Price Change: Income and Substitution Effects

THE IMPACT OF A PRICE CHANGE

- **Economists often separate the impact of a price change into two components:**
  - **the substitution effect; and**
  - **the income effect.**

THE IMPACT OF A PRICE CHANGE

- **The substitution effect involves the substitution of good x_1 for good x_2 or vice-versa due to a change in relative prices of the two goods.**
- **The income effect results from an increase or decrease in the consumer's real income or purchasing power as a result of the price change.**
- **The sum of these two effects is called the price effect.**

THE IMPACT OF A PRICE CHANGE

- **The decomposition of the price effect into the income and substitution effect can be done in several ways**
- **There are two main methods:**

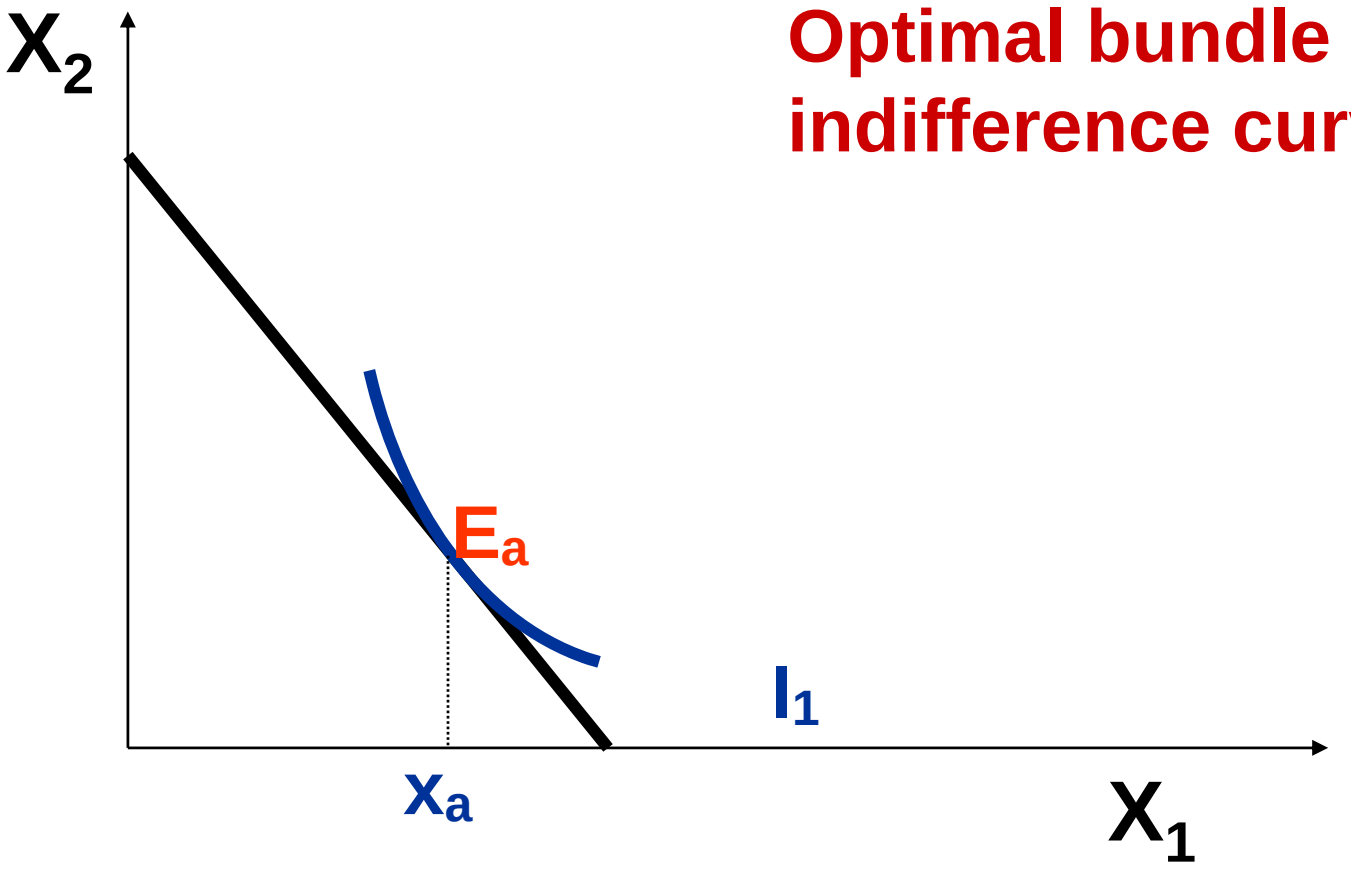
  (i) The Hicksian method; and

  (ii) The Slutsky method

THE HICKSIAN METHOD

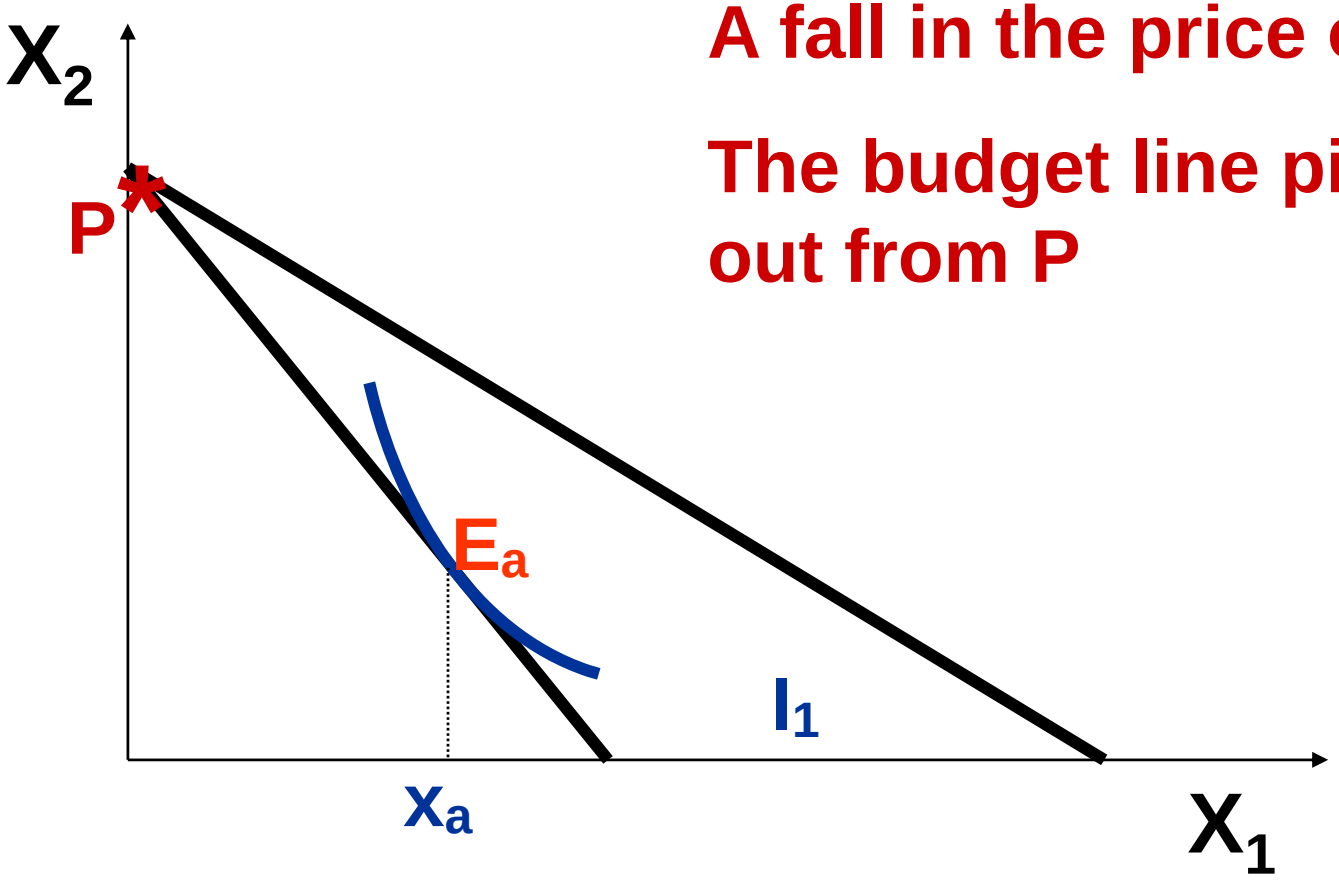
- **Sir John R.Hicks (1904-1989)**
- **Awarded the Nobel Laureate in Economics (with Kenneth J. Arrrow) in 1972 for work on general equilibrium theory and welfare economics.**

THE HICKSIAN METHOD



Optimal bundle is E_a, on indifference curve I_1.

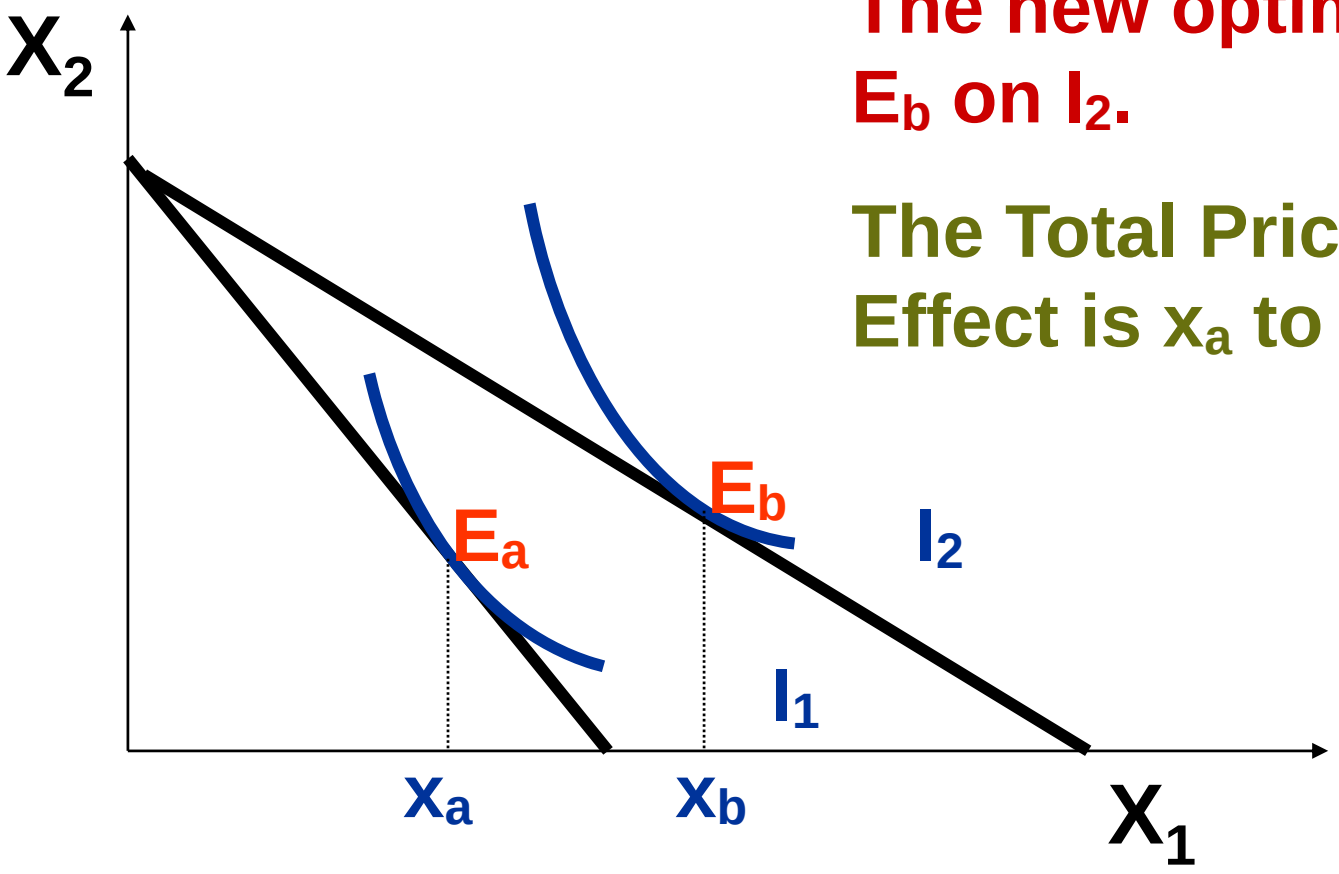
THE HICKSIAN METHOD



A fall in the price of X_1

The budget line pivots out from P

THE HICKSIAN METHOD



The new optimum is E_b on I_2.

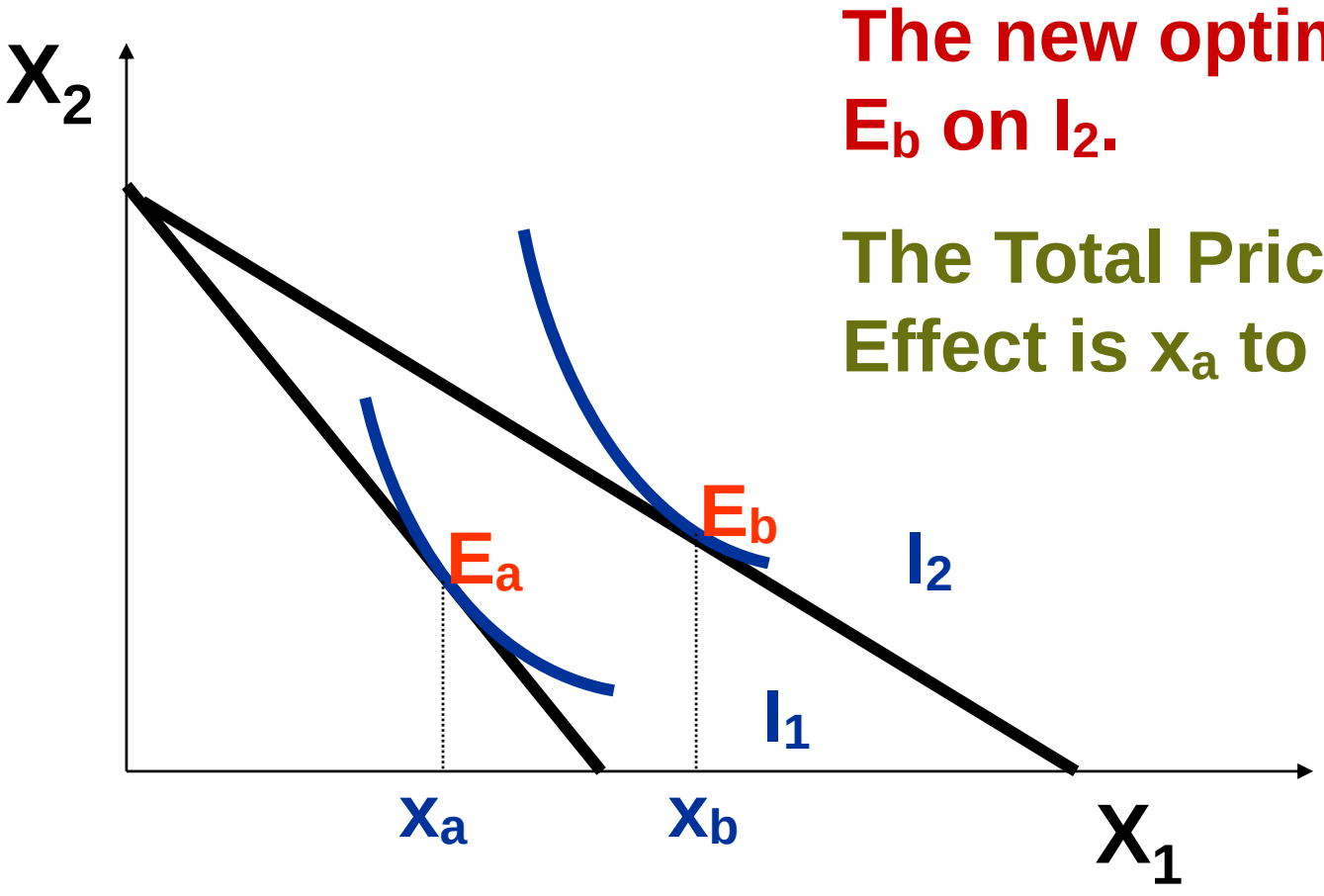
The Total Price Effect is x_a to x_b

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



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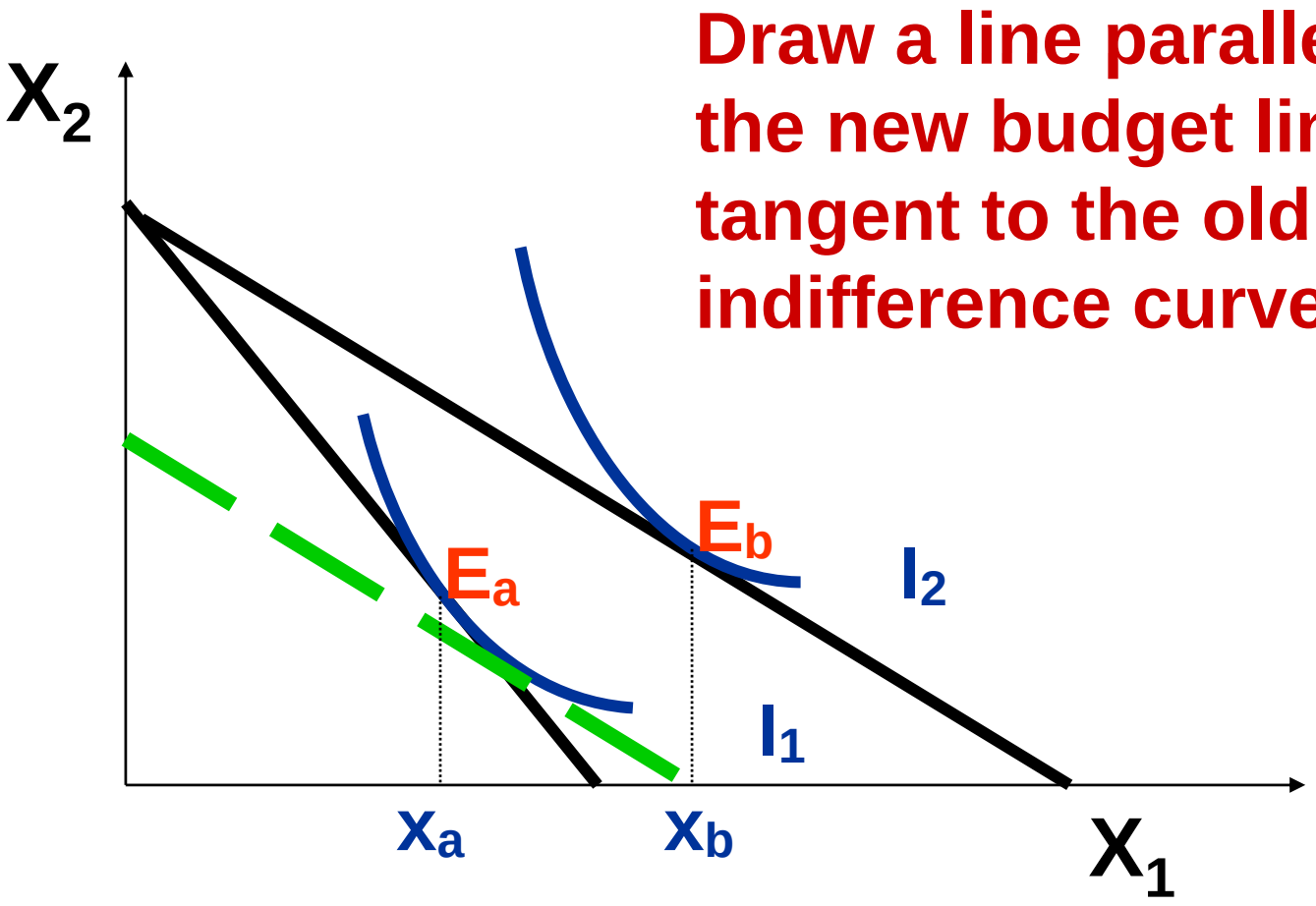
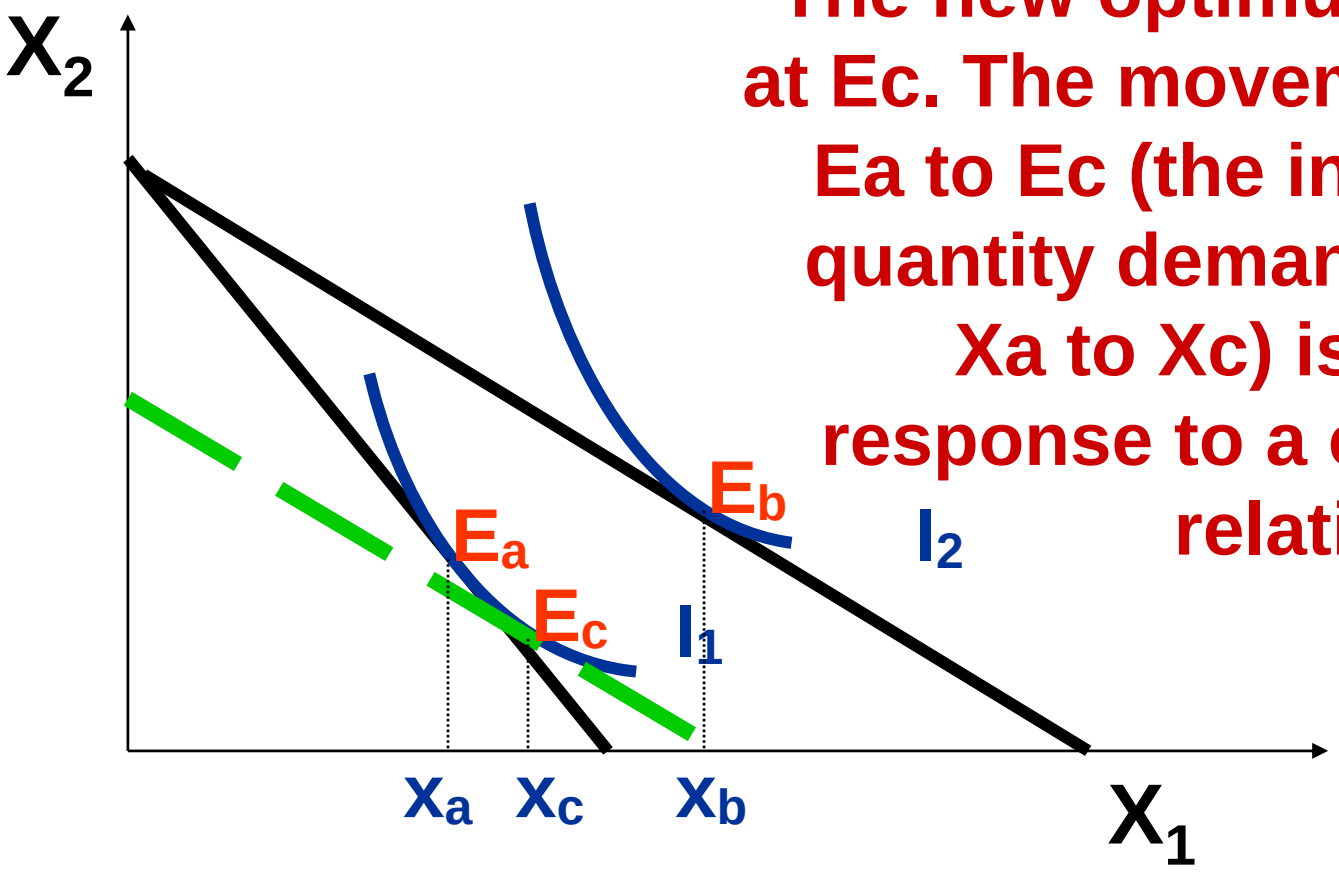
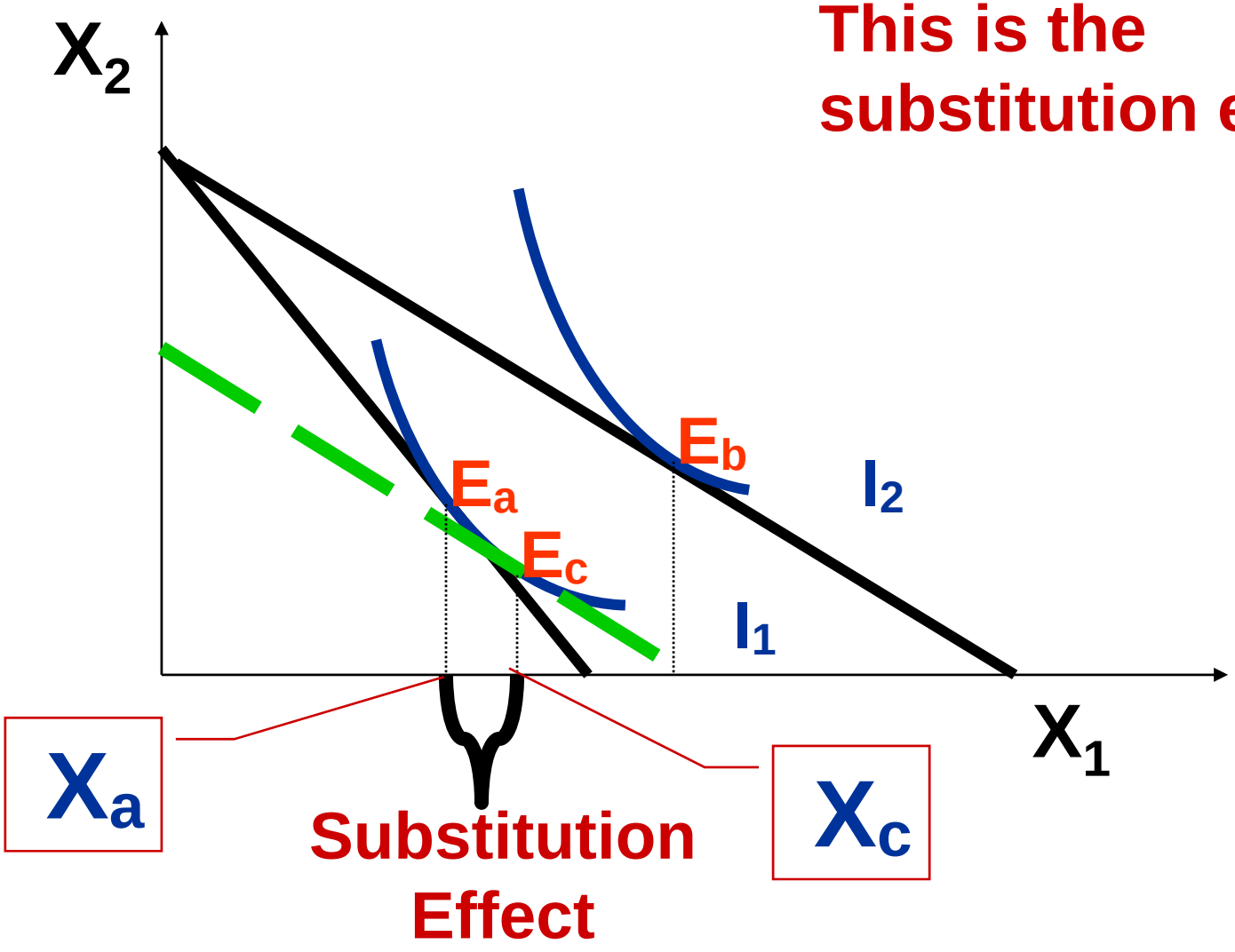


THE HICKSIAN METHOD



The new optimum on I_1 is at Ec. The movement from Ea to Ec (the increase in quantity demanded from Xa to Xc) is solely in response to a change in relative prices

THE HICKSIAN METHOD

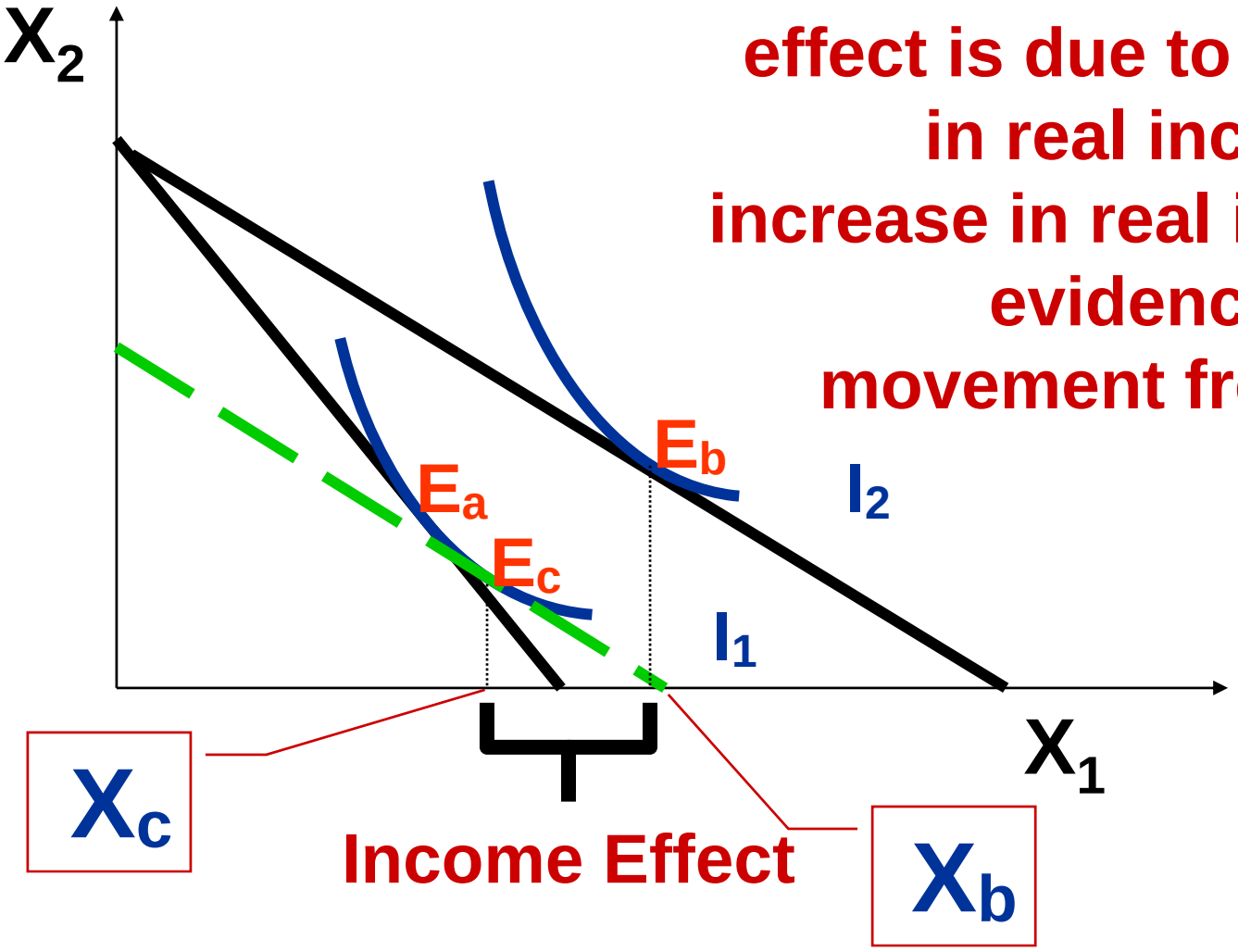


THE HICKSIAN METHOD

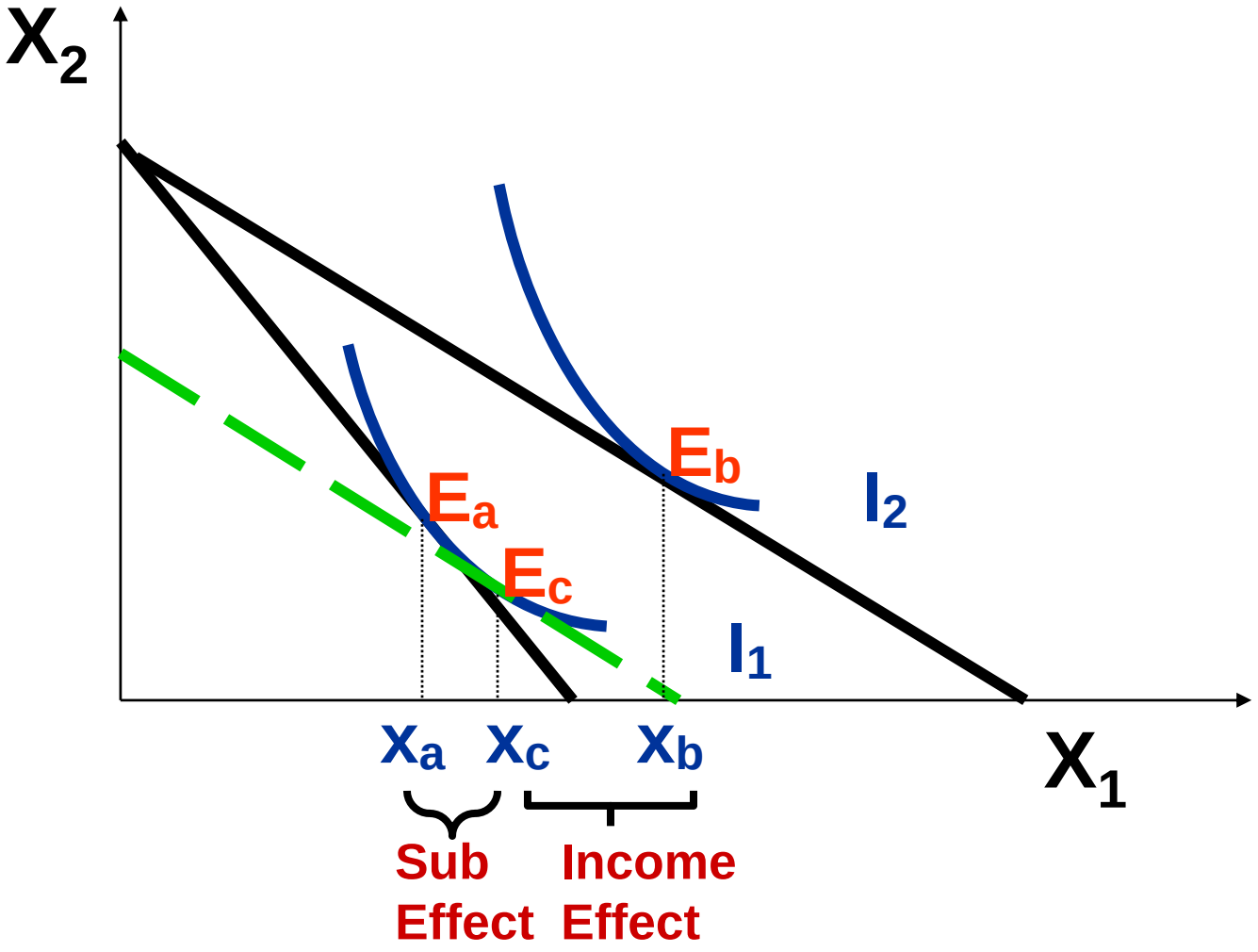
- **To isolate the income effect …**
- **Look at the remainder of the total price effect**
- **This is due to a change in real income.**

THE HICKSIAN METHOD

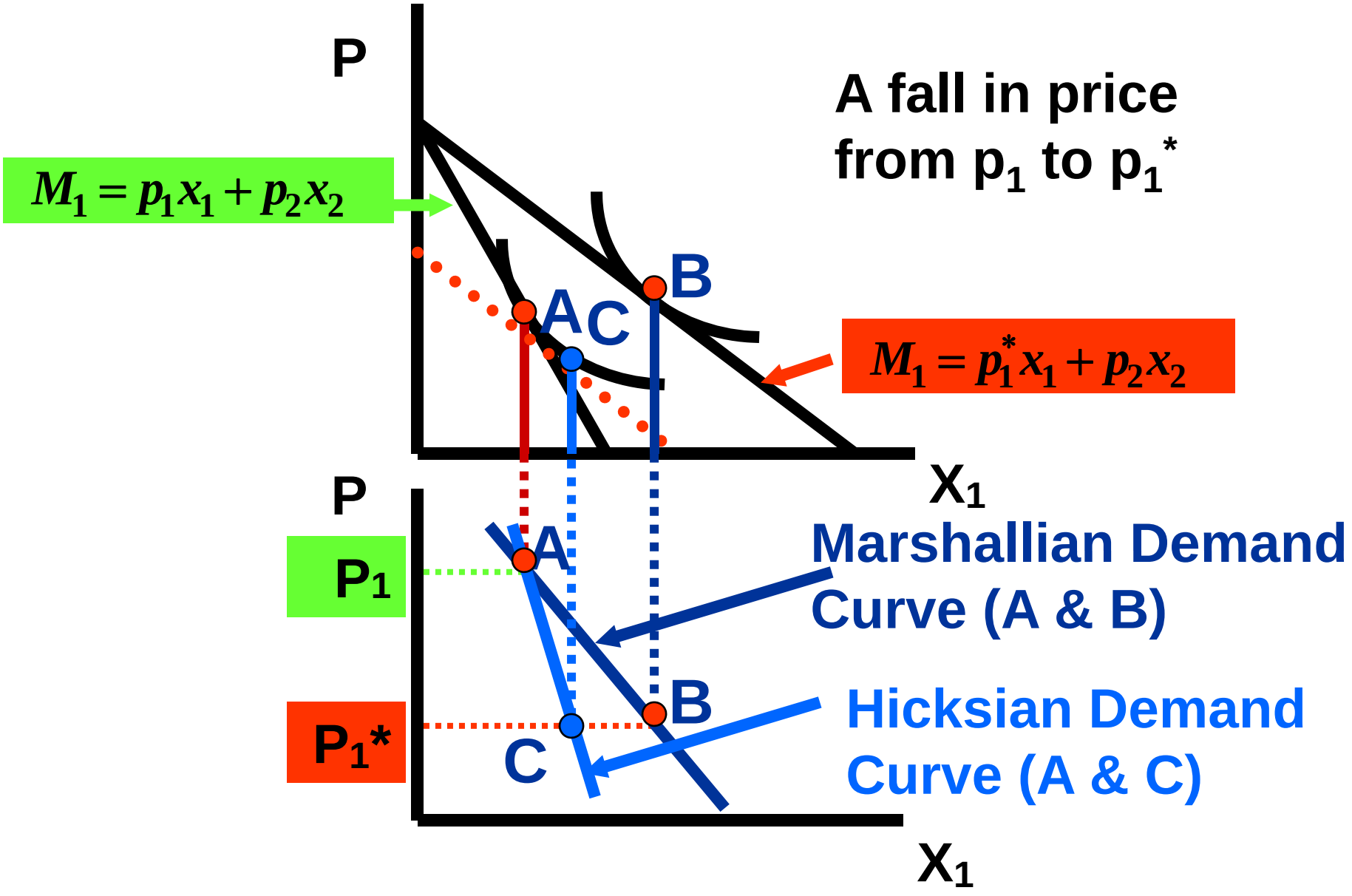
The remainder of the total effect is due to a change in real income. The increase in real income is evidenced by the movement from I_1 to I_2



THE HICKSIAN METHOD



HICKSIAN ANALYSIS and DEMAND CURVES



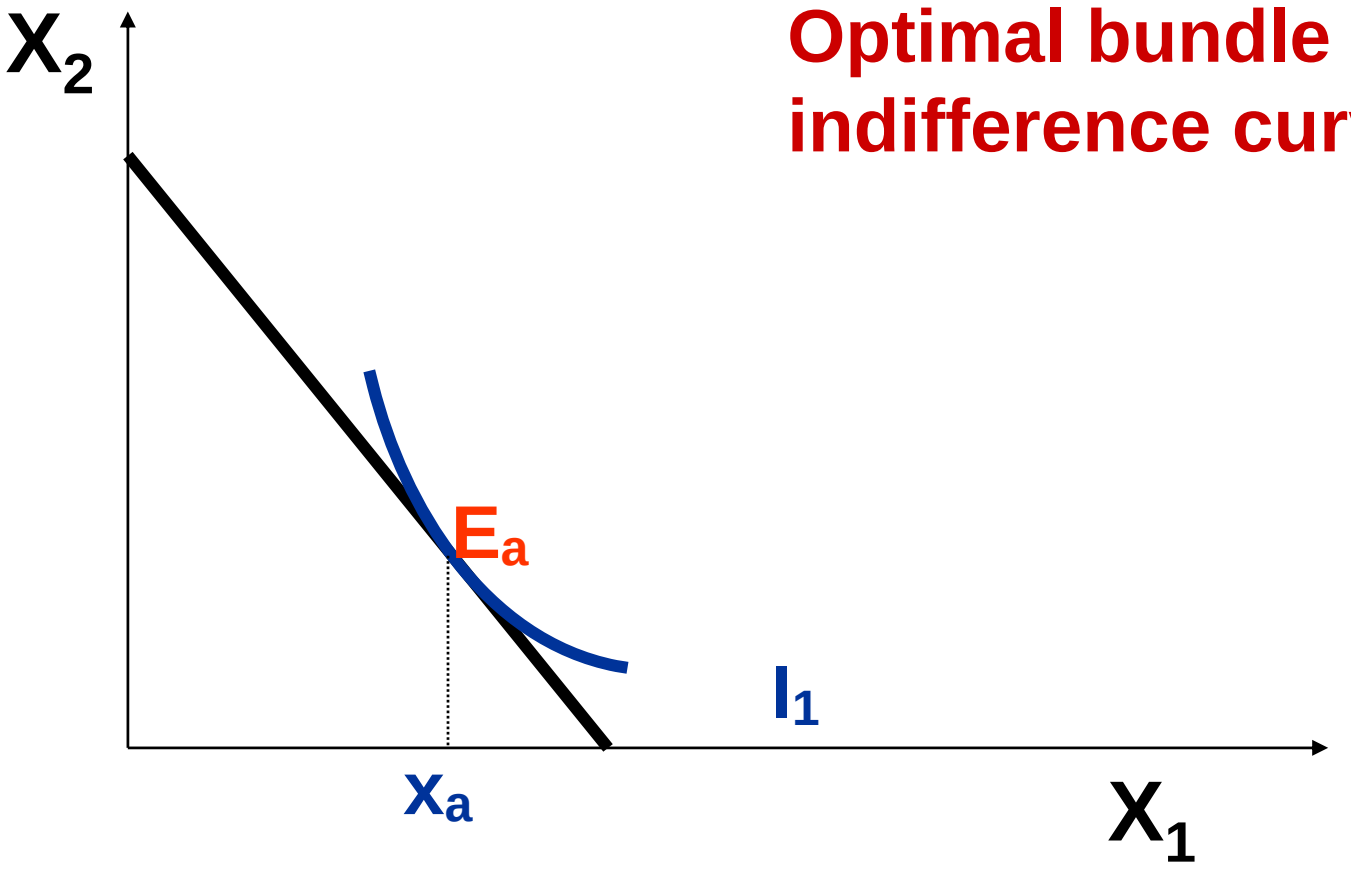
HICKSIAN ANALYSIS and DEMAND CURVES

Hicksian (compensated) demand curves cannot be upward-sloping (i.e. substitution effect cannot be positive)

THE SLUTSKY METHOD

- **Eugene Slutsky (1880-1948)**
- **Russian economist expelled from the University of Kiev for participating in student revolts.**
- **In his 1915 paper, “On the theory of the Budget of the Consumer” he introduced “Slutsky Decomposition”.**

THE SLUTSKY METHOD



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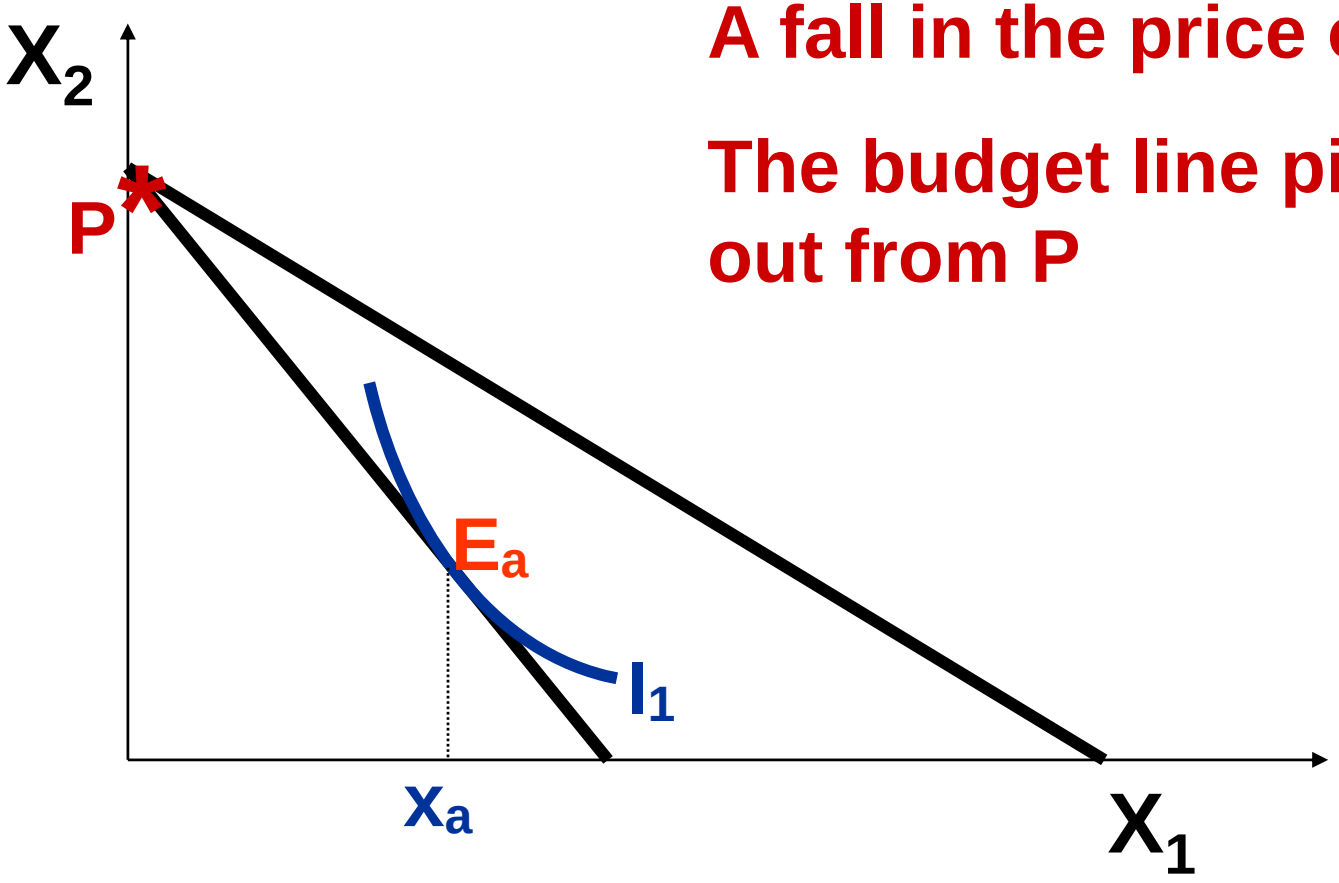
THE SLUTSKY METHOD



A fall in the price of X_1

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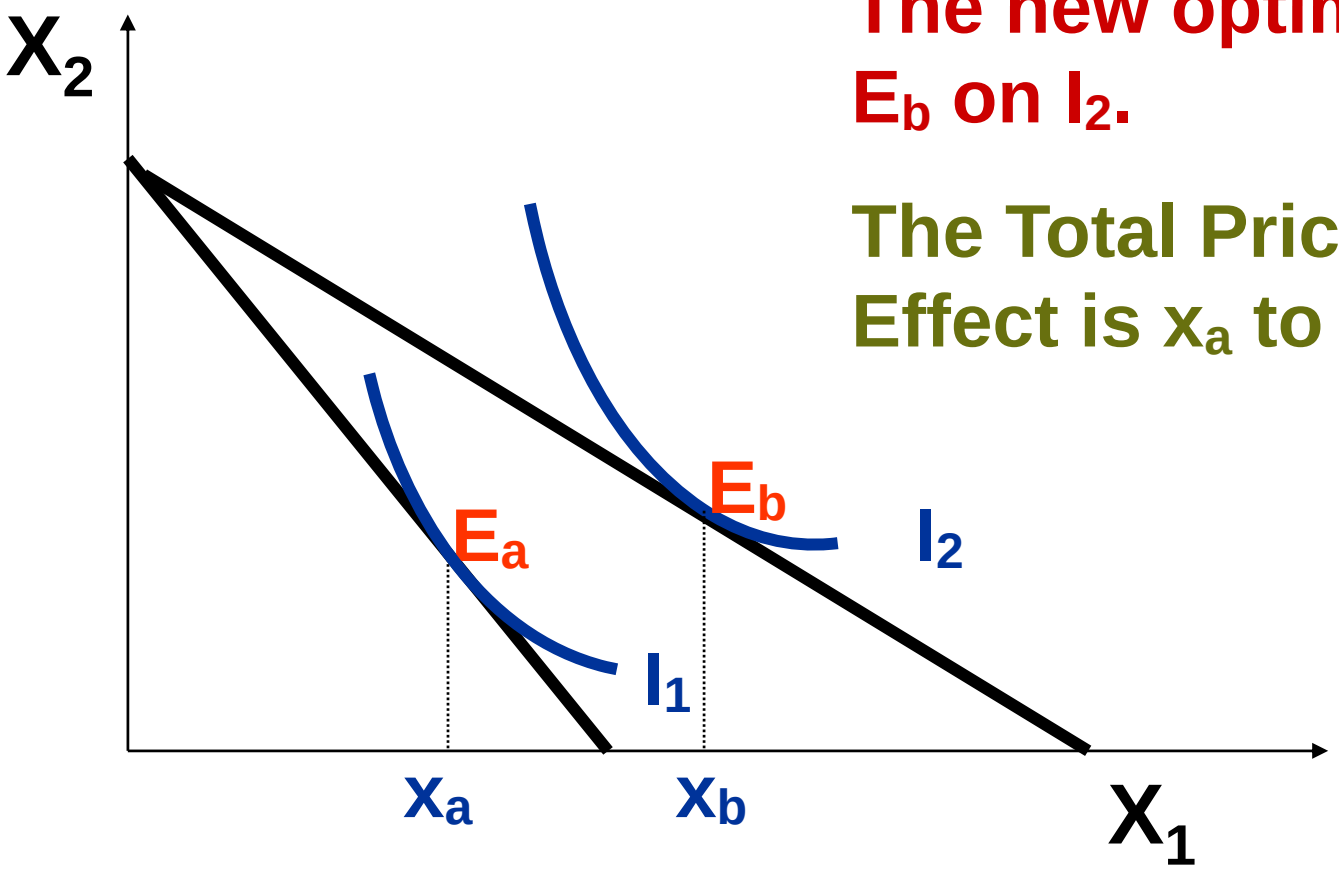
THE SLUTSKY METHOD



The new optimum is E_b on I_2.

The Total Price Effect is x_a to x_b

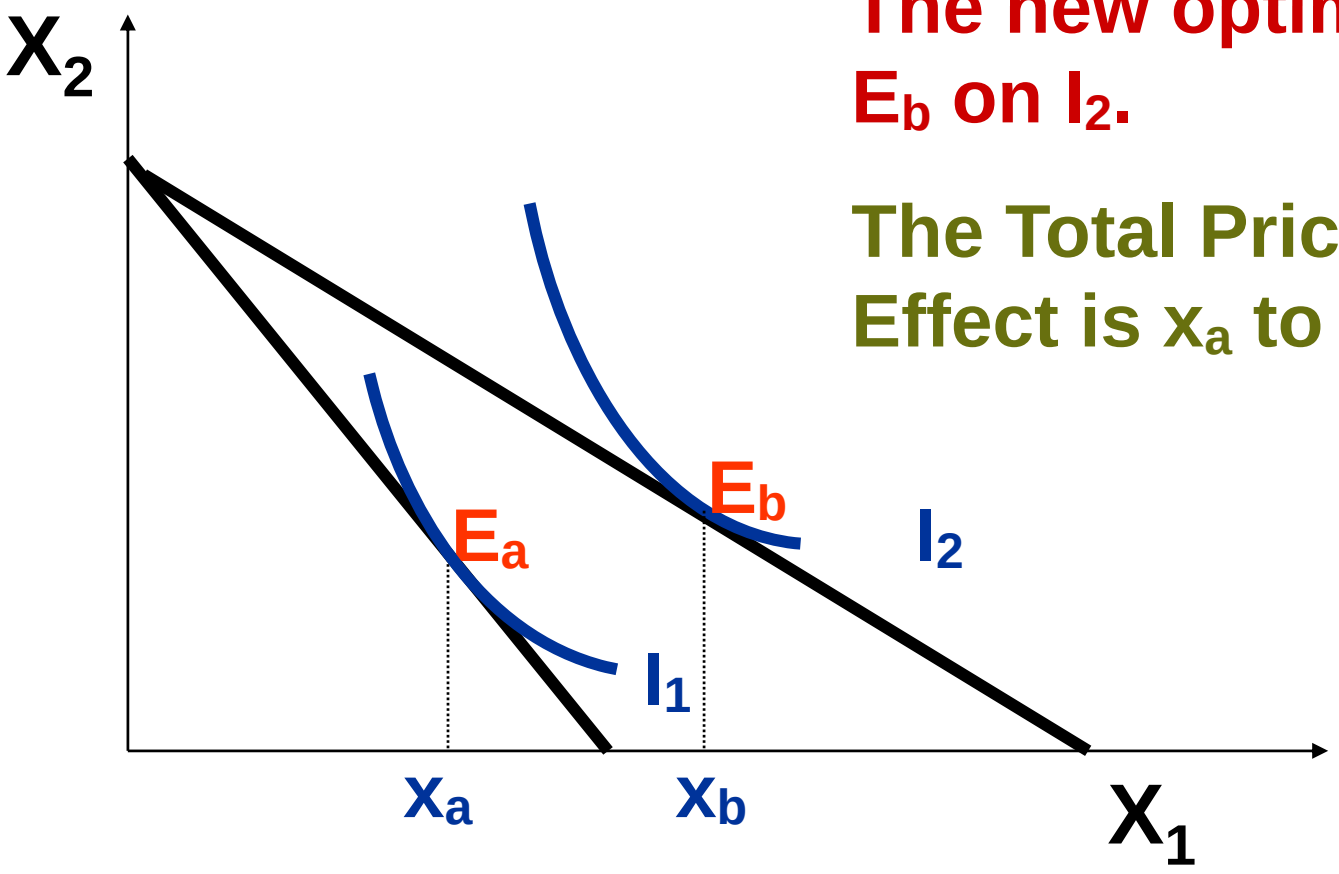
THE SLUTSKY METHOD

- **Slutsky claimed that if, 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**
- **Slutsky isolated 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 we adjust the consumer's money income so that s/he change can just afford the original consumption bundle.**
- **In other words we are holding purchasing power constant.**

THE SLUTSKY METHOD



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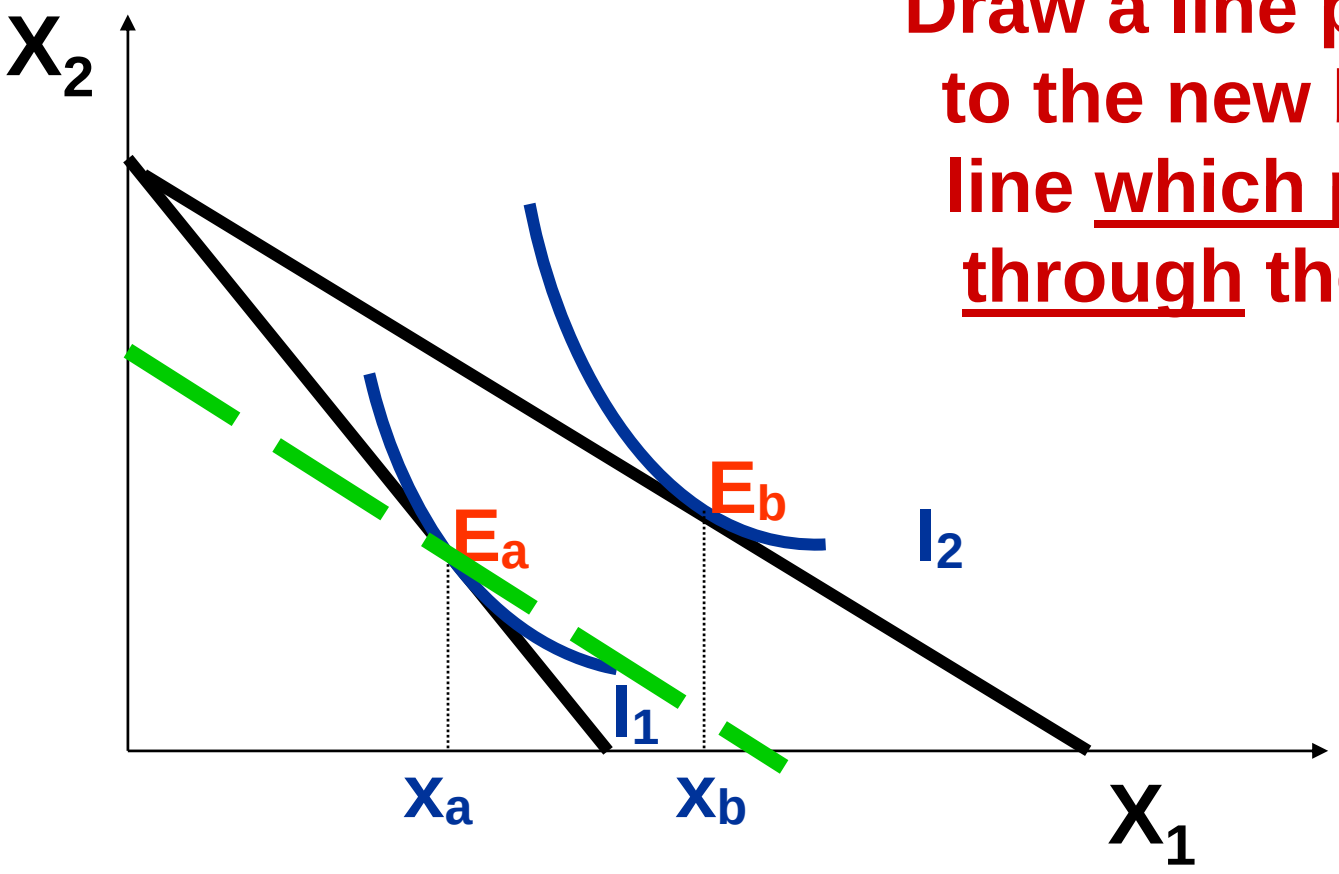
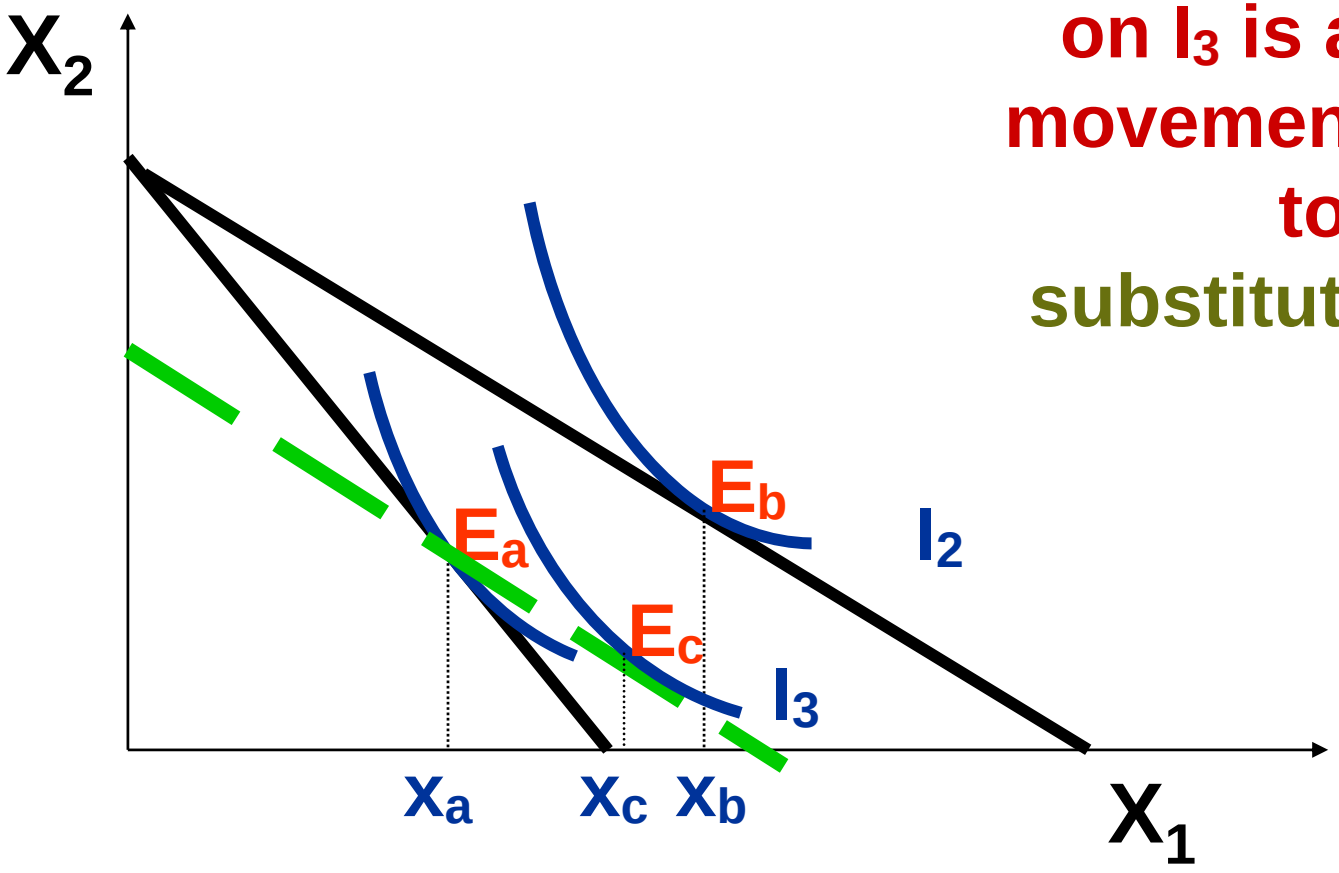
THE SLUTSKY METHOD



Draw a line parallel to the new budget line <u>which passes through</u> the point Ea.

THE SLUTSKY METHOD

The new optimum on I_3 is at Ec. The movement from Ea to Ec is the substitution effect



THE SLUTSKY METHOD

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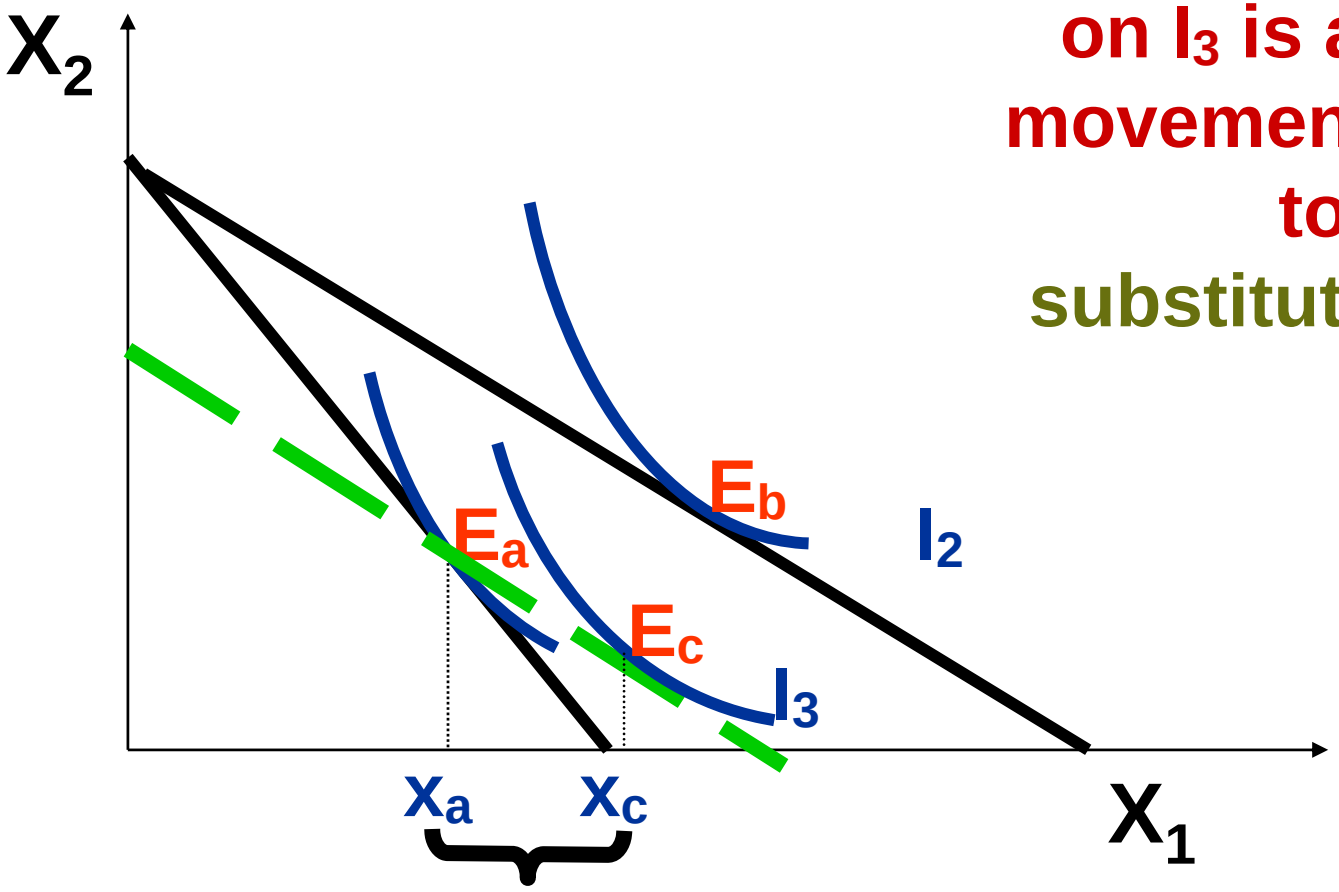
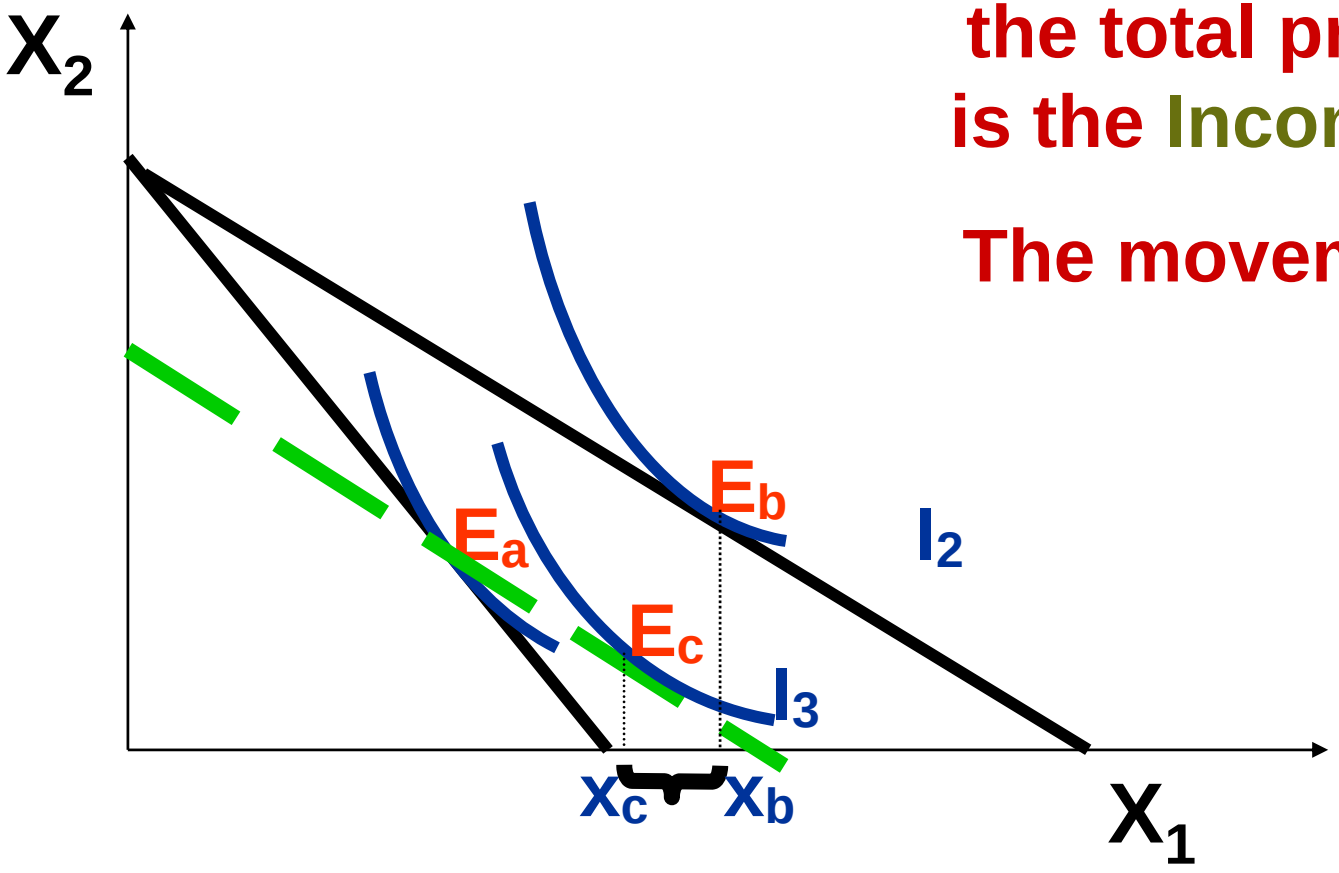


Substitution Effect

THE SLUTSKY METHOD

The remainder of the total price effect is the Income Effect.

The movement from Ec to Eb.



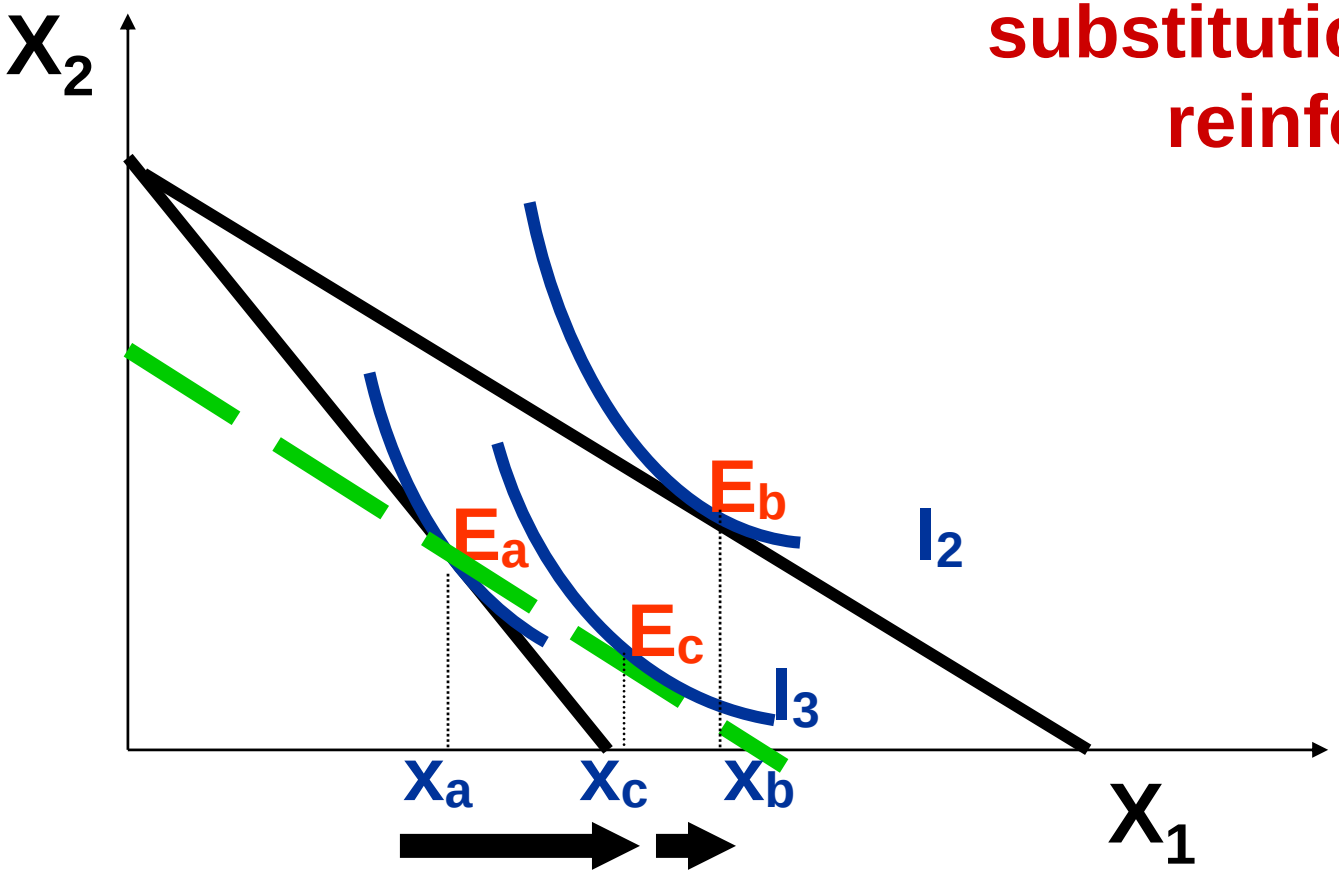
Income Effect

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.



THE SLUTSKY METHOD for NORMAL GOODS

- **Since both the substitution and income effects increase demand when own-price falls, a normal good's ordinary demand curve slopes downwards.**
- **The "Law" of Downward-Sloping Demand therefore always applies to normal goods.**

THE SLUTSKY EQUATION

Let

$$M_1 = p_1 x_1 + p_2 x_2$$

be the original budget constraint

and let

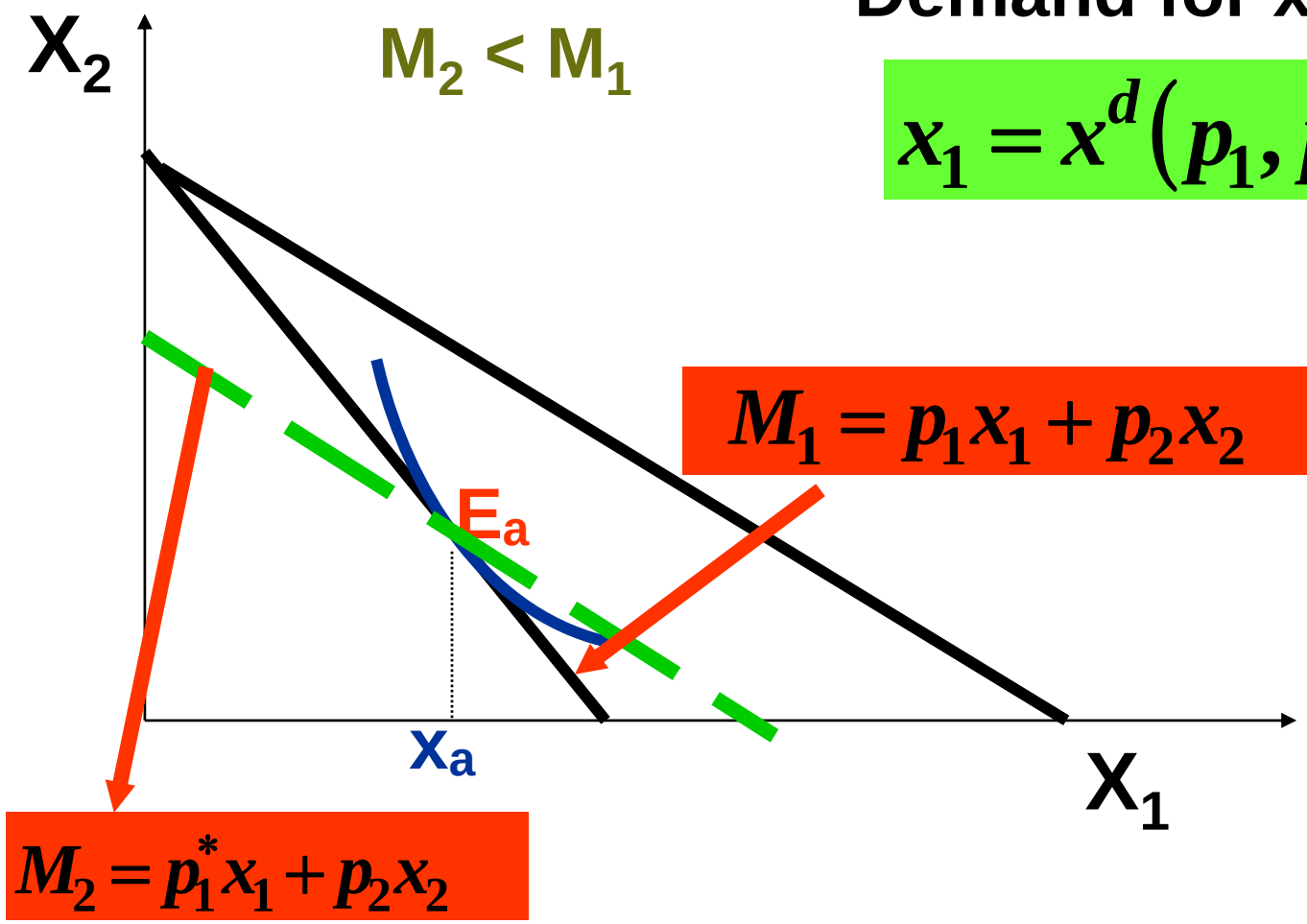
$$M_2 = p_1^* x_1 + p_2 x_2$$

represent the budget constraint after the Slutsky compensating variation in income has been carried out.

THE SLUTSKY EQUATION

Demand for x_1 is

$$x_1 = x^d(p_1, p_2, M)$$



THE SLUTSKY EQUATION

$M_2 - M_1$

$$\Delta M = M_2 - M_1 = \left(p_1^* x_1 + p_2 x_2\right) - \left(p_1 x_1 + p_2 x_2\right)$$

$$\Delta M = M_2 - M_1 = p_1^* x_1 + p_2 x_2 - p_1 x_1 - p_2 x_2$$

$$\Delta M = M_2 - M_1 = p_1^* x_1 - p_1 x_1$$

$$\Delta M = M_2 - M_1 = x_1\left(p_1^* - p_1\right)$$

$$\Delta M = x_1 \Delta p_1 \quad as \quad \left(p_1^* - p_1\right) = \Delta p_1$$

gives the change in money income needed to consume the original bundle of goods (at E_A)

$$\Delta M = x_1 \Delta p_1$$

THE SLUTSKY EQUATION

The demand curve holding M constant is given by

$$\Delta x_1 = x^d\left(p_1^*, p_2, M_1\right) - x^d\left(p_1, p_2, M_1\right) \qquad (1)$$

which is the change in demand for x_1 due to the change in its own price, holding M and the price of x_2 constant

THE SLUTSKY EQUATION

The income effect is given by

$$\Delta x_m = x^d\left(p_1^*, p_2, M_1\right) - x^d\left(p_1^*, p_2, M_2\right) \qquad (2)$$

The change in demand due to the Slutsky substitution effect is given by

$$\Delta x_s = x^d\left(p_1^*, p_2, M_2\right) - x^d\left(p_1, p_2, M_1\right) \qquad (3)$$

THE SLUTSKY EQUATION

Given

$$\Delta x_1 = x^d\left(p_1^*, p_2, M_1\right) - x^d\left(p_1, p_2, M_1\right) \quad (1)$$

$$\Delta x_m = x^d\left(p_1^*, p_2, M_1\right) - x^d\left(p_1^*, p_2, M_2\right) \quad (2)$$

$$\Delta x_s = x^d\left(p_1^*, p_2, M_2\right) - x^d\left(p_1, p_2, M_1\right) \quad (3)$$

Claim

$$\Delta x_1 = \Delta x_s + \Delta x_m \quad (4)$$

Show this by substituting equations (1), (2) and (3) into equation (4)

THE SLUTSKY EQUATION

$$\Delta x_1 = \Delta x_s + \Delta x_m$$

Divide across by Δp_1

$$\frac{\Delta x_1}{\Delta p_1} = \frac{\Delta x_s}{\Delta p_1} + \frac{\Delta x_m}{\Delta p_1}$$

Recall $\Delta M = x_1 \Delta p_1$

so $\Delta p_1 = (-)\, \Delta M / x_1$

THE SLUTSKY EQUATION

Substituting

$$\Delta p_1 = (-)\Delta M / x_1$$

$$\frac{\Delta x_1}{\Delta p_1} = \frac{\Delta x_s}{\Delta p_1} + \frac{\Delta x_m}{\Delta p_1}$$

Gives

$$\frac{\Delta x_1}{\Delta p_1} = \frac{\Delta x_s}{\Delta p_1} - \frac{\Delta x_m}{\Delta M} x_1$$

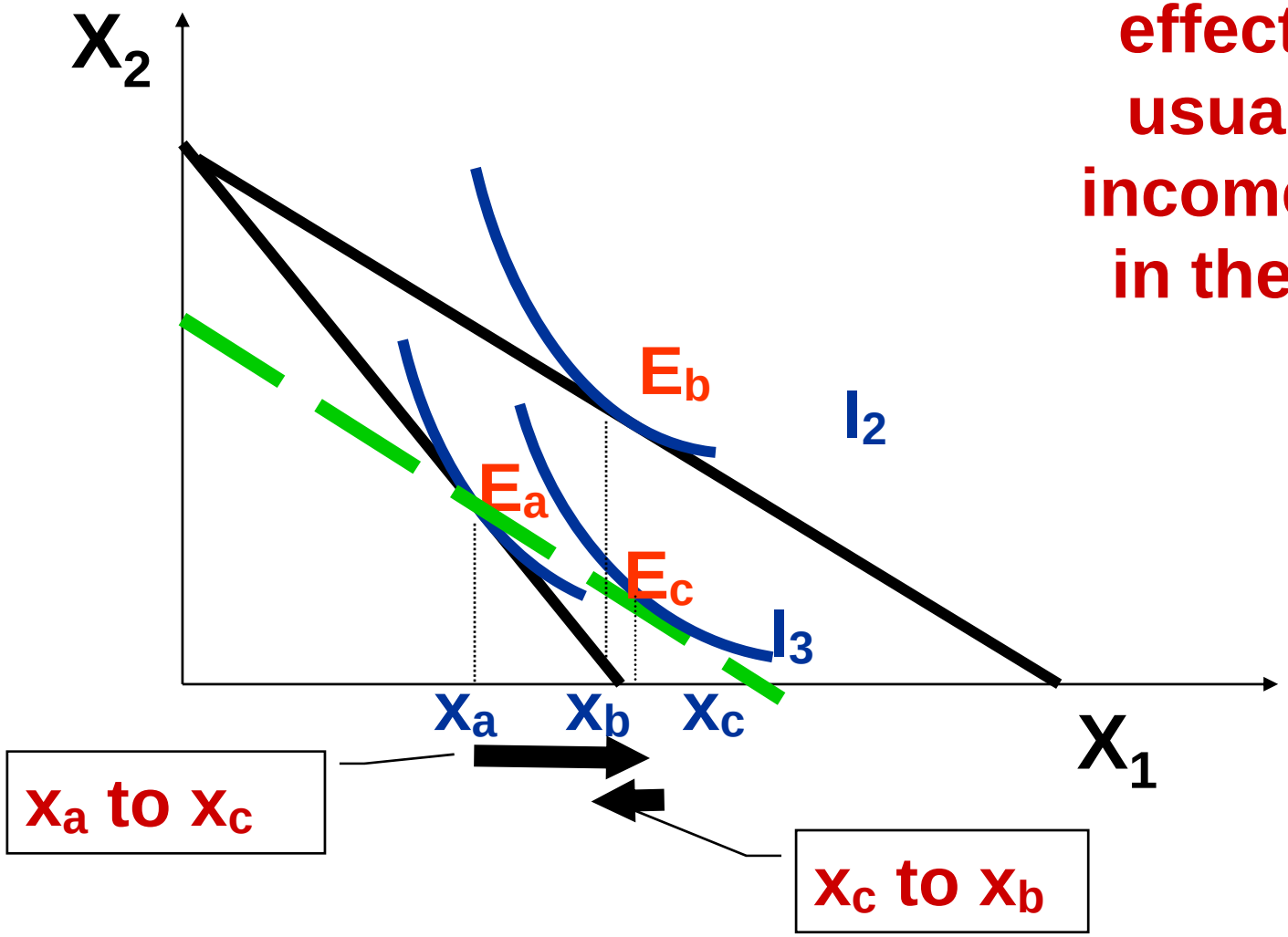
THE SLUTSKY EQUATION

THE SLUTSKY METHOD: 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

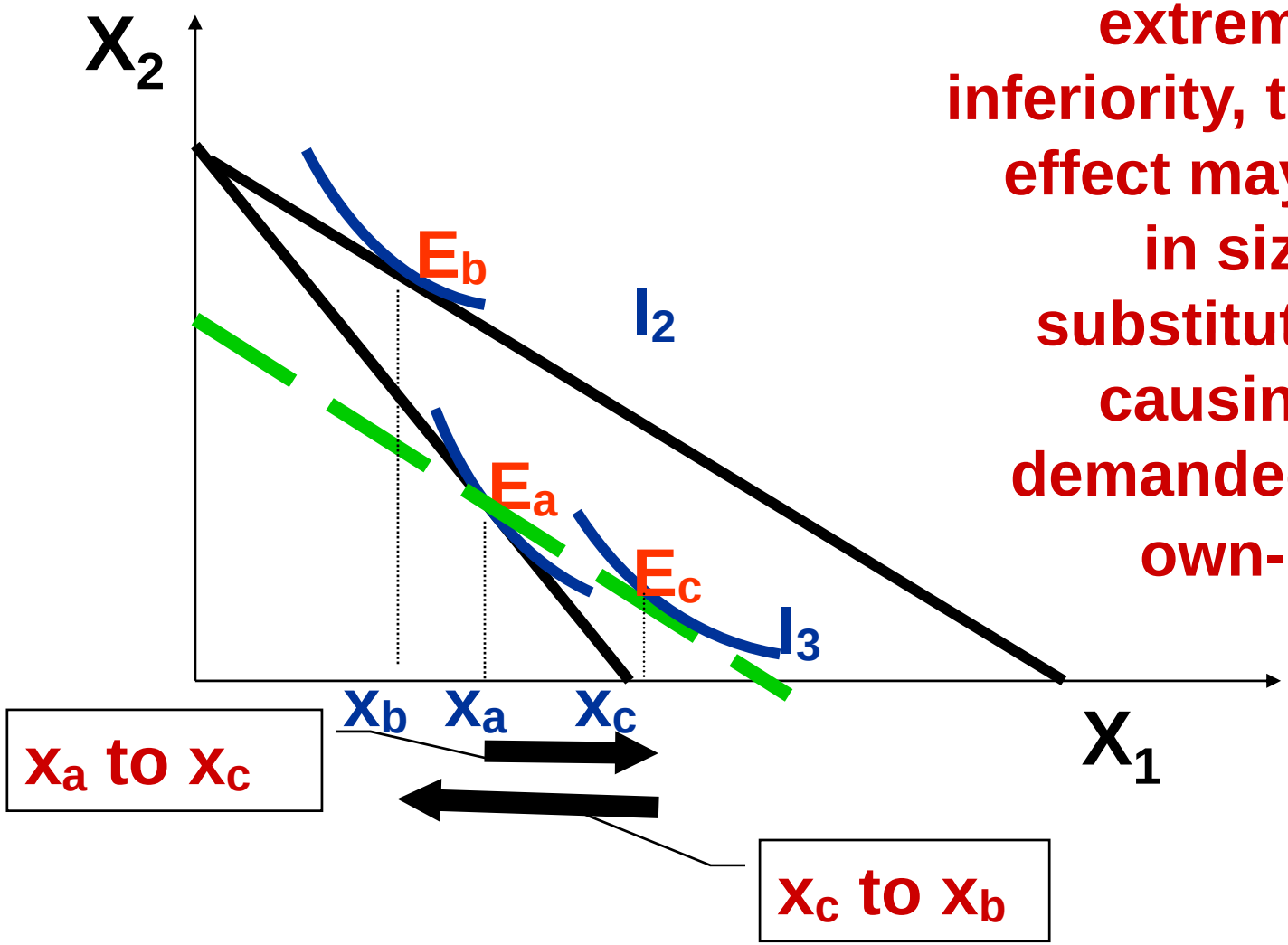
The substitution effect is as per usual. But, the income effect is in the opposite direction.



GIFFEN GOODS

- **In rare cases of extreme inferiority, the income effect may be larger in size than the substitution effect, causing quantity demanded to rise as own price falls.**
- **Such goods are Giffen goods.**
- **Giffen goods are very inferior goods.**

THE SLUTSKY METHOD for INFERIOR GOODS

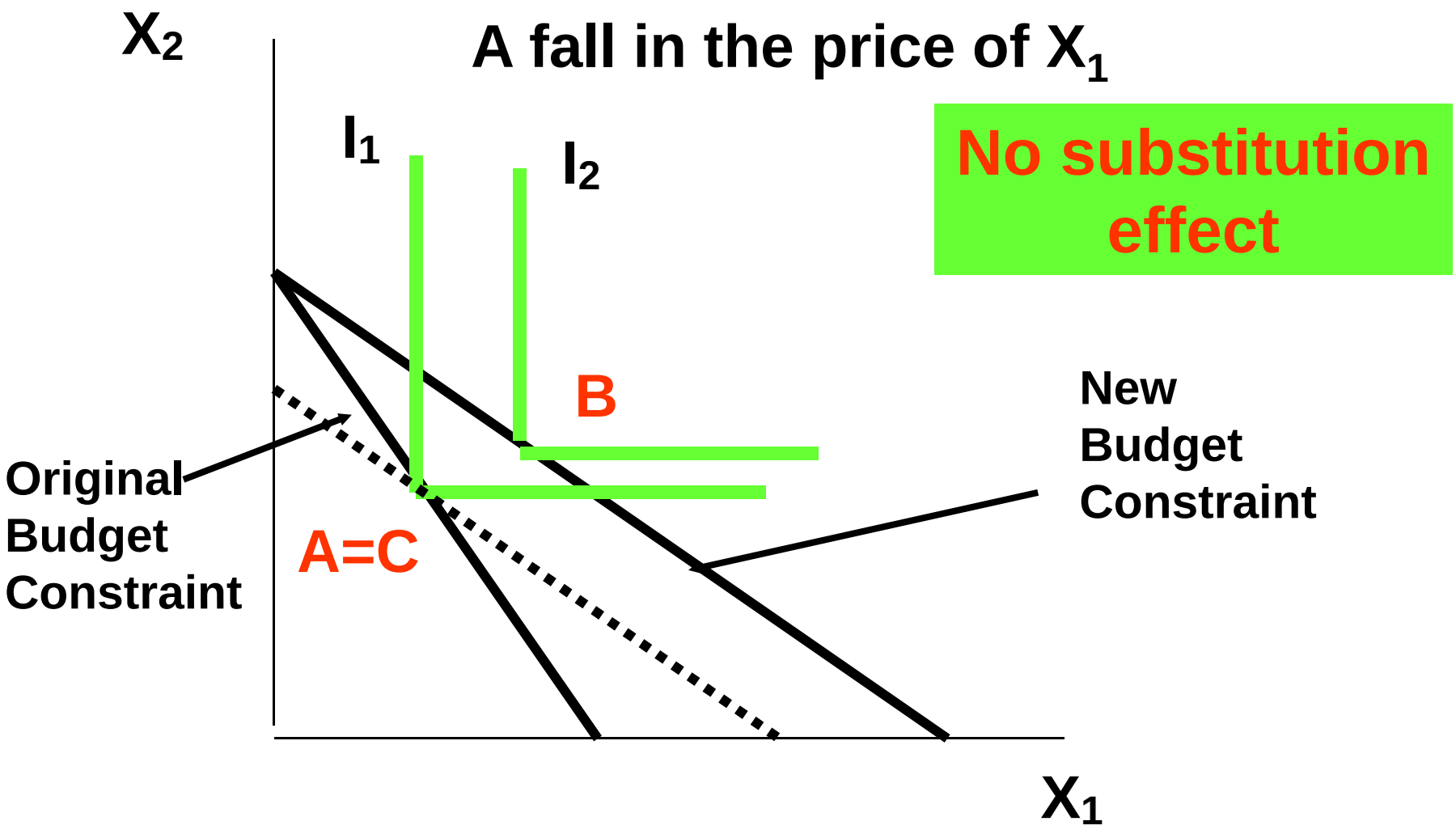


In rare cases of extreme income-inferiority, the income effect may be larger in size than the substitution effect, causing quantity demanded to fall as own-price falls.

SLUTSKY'S EFFECT FOR GIFFEN GOODS

- **Slutsky's decomposition of the effect of a price change into a pure substitution effect and an income effect thus explains why the "Law" of Downward-Sloping Demand is violated for very inferior goods.**

DECOMPOSITION of TOTAL PRICE EFFECT: PERFECT COMPLEMENTS



DECOMPOSITION of TOTAL PRICE EFFECT

PERFECT SUBSTITUTES

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