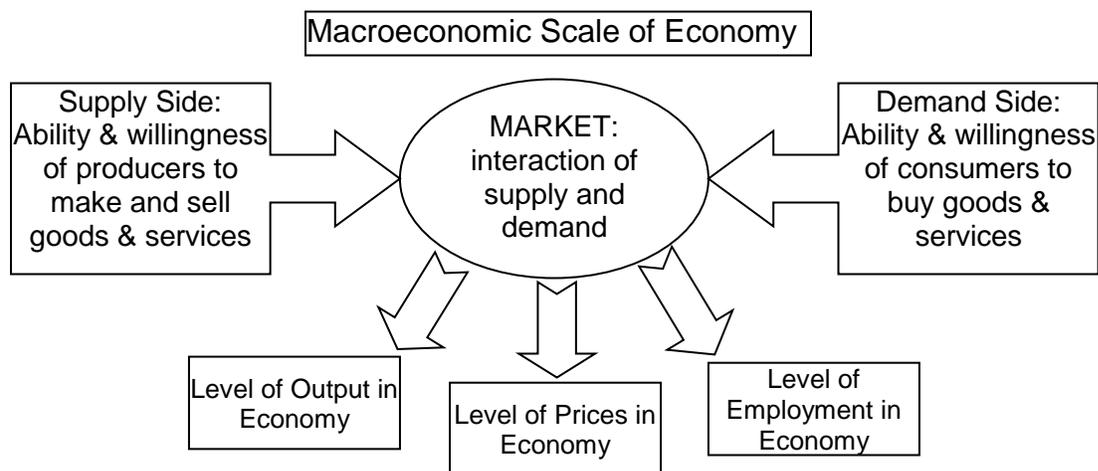




# Macroeconomics: GDP, GDP Deflator, CPI, & Inflation

Macroeconomics is the big picture view of an economy. Microeconomics looks at the market for a specific good, like cell phones or bicycles, but macroeconomics deals with ALL goods and services produced in an economy and the AVERAGE PRICE LEVEL of those goods. Macroeconomics is also concerned with inflation/recession, taxes, fiscal/monetary policies, and overall levels of unemployment.



\*Canadian Macroeconomics Problems and Policies, 7<sup>th</sup> edition, Brian Lyons, Pearson Education Canada, 2004

## ECONOMIC PRODUCTIVITY

How do we evaluate a nation's productivity (or output)? There are two measurements of a country's productivity: gross domestic product (GDP) and gross national product (GNP). GDP is the BETTER measure of domestic economic activity.

**Gross domestic product** is the total value of all **final** goods and services produced within a country over a given year. **Final goods** are goods that are consumed and used as is (e.g. loaf of bread), as opposed to **intermediate goods** which are sold and used for some further stage of production (e.g. wheat, flour to make loaf of bread).

**Gross national product** is the total value of income acquired by a country's citizens both domestically and abroad in a given year, no matter where business production occurs. Measures economic wellbeing of a country's citizens.

The **circular flow model** tells us that an economy's total spending will be equal to the income earned by its citizens. Because of this reason, GDP can be calculated two ways:



(1) Expenditure Approach: GDP is treated as the sum of goods & services bought by four sectors of the economy: household consumers, businesses, government, and foreign buyers.

**Household consumption (C)** is all consumer goods and services bought by individual households. **Businesses** spend money investing (I) in equipment, buildings, construction, and product inventory. Also include the purchases of new homes. **Government (G)** also purchases goods and services (like health care). Foreign buyers purchase exports (X) (goods produced domestically and sold abroad), but some of the purchased goods recorded in C, I, and G, are imports (produced abroad), so to accurately account for goods PRODUCED in a country, use the value of net exports: total exports (X) minus total imports (M).

$$GDP = C + I + G + (X - M)$$

(2) Income Approach: GDP is the sum of a country's wages, rent, corporate profit before tax, interest, depreciation, and indirect taxes less subsidies. (see class notes for more)

When GDP is calculated using current prices, it is called **money GDP** or **nominal GDP**. It is the sum of each good's quantity (output) multiplied by the current price of the good.

$$\text{Money GDP} = \sum [\text{Output}_{\text{current}} \times \text{Prices}_{\text{current}}]$$

Nominal GDP depends on the current dollar, but the value of the dollar changes with time! Using nominal GDP to compare economic growth isn't helpful. If overall price levels have risen (inflation), GDP will appear to have increased even if the economy isn't actually producing a higher output of goods and services.

The **real GDP** (RGDP) is a measure of productivity that is NOT affected by rising prices (inflation). To calculate RGDP, take the sum of current output (quantity) evaluated at base year prices.

$$\text{Real GDP} = \sum [\text{Output}_{\text{current}} \times \text{Prices}_{\text{base year}}]$$

*Example:* Calculate the nominal and real GDP for 2009 and 2010 using 2009 as the base year price level. Remember the older year is the base year.

Year	Item	Quantity	Price
2009	Desks	100	\$50
	Chairs	50	\$20
2010	Desks	80	\$60
	Chairs	70	\$40

*Solution:*

$$\text{Nominal GDP}_{2009} = (100 \times \$50 + 50 \times \$20) = \$6000$$

$$\text{RGDP}_{2009} = (100 \times \$50 + 50 \times \$20) = \$6000 \quad (\text{nominal} = \text{real GDP for base year})$$



$$\text{Nominal GDP}_{2010} = (80 \times \$60 + 70 \times \$40) = \$7600$$

$$\text{RGDP}_{2010} = (80 \times \$50 + 70 \times \$20) = \$5400$$

If we compare nominal GDP, it appears that GDP has increased from 2009 to 2010 by \$1600. However, using RGDP, we can see that the value of economic output has in fact decreased from \$6000 to \$5400.

- **Nominal GDP increases can be due to:**
  - an increase in output of goods & services and no change in price level
  - an increase in both output of goods & services and price level
  - an increase in price level & no change in output of goods & services
- **Real GDP increases can only be due to an increase in output quantity of goods & services**

To calculate the **economic growth** of a country, find the percent change in RGDP using the basic percentage change formula:  $(\text{new} - \text{old})/\text{old}$ . Remember since RGDP reflects changing levels of OUTPUT, this % change shows how the productivity of a country changes.

$$\frac{\text{RGDP}_{\text{current year}} - \text{RGDP}_{\text{last year}}}{\text{RGDP}_{\text{last year}}} \times 100 = \% \text{ growth in RGDP}$$

For the example from page 2, this would give  $(\$5400 - \$6000)/\$6000 \times 100 = -10\%$  RGDP has fallen 10% from 2009 to 2010.

## TWO METHODS OF MEASURING CHANGING PRICE LEVELS

To measure changes in price level (inflation/deflation) in an economy, two statistics can be used: the GDP deflator or the consumer price index (CPI). In both cases, a year of interest is compared to the base year to see how price levels have changed.

### (1) GDP Deflator

The GDP Deflator is an index number that compares the nominal GDP to real GDP for a given year. It is more comprehensive than CPI since it includes all domestically produced goods and services in a country. Changes in consumer preference and the arrival of new goods/services in the market are also reflected in the GDP deflator.

$$\text{GDP Deflator} = \frac{\text{Nominal GDP}}{\text{Real GDP}} \times 100$$

If the GDP deflator for 2010 is 105.1 and the base year is 2005, this means that the price level has risen 5.1% since 2005. Another way to say it is that the 2005 dollar could buy 5.1% more than the 2010 dollar.

### (2) Consumer Price Index (CPI)

The CPI is another index number calculated using a specific set, or basket, of 600 retail goods and services. Each good in the basket is weighted according to the



proportion of average household expenditure accounted for by that good. The CPI indicates the change in prices of the basket from the base year (which is normalized to 100) to the given year: a CPI of 98 indicates that price levels have decreased 2% from the base year.

To calculate CPI, take the ratio of the cost of the CPI basket at current prices to the CPI basket at base year prices.

$$\text{CPI} = \frac{\text{CPI Basket Cost @ Current Prices}}{\text{CPI Basket Cost @ Base Prices}} \times 100$$

CPI has some drawbacks in analyzing price level changes. First, CPI is calculated using a specific set and percentage of CONSUMER goods. It is a fixed basket not often adjusted to reflect changes in goods available or consumer preferences. Also, things like machinery and medical equipment are not included. CPI also does not reflect the change in the quality of goods, only the prices of goods. Although a laptop costs less today than 3 years ago, the quality has improved significantly.

### Inflation

Inflation is an increase in the general level of prices of goods and services. Deflation is a decrease in the general level of prices of goods and services. From both an individual and government's point of view, inflation is a huge concern.

The CPI and GDP deflator tell us how high prices are relative to a base year, but the rate of inflation can be used to express the change in price level between 2 years when neither is the base year.

The **rate of inflation** is calculated by using the basic percentage change formula with either two CPI numbers or two GDP deflator numbers:  $(\text{new} - \text{old})/\text{old} \times 100$ .

If the CPI last year was 121 and the CPI this year is 125, the rate of inflation is:

$$\text{rate of inflation} = \frac{125 - 121}{121} \times 100 = 3.3\%$$

Another statistic used to assess inflation is the **real wage rate** which basically corrects your current hourly wage (or nominal wage) for the rising cost of inflation.

$$\text{real wage rate} = \frac{\text{nominal (or current) wage rate}}{\text{CPI or GDP deflator}} \times 100$$

You may have received a pay raise last year but if the overall inflation rate increased by a greater percent, you're now making "less" than you did last year.



## Practice Problems

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1. Money flows from businesses to households as incomes:
  - (a) In exchange for goods and services
  - (b) In exchange for incomes
  - (c) Because money is a medium of exchange
  - (d) In exchange for productive inputs
2. Norway's real GDP for 2010 is \$900 billion. If the economic growth rate from 2010 to 2011 is 5%, what is the real GDP for 2011?
3. Using the table below which shows the total output for the US economy over 2 years, calculate (a) nominal GDP for 2007 (b) real GDP for 2007 using 2006 as the base year (c) economic growth from 2006 to 2007.

Year	Item	Price	Quantity
<b>2006</b>	Ice cream	\$4.00	400 units
	Waffle cones	\$2.00	200 units
	Maraschino cherries	\$0.75	100 units
<b>2007</b>	Ice cream	\$4.25	500 units
	Waffle cones	\$2.50	300 units
	Maraschino cherries	\$1.00	50 units

4. Canada's nominal GDP increased 6% from 2001 to 2002. Canada's real GDP decreased 2% from 2001 to 2002. Explain.
5. If money GDP has increased by 5.3% from last year's level, and the average level of prices has increased by 3.2%, (a) what can be determined about the economy's output of goods and services? (b) If INSTEAD the average level of prices has increased by 6.3%, what can be concluded about the economy's output of goods and services?
6. Calculate the GDP deflator for each year in the table below. What is the rate of inflation from 2008 to 2010?

Year	Nominal GDP (billions)	Real GDP (billions)	GDP deflator
2008	864.5	845.5	
2009	882.6	851.9	
2010	923.4	875.1	



7. Calculate the (a) basket CPI for 2004, (b) CPI for 2004 based on 2003 prices, (c) the percent increase in price level from 2003 to 2004.

Year	Item	Price	Quantity
<b>2003</b>	Coffee	\$2.00	100 units
	Scones	\$3.50	200 units
<b>2004</b>	Coffee	\$2.25	100 units
	Scones	\$4.00	200 units

8. If the consumer price index in 1994 was 102.0 and in 1995, the CPI was 104.2, calculate the rate of inflation for 1995.
9. Your boss gave you a raise this year that increased your salary from \$72,000 to \$76,000. The CPI for this year is 106 compared to last year (the base year). Has your real wage rate increased or decreased from last year?

## Solutions

1. d  
 2. \$945 billion  
 3. (a) \$2,925 (b) \$2,637.50 (c) 27%  
 4. Price increase of 8% from 2001 to 2002; Output decrease of 2% from 2001 to 2002  
 5. (a) Level of output of goods and services has risen by 2.1%; (b) level of output of goods and services has fallen 1%  
 6.

Year	Nominal GDP (billions)	Real GDP (billions)	GDP deflator
2008	864.5	845.5	102
2009	882.6	851.9	104
2010	923.4	875.1	106

The rate of inflation from 2008 to 2010 was 3.9% (~4%):

$$\frac{(106 - 102)}{102} \times 100 = 3.9\%$$

7. (a) \$1,025 (b) 114 (c) 14%  
 8. rate of inflation =  $\frac{104.2 - 102}{102} \times 100 = 2.2\%$   
 9. \$71,698.11 is your real "wage rate" for this year – so it has decreased.

