

Calculating GDP

Nominal GDP, Real GDP, and the
GDP Deflator

There are two ways that GDP can increase:

1. An increase in the PRICES of goods and services.
2. An increase in the QUANTITY of goods and services.

We need a method to calculate GDP that addresses rising prices

Our Simple Economy

- Suppose an economy produces three goods or services, Window Washing, Baseballs, and Hammers. Data for the past three years can be found below.

Prices and Quantities for our Simple Economy

Product	2006 Statistics		2007 Statistics		2008 Statistics	
	Quantity	Price	Quantity	Price	Quantity	Price
Window Washing	90	\$50.00	100	\$60.00	100	\$65.00
Baseballs	75	\$2.00	100	\$2.00	120	\$2.25
Hammers	50	\$30.00	50	\$25.00	65	\$25.00

Nominal GDP

Step 1: Calculate Nominal GDP (*The value of final goods and services evaluated at current-year prices*) for each year:

$$\begin{aligned}\text{NGDP}_{2006} &= Q_{2006} \times P_{2006} \\ &= (90 \times \$50.00) \text{ Window Washing} \\ &\quad + (75 \times \$2.00) \text{ Baseballs} \\ &\quad + (50 \times \$30.00) \text{ Hammers} \\ &= \$6,150\end{aligned}$$

Nominal GDP 2007

$$\begin{aligned}\text{NGDP}_{2007} &= Q_{2007} \times P_{2007} \\ &= (100 \times \$60.00) \text{ Window Washing} \\ &\quad + (100 \times \$2.00) \text{ Baseballs} \\ &\quad + (50 \times \$25.00) \text{ Hammers} \\ &= \$7,450\end{aligned}$$

Nominal GDP 2008

$$\begin{aligned}\text{NGDP}_{2008} &= Q_{2008} \times P_{2008} \\ &= (100 \times \$65.00) \text{ Window Washing} \\ &\quad + (120 \times \$2.25) \text{ Baseballs} \\ &\quad + (65 \times \$25.00) \text{ Hammers} \\ &= \$8,395\end{aligned}$$

Real GDP

- Step 2: Calculate Real GDP (*The value of final goods and services evaluated at base-year prices*) for each year. For our example assume 2006 is the base year. *This means that all values are in what we call "2006 Dollars", or "Constant Dollars".*

Real GDP

- By using the prices from the base-year, (or holding prices constant over time), we eliminate the impact that rising prices have on GDP, to get a measure of “Real” economic activity.

Real GDP in 2006

$$\begin{aligned}\text{RGDP}_{2006} &= Q_{2006} \times P_{2006} \\ &= (90 \times \$50.00) \text{ Window Washing} \\ &\quad + (75 \times \$2.00) \text{ Baseballs} \\ &\quad + (50 \times \$30.00) \text{ Hammers} \\ &= \$6,150\end{aligned}$$

Note: For the Base-Year Nominal GDP
always equals Real GDP

Real GDP in 2007

$$\begin{aligned}\text{RGDP}_{2007} &= Q_{2007} \times P_{2006} \\ &= (100 \times \$50.00) \text{ Window Washing} \\ &\quad + (100 \times \$2.00) \text{ Baseballs} \\ &\quad + (50 \times \$30.00) \text{ Hammers} \\ &= \$6,700\end{aligned}$$

Note: We use “Current Quantities” and “Constant Prices”.

Real GDP in 2008

$$\begin{aligned}\text{RGDP}_{2008} &= Q_{2008} \times P_{2006} \\ &= (100 \times \$50.00) \text{ Window Washing} \\ &\quad + (120 \times \$2.00) \text{ Baseballs} \\ &\quad + (65 \times \$30.00) \text{ Hammers} \\ &= \$7,190\end{aligned}$$

Note: We still use “Current Quantities” and “Constant Prices”.

The General Formula for Calculating a Growth Rate

$$\text{Percent_Change} = \% \Delta = \frac{\text{New_Value} - \text{Old_Value}}{\text{Old_Value}} \times 100$$

$$\text{Percent_Change} = \% \Delta = \frac{X_t - X_{t-1}}{X_{t-1}} \times 100$$

Calculate the Growth Rate in Real GDP between 2006 and 2007

$$\% \text{Change} = [(RGDP_{2007} - RGDP_{2006}) / RGDP_{2006}] \times 100$$

$$\% \text{Change} = [(6,700 - 6,150) / 6,150] \times 100$$

$$\% \text{Change} = 8.94\%$$

That is real GDP grew by 8.94% between 2006 and 2007.

Calculate the Growth Rate in Real GDP between 2007 and 2008

$$\% \text{Change} = [(RGDP_{2008} - RGDP_{2007}) / RGDP_{2007}] \times 100$$

$$\% \text{Change} = [(7,190 - 6,700) / 6,700] \times 100$$

$$\% \text{Change} = 7.31\%$$

That is real GDP grew by 7.31% between 2007 and 2008.

The Price Level

We can use our calculations of Nominal GDP and Real GDP to calculate the Price Level
(*A measure of the average prices of goods and services in the economy.*)

The GDP Deflator

One example of a measure of the average price level is the GDP deflator.

$$GDP_Deflator_t = \frac{NGDP_t}{RGDP_t} \times 100$$

Calculate the GDP Deflator for 2006

$$\text{GDP Deflator}_{2006} = (\text{NGDP}_{2006} / \text{RGDP}_{2006}) \times 100$$

$$\text{GDP Deflator}_{2006} = (6,150 / 6,150) \times 100 = 100$$

Note: The GDP Deflator is always equal to 100 in the base-year.

The Price Index is “unitless”

Calculate the GDP Deflator for 2007 and 2008

$$\text{GDP Deflator}_{2007} = (\text{NGDP}_{2007} / \text{RGDP}_{2007}) \times 100$$

$$\text{GDP Deflator}_{2007} = (7,450 / 6,700) \times 100 = 111.19$$

$$\text{GDP Deflator}_{2008} = (\text{NGDP}_{2008} / \text{RGDP}_{2008}) \times 100$$

$$\text{GDP Deflator}_{2008} = (8,395 / 7,190) \times 100 = 116.76$$

The Inflation Rate

We can use the growth rate formula from previous to calculate the Inflation Rate (the Inflation Rate is *The percentage increase in the price level from one year to the next.*)

Calculate the Inflation Rate from 2006 to 2007

$$\text{Inflation Rate Between 2006 and 2007} = \frac{(\text{GDP Def.}_{2007} - \text{GDP Def.}_{2006})}{\text{GDP Def.}_{2006}} \times 100$$

$$\text{Inflation Rate Between 2006 and 2007} = \frac{(111.19 - 100)}{100} \times 100 = 11.19$$

That is the inflation rate between 2006 and 2007 was 11.19%.

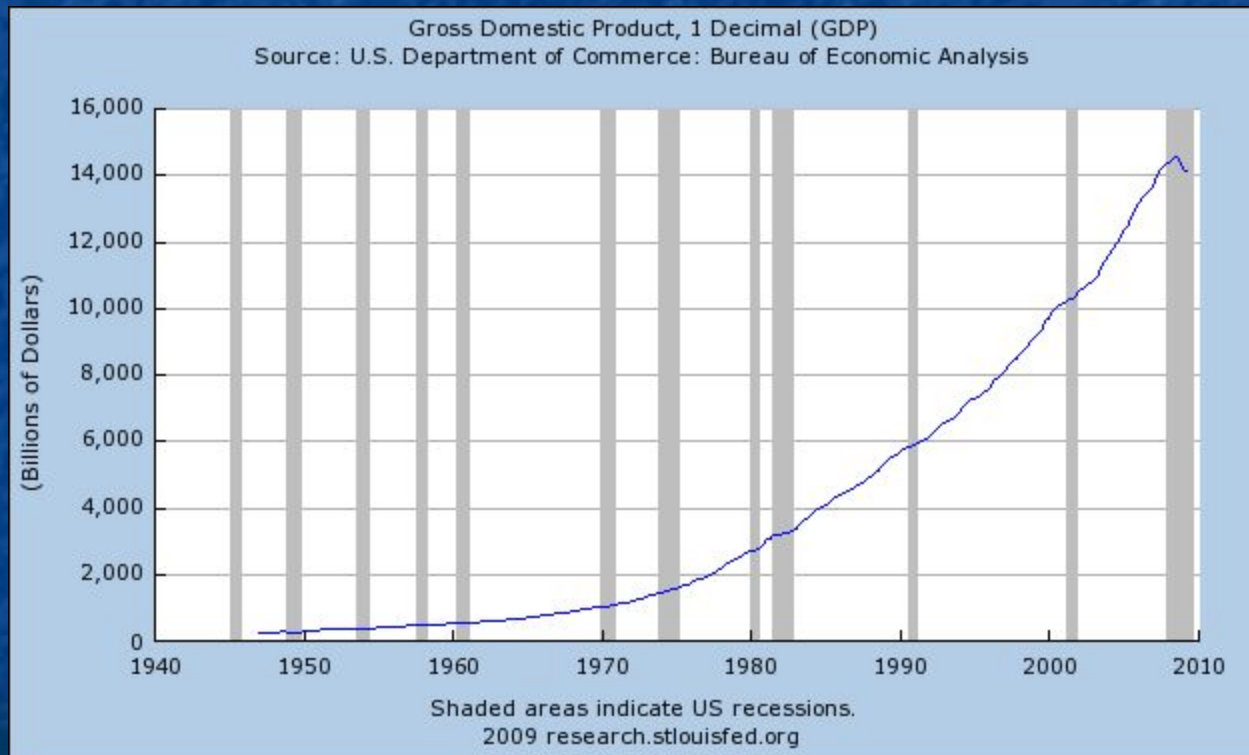
Calculate the Inflation Rate from 2007 to 2008

$$\text{Inflation Rate Between 2007 and 2008} = \frac{(\text{GDP Def.}_{2008} - \text{GDP Def.}_{2007})}{\text{GDP Def.}_{2007}} \times 100$$

$$\text{Inflation Rate Between 2007 and 2008} = \frac{(116.76 - 111.19)}{111.19} \times 100 = 5.01$$

That is the inflation rate between 2007 and 2008
was 5.01%.

Nominal GDP in the U.S. 1947 to 2008



Real GDP in the U.S. 1929 to 2008

