Microeconomics

EVROPSKÁ UNIE
Evropské strukturální a investiční fondy
Operační program Výzkum, vývoj a vzdělávání

MINISTERSTVO ŠKOLSTVÍ,
MLÁDEŽE A TĚLOVÝCHOVY

Lecture 3

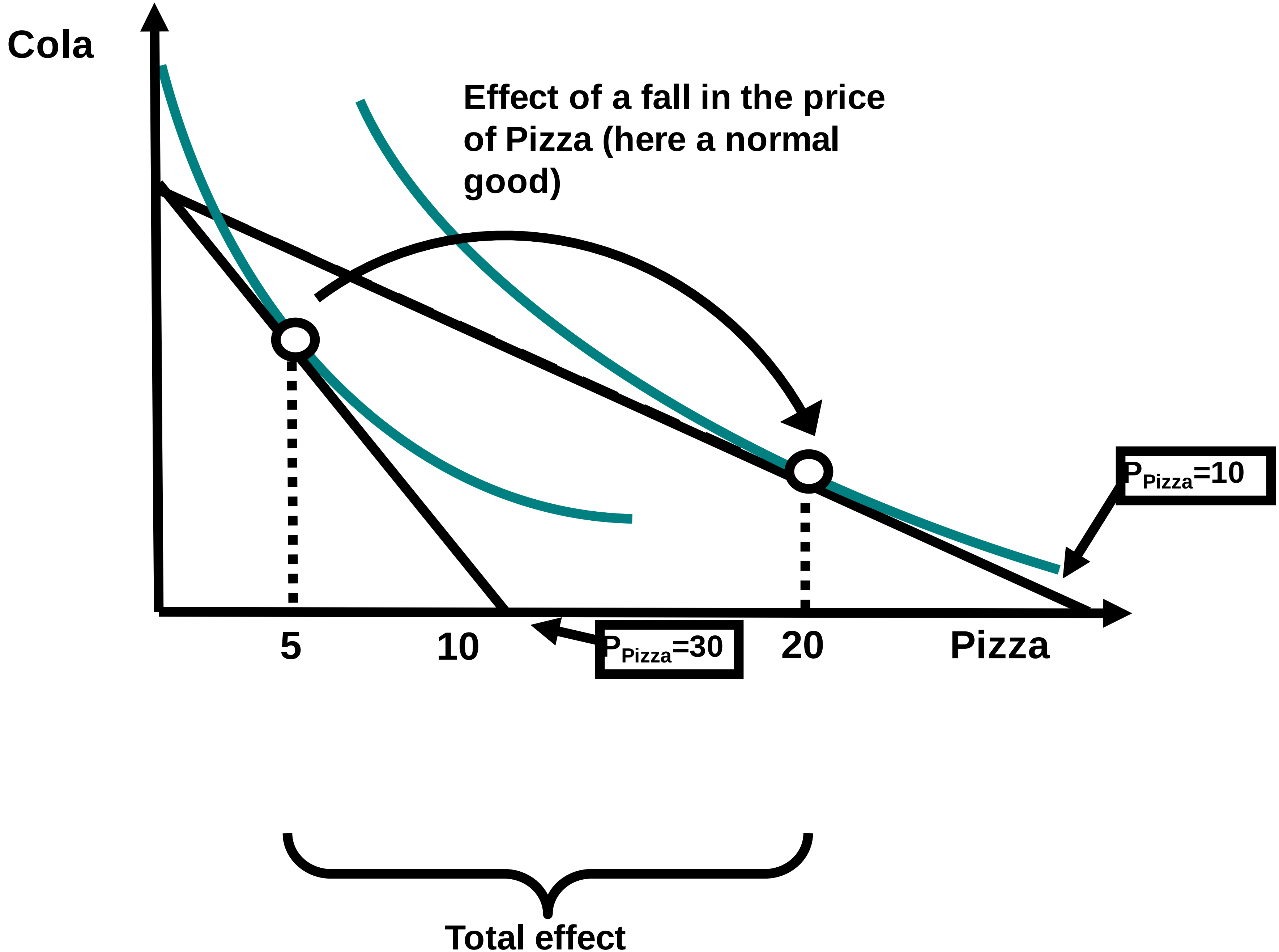
Silvester van Koten

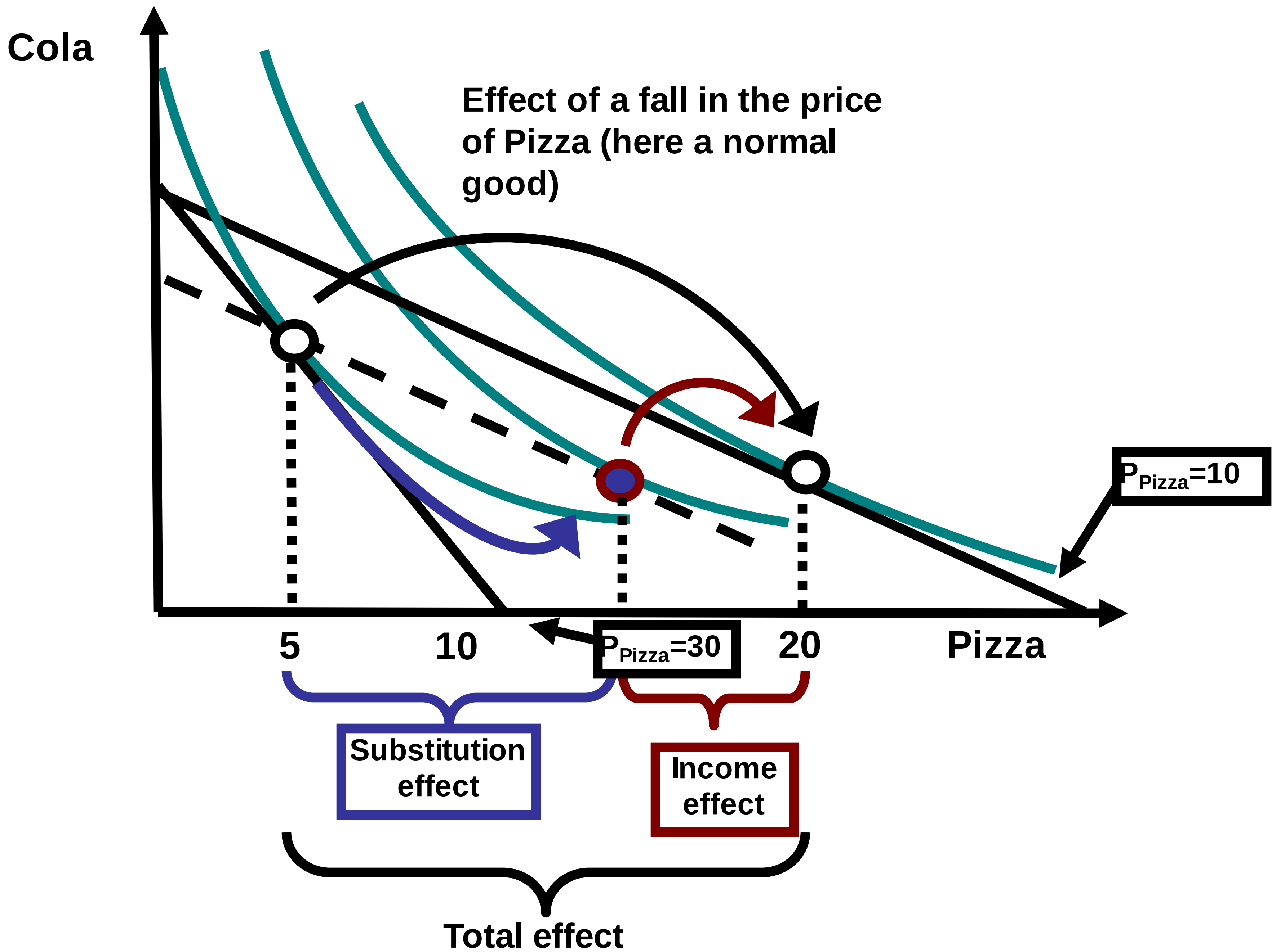
- The presentation is based on the following sources:

- Snyder Christopher M Walter Nicholson and Robert Stewart. 2015. Microeconomic Theory : Basic Principles and Extensions EMEA ed. Andover: Cengage Learning. +
- Varian Hal R. 2020. Intermediate Microeconomics : A Modern Approach Ninth ed. New York: W.W. Norton & Company. +
- Excerpts from Gravelle H O Hart and R Rees. 2004. Advanced Microeconomics.

Warning

  - Up till now all the Hicks substitution effect (8.8)
  - There is also the Slutsky substitution effect
- What is the difference?


Cola
Effect of a fall in the price of Pizza (here a normal good)
P_{Pizza}=10
P_{Pizza}=30
5
10
20
Pizza
Total effect



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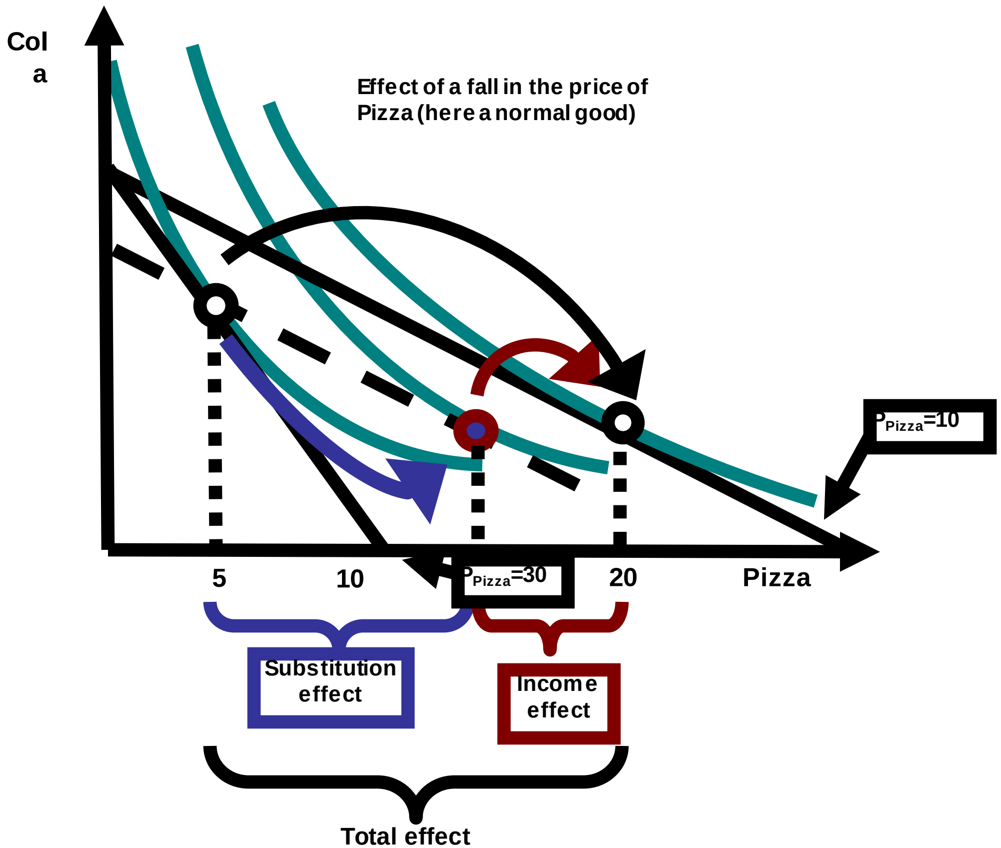


1. Draw the new price line (P_{Pizza}=10)
2. Find the point where a IC touches the new price line
3. The difference between the original point and the new point is **the total effect.**
4. Move the new price line, until it is *going through the original consumption point*
5. Mark the point where it touches with a special “in-between point”.
6. Now:
   - The difference between the original point and the “in-between” point is the substitution effect. (a movement along the IC)
   - The difference between the “in-between” point and new point the income effect (a movement between the two parallel budged lines).

How must the budget be adjusted to be able to buy the original bundle?

$$m' = p_1' x_1 + p_2 x_2$$
$$m = p_1 x_1 + p_2 x_2$$

$$m' - m = x_1 [p_1' - p_1]$$

$$\Delta m = x_1 \Delta p_1$$

Substitution effect

$$\Delta x_1^s = x_1(p_1', m') - x_1(p_1, m)$$

$$m' - m = x_1[p_1' - p_1]$$

EXAMPLE: Calculating the Substitution Effect

Suppose that the consumer has a demand function for milk of the form

$$x_1 = 10 + \frac{m}{10p_1}.$$

Originally his income is \$120 per week and the price of milk is \$3 per quart. Thus his demand for milk will be $10 + 120/(10 \times 3) = 14$ quarts per week.

$$x_1 = 10 + \frac{m}{10p_1}$$

income is \$120

price of milk is \$3

demand for milk will be $10 + 120/(10 \times 3) = 14$

price of milk falls to \$2

demand at this new price will be $10 + 120/(10 \times 2) = 16$

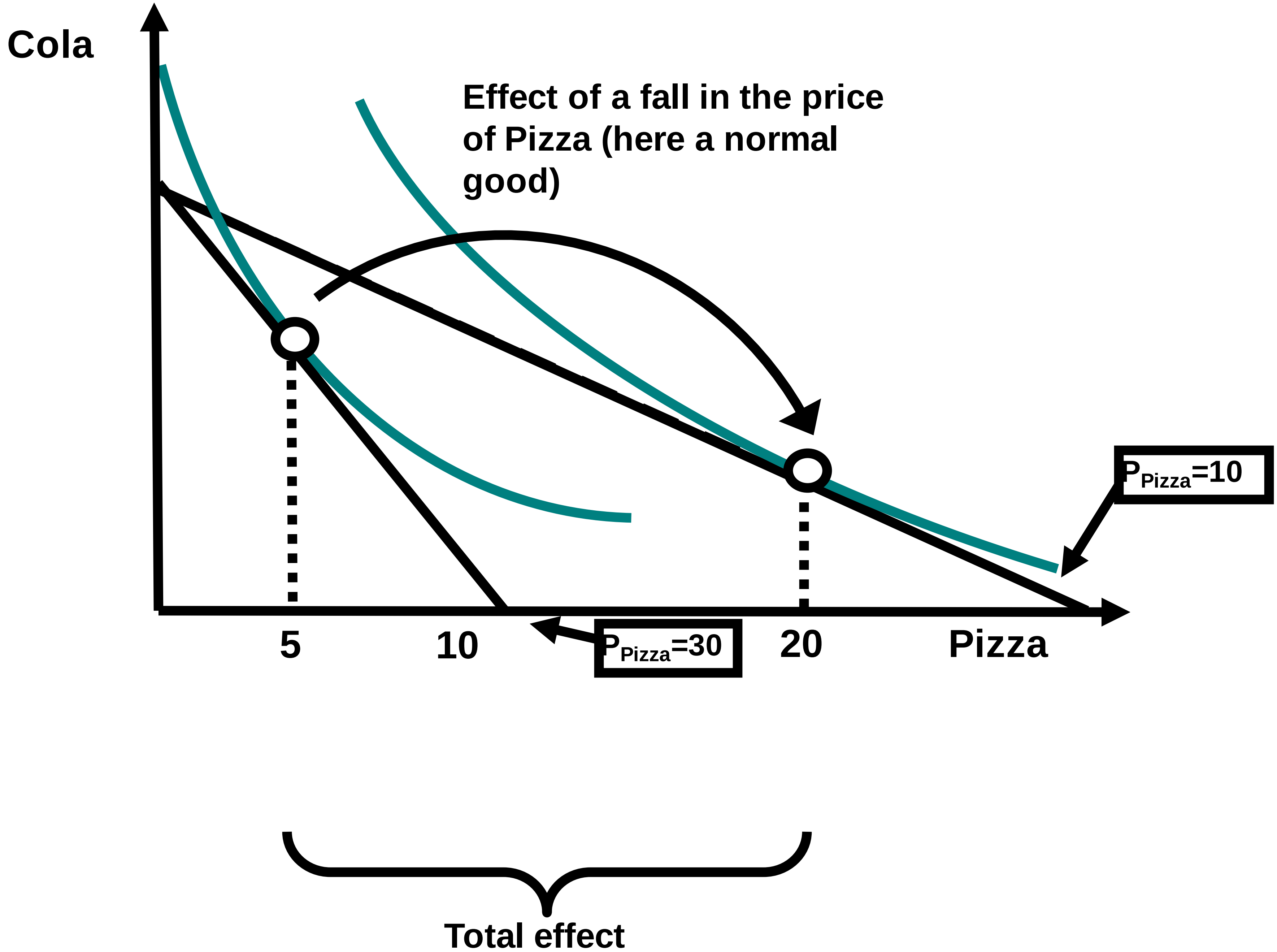
$$\Delta m = x_1 \Delta p_1 = 14 \times (2 - 3) = -\$14.$$

$$m' = m + \Delta m = 120 - 14 = 106.$$

$$x_1(p_1', m') = x_1(2, 106) = 10 + \frac{106}{10 \times 2} = 15.3.$$

$$\Delta x_1^s = x_1(2, 106) - x_1(3, 120) = 15.3 - 14 = 1.3$$

The income effect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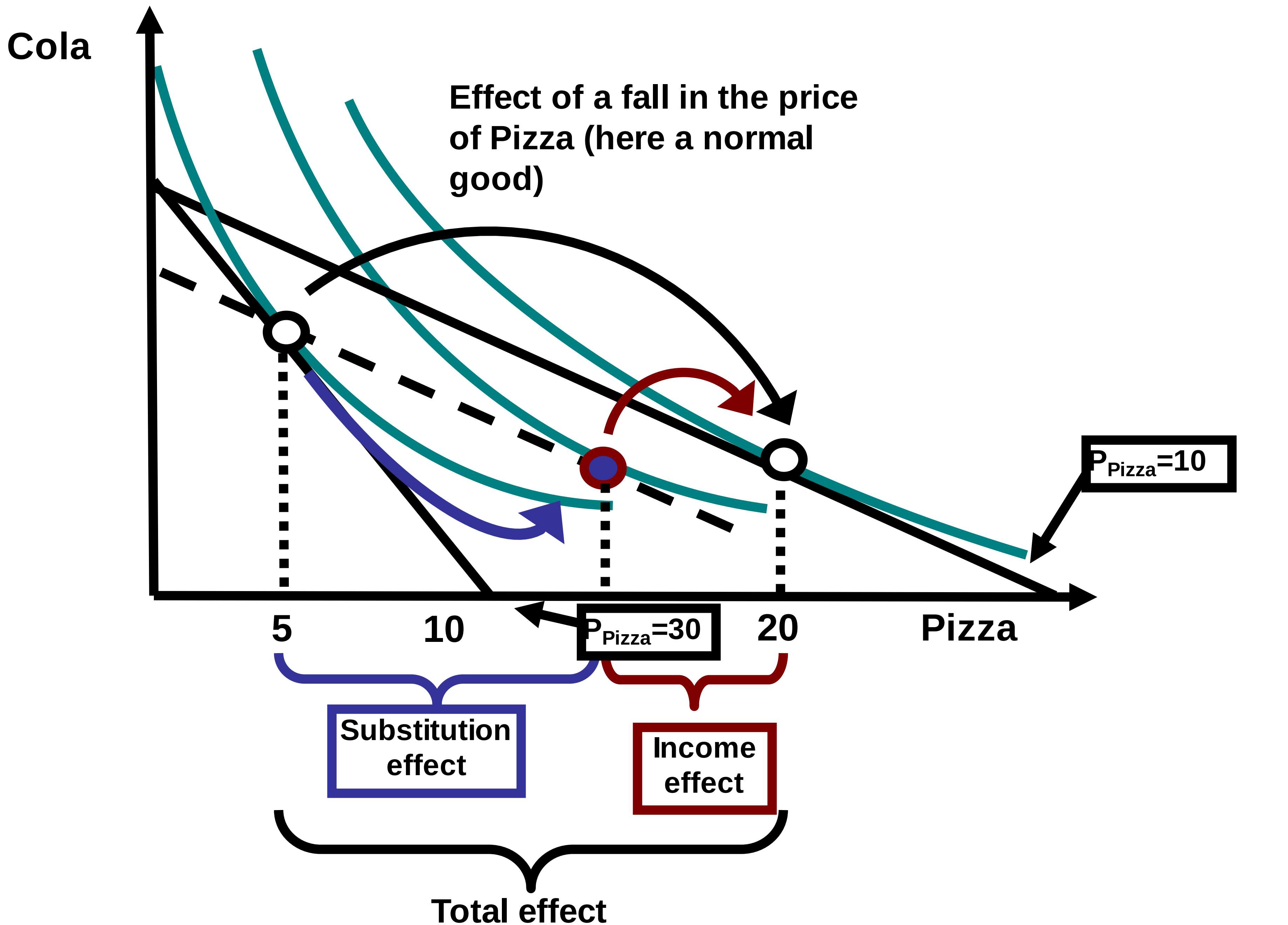

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The income effect

$$\Delta x_1^n = x_1(p_1', m) - x_1(p_1', m')$$

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What is the income effect?

$$x_1 = 10 + \frac{m}{10p_1}$$

income is \$120

price of milk is \$3

demand for milk will be $10 + 120/(10 \times 3) = 14$

price of milk falls to \$2

$\boxed{\text{demand at this new price will be } 10 + 120/(10 \times 2) = 16}$

$$\Delta m = x_1 \Delta p_1 = 14 \times (2 - 3) = -\$14.$$

$$m' = m + \Delta m = 120 - 14 = 106.$$

$$\boxed{x_1(p_1', m') = x_1(2, 106) = 10 + \frac{106}{10 \times 2} = 15.3.}$$

$$\Delta x_1^s = x_1(2, 106) - x_1(3, 120) = 15.3 - 14 = 1.3$$

EXAMPLE: Calculating the Substitution Effect

Suppose that the consumer has a demand function for milk of the form

$$x_1 = 10 + \frac{m}{10p_1}.$$

Originally his income is \$120 per week and the price of milk is \$3 per quart. Thus his demand for milk will be $10 + 120/(10 \times 3) = 14$ quarts per week.

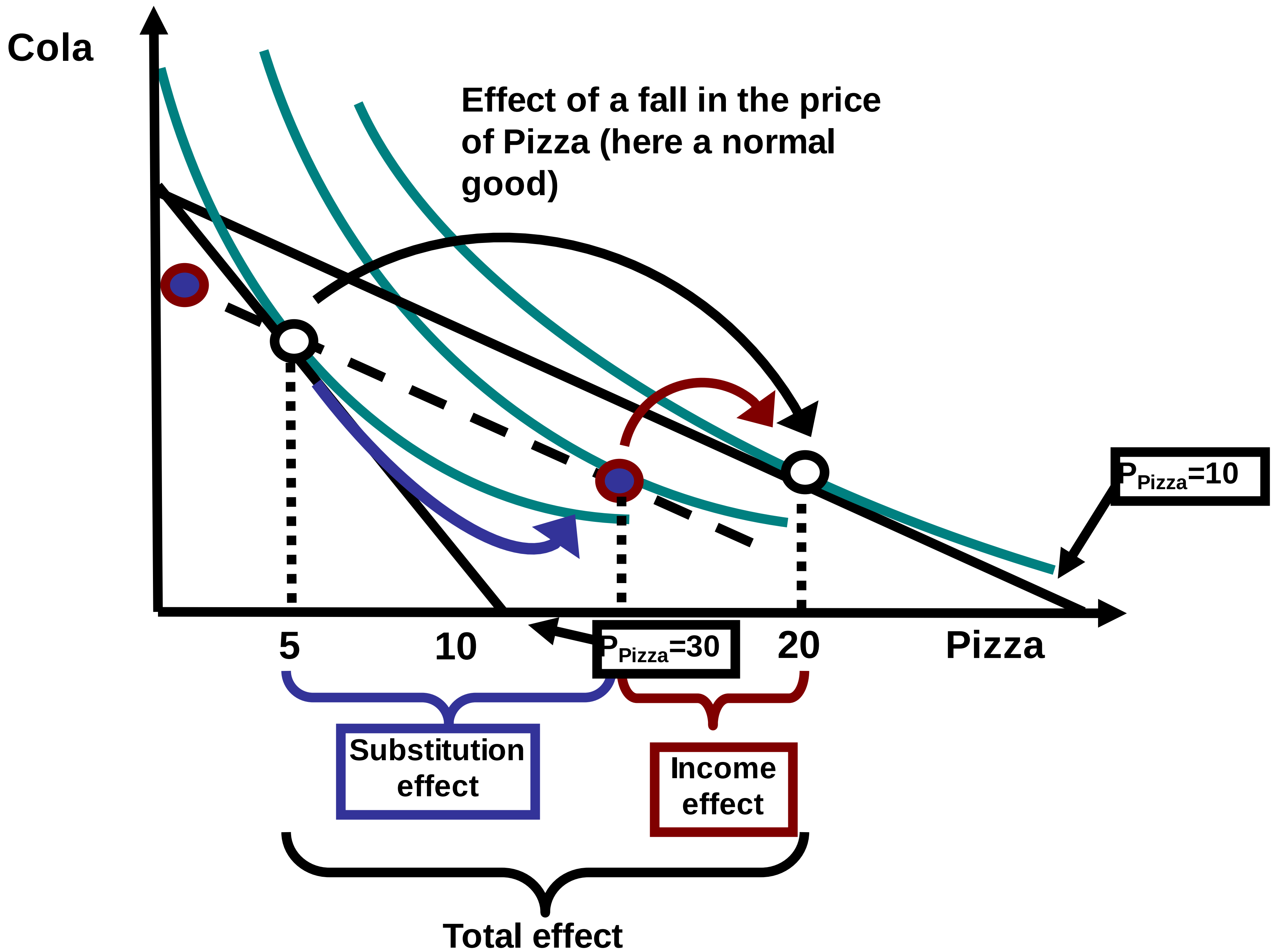
$$x_1(p_1', m) = x_1(2, 120) = 16$$
$$x_1(p_1', m') = x_1(2, 106) = 15.3$$

$$\Delta x_1^n = x_1(2, 120) - x_1(2, 106) = 16 - 15.3 = 0.7.$$

Sign of the Substitution Effect

- If the price of a good goes down, as in Figure 8.2, then the change in the demand for the good due to the substitution effect must be nonnegative.
- That is, if $p1>p'1$, then we must have $x1(p'1,m') \geq x1(p1,m)$, so that $\Delta xs1 \geq 0$.

- We say that the substitution effect is negative, since the change in demand due to the substitution effect is opposite to the change in price: if the price increases, the demand for the good due to the substitution effect decreases.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Total change in demand

$$\Delta x_1 = x_1(p_1', m) - x_1(p_1, m)$$

The Slutsky identity

$$\Delta x_1 = \Delta x_1^s + \Delta x_1^n$$

$$x_1(p_1', m) - x_1(p_1, m) = [x_1(p_1', m') - x_1(p_1, m)] + [x_1(p_1', m) - x_1(p_1', m')]$$

Rate of change

$$\Delta x_1 = \Delta x_1^s + \Delta x_1^n$$

$$\Delta x_1^m = x_1(p_1', m') - x_1(p_1', m) = -\Delta x_1^n$$

$$\Delta x_1 = \Delta x_1^s - \Delta x_1^m$$

$$\frac{\Delta x_1}{\Delta p_1} = \frac{\Delta x_1^s}{\Delta p_1} - \frac{\Delta x_1^m}{\Delta p_1}$$

The first term on the right-hand side is the rate of change of demand when price changes and income is adjusted so as to keep the old bundle affordable—the substitution effect. Let's work on the second term. Since we have an income change in the numerator, it would be nice to get an income change in the denominator.

Rate of change

$$\Delta x_1 = \Delta x_1^s + \Delta x_1^n$$

$$\Delta x_1^m = x_1(p_1', m') - x_1(p_1', m) = -\Delta x_1^n$$

$$\Delta x_1 = \Delta x_1^s - \Delta x_1^m$$

$$\frac{\Delta x_1}{\Delta p_1} = \frac{\Delta x_1^s}{\Delta p_1} - \frac{\Delta x_1^m}{\Delta p_1}$$

$$\Delta m = x_1 \Delta p_1 \qquad \Delta p_1 = \frac{\Delta m}{x_1}$$

$$\frac{\Delta x_1}{\Delta p_1} = \frac{\Delta x_1^s}{\Delta p_1} - \frac{\Delta x_1^m}{\Delta m} x_1$$

$$\frac{\Delta x_1}{\Delta p_1} = \frac{\Delta x_1^s}{\Delta p_1} - \frac{\Delta x_1^m}{\Delta m} x_1$$

The Slutsky Identity

$$\frac{\Delta x_1}{\Delta p_1} = \frac{\Delta x_1^s}{\Delta p_1} - \frac{\Delta x_1^m}{\Delta m} x_1$$

$$\frac{\Delta x_1}{\Delta p_1} = \frac{x_1(p_1', m) - x_1(p_1, m)}{\Delta p_1}$$

is the rate of change in demand as price changes, holding income fixed

$$\frac{\Delta x_1^s}{\Delta p_1} = \frac{x_1(p_1', m') - x_1(p_1, m)}{\Delta p_1}$$

is the rate of change in demand as the price changes, adjusting income so as to keep the old bundle just affordable, that is, the substitution effect

$$\frac{\Delta x_1^m}{\Delta m} x_1 = \frac{x_1(p_1', m') - x_1(p_1', m)}{m' - m} x_1$$

is the rate of change of demand holding prices fixed and adjusting income, that is, the income effect.

More general derivation: see Appendix p.157

Slutsky demand function for good 1

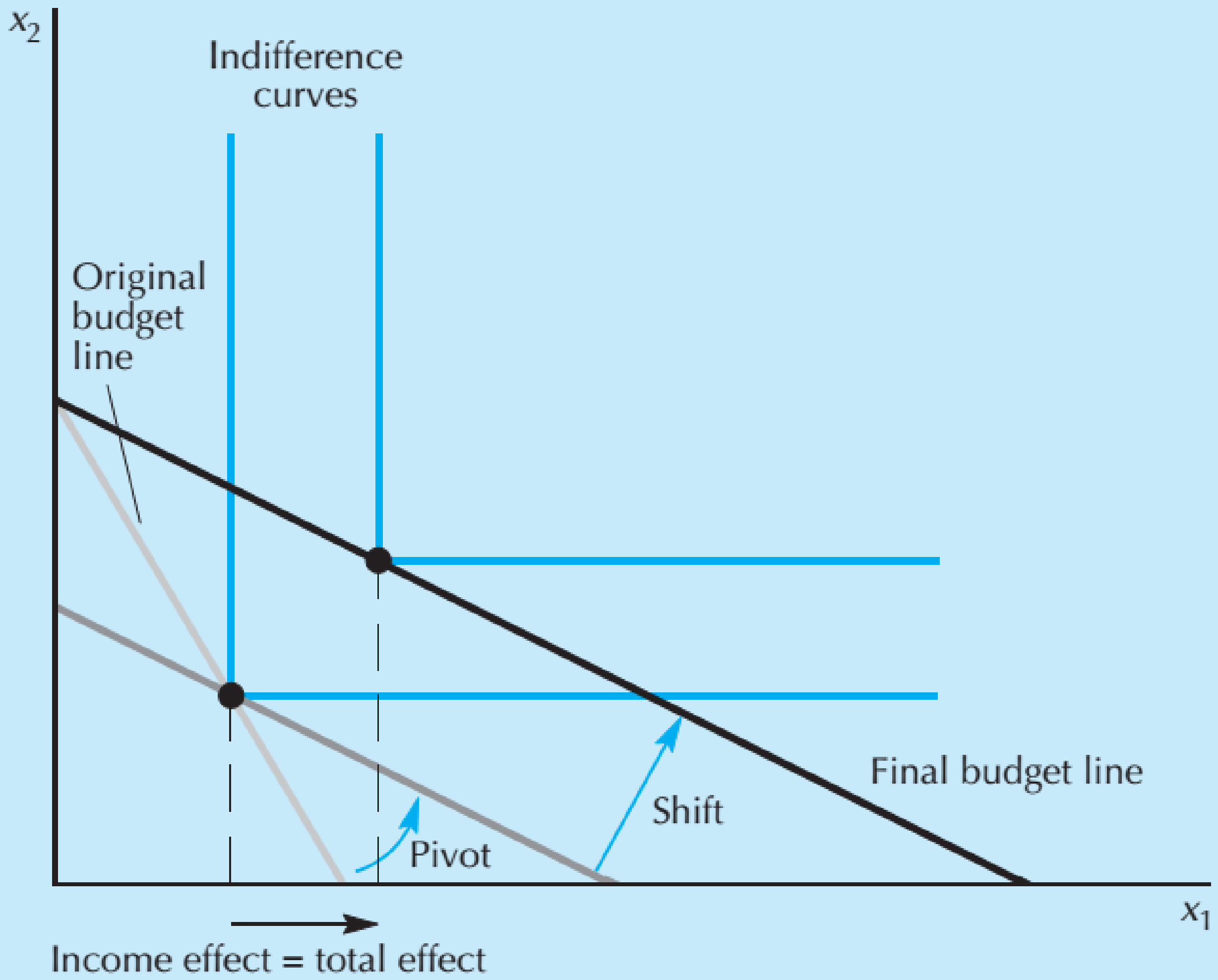
the income is adjusted so as to give the consumer just enough to buy the original consumption bundle

$$x_1^s(p_1, p_2, \overline{x}_1, \overline{x}_2) \equiv$$

$$\frac{\partial x_1^s(p_1, p_2, \overline{x}_1, \overline{x}_2)}{\partial p_1} = \frac{\partial x_1(p_1, p_2, \overline{m})}{\partial p_1} + \frac{\partial x_1(p_1, p_2, \overline{m})}{\partial m}\overline{x}_1$$

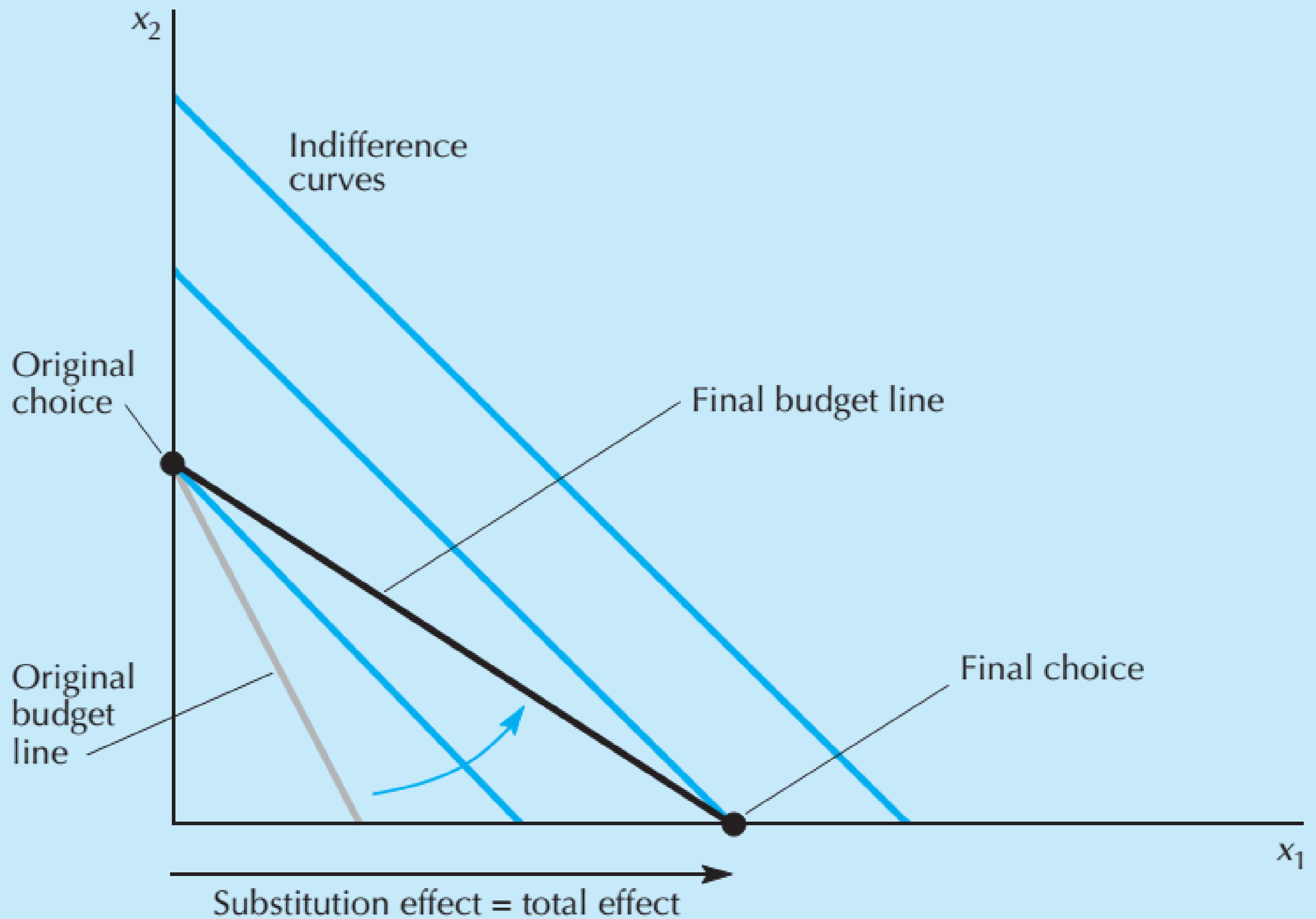
$$\frac{\partial x_1(p_1, p_2, \overline{m})}{\partial p_1} = \frac{\partial x_1^s(p_1, p_2, \overline{x}_1, \overline{x}_2)}{\partial p_1} - \frac{\partial x_1(p_1, p_2, \overline{m})}{\partial m}\overline{x}_1$$

Examples of Income and Substitution Effects



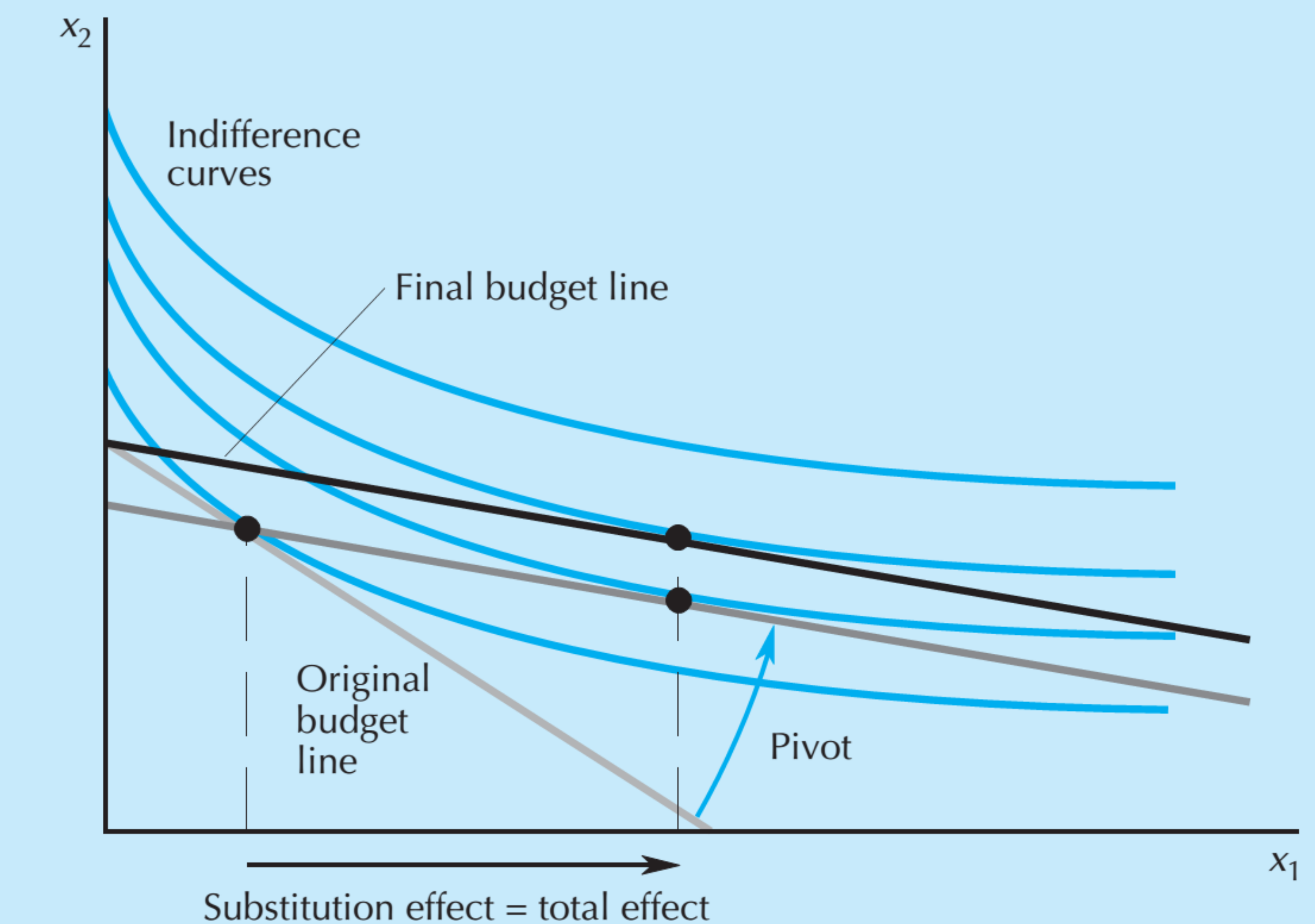
Perfect complements. Slutsky decomposition with perfect complements.

Examples of Income and Substitution Effects



Perfect substitutes. Slutsky decomposition with perfect substitutes.

Examples of Income and Substitution Effects



Quasilinear preferences. In the case of quasilinear preferences, the entire change in demand is due to the substitution effect.

- In 1974 the Organization of Petroleum Exporting Countries (OPEC) instituted an oil embargo against the United States.
- There were many plans proposed to reduce the United States's dependence on foreign oil. One such plan involved increasing the gasoline tax. Increasing the cost of gasoline to the consumers would make them reduce their consumption of gasoline.
- It was suggested that the revenues raised from consumers by this tax would be returned to the consumers in the form of direct money payments, or via the reduction of some other tax.
- Critics of this proposal argued that paying the revenue raised by the tax back to the consumers would have no effect on demand since they could just use the rebated money to purchase more gasoline.
- What does economic analysis say about this plan?

Suppose that the tax would raise the price of gasoline from p to $p' = p + t$, and that the average consumer would respond by reducing his demand from x to x'.

$$R = tx' = (p' - p)x'$$

$$px + y = m.$$

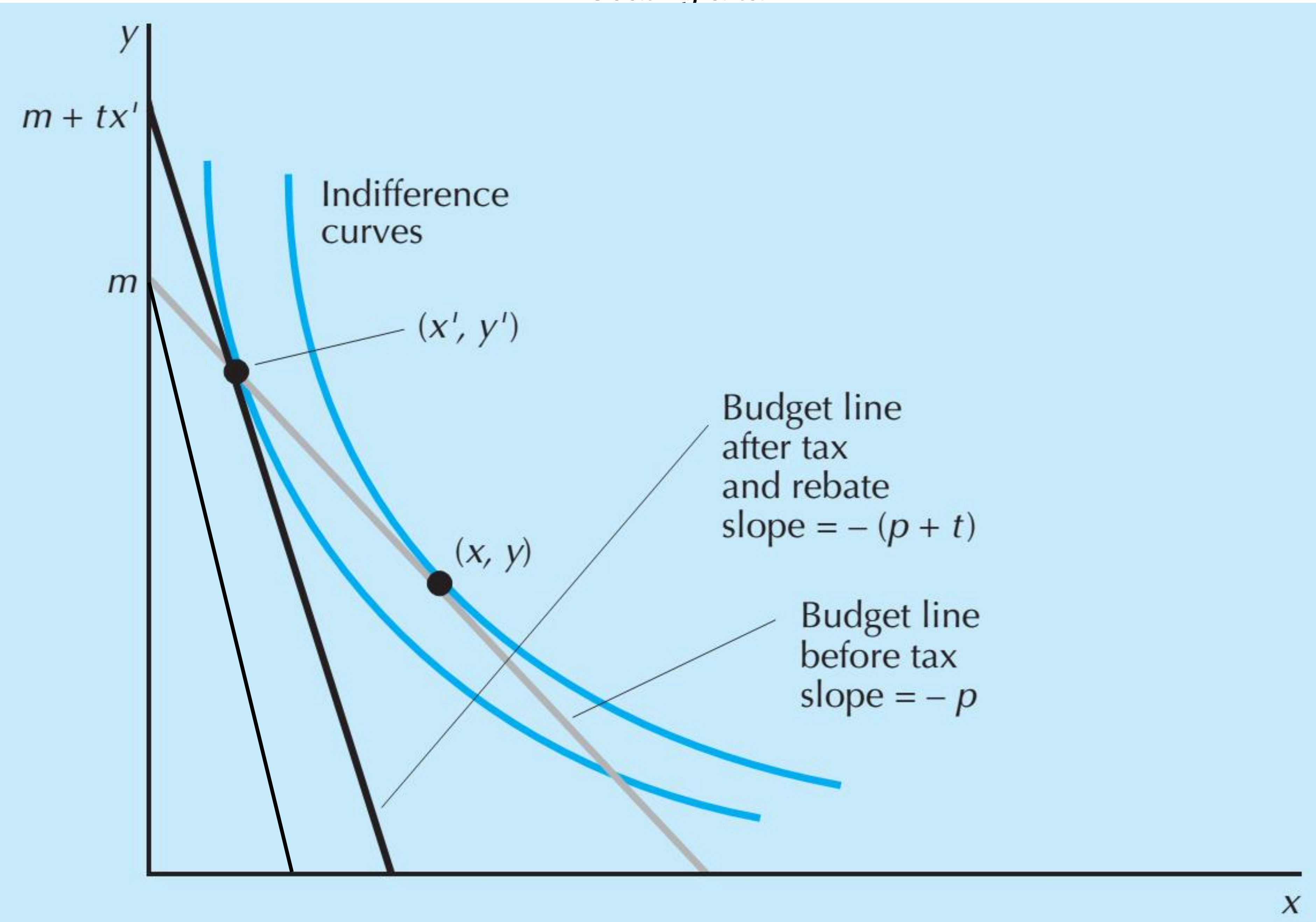
$$(p + t)x' + y' = m + tx'$$

the average consumer is choosing the left-hand side variables—the consumption of each good—but the right-hand side— his income and the rebate from the government—are taken as fixed.

$$px' + y' = m$$

Thus (x', y') is a bundle that was affordable under the original budget constraint and rejected in favor of (x, y). Thus it must be that (x, y) is preferred to (x', y')

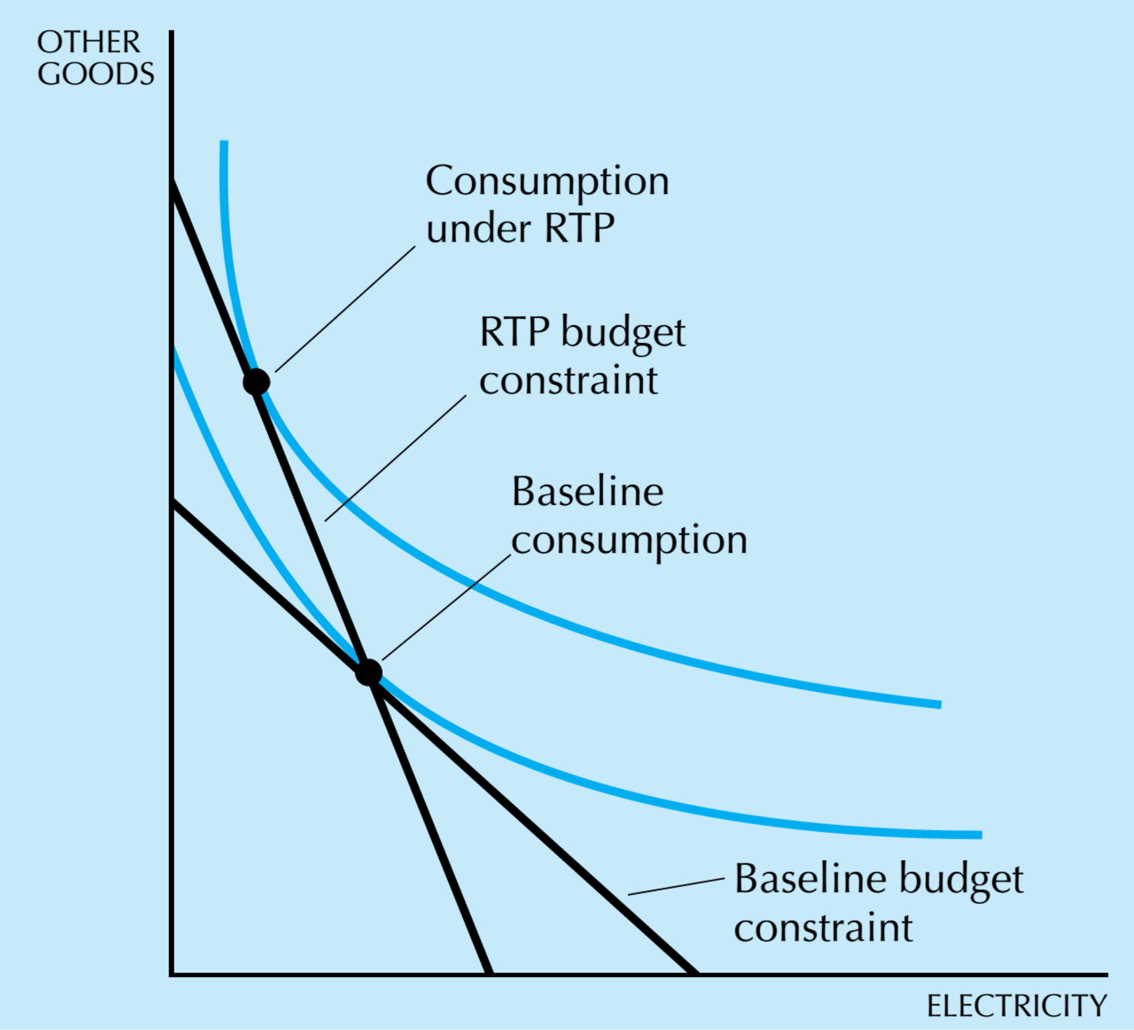
Rebating a tax



Voluntary Real Time Pricing

- In states with warm climates, such as Georgia, roughly 30 percent of usage during periods of peak demand is due to air conditioning. Furthermore, it is relatively easy to forecast temperature one day ahead

In one pricing plan, customers are assigned a baseline quantity, which represents their normal usage. When electricity is in short supply and the real time price increases, these users face a higher price for electricity use in excess of their baseline quantity. But they also receive a rebate if they can manage to cut their electricity use below their baseline amount.



Voluntary real time pricing. Users pay higher rates for additional electricity when the real time price rises, but they also get rebates at the same price if they cut back their use. This results in a pivot around the baseline use and tends to make the customers better off.

Exercises

1. Suppose a consumer has preferences between two goods that are perfect substitutes. Can you change prices in such a way that the entire demand response is due to the income effect?

8.1. Yes. To see this, use our favorite example of red pencils and blue pencils. Suppose red pencils cost 10 cents a piece, and blue pencils cost 5 cents a piece, and the consumer spends $1 on pencils. She would then consume 20 blue pencils. If the price of blue pencils falls to 4 cents a piece, she would consume 25 blue pencils, a change which is entirely due to the income effect.

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