Chapter 4: Measuring National Economic Activity and Performance

Macroeconomics is the study of the "big picture" economic issues. Economics depends on the measurement of relevant variables. Models are used to understand and predict economic events. Policies can be suggested based on theoretical results/predictions. Why is it important?

- Financial crisis 2008-2009 (U.S.)
- Government budget deficit crisis 2010-2012 (E.U.)

(Related articles:
http://en.wikipedia.org/wiki/Late-2000s_financial_crisis
http://www.nytimes.com/2011/01/26/business/economy/26inquiry.html)

4.1 Three main indicators of macroeconomic activity

- **Real Gross Domestic Product (real GDP)** measures
  (i) Quantity of final goods & services produced in the economy in a specific time period
  (ii) The real incomes generated in producing those goods & services

  Percentage changes in real GDP over time are called the growth rate (note that the growth rate can be positive or negative). To calculate the annual growth rate of real GDP use

$$growth\ rate\ of\ r.GDP_{year\ 2} = \frac{r.GDP_{year\ 2} - r.GDP_{year\ 1}}{r.GDP_{year\ 1}} \times 100$$

Example 1 The Canadian real GDP was C$1,325 billion in 2010 and C$1,357 in 2011. The corresponding growth rate was

$$growth\ rate\ of\ r.GDP_{2011} = \frac{1357 - 1325}{1325} \times 100 = 2.42\%$$

- **Price level**

When considering the entire economy, there are so many different goods & services, and equally many prices. When referring to the price level of the economy we mean a ***weighted average price*** of a basket of goods & services (*e.g.*, Consumer Price Index).

Percentage changes in the price level over time are called the inflation rate (or just inflation). To calculate the annual inflation rate use

$$\boldsymbol{Inflation\ rate_{year\ 2}} = \frac{\boldsymbol{CPI_{year\ 2} - CPI_{year\ 1}}}{\boldsymbol{CPI_{year\ 1}}} \times \mathbf{100}$$

Example 2 The Canadian CPI was in 116.5 2010 and 119.9 in 2011. The corresponding inflation rate was

$$\boldsymbol{Inflation\ rate_{2011}} = \frac{\mathbf{119.9 - 116.5}}{\mathbf{116.5}} \times \mathbf{100} = \mathbf{2.92\%}$$

- **Unemployment**

We define the following:

(a) **Employment (E):** the number of adults (+15 years of age) who currently work full or part-time, or self-employed.

(b) **Unemployment (U):** the number of adults (+15 years of age) who are not employed but ACTIVELY looking for a job.

(c) **Labour Force (L):** the sum of people employed and unemployed.

(d) **Non-institutionalized adult population:** the number of adults not in hospitals and/or in jails.

There are three important labour market indicators:

(1) **Participation rate:** the percentage of non-institutionalized adult population that is in the labour force, *i.e.*,

$$\boldsymbol{Participation\ rate} = \frac{\boldsymbol{Labour\ Force}}{\boldsymbol{Non-institut.\ adult\ population}} \times \mathbf{100}$$

(2) **Unemployment rate (u):** the percentage of people unemployed out of the labour force, *i.e.*,

$$\boldsymbol{Unemployment\ rate} = \frac{\boldsymbol{Unemployment}}{\boldsymbol{Labour\ Force}} \times \mathbf{100}$$

(3) **Employment rate:** the percentage of non-institutionalized population that is currently employed, *i.e.*,

$$\boldsymbol{Employment\ rate} = \frac{\boldsymbol{Employment}}{\boldsymbol{Non-institut.\ adult\ population}} \times \mathbf{100}$$

Example 3 Statistics Canada provides the following data about the labour market in 2008 (in thousands of people):

- Non-Institutional pop 15+ yrs 27,013
- Labour force 18,326
- Employment 17,206

Find the unemployment (U), the unemployment rate (u), the participation rate, and the employment rate.

- U = L – E → U = 18326 – 17206 → U = 1120
- Unemployment rate = (1120/18326)x100 → u = 6.1%
- Participation rate = (18326/27013)x100 = 67.8%
- Employment rate = (17206/27013)x100 = 63.7%

Categories of unemployment:

(i) ***Cyclical Unemployment.*** Unemployment resulting from business recessions.

(ii) ***Structural Unemployment.*** Unemployment caused by changes in the structure of the economy, large decreases in demand, or changes in technology that reduce demand for labour. The level of structural unemployment is used to define **Natural Rate of Unemployment** (NRU). NRU is estimated to be between 6.5 and 7.5 percent. At NRU, the economy achieves **full employment.**

4.2 Canadian economic performance

(For details refer to the book, pp.71-75)

	Canada %	United States %
Real GDP growth rate		
1980s	3.0	3.0
1990s	2.5	3.0
2000–2008	2.9	2.5
Inflation rate		
1980s	6.5	5.6
1990s	2.2	3.0
2000–2008	2.3	2.8
Unemployment rate		
1980s	9.4	7.3
1990s	9.5	5.8
2000–2008	7.0	5.0

Practice problem (end of chapter question #1):
You have the following data for an economy:

Year	Real GDP (2002 $)	Consumer Price Index (2002 = 100)	Labour Force (000)	Employment (000)
2006	1282	109.1	17,593	16,537
2007	1307	111.9	17,857	16,696
2008	1288	138.9	18,125	16,856

a. What was the rate of growth of real GDP from 2006 to 2007, and from 2007 to 2008?

2006-07: $\left(\frac{1307-1282}{1282}\right)\times 100\% = 1.95\%$, 2007-08: $\left(\frac{1288-1307}{1307}\right)\times 100\% = -1.45\%$

b. What was the rate of inflation in 2007 and in 2008?

2007: $\left(\frac{111.9-109.1}{109.1}\right)\times 100\% = 2.7\%$, 2008: $\left(\frac{138.9-111.9}{111.9}\right)\times 100\% = 24.1\%$,

c. What were the rates of growth of the labour force and employment from 2006 to 2007, and from 2007 to 2008?

2006-07
Labour: $\left(\frac{17857-17593}{17593}\right)\times 100\% = 1.5\%$,
Employ: $\left(\frac{16696-16573}{16573}\right)\times 100\% = 0.95\%$

2007-08
Labour: $\left(\frac{18125-17857}{17857}\right)\times 100\% = 1.5\%$,
Employ: $\left(\frac{16856-16696}{16573}\right)\times 100\% = 0.96\%$

d. What happened to the unemployment rate between 2006 and 2007, and between 2007 and 2008?

2006: $\left(\frac{17593-16537}{17593}\right)\times 100\% = 6.0\%$,
2007: $\left(\frac{17857-16696}{17857}\right)\times 100\% = 6.5\%$,

2008: $\left(\frac{18125-16856}{18125}\right)\times 100\% = 7.0\%$

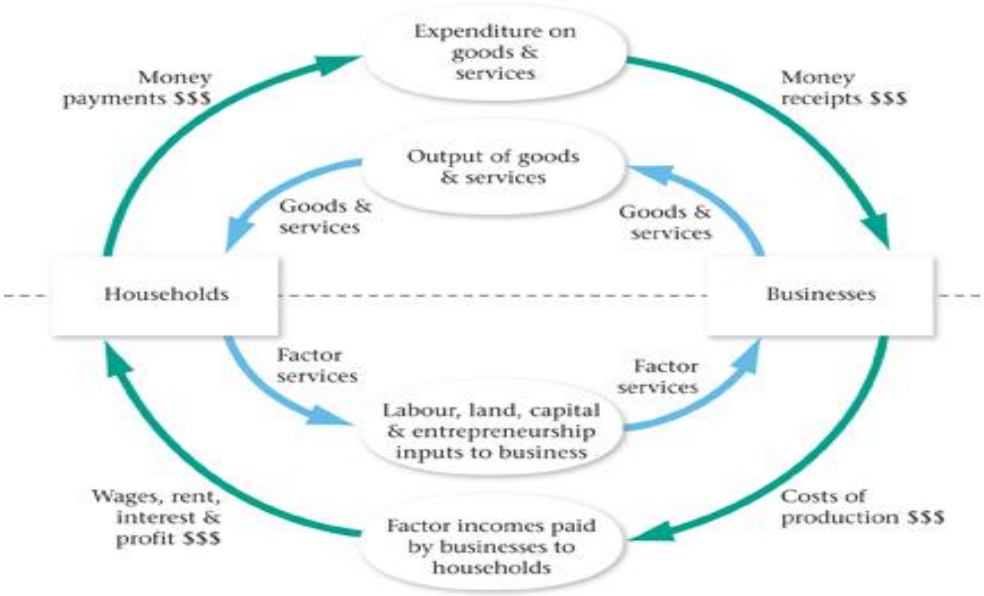
Unemployment increased in 2007 and 2008 because the growth in employment was less than the growth in the labour force.

4.3 National Accounting Measures of the economy

National Accounts provide:

- A set of definitions and concepts for use in measuring GDP
- A framework for an aggregate demand (AD) and supply (AS) model of the economy

The **circular flow diagram** shows how real resources and money flow between households and businesses.



According to the principle behind the circular flow diagram, we get

$$Market\ value\ of\ output \equiv Total\ Expenditure \equiv Total\ Income$$

Output-Based GDP

Essential to this approach of measuring the GDP is the concept of **Value Added**. To understand it we need to define:

- **Intermediate goods** are those that are going to be used into the production process of another good.
- **Final goods** are those that are purchased by the ultimate user.

Then we define

- **Value added** as the difference between the market value of a firm's product and the cost of intermediate goods that this firm used.

Example 4 Consider a hypothetical economy where the only final good is loafs of bread. On the first stage, the farmer grows wheat in his land with the use of seeds and fertilizer. He pays for these inputs $0.03 per kilo of wheat. After he collects his crop, he is selling it to the miller for $0.07 per kilo. The miller, using one kilo of wheat, produces 750 grams of flour and sells it to the baker for $0.12. The baker uses the 750 grams of flour and produces one loaf of bread. The bread is then sold to a super market for $0.30

per loaf. Bread is the final good that households buy from the super market at $0.45 per loaf.

The above production story can be described analytically in a table form:

Stage of Production	Purchase of Intermediate Goods	Total Sales	Value Added
Seeds and fertilizer	$0.00	$0.03	0.03 – 0.00 = $0.03
Growing wheat	$0.03	$0.07	0.07 – 0.03 = $0.04
Milling	$0.07	$0.12	0.12 – 0.07 = $0.05
Baking	$0.12	$0.30	0.30 – 0.15 = $0.18
Retailing	$0.30	$0.45	0.45 – 0.30 = $0.15
		$0.97	$0.45

Note: if we add the production of all goods and services (that is the sum of total sales) we will be overestimating the true value of real GDP ($0.97 instead of $0.45). When we include in the calculation of real GDP the sales of intermediate goods we make the mistake of double counting.

Expenditure-Based GDP

All the different types of expenditures on final goods and services are added together.

• **Consumption Expenditures (C)** include household spending on currently produced goods and services.

• **(Gross) Investment (I)** includes

- Changes in buildings, equipment, machinery, facilities, etc.
- Changes in inventories
- Housing
- Depreciation (or Capital Consumption Allowance, CCA) → the value the physical capital is losing because it's been used.

Note that if **Net Investment is given depreciation must be added to it to get the gross investment, i.e.,

$$\boldsymbol{Gross\ Investment = Net\ Investment + Depreciation}$$

• **Government Expenditures (G)** include government spending on currently produced goods and services. → salaries and wages of government employees and military personnel, spending on health care ,public education, and public infrastructure.

• **Net Exports (NX = X – Z).** Net exports are equal to total exports minus total imports.
- **Exports** → spending of foreigners on domestic goods and services
- **Imports** → spending on foreign goods and services

Algebraically,

$$\boldsymbol{GDP = C + I + G + NX}$$

Example 5 The Statistical Agency of Euphoria has collected the following information about Euphoria's expenditures:

Household expenditure on goods and services	600
Government expenditure on goods and services	200
Depreciation	40
Net private domestic investment	160
Exports	50
Imports	80

a. What is the value of gross investment?
Gross Investment = Net Investment + Depreciation = 160 + 40 = $200

b. What is the expenditure value of the GDP?
GDP = C + I + G + X – Z = 600 + 200 + 200 + 50 – 80 = $970

Income-Based GDP

All the different types of income generated in the economy are added together. Need also to add the depreciation (in order to make it GROSS) and the Net Indirect Taxes (in order to make it MARKET VALUE).
The different types of income generated include:

1. Wages and salaries **(W)**
2. Profits and business income
3. Interest and investment income

} **(BI)**

We define the **Net Domestic Income (NDI)** as the sum of all incomes generated in the economy, i.e.,

$$\boldsymbol{NDI = W + BI}$$

By adding the depreciation to the NDI we get

$$\boldsymbol{GDP\ at\ basic\ prices = NDI + CCA}$$

Finally, to get the GDP at market prices we need to add the **indirect taxes** paid on the products (like the GST, HST) and **subtract** the awarded subsidies. The difference between indirect taxes and subsidies is called Net indirect Taxes (T_{IN}). Therefore,

$$\boldsymbol{GDP\ at\ market\ prices = NDI + CCA + T_{IN}}$$

Another measure is that of Gross National Product (GNP) or Gross National Income (GNI). This is defined as

$$\boldsymbol{GNP = GDP - Net\ foreign\ property\ income}$$

Example 6 The Statistical Agency of Euphoria has collected the following information about Euphoria's incomes:

Profits	500
Interest and investment income	40
Wages, salaries and other compensations	1,000
Farm and Non-incorporated Non-farm Business Income	250
Indirect taxes	80
Depreciation	30
Subsidies	120

a. What is the NDI?

NDI = 1,000 + 500 + 250 + 40 = \$1,790

b. What is the GDP at basic prices?

$GDP_{BASIC\ PRICES}$ = NDI + depreciation = 1,790 + 30 = \$1,820

c. What is the GDP at market prices?

GDP = NDI + depreciation + T_{IN}= 1,790 + 30 + (80 – 120) = \$1,780

4.4 Nominal and Real GDP and GDP deflator

Note that GDP measures the market value of production. However, prices of goods change over time and comparing GDPs form different periods cannot be done without holding prices constant. We distinguish in

• Current prices (or nominal prices): the

• Real prices (or base year prices):

Depending on what prices we consider, we get different type of GDP (nominal or real). These concepts can become clear with the following example:

Example 7 The table below shows the production level of two goods (apples and bananas) and the corresponding prices in the economy of Euphoria for two consecutive years:

	YEAR 2008		YEAR 2009	
	Price	**Quantity**	**Price**	**Quantity**
Apples	$1.00	24	$1.10	27
Bananas	$1.20	34	$1.25	37

a. Find the nominal GDP of Euphoria for the years 2008, and 2009, as well as the corresponding growth rate of nominal GDP.

For the nominal GDP we add up the values of the production AT CURRENT PRICES. That means that when calculating the nominal GDP of 2008, for example, we will multiply the quantity of apples produced in 2008 by the price of an apple in 2008. Analytically,

$$n.GDP_{2008} = P^A_{2008} \times Q^A_{2008} + P^B_{2008} \times Q^B_{2008} = \$1.00 \times 24 + \$1.20 \times 34 = \$64.80$$

$$n.\ GDP_{2009} = P^A_{2009} \times Q^A_{2009} + P^B_{2009} \times Q^B_{2009} = \$1.10 \times 27 + \$1.25 \times 37 = \$75.95$$

We are interested on how the production changes over time. Most of the times, we express this change in the value of the production as a percentage (the GROWTH RATE of the production). For the growth rate of nominal GDP found above we get

$$\text{Growth of } n.GDP_{2009} = 100\% \times (n.GDP_{2009} - n.GDP_{2008})/n.GDP_{2008} = 100\% \times (75.95 - 64.80)/64.80 = 17.02\%$$

b. Assuming that year 2008 is the base year, find the real GDP of Euphoria for the years 2008, and 2009, as well as the corresponding growth rate of real GDP.

For the real GDP we add up the values of the production AT CONSTANT PRICES. That means that when calculating the nominal GDP of 2008, for example, we will multiply the quantity of apples produced in 2008 by the price of an apple in BASE YEAR. Analytically, for 2009 being the base year we get

$$r.GDP_{2008} = P^A_{BASE} \times Q^A_{2008} + P^B_{BASE} \times Q^B_{2008} = \$1.10 \times 24 + \$1.25 \times 34 = \$68.90$$

$$r.\ GDP_{2009} = P^A_{BASE} \times Q^A_{2009} + P^B_{BASE} \times Q^B_{2009} = \$1.10 \times 27 + \$1.25 \times 37 = \$75.95$$

For the growth rate of real GDP found above we get

$$\text{Growth of } r.GDP_{2009} = 100\% \times (r.GDP_{2009} - r.GDP_{2008})/r.GDP_{2008} = 100\% \times (75.95 - 68.90)/68.90 = 10.23\%$$

c. Find the GDP deflator of Euphoria for the years 2008, and 2009, as well as the corresponding inflation rate.

The GDP deflator is given by

$$GDP\ DEFLATOR_{YEAR\ X} = \frac{n.GDP_{YEAR\ X}}{r.GDP_{YEAR\ X}} \times 100$$

Therefore we get

$$GDP\ DEFLATOR_{2008} = \frac{n.GDP_{2008}}{r.GDP_{2008}} \times 100 = \frac{64.80}{68.90} \times 100 = 94.05$$

$$GDP\ DEFLATOR_{2009} = \frac{n.GDP_{2009}}{r.GDP_{2009}} \times 100 = \frac{75.95}{75.95} \times 100 = 100.00$$

Given these values for the GDP Deflators we can calculate the inflation rates (since GDP Deflators represent average annual prices).

$$INFLATION_{YEAR\ 2009} = \frac{100.00 - 94.05}{94.05} \times 100\% = 6.33\%$$

d. Using the information necessary from the table above, and assuming that 2009 is the base year, calculate the CPIs of Euphoria for the years 2008, and 2009, as well as the corresponding inflation rate.

Step 1: Identify a "representative" basket of goods that households buy each period (in an exercise this basket will be given to us or –when it is not given- we use the base year quantities as the basket quantities. Therefore, we will use the base year quantities. Given that 2009 is the base year we can assume that the quantities included in the basket (according to the table) are 27 apples and 37 bananas.

Step 2: Find the cost of the basket, i.e.,

$$\boldsymbol{Cost\ of\ Basket_{2008}} = \$\mathbf{1.00} \times (\mathbf{27}) + \$\mathbf{1.20} \times (\mathbf{37}) = \$\mathbf{71.40}$$

$$\boldsymbol{Cost\ of\ Basket_{2009}} = \$\mathbf{1.10} \times (\mathbf{27}) + \$\mathbf{1.25} \times (\mathbf{37}) = \$\mathbf{75.95}$$

Step 3: Find the CPIs using

$$\boldsymbol{CPI_{YEAR\ X}} = \frac{\boldsymbol{Cost\ of\ Basket_{YEAR\ X}}}{\boldsymbol{Cost\ of\ Basket_{BASE\ YEAR}}} \times \mathbf{100}$$

Therefore,

$$\boldsymbol{CPI_{2008}} = \frac{\boldsymbol{Cost\ of\ Basket_{2008}}}{\boldsymbol{Cost\ of\ Basket_{2009}}} \times \mathbf{100} = \frac{\mathbf{71.40}}{\mathbf{75.95}} \times \mathbf{100} = \mathbf{94.01}$$

$$\boldsymbol{CPI_{2009}} = \frac{\boldsymbol{Cost\ of\ Basket_{2009}}}{\boldsymbol{Cost\ of\ Basket_{2009}}} \times \mathbf{100} = \frac{\mathbf{75.95}}{\mathbf{75.95}} \times \mathbf{100} = \mathbf{100.00}$$

and

$$\boldsymbol{INFLATION_{2009}} = \frac{\mathbf{100.00} - \mathbf{94.01}}{\mathbf{94.01}} \times \mathbf{100\%} = \mathbf{6.37\%}$$

4.5 Per capita Real GDP

The per capita real GDP is a measure of a standard of living and it is defined as the real GDP per person, i.e.,

$$\boldsymbol{Per\ capita\ real\ GDP} = \frac{\boldsymbol{real\ GDP}}{\boldsymbol{population}}$$

This allows the comparison between different countries (different countries usually have not only different real GDP but also different population).

Limitations of GDP

The GDP does not take into account quality characteristics like:

- The quality of the environment (some production causes pollution & other externalities)
- The composition of output affects standard of living (Military production vs. health care)
- Unreported income & output
- Non-marketed goods & services
- Income distribution
- Literacy level
- Life expectancy