

# **Topic 5: DEMAND AND CONSUMER BEHAVIOR**

# CHAPTER OUTLINE

- Choice and Utility Theory
  - Marginal Utility and the Law of Diminishing Marginal Utility
    - Relationship of Total and Marginal Utility
- Derivation of Demand Curves
  - Why Demand Curves Slope Downward
    - Leisure and the Optimal Allocation of Time
    - Analytical Developments in Utility Theory

# Ordinal Approach to Utility

## Measurement: Indifference Curve

- Substitution Effect and income Effect
  - Substitution Effect
  - Income Effect
- From individual to Market Demand
  - Demand Shifts
  - Substitutes and Complements
  - Empirical Estimates of Price and Income Elasticities
- The Economics of Addiction
- The Paradox of Value
- Consumer Surplus
  - Applications of Consumer Surplus
- Summary

# Concepts

- **Utility** measures the want-satisfying power of a good or service. Utility is the driving force for demand for commodities.
- **Consumer's economic problem**: Maximize utility given the income or budget constraint
- **Marginal utility** is the additional utility due to consumption of an *additional unit* of a particular good. If
- If Total Utility function is  $U = f(Q_x)$ , then  $dU/dQ_x$  (slope) is the marginal utility at a given point on the Total Utility curve.

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# Measurement of utility: Cardinal or Ordinal?

- **Cardinal measurement:** In numbers, the difference between the numbers can also be measured.
- Example of cardinal measurement 10, 15, 23, 45, etc.

**Ordinal measurement:** Higher or lower utility, only ranking of utilities possible.

- If utility is cardinally measureable, it is also ordinally measureable.
- If utility is ordinally measureable, it is not cardinally measuerable

# The Law of Diminishing Marginal Utility

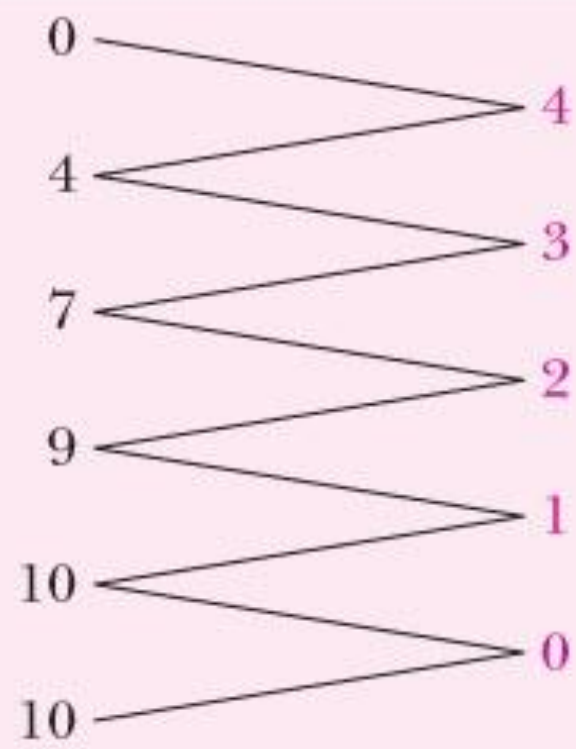
- As the amount of a good consumed increases, the *marginal* utility derived from consumption of that good tends to fall. In brief, as one consumes more and more of a good, the incremental satisfaction (MU) due to additional units goes on falling. Consumers prefer variety. Instead of allocating their income to the same good, they will be attracted to buy other goods. As consumption of a commodity increase, the total utility rises but a slower and slower rate. When this rate of increase in total utility becomes zero, the total utility is maximum.

# Relationship between Total and Marginal Utility

- $U = f(Q_x)$  : for Max U,
- $dU/dQ_x = 0$  (marginal utility =0) &  $d^2U/dQ_x^2 < 0$
- Total utility increases at a diminishing rate
- Total utility is the sum of marginal utilities
- In the case of consumption of a single good, will the consumer keep on buying the commodity till the marginal utility of that good falls to zero so that s(he) maximizes utility?: **NOT NECESSARILY**

# Relationship between Total and Marginal Utility

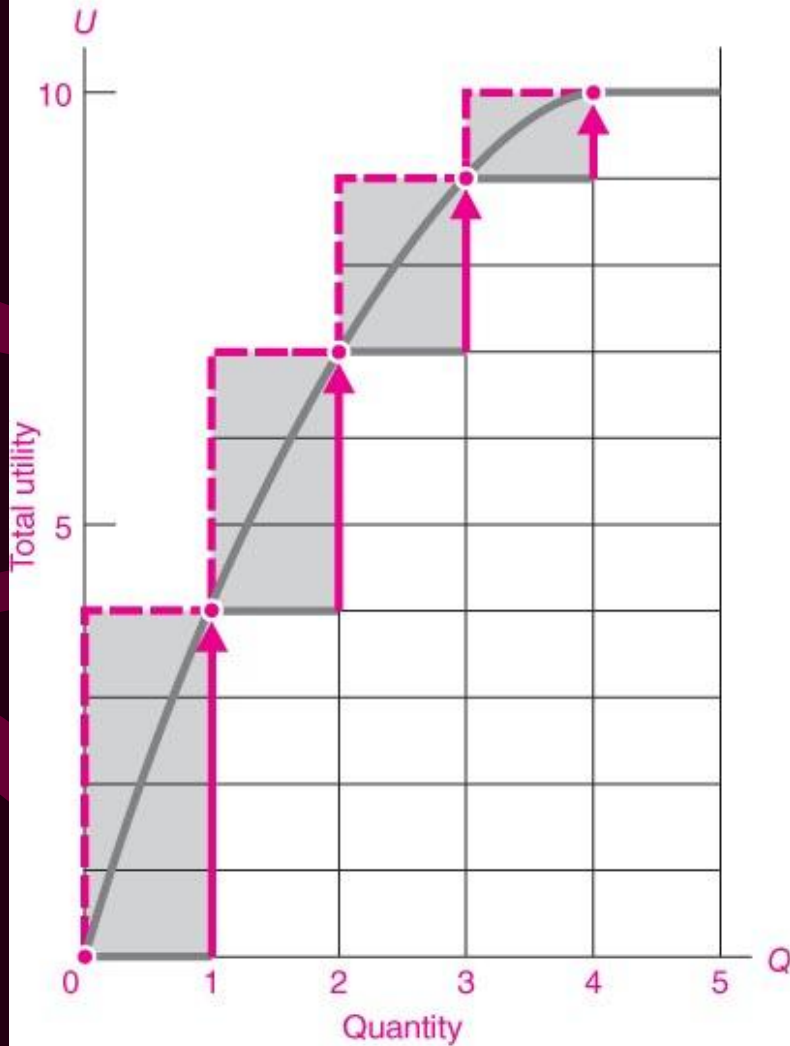
(1) Quantity of a good consumed $Q$	(2) Total utility $U$	(3) Marginal utility $MU$
0	0	
1	4	4
2	7	3
3	9	2
4	10	1
5	10	0



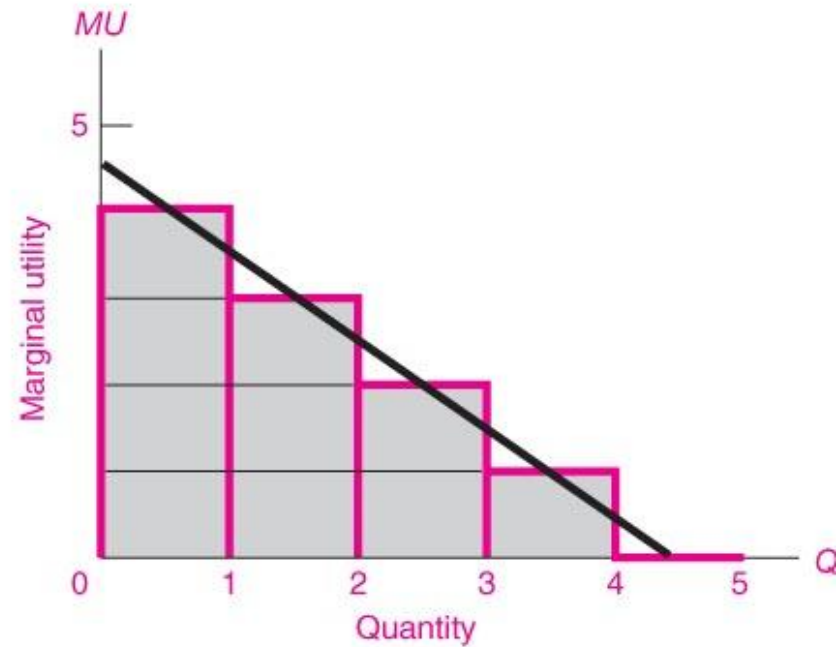


# The Law of Diminishing MU

(a) Total Utility



(b) Marginal Utility



# Consumer's Equilibrium for one good

- Consumer has to pay for the good. So s(he) will balance the benefits (extra utility) with the price of that good. S(he) will stop buying good after  $MU_x = P_x$ , the consumer maximizes utility subject to budget constraint. Only if the price of good = 0, i.e., the good is a free good, will the consumer be at the highest point of the total utility curve.
- **Assumptions:** (i) Consumers are rational
- (ii) Utility can be measured

# Law of Equimarginal Utility: Consumer's Equilibrium with More Than One Commodity

- Applied when consumer consumes more than one commodity to ascertain consumer's equilibrium
- A consumer with a given income and a given set of prices, will maximize utility when the ratio of marginal utility to price for all the goods become equal.
- $MU_x/P_x = MU_y/P_y = MU_z/P_z = \underline{MU \text{ per unit of money}}$

# Convergence to Consumer's Equilibrium

- If  $MU_x/P_x > MU_y/P_y$ , then the consumer will reallocate expenditure, purchase more of 'x' and less of 'y'. This is because if s(he) spends one rupee on purchase of 'x', he gets more utility than if it is spent on 'y'.
- If  $MU_z/P_z < MU_y/P_y$ , then the consumer will reallocate expenditure and purchase more of 'y' and less of 'z'. This is because if s(he) spends one rupee on purchase of 'y', he gets more utility than if it is spent on 'z'. This reallocation of expenditure process will stop only when

- This reallocation of expenditure process will stop only when
- $MU_x/P_x = MU_y/P_y = MU_z/P_z = \underline{MU \text{ per unit of money}}$
- i.e, every rupee spent on different commodity gives the same utility, so that the consumer has no reason to change his/her expenditure pattern.

# Why does the demand curve slope downwards

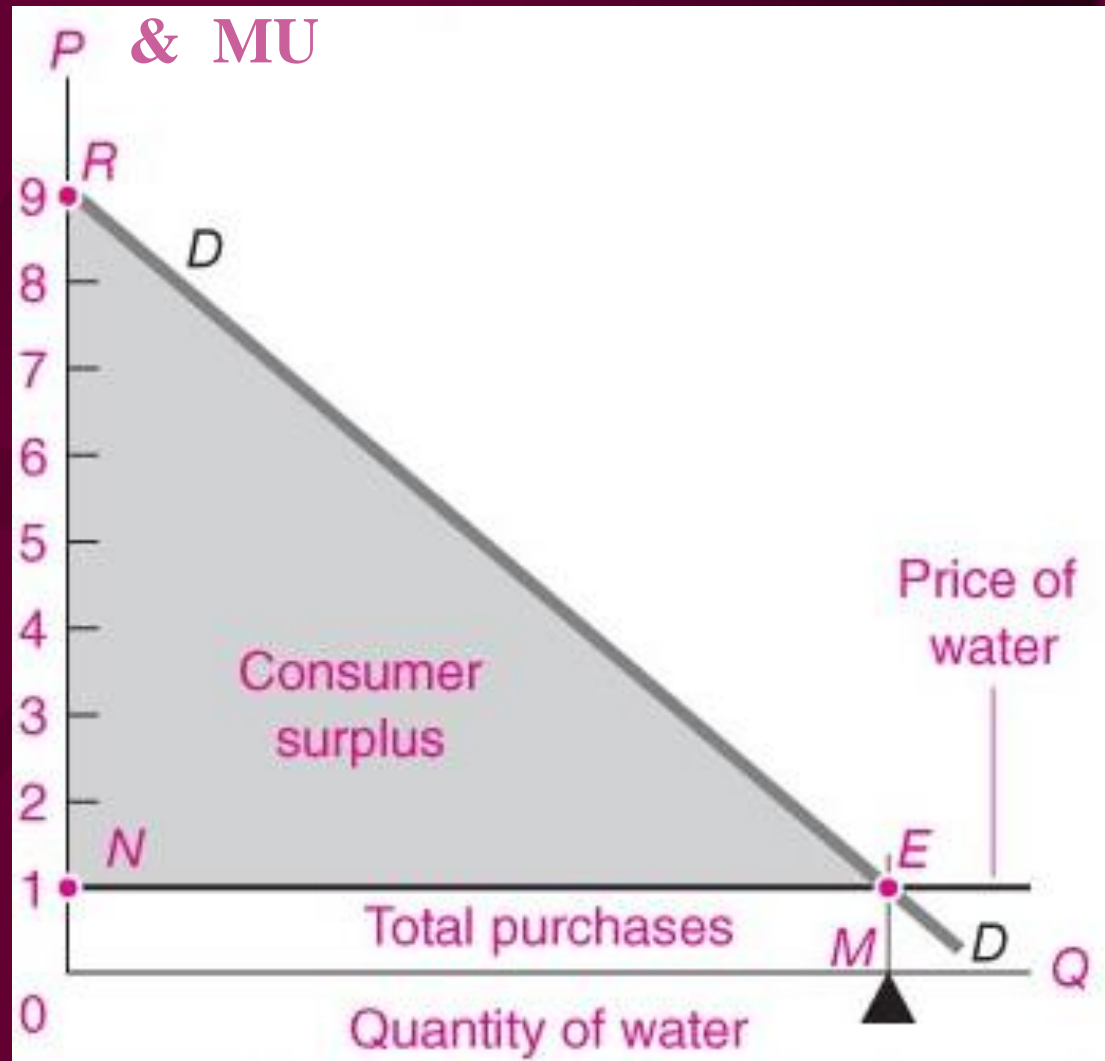
- Law of diminishing marginal utility
- One good case: Satisfaction derived from extra unit of consumption goes down and therefore, we are willing to pay a lower price for the successive units of purchases.
- Multiple goods case: three goods case: x, y and z
- Initial equilibrium when  $MU_x/P_x = MU_y/P_y = MU_z/P_z$
- If price of x goes up,  $MU_x/P_x$  becomes  $< MU_y/P_y$  &  $MU_z/P_z$ , therefore, consumer will reduce purchase of 'x' and increase purchase of 'y' and 'z' commodities.

# CONSUMER SURPLUS

- *Willingness to pay* is the maximum amount that a buyer will pay for a good.
- It measures how much the buyer values the good or service. The area below the demand curve depicts the various quantities that buyer(s) would be willing and able to purchase at different prices.
- **Actual Payment** =  $P * Q$
- *Consumer surplus* is the buyer's willingness to pay for a good minus the amount the buyer actually pays for it.

# Consumer Surplus for an Individual/ Market

- The demand curve depicts the various quantities that buyer(s) would be willing and able to purchase at different prices.



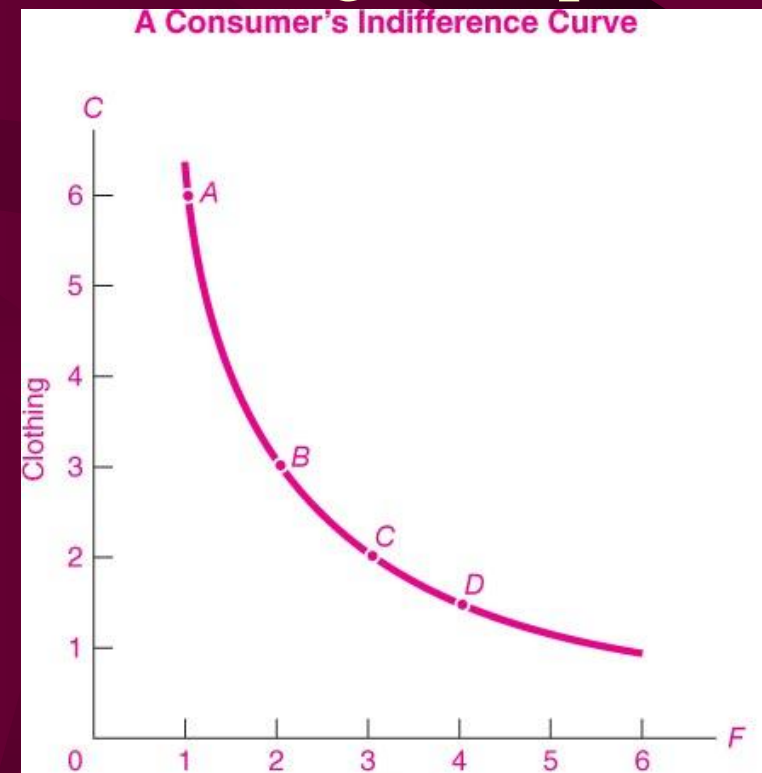


# Ordinal measurement of Utility and Consumer Equilibrium

- Indifference Curve is the loci of points that give equal satisfaction (iso utility curve) to the consumer. If we measure quantities of two goods X and Y on the two axis then an IC indicates combinations of goods X and Y which give equal satisfaction to a consumer.

Indifference Combinations

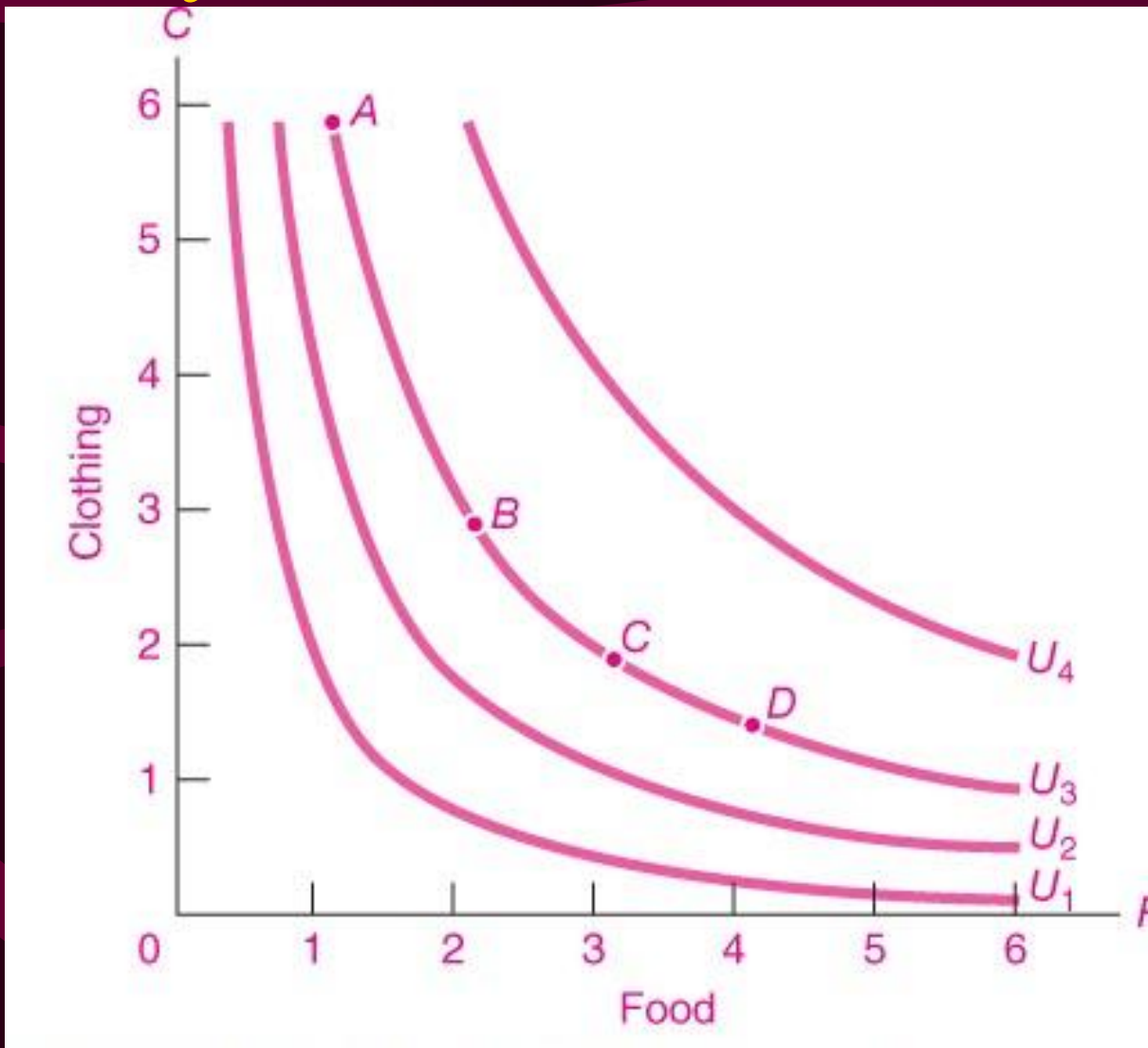
	Food	Clothing
A	1	6
B	2	3
C	3	2
D	4	1½



# Properties of Indifference curves:

- **Downward sloping:** When more of a commodity is always preferred, the commodity is a good. If every commodity is a good then indifference curves are negatively sloped. If less of a commodity is always preferred then the commodity is a bad.
- **Well-Behaved Preferences:** A preference relation is “well-behaved” if it is monotonic and convex.
- **Monotonicity:** More of any commodity is always preferred (i.e. no satiation and every commodity is a good). Do not intersect each other.
- **Convex to origin** (imperfect Substitutes)
  - L shaped: perfect complementary goods
  - Linear: perfect substitutes

# Family (MAP) of Indifference Curves



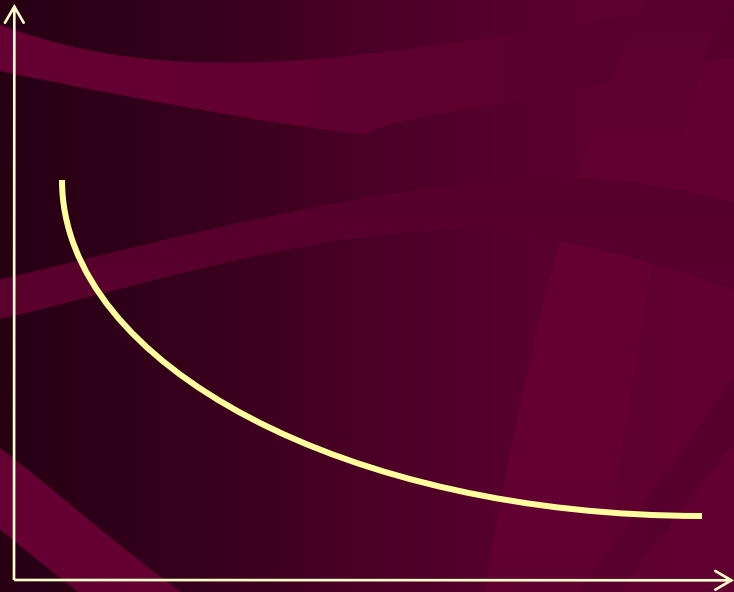
- Indifference Map is a set of indifference curves.

# Marginal rate of substitution (MRS).

- Marginal rate of substitution (MRS): slope of IC-willingness of the consumer to sacrifice amount of good Y for an additional unit of good X. We ignore the negative sign of MRS.
- Diminishing MRS and imperfect substitution of the goods (leads to convex ICs), as more of a good is consumed, is an important characteristic of consumer preferences.

# Preferences and Location of ICs

- Fig 1: Stronger pref for Y

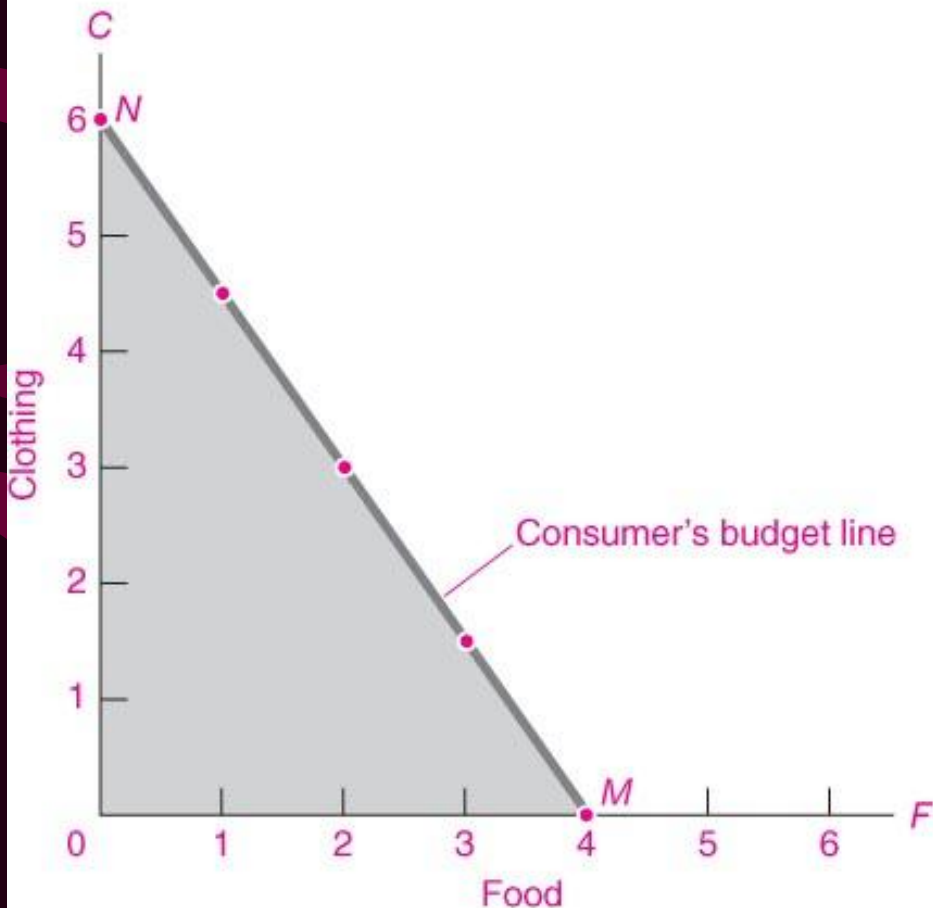


- Fig 2: Stronger pref for X



# Budget Constraint

A Consumer's Budget Line



Alternative Consumption Possibilities

	Food	Clothing
M	4	0
	3	1 <sup>1</sup> / <sub>2</sub>
	2	3
	1	4 <sup>1</sup> / <sub>2</sub>
N	0	6

- Budget constraint (price Line):  $I = P_x Q_x + P_y Q_y$   
Consumer spends all income on the purchases of the two goods.
- Slope of price line:  $-P_x/P_y$   
Shifts in price line due to change in  $P_y$ ,  $P_x$  and  $I$

## Budget Line ( $P_x = 1$ , $P_y = 2$ , $I = 40$ )

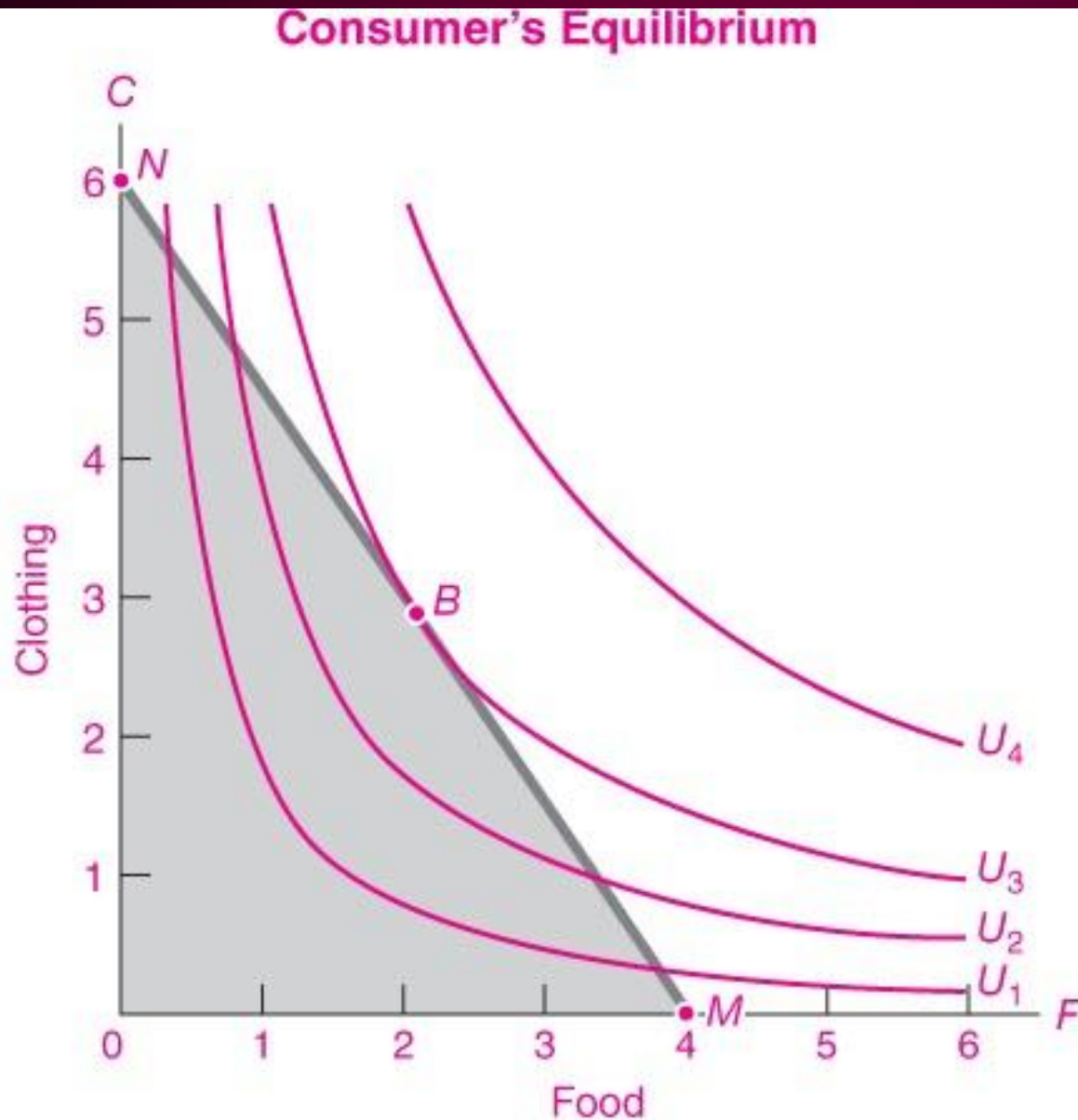
Goods Basket	$Q_x$	$Q_y$	Income spent
A	0	20	40
B	10	15	40
C	20	10	40
D	30	5	40
E	40	0	40

# Shifts in Budget line

- **Change in Money Income ( $I$ ): Constant  $P_y$  and  $P_x$** 
  - Increase in money income: Parallel rightward shift
  - Decrease in money income: Parallel leftward shift
- **Change in Price of  $X$  ( $P_x$ ):  $P_y$  and  $I$  constant**
  - Increase in  $P_x$  reduces the  $X$  intercept
  - Decrease in  $P_x$  increases the  $X$  intercept
- **Change in Price of  $Y$  ( $P_y$ ):  $P_x$  and  $I$  constant**
  - Increase in  $P_y$  reduces the  $Y$  intercept
  - Decrease in  $P_y$  increases the  $Y$  intercept



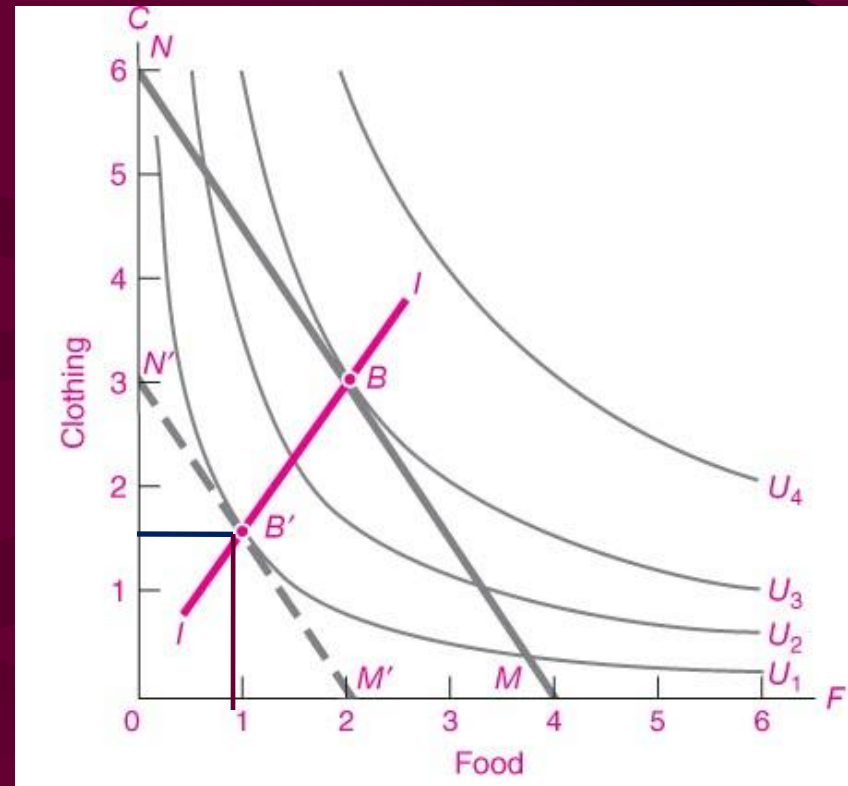
# Consumer's Equilibrium



- Slope of IC ( $MRS_{x-y}$ ) = Slope of Budget Line ( $-P_x/P_y$ )

# Income Effect

- Income effects* describe the fact that as money income of the consumers changes, prices remaining the same, there is a parallel shift in the budget line. An increase (decrease) in money income will cause a parallel outward (inward) shift in the budget line.



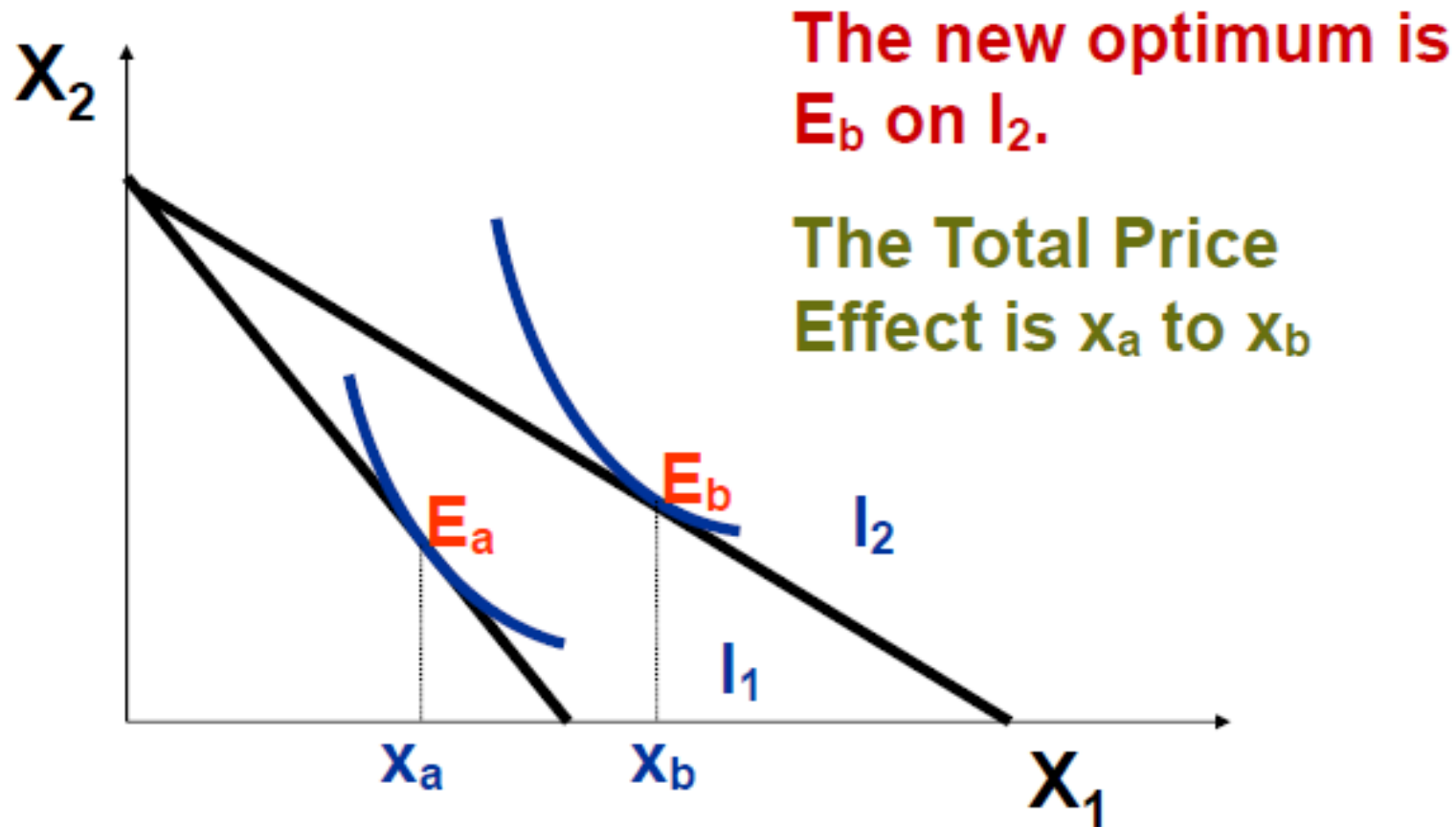
Initial equilibrium is at B, new equilibrium when money income of the consumer falls is at B'. II is income consumption curve.

# Price Effect decomposition

- Price Effect = Substitution Effect + Income effect
- Two methods of decomposition
  1. Hicksian Method (John R. Hicks)
  2. Slutsky Method

# Price Effect

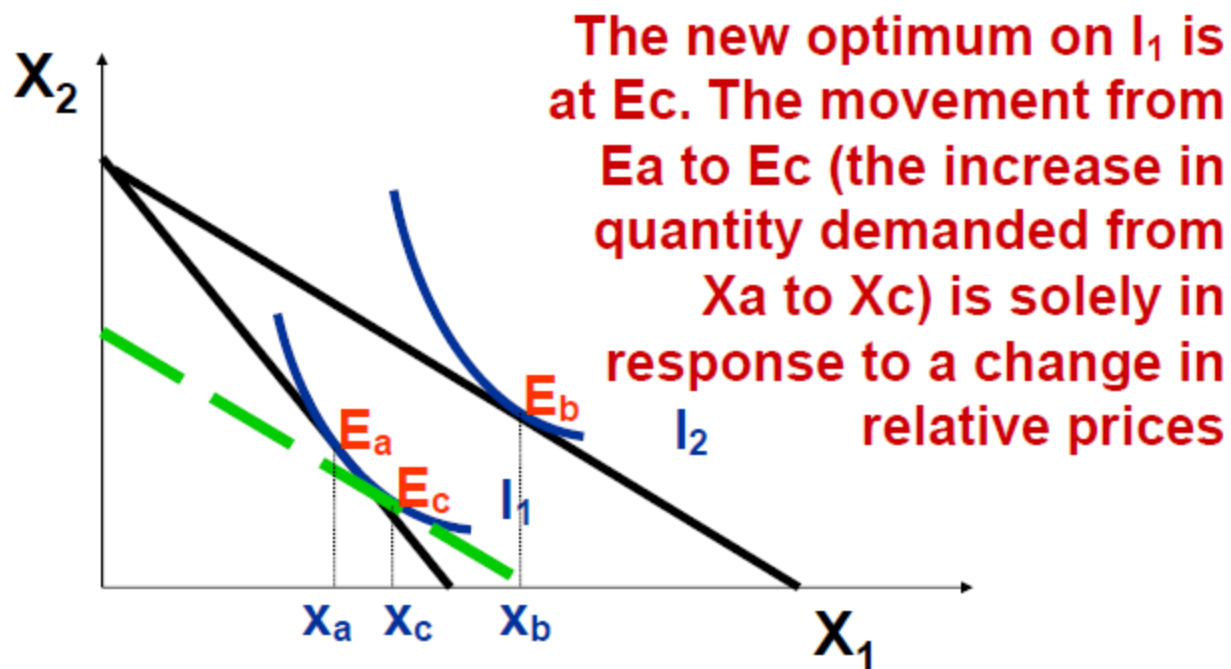
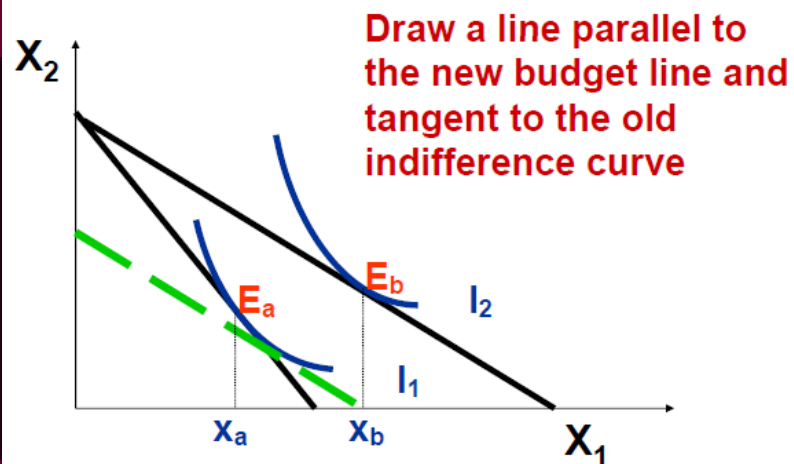
## THE HICKSIAN METHOD



# THE HICKSIAN METHOD

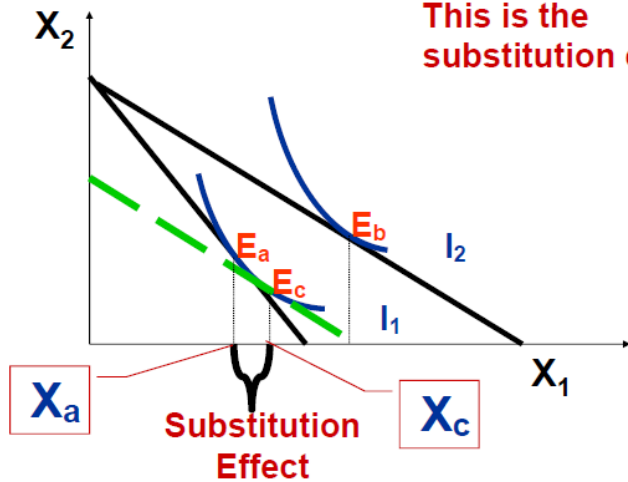
- To isolate the substitution effect we ask....
- “what would the consumer’s optimal bundle be if s/he faced the new lower price for  $X_1$  but experienced no change in real income?”
- This amounts to returning the consumer to the original indifference curve ( $I_1$ )

## THE HICKSIAN METHOD

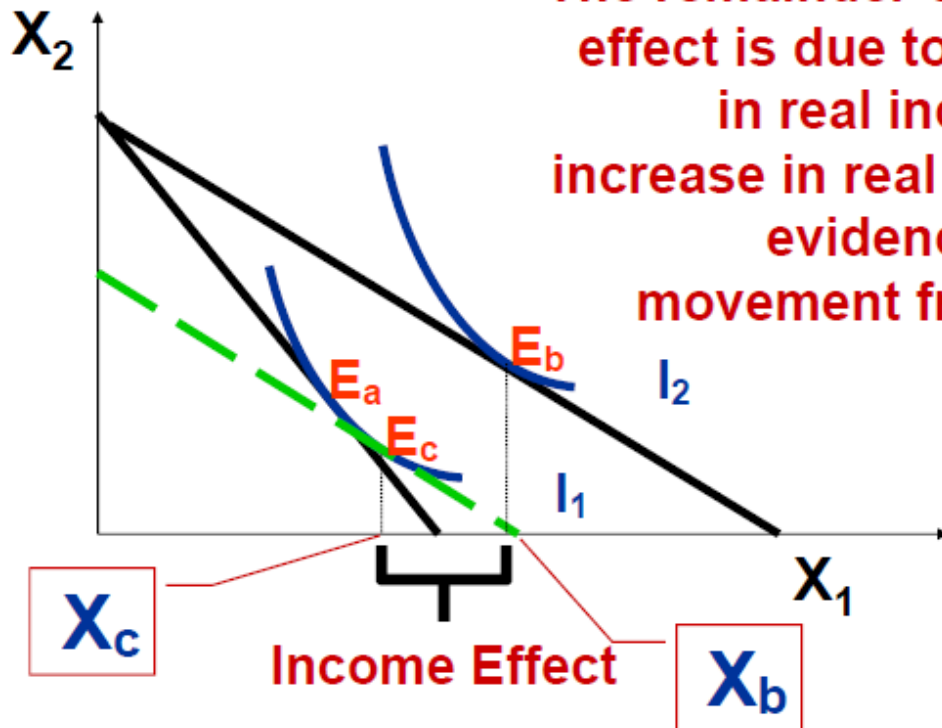


## THE HICKSIAN METHOD

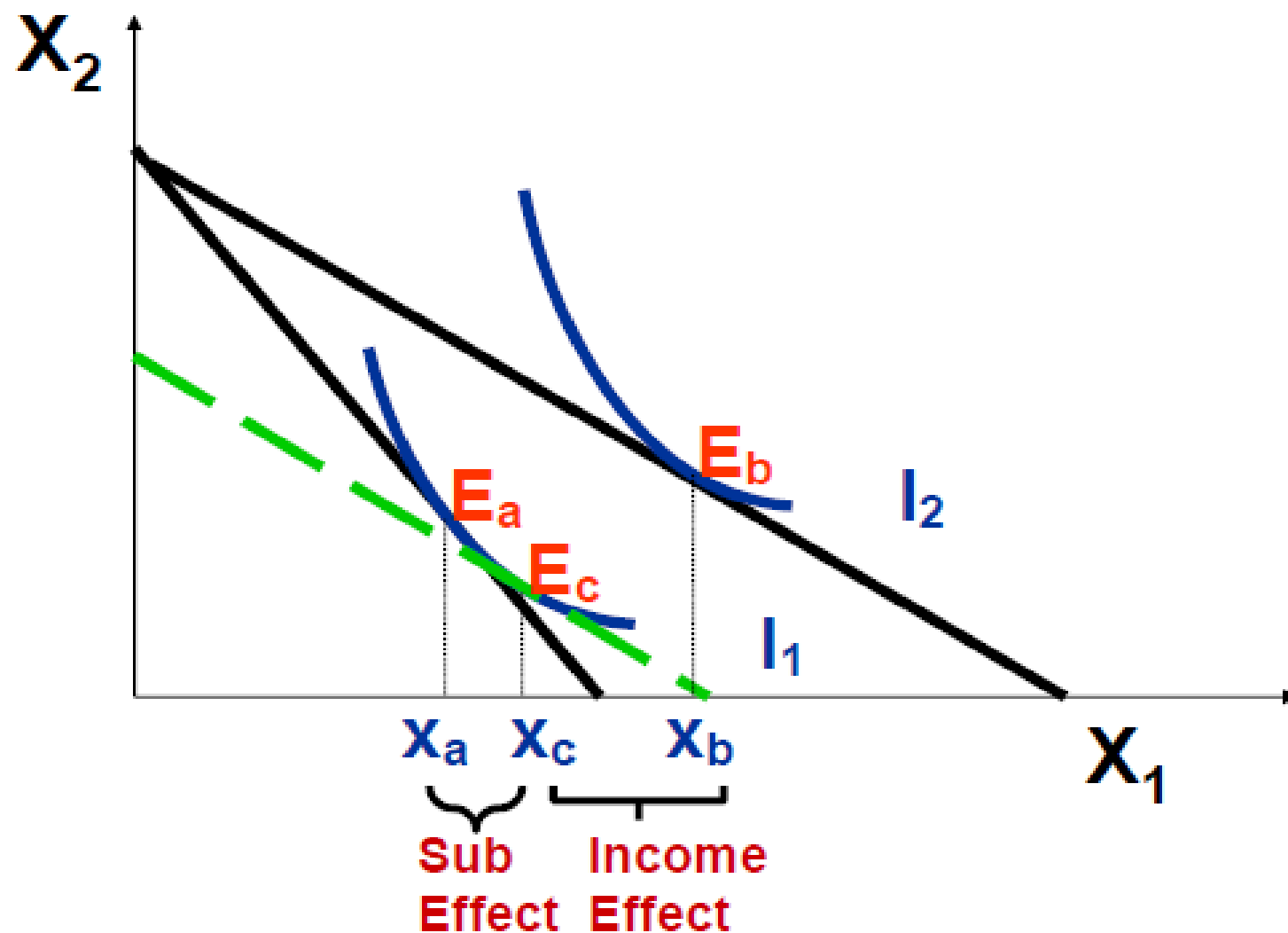
This is the substitution effect.



The remainder of the total effect is due to a change in real income. The increase in real income is evidenced by the movement from  $I_1$  to  $I_2$

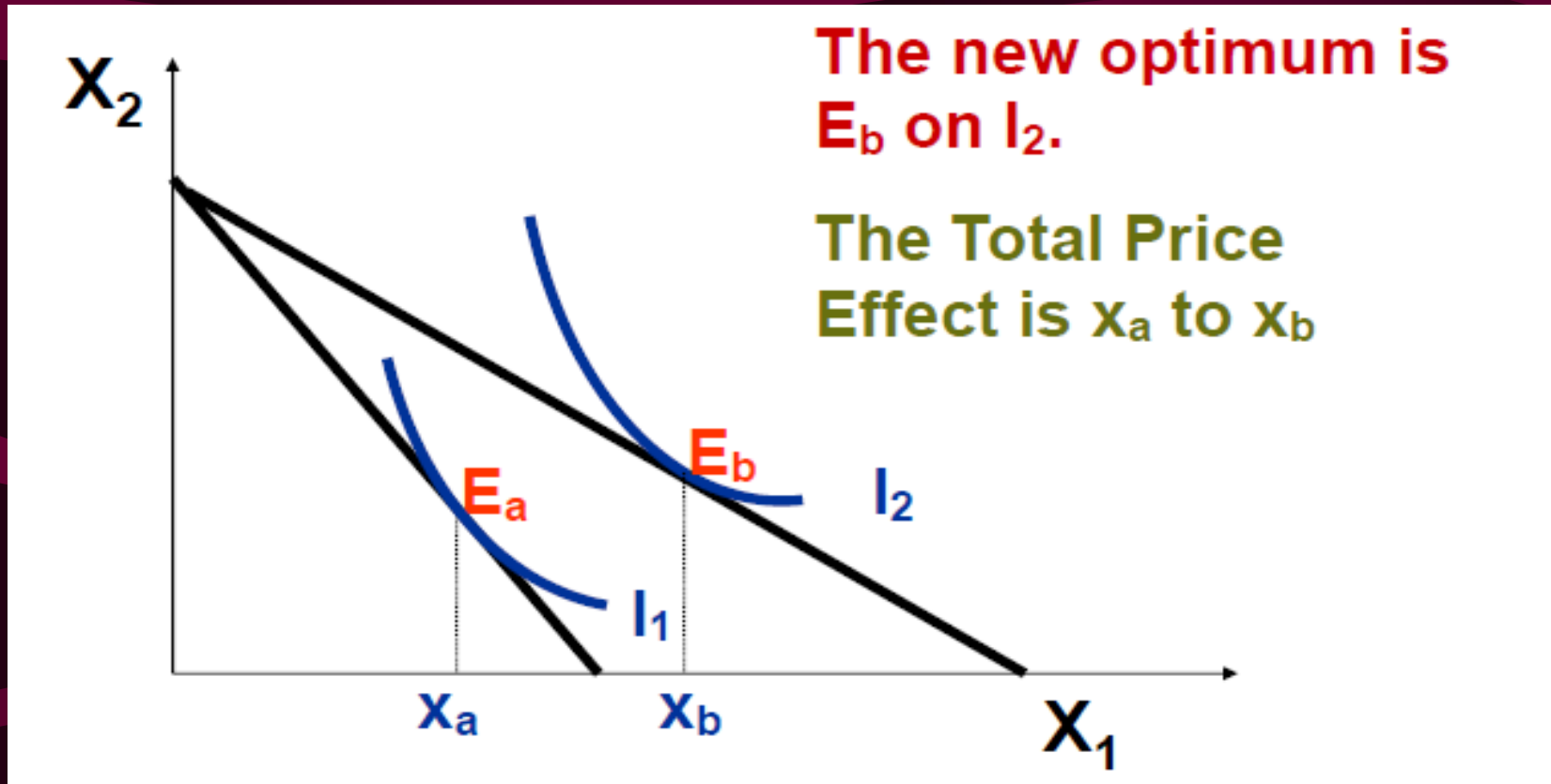


# THE HICKSIAN METHOD





# Slutsky Method of Decomposition



- Optimal bundle is  $E_a$ , on indifference curve  $I_1$ .
- A fall in the price of  $X_1$ , The budget line pivots out from  $P$ .
- The new optimum is  $E_b$  on  $I_2$ .

# THE SLUTSKY METHOD

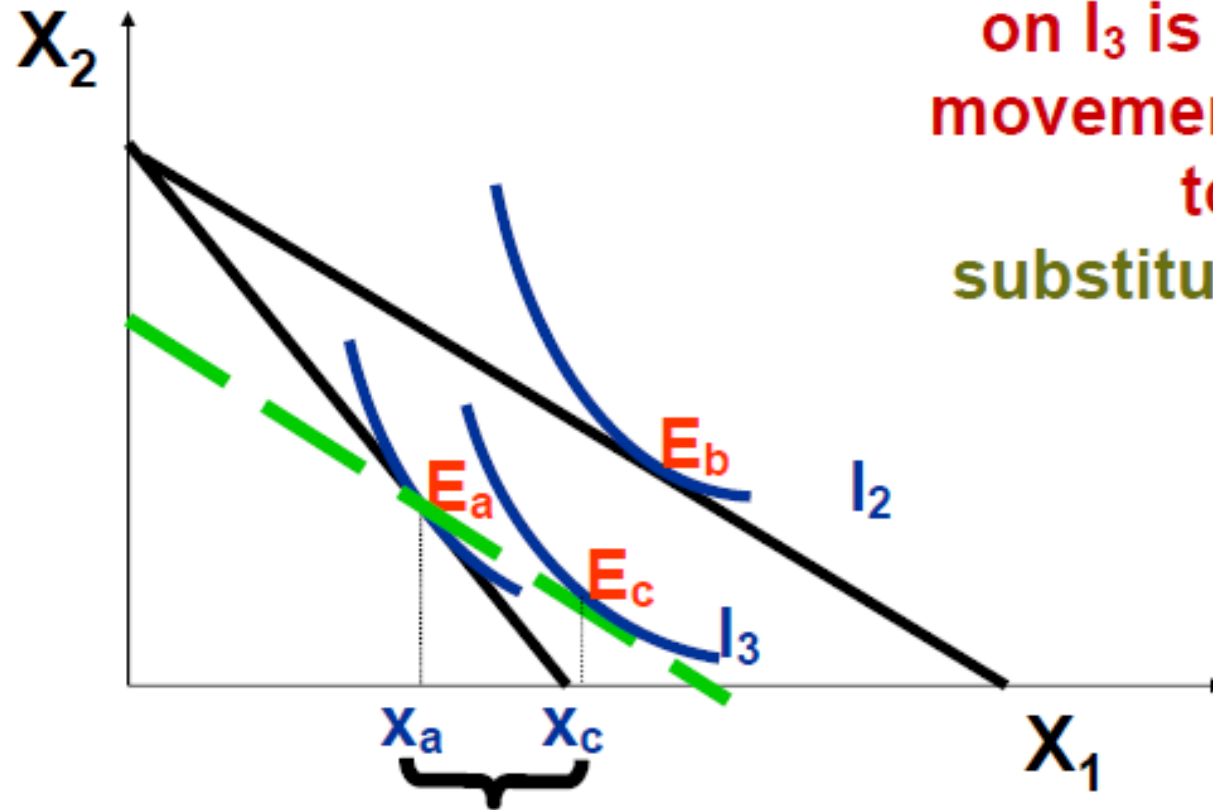
At the new prices,

- less income is needed to buy the original bundle then “real income” has increased
- more income is needed to buy the original bundle then “real income” has decreased

Isolate the change in demand due only to the change in relative prices by asking “What is the change in demand when the consumer’s income is adjusted so that, at the new prices, s/he can just afford to **buy the original bundle?**”

# THE SLUTSKY METHOD

- To isolate the substitution effect the consumer's money income is adjusted so that s/he change can just afford the original consumption bundle.
- In other words purchasing power is held constant.



The new optimum on  $I_3$  is at  $E_c$ . The movement from  $E_a$  to  $E_c$  is the substitution effect

**Substitution Effect**

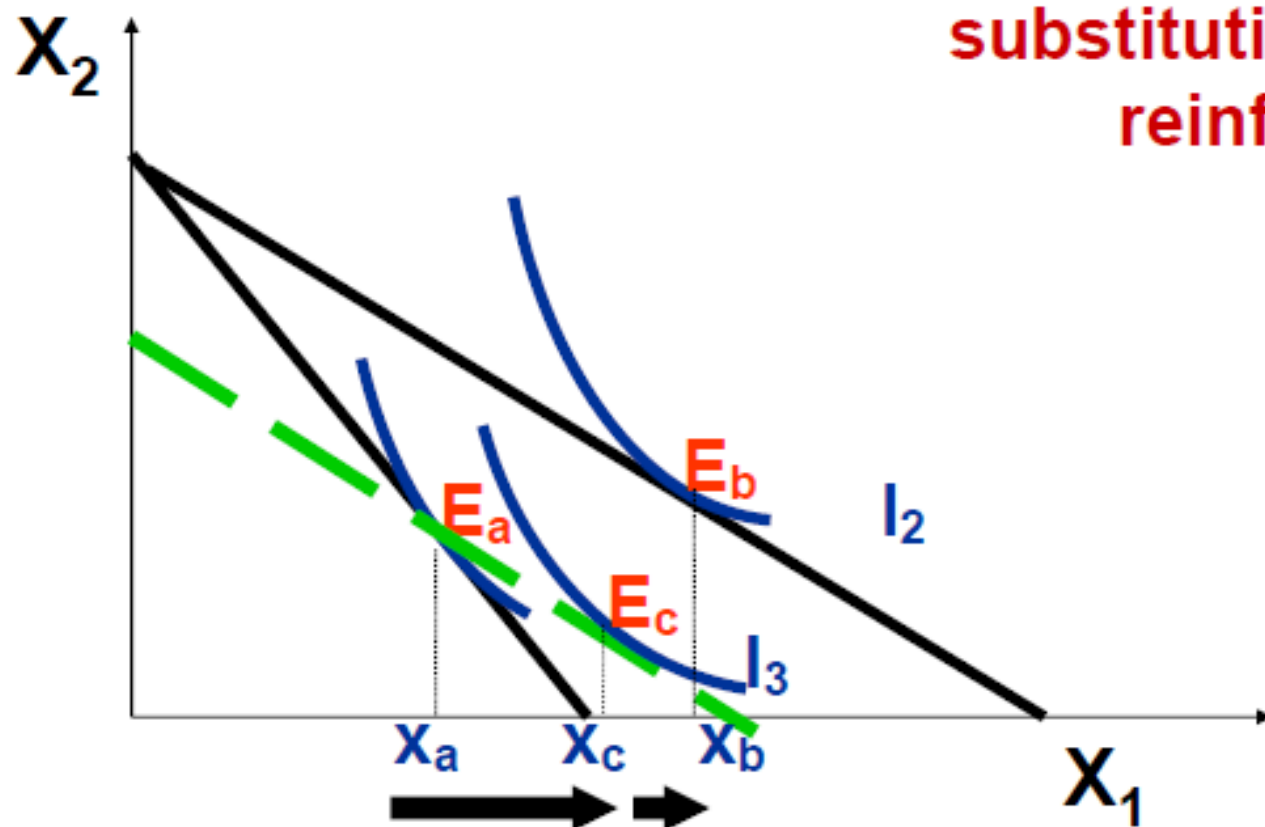
- Draw a line parallel to the new budget line which passes through the point  $E_a$ .  $I_3$  is tangent to this new budget line at  $E_c$ . Total Price effect is from  $E_a$  to  $E_b$ . Income effect  $E_c$  to  $E_b$  =

# THE SLUTSKY METHOD for NORMAL GOODS

- ◆ Most goods are normal (i.e. demand increases with income).
- ◆ The substitution and income effects reinforce each other when a normal good's own price changes.

# THE SLUTSKY METHOD for NORMAL GOODS

**The income and  
substitution effects  
reinforce each  
other.**

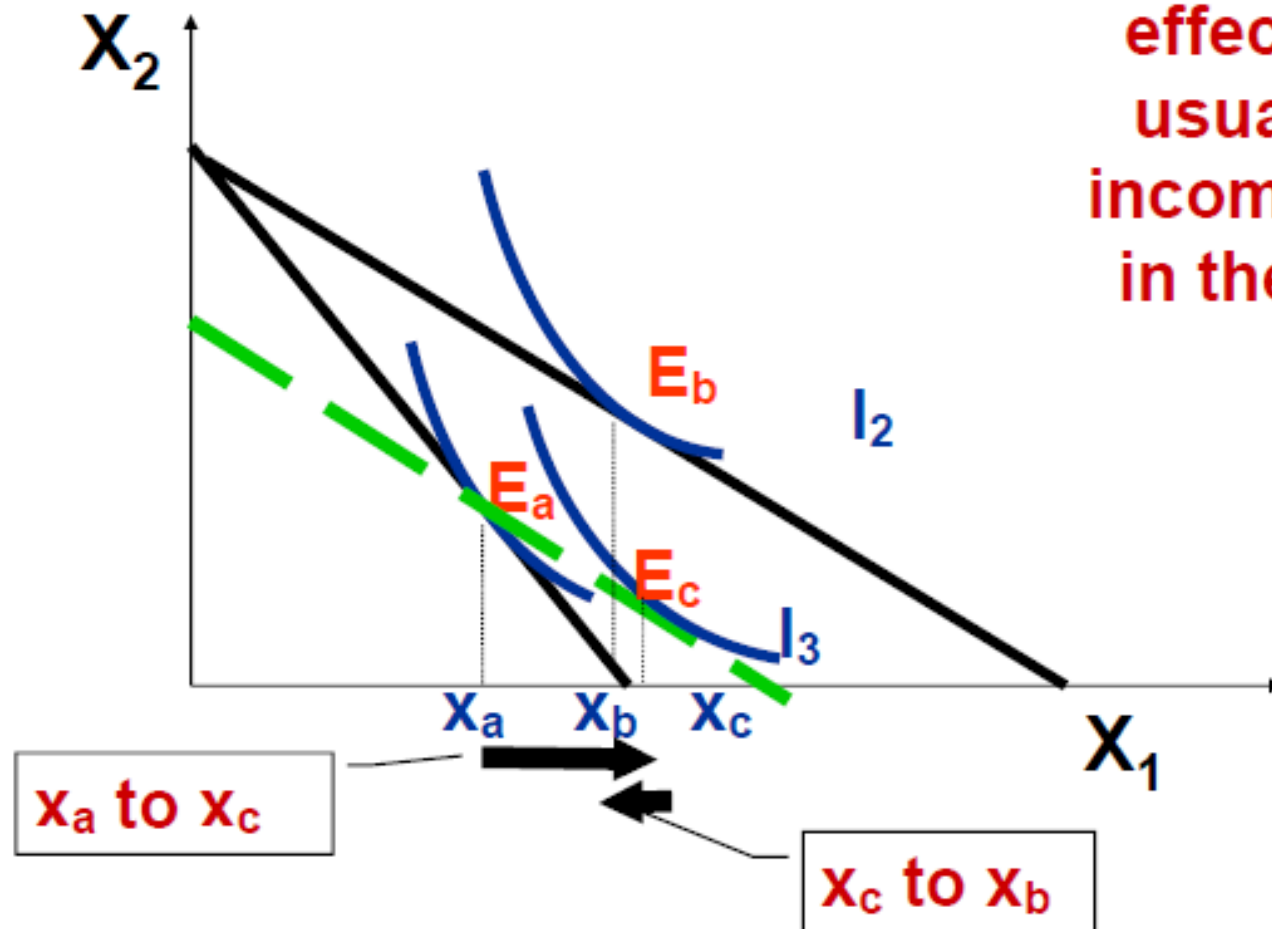


# Inferior Goods

- ◆ Some goods are (sometimes) inferior (i.e. demand is reduced by higher income).
- ◆ The substitution and income effects “oppose” each other when an inferior good’s own price changes.

# THE SLUTSKY METHOD: INFERIOR GOODS

The substitution effect is as per usual. But, the income effect is in the opposite direction.





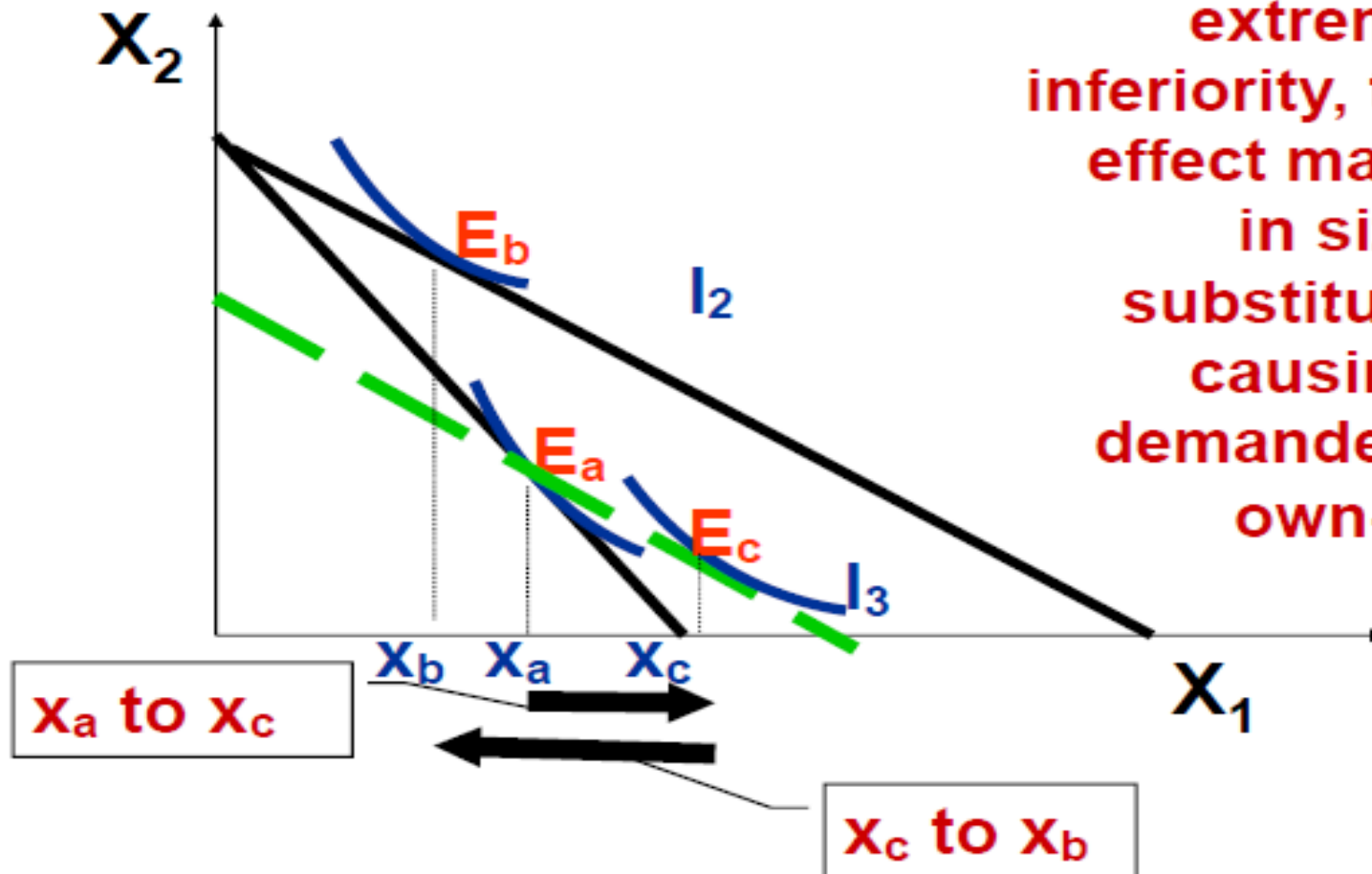
# Giffen Goods

- Alfred Marshall (1949) described the case of upward sloping demand curve and gave the credit for this idea to Robert Giffen. If the negative income effect of a fall in price of a good is larger than the positive substitution effect, demand curve for such a good will be upward sloping.

# GIFFEN GOODS

## THE SLUTSKY METHOD for INFERIOR GOODS

In rare cases of extreme income-inferiority, the income effect may be larger in size than the substitution effect, causing quantity demanded to fall as own-price falls.



# Effect of a decline in price of a good.

Type of good	Substitution effect	Income Effect	Price effect
Normal	Positive	positive	positive
Inferior	positive	negative	positive
Giffen	positive	negative	negative