

# 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

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

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

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

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

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

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

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

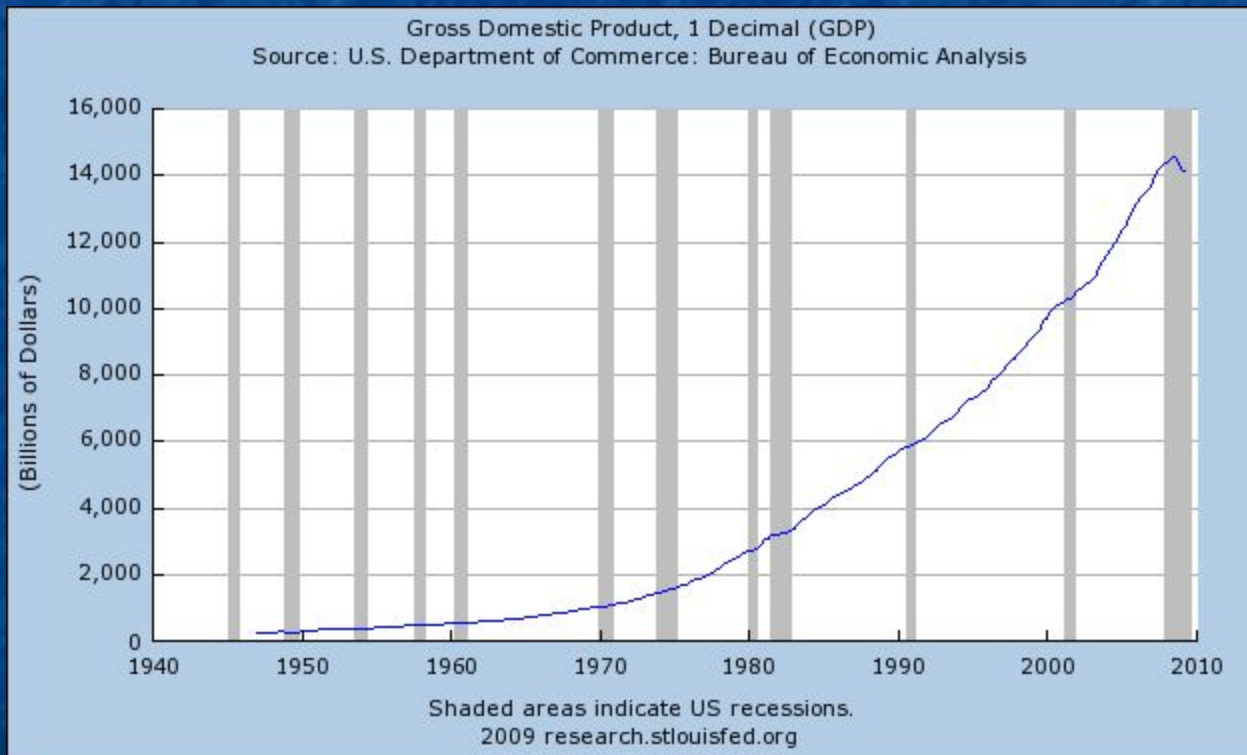
# Calculate the Inflation Rate from 2007 to 2008

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

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

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

