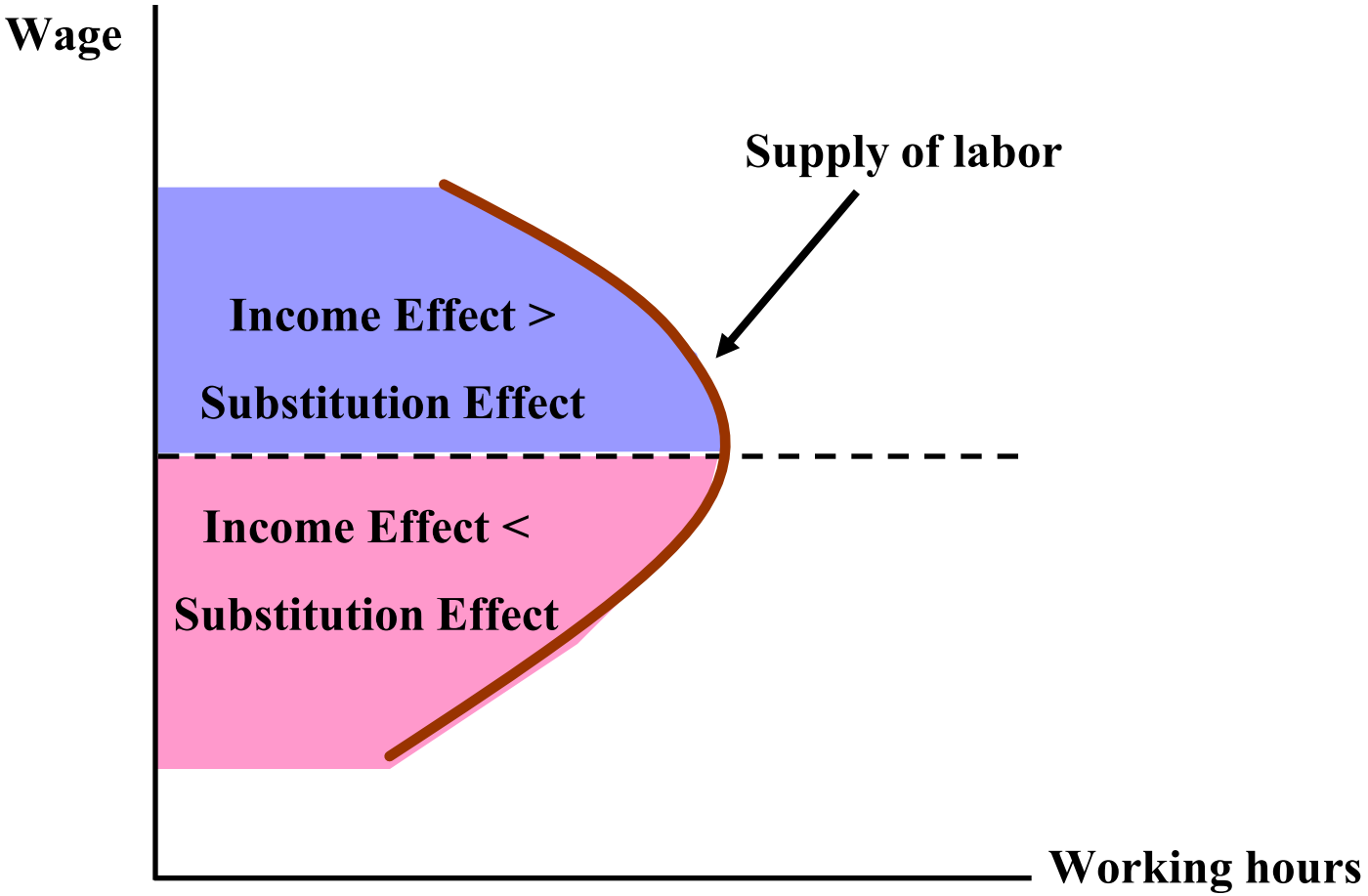
Wage rate increases to ฿200
Budget line rotate to R′Q
- rest 19 hours, work 5 hours
- Income = ฿1,000

Income effect is greater than substitution effect → more leisure

# Supply of labor

- The higher wage increases the opportunity cost of leisure. Substitute leisure for other goods, more working hours
  - The substitution effect
- The higher wage also increases income, want to consume more normal goods, including leisure; less working hours
  - The income effect
- If the income effect is higher, the labor supply curve will bend backward

# Backward-Bending Supply of Labor



# Donation

- Most people treat income level of others as neuter; hence, they will not donate
- Some donors will donate when they see some one poorer than they are. Others' income are substitutes for their income when others are poorer, but they will be neuters when others are richer

# Donation

**If I envy the one who is richer than me, how should the ICs look like?**