

Real vs. Nominal GDP Practice

Real versus Nominal Values

Prices in an economy do not stay the same. Over time the price level changes (i.e., there is inflation or deflation). A change in the price level changes the value of economic measures denominated in dollars. Values that increase or decrease with price level are called *nominal* values. *Real* values are adjusted for price changes. That is, they are calculated as though prices did not change from the base year. For example, gross domestic product (GDP) is used to measure fluctuations in output. However, since GDP is the *dollar value* of goods and services produced in the economy, it increases when prices increase. This means that nominal GDP increases with inflation and decreases with deflation. But when GDP is used as a measure of short-run economic growth, we are interested in measuring performance—real GDP takes out the effects of price changes and allows us to isolate changes in output. Price indices are used to adjust for price changes. They are used to convert nominal values into real values.

Converting Nominal GDP to Real GDP

To use GDP to measure output growth, it must be converted from nominal to real. Let's say nominal GDP in Year 1 is \$1,000 and in Year 2 it is \$1,100. Does this mean the economy has grown 10 percent between Year 1 and Year 2? Not necessarily. If prices have risen, part of the increase in nominal GDP for Year 2 will represent the increase in prices. GDP that has been adjusted for price changes is called *real* GDP. If GDP isn't adjusted for price changes, we call it *nominal* GDP.

To compute real GDP in a given year, use the *GDP Deflator*. The GDP deflator for a given year is 100 times the ratio of nominal GDP to real GDP in that year. The GDP deflator is a type of price index, or form of measurement, that tracks changes in the value of goods produced in a nation from one year to another. Here is the formula to find the real GDP in a given year using the GDP deflator:

$$\text{real GDP} = \frac{\text{nominal GDP} \times 100}{\text{GDP deflator}}$$

If the GDP deflator is not provided, the following is the formula:

$$\text{GDP deflator} = \frac{\text{nominal GDP} \times 100}{\text{real GDP}}$$

To compute real output growth in GDP from one year to another, subtract real GDP for Year 2 from real GDP from Year 1. Divided the answer (the change in real GDP from the previous year) by real GDP in GDP declines from Year 1 to Year 2, the answer will be a negative percentage.) Here's the formula:

$$\text{Output growth} = \frac{(\text{real GDP in Year 2} - \text{real GDP in Year 1}) \times 100}{\text{real GDP in Year 1}}$$

For example, if real GDP in Year 1 = \$1,000 and in Year 2 = \$1,028, then the output growth rate from Year 1 to Year 2 is 2.8%; $(1,028-1,000)/1,000 = .028$, which we multiply by 100 in order to express the result as a percentage.

To understand the impact of output changes, we usually look at real GDP per capita. To do so, we divide the real GDP of any period by a country's average population during the same period. This procedure enables us to determine how much of the output growth of a country simply went to supply the increase in population and how much of the growth represented improvements in the standard of living of the entire population. In our example, let's say the population in Year 1 was 100 and in Year 2 it was 110. What is the real GDP per capita in Years 1 and 2?

Year 1

$$\text{Real GDP per capita} = \frac{\text{Year 1 real GDP}}{\text{Population in Year 1}} = \frac{\$1,000}{100} = \$10$$

Year 2

$$\text{Real GDP per capita} = \frac{\$1,028}{110} = \$9.30$$

In this example, real GDP per capita fell even though output growth was positive. Developing countries with positive output growth but higher rates of population growth often experience this condition.

Practicing Conversions of Nominal GDP to Real GDP

Use the table below to answer the questions 1-6.

	Nominal GDP	GDP deflator	Population
Year 3	\$5,000	125	11
Year 4	\$6,600	150	12

1. What is the real GDP in Year 3?
2. What is the real GDP in Year 4?
3. What is the real GDP per capita in Year 3?
4. What is the real GDP per capita in Year 4?
5. What is the rate of real output growth between Years 3 and 4?
6. What is the rate of real output growth per capita between Years 3 and 4?
(*Hint: Use per capita data in the output growth rate formula.*)

The economy of Grossmania produces three goods: Widgets, Gizmos, and Thingamajigs. The accompanying table shows the output and prices for years 2006 and 2007. (*Hint: GDP, in its most basic form, is $P \times Q$. You take the quantity of output and multiply by the price of output.*)

Year	Widgets		Gizmos		Thingamajigs	
	Price	Quantity	Price	Quantity	Price	Quantity
2006	\$100	1	\$10	8	\$5	4
2007	\$110	1	\$12	10	\$4	5

7. Calculate the nominal GDP for:
 - a. 2006
 - b. 2007
8. Compute the percentage of growth in nominal GDP from 2006 to 2007.
9. Using 2006 as the base year, calculate the real GDP for 2007.
10. What is the GDP deflator for 2007? What was the inflation rate between 2006 and 2007?
11. Compute the real rate of output growth from 2006 to 2007.

12. Which of the following is true of real GDP?
 - I. It is adjusted for changes in prices.
 - II. It is always equal to nominal GDP.
 - III. It increases whenever aggregate output increases.
 - a. I only
 - b. II only
 - c. III only
 - d. I and III
 - e. I, II, and III

For questions 14-15 use the information provided in the table below for an economy that produces only apples and oranges. Assume year 1 is the base year.

	Year 1	Year 2
Quantity of Apples	3,000	4,000
Price of Apples	\$0.20	\$0.30
Quantity of Oranges	2,000	3,000
Price of Oranges	\$0.40	\$0.50

13. The best measure for comparing a country's aggregate output over time is
 - a. Nominal GDP.
 - b. Real GDP.
 - c. Nominal GDP per capita.
 - d. Real GDP per capita.
 - e. Average GDP per capita.

14. What was the value of real GDP in each year?

	Year 1	Year 2
a.	\$1,400	\$2,700
b.	\$1,900	\$2,700
c.	\$1,400	\$2,000
d.	\$1,900	\$2,000
e.	\$1,400	\$1,900

15. What is the GDP Deflator for Year 2?
 - a. 105
 - b. 135
 - c. 136
 - d. 142
 - e. 143

Real vs. Nominal GDP Practice **KEY**

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Year 1

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Year 2

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	Nominal GDP	GDP deflator	Population
Year 3	\$5,000	125	11
Year 4	\$6,600	150	12

1. What is the real GDP in Year 3? **\$4,000**

$$\frac{5,000}{125} \times 100 = 4,000$$

2. What is the real GDP in Year 4? **\$4,400**

$$\frac{6,600}{150} \times 100 = 4,400$$

3. What is the real GDP per capita in Year 3? **\$364**

$$\frac{4,000}{11} = 364$$

4. What is the real GDP per capita in Year 4? **\$367**

$$\frac{4,400}{12} = 367$$

5. What is the rate of real output growth between Years 3 and 4? **10%**

$$\frac{(4,400 - 4,000)}{4,000} \times 100 = 10\%$$

6. What is the rate of real output growth per capita between Years 3 and 4? **.82%**

(Hint: Use per capita data in the output growth rate formula.)

$$\frac{(367 - 364)}{364} \times 100 = .82\%$$

The economy of Grossmania produces three goods: Widgets, Gizmos, and Thingamajigs. The accompanying table shows the output and prices for years 2006 and 2007.

Year	Widgets		Gizmos		Thingamajigs	
	Price	Quantity	Price	Quantity	Price	Quantity
2006	\$100	1	\$10	8	\$5	4
2007	\$110	1	\$12	10	\$4	5

7. Calculate the nominal GDP for:

c. $2006 = (\$100 \times 1) + (\$10 \times 8) + (\$5 \times 4) = \200

d. $2007 = (\$110 \times 1) + (\$12 \times 10) + (\$4 \times 5) = \250

8. Compute the percentage of growth in nominal GDP from 2006 to 2007. 25%

$$\frac{(\$250 - \$200) \times 100}{\$200} = 25\%$$

9. Using 2006 as the base year, calculate the real GDP for 2007. \$225

$$= (\$100 \times 1) + (\$10 \times 10) + (\$5 \times 5) = \$225$$

10. What is the GDP deflator for 2007? 111 What was the inflation rate between 2006 and 2007? 11%

$$= \frac{\$250 \times 100}{\$225} = 111 \quad 11\%$$

11. Compute the real rate of output growth from 2006 to 2007. 12.5%

$$\frac{(\$225 - \$200) \times 100}{\$200} = 12.5\%$$

12. Which of the following is true of real GDP?

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 - I. It is always equal to nominal GDP.
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- a. I only
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14. What was the value of real GDP in each year?

- | | Year 1 | Year 2 |
|----|---------|---------|
| a. | \$1,400 | \$2,700 |
| b. | \$1,900 | \$2,700 |
| c. | \$1,400 | \$2,000 |
| d. | \$1,900 | \$2,000 |
| e. | \$1,400 | \$1,900 |

15. What is the GDP Deflator for Year 2?

- a. 105
- b. 135
- c. 136
- d. 142
- e. 143