Adjusting nominal values to real values

Learn how and why we adjust GDP numbers for inflation.

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Key points

- The **nominal value** of any economic statistic is measured in terms of actual prices that exist at the time.

- The **real value** refers to the same statistic after it has been adjusted for inflation.

- To convert nominal economic data from several different years into real, inflation-adjusted data, the starting point is to choose a **base year**arbitrarily and then use a price index to convert the measurements so that they are measured in the money prevailing in the base year.

Introduction

When we examine economic statistics, it's crucial to distinguish between nominal and real measurements so we know whether or not inflation has distorted a given statistic.

Looking at economic statistics without considering inflation is like looking through a pair of binoculars and trying to guess how close something is—unless you know how strong the lenses are, you cannot guess the distance very accurately. Similarly, if you do not know the rate of inflation, it is difficult to figure out if a rise in gross domestic product, or GDP, is due mainly to a rise in the overall level of prices or to a rise in quantities of goods produced.

The *nominal value* of any economic statistic means the statistic is measured in terms of actual prices that exist at the time. The *real value* refers to the same statistic after it has been adjusted for inflation. Generally, it is the real value that is more important.

Converting nominal GDP to real GDP

The table and graph below shows US GDP at five-year intervals since 1960 in nominal dollars, in other words, GDP measured using the actual market prices prevailing in each stated year.

If an unwary analyst compared nominal GDP in 1960 to nominal GDP in 2010, it might appear that national output had risen by a factor of 27 over this time—GDP of $\$14,958$ billion in 2010 divided by GDP of $\$543$ billion in 1960. This conclusion would be highly misleading, though.

We need to figure out the change in *real GDP* from 1960 to 2010 to truly understand how much the national output has risen.

US nominal GDP and the GDP deflator

Year	Nominal GDP in billions of dollars	GDP deflator, 2005 = 100
1960	543.3	19.0
1965	743.7	20.3
1970	1,075.9	24.8
1975	1,688.9	34.1
1980	2,862.5	48.3
1985	4,346.7	62.3
1990	5,979.6	72.7
1995	7,664.0	81.7
2000	10,289.7	89.0
2005	13,095.4	100.0
2010	14,958.3	110.0

Source: www.bea.gov

Image credit: *Figure 1* in "Adjusting Nominal Values to Real Values" by
OpenStaxCollege, CC BY 4.0

Remember, nominal GDP is defined as the quantity of every good or service produced multiplied by the price *at which it was sold*, summed up for all goods and services. In order to see how much production has actually increased, we need to extract the effects of higher prices on nominal GDP. We can do this using the GDP deflator.

The *GDP deflator* is a price index measuring the average prices of all goods and services included in the economy. The data for the GDP deflator are given in the table above and shown visually in the graph below.

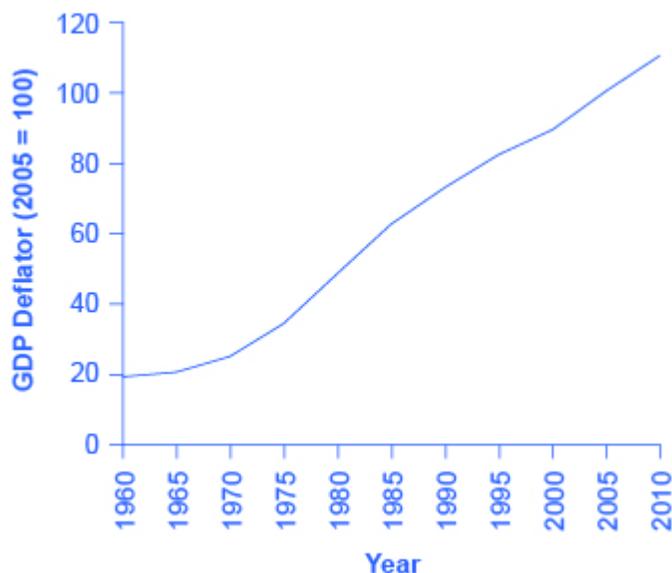[Why does the table read "GDP deflator, 2005=100"? What does that mean?]

Image credit: *Figure 2* in "Adjusting Nominal Values to Real Values" by OpenStaxCollege, CC BY 4.0

The graph above shows that the price level has risen dramatically since 1960. The price level in 2010 was almost six times higher than in 1960—the deflator for 2010 was 110 versus a level of 19 in 1960. Based on this information, we know that much of the apparent growth in nominal GDP was due to inflation, not an actual change in the quantity of goods and services produced—in other words, not in real GDP.

The graph below shows the US nominal and real GDP since 1960. Because 2005 is the base year, the nominal and real values are exactly the same in that year. However, over time, the rise in nominal GDP looks much larger than the rise in real GDP—the nominal GDP line rises more steeply than the real GDP line—because the rise in nominal GDP is exaggerated by the presence of inflation, especially in the 1970s.
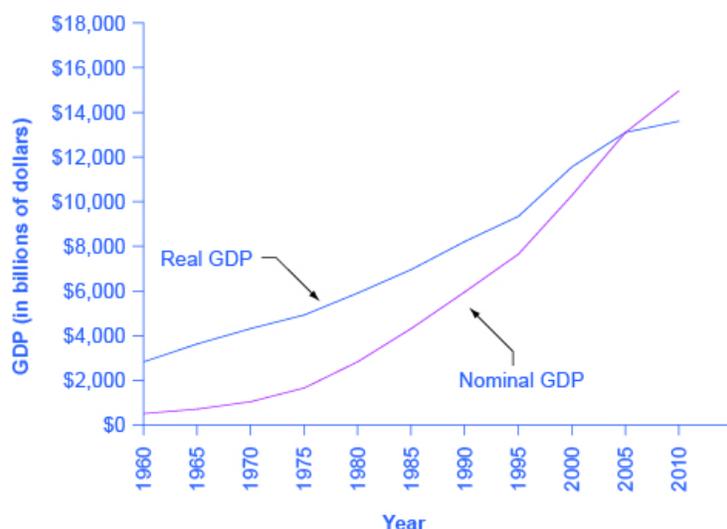

Image credit: *Figure 3* in "Adjusting Nominal Values to Real Values" by OpenStaxCollege, CC BY 4.0

Okay! Now to solve our problem! How much did the national output rise between 1960 and 2010? In other words, what was the change in real GDP?

Nominal GDP can rise for two reasons: an increase in output and/or an increase in prices. Knowing that, we can extract the increase in prices from nominal GDP in order to measure only changes in output.

Step 1: Understand that nominal measurements are in value terms.

$$\text{Value} = \text{Price} \times \text{Quantity}$$

or

$$\text{Nominal GDP} = \text{GDP Deflator} \times \text{Real GDP}$$

[Could I see a simpler example to help me understand?]

Step 2: Calculate real GDP using the formula below.

$$\text{Real GDP} = \frac{\text{Nominal GDP}}{\text{Price Index}}$$

Mathematically, a price index is a two-digit decimal number like 1.00 or 0.85 or 1.25. But—because some people have trouble working with decimals—the price index has traditionally been multiplied by 100 to get integer numbers like 100, 85, or 125 when it's published. This means that when we deflate nominal figures to get real figures—by dividing the nominal by the price index —we also need to remember to divide the published price index by 100 to make the math work. So, we change our real GDP formula slightly:

$$\text{Real GDP} = \frac{\text{Nominal GDP}}{\text{Price Index}/100}$$

Step 3: Calculate rate of growth of real GDP from 1960 to 2010.

To find the real growth rate, we apply the formula for percentage change:

$$\frac{2010 \text{ real GDP} - 1960 \text{ real GDP}}{1960 \text{ real GDP}} \times 100 = \text{percent change}$$

$$13,598.5 - 2,859.52,859.5 \times 100 = 376$$

In other words, the US economy has increased real production of goods and services by 376%—nearly a factor of four—since 1960. Of course, that understates the material improvement since it fails to capture improvements in the quality of products and the invention of new products.

Try it on your own!

The table below contains all the data you need to compute real GDP.

Step 1. Pull necessary information from the table.

To compute real GPD for 1960, we need to know that in 1960 nominal GDP was $543.3 billion and the price index, or GDP deflator, was 19.0.

Step 2. Calculate the real GDP in 1960.

$$\text{Real GDP} = \frac{\text{Nominal GDP}}{\text{Price Index}/100}$$

$$\text{Real GDP} = \frac{\$543.3 \text{ billion}}{19/100}$$

$$\text{Real GDP} = \$2,859.5 \text{ billion}$$

[I need a little help with the math.]

Step 3. Use the same formula to calculate the real GDP in 1965.

$$\text{Real GDP} = \frac{\text{Nominal GDP}}{\text{Price Index}/100}$$

$$\text{Real GDP} = \frac{\$743.7 \text{ billion}}{20.3/100}$$

$$\text{Real GDP} = \$3,663.5 \text{ billion}$$

Step 4. Continue using this formula to calculate all of the real GDP values from 1970 through 2010.

You can double check your answers by looking at the far-right column in the table below.

Converting nominal to real GDP

Year	Nominal GDP in billions of dollars	GDP deflator, 2005 = 100	Calculations	Real GDP in billions of 2005 dollars
1960	543.3	19.0	543.3 / (19.0/100)	2859.5
1965	743.7	20.3	743.7 / (20.3/100)	3663.5
1970	1075.9	24.8	1,075.9 / (24.8/100)	4338.3
1975	1688.9	34.1	1,688.9 / (34.1/100)	4952.8
1980	2862.5	48.3	2,862.5 / (48.3/100)	5926.5
1985	4346.7	62.3	4,346.7 / (62.3/100)	6977.0
1990	5979.6	72.7	5,979.6 / (72.7/100)	8225.0
1995	7664.0	82.0	7,664 / (82.0/100)	9346.3
2000	10289.7	89.0	10,289.7 / (89.0/100)	11561.5
2005	13095.4	100.0	13,095.4 / (100.0/100)	13095.4
2010	14958.3	110.0	14,958.3 / (110.0/100)	13598.5

Source: Bureau of Economic Analysis, www.bea.gov

Summary

- The **nominal value** of any economic statistic is measured in terms of actual prices that exist at the time.

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- To convert nominal economic data from several different years into real, inflation-adjusted data, the starting point is to choose a **base year**arbitrarily and then use a price index to convert the measurements so that they are measured in the money prevailing in the base year.