

## Chapter 2 The Data of Macroeconomics

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### Learning Objectives

In this chapter, you will learn about:

- Gross Domestic Product (GDP)
- the Consumer Price Index (CPI)
- the Unemployment Rate

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### GROSS DOMESTIC PRODUCT

...measures:

1. \*Total expenditure on domestically produced final goods and services
2. \*Total income earned by domestically-located factors of production
3. Total output
4. The sum of value-added at all stages in the production of final goods

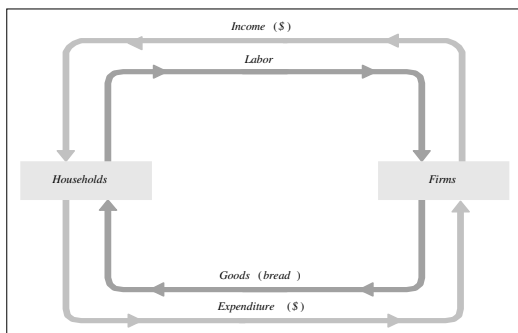
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### Why expenditure = income

In every transaction,  
the buyer's expenditure becomes  
the seller's income.  
  
Thus, the sum of all expenditure  
equals  
the sum of all income.

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### The Circular Flow



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### Stocks vs. Flows

- | <i>stock</i>                        | <i>flow</i>                |
|-------------------------------------|----------------------------|
| 1. a person's wealth                | a person's saving          |
| 2. # of people with college degrees | # of new college graduates |
| 3. govt. debt                       | govt. budget deficit       |

Stock: Quantity measured at a given point in time

Flow: Quantity measured per unit of time

GDP????

How many \$ are flowing around the circular system per unit of time.

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### What if number of goods produced > 1?

1. Adding apples and oranges: different products have different values → use market prices because they reflect willingness to pay
2. Used goods are NOT included in GDP (GDP measures flow, sales of used goods is a transfer of assets, i.e. stocks)
3. Inventories are seen as purchases of the firms → increase GDP at the time accumulated  
What happens when they are sold?

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### What if number of goods produced > 1?

4. Value of intermediate goods (goods that are used in the production of other goods) is included as part of the market price of the final goods → GDP = value of final goods produced
5. Alternatively, a firm's value added is **TV(output) - TV(intermediate goods)**
6. Housing services and imputations (homework)

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### What if number of goods produced > 1?

- GDP = value of final goods produced  
= sum of value added at all stages of production

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### Allocation of GDP

#### The Expenditure Components of GDP

- consumption
- investment
- government spending
- net exports

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### 1. Consumption (C)

Def: the value of all goods and services bought by households.



- Includes:
- **durable goods**   
last a long time  
ex: cars, home appliances
  - **non-durable goods**   
last a short time  
ex: food, clothing
  - **services**   
work done for consumers  
ex: dry cleaning, air travel.

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### U.S. Consumption, 2001

	\$ billions	% of GDP
Consumption	\$7,064.5	69.2%
Durables	858.3	8.4
Nondurables	2,055.1	20.1
Services	4,151.1	40.7

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## 2. Investment (I)

Def1: spending on [the factor of production] capital.

Def2: spending on goods bought for future use.

Includes:

- **business fixed investment**  
spending on plant and equipment that firms will use to produce other goods & services
- **residential fixed investment**  
spending on housing units by consumers and landlords
- **inventory investment**  
the change in the value of all firms' inventories

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## U.S. Investment, 2001

	\$ billions	% of GDP
Investment	\$1,633.9	16.0%
Business fixed	1,246.0	12.2
Residential fixed	446.3	4.4
Inventory	-58.4	-0.6

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## 3. Government spending (G)

- **G** includes all government spending on goods and services.
- **G** excludes transfer payments (e.g. unemployment insurance payments), because they do not represent spending on goods and services.

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## Government spending, 2001

	\$ billions	% of GDP
Gov spending	\$1,839.5	18.0%
Federal	615.7	6.0
Non-defense	216.6	2.1
Defense	399.0	3.9
State & local	1,223.8	12.0

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## 4. Net exports (NX = EX - IM)

Def: the value of total exports (**EX**) minus the value of total imports (**IM**)



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## An Important Identity!!!

$$Y = C + I + G + NX$$

where

**Y** = GDP = the value of total output

**C + I + G + NX** = aggregate expenditure

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## GDP: An Important and Versatile Concept

We have now seen that GDP measures

- total income
- total output
- total expenditure
- the sum of value-added at all stages in the production of final goods

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## GNP vs. GDP

- Gross **National** Product (GNP):  
total income earned by the nation's factors of production, regardless of where located
- Gross **Domestic** Product (GDP):  
total income earned by domestically-located factors of production, regardless of nationality.

$$(\text{GNP} - \text{GDP}) = (\text{factor payments from abroad}) - (\text{factor payments to abroad})$$

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## Real vs. Nominal GDP

- GDP is the value of all final goods and services produced.

- **Nominal GDP** measures these values using current prices.

$$\text{NGDP}_{2003} = \sum (P_{03i} * Q_{03i})$$

- **Real GDP** measure these values using the prices of a base year.

$$\text{RGDP}_{2003} = \sum (P_{02i} * Q_{03i})$$

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## Real GDP controls for inflation

Changes in nominal GDP can be due to:

- changes in prices
- changes in quantities of output produced

Changes in real GDP can only be due to changes in quantities, because real GDP is constructed using constant base-year prices.

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## GDP Deflator

- The **inflation rate** is the percentage increase in the overall level of prices.
- One measure of the price level is the **GDP Deflator**, defined as

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

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## Understanding the GDP deflator

For good  $i = 1, 2, 3$

$P_{it}$  = the market price of good  $i$  in month  $t$

$Q_{it}$  = the quantity of good  $i$  produced in month  $t$

$\text{NGDP}_t$  = Nominal GDP in month  $t$

$\text{RGDP}_t$  = Real GDP in month  $t$

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## Understanding the GDP deflator

$$\text{GDP deflator} = 100 \times \frac{\text{NGDP}_t}{\text{RGDP}_t} = 100 \times \frac{P_{1t}Q_{1t} + P_{2t}Q_{2t} + P_{3t}Q_{3t}}{\text{RGDP}_t}$$

$$= 100 \times \left[ \left( \frac{Q_{1t}}{\text{RGDP}_t} \right) P_{1t} + \left( \frac{Q_{2t}}{\text{RGDP}_t} \right) P_{2t} + \left( \frac{Q_{3t}}{\text{RGDP}_t} \right) P_{3t} \right]$$

*The GDP deflator is a weighted average of prices.*

*The weight on each price reflects that good's relative importance in GDP.*

*Note that the weights change over time.*

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## Understanding the GDP deflator

- Nominal GDP measures the current \$ value of the output of the economy.
- Real GDP measures output valued at constant prices.
- GDP deflator measures the price of output relative to its price in the base year.

e.g. 1 good case

$$\text{GDP deflator} = \frac{P_t * Q_t}{P_{t-1} * Q_t} = \frac{P_t}{P_{t-1}}$$

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## CONSUMER PRICE INDEX (CPI)

- A measure of the overall level of prices
- Published by the **Bureau of Labor Statistics (BLS)**
- Used to
  - track changes in the typical household's cost of living
  - allow comparisons of dollar figures from different years
- Tells us how much it costs now to buy X relative to how much it cost to buy it in the base year

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## How the BLS constructs the CPI

1. Survey consumers to determine composition of the typical consumer's "basket" of goods. (e.g. 5 apples, 2 oranges etc)
2. Every month, collect data on prices of all items in the basket; compute cost of basket
3. CPI in any month equals

$$100 \times \frac{\text{Cost of basket in that month}}{\text{Cost of basket in base period}}$$

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## Understanding the CPI

For good  $i = 1, 2, 3$

$C_i$  = amount of good  $i$  in the CPI's basket

$P_{it}$  = price of good  $i$  in month  $t$

$E_t$  = cost of the CPI basket in month  $t$

$E_b$  = cost of the basket in the base period

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## Understanding the CPI

$$\text{CPI in month } t = 100 \times \frac{E_t}{E_b} = 100 \times \frac{P_{1t}C_1 + P_{2t}C_2 + P_{3t}C_3}{E_b}$$

$$= 100 \times \left[ \left( \frac{C_1}{E_b} \right) P_{1t} + \left( \frac{C_2}{E_b} \right) P_{2t} + \left( \frac{C_3}{E_b} \right) P_{3t} \right]$$

*The CPI is a weighted average of prices.*

*The weight on each price reflects that good's relative importance in the CPI's basket.*

*Note that the weights remain fixed over time.*

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## CPI vs. GDP Deflator

1. prices of capital goods
  - included in GDP deflator (if produced domestically)
  - excluded from CPI
2. prices of imported consumer goods
  - included in CPI
  - excluded from GDP deflator
3. the basket of goods
  - CPI: fixed
  - GDP deflator: changes every year

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## Fixed versus Changing Weights

- e.g. Major frosts destroy nation's X crop.
- Q(X) produced falls to zero
  - P(remaining X) increases significantly
- Fixed weights overstate the impact because it doesn't take into account the substitutability of goods

$$= 100 \times \left[ \left( \frac{C_1}{E_1} \right) P_1 + \left( \frac{C_2}{E_2} \right) P_2 + \left( \frac{C_3}{E_3} \right) P_3 \right]$$

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## Fixed versus Changing Weights

- Changing weights understate the impact because it doesn't take into account the possible loss of welfare due to substitution

$$= 100 \times \left[ \left( \frac{Q_{1t}}{RGDP_t} \right) P_{1t} + \left( \frac{Q_{2t}}{RGDP_t} \right) P_{2t} + \left( \frac{Q_{3t}}{RGDP_t} \right) P_{3t} \right]$$

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## Additional reasons why the CPI may overstate inflation

- **Substitution bias:** The CPI uses fixed weights, so it cannot reflect consumers' ability to substitute toward goods whose relative prices have fallen.
- **Introduction of new goods:** The introduction of new goods makes consumers better off and, in effect, increases the real value of the dollar. But it does not reduce the CPI, because the CPI uses fixed weights.
- **Unmeasured changes in quality:** Quality improvements increase the value of the dollar, but are often not fully measured.

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## The CPI's bias

- The Boskin Panel's "best estimate": The CPI overstates the true increase in the cost of living by 1.1% per year.
- Result: the BLS has refined the way it calculates the CPI to reduce the bias.
- It is now believed that the CPI's bias is slightly less than 1% per year.

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## CATEGORIES OF THE POPULATION

- **employed**  
working at a paid job
- **unemployed**  
not employed but looking for a job
- **labor force**  
the amount of labor available for producing goods and services; all employed plus unemployed persons
- **not in the labor force**  
not employed, not looking for work.

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## Two important labor force concepts

- **unemployment rate**

percentage of the labor force that is unemployed

$$UR = [N(\text{unemployed}) / \text{Labor Force}] * 100$$

- **labor force participation rate**

the fraction of the adult population that 'participates' in the labor force

$$LFR = [\text{Labor Force} / \text{Adult Population}] * 100$$

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## Okun's Law

- Employed workers help produce GDP, while unemployed workers do not. So one would expect a negative relationship between unemployment and real GDP.

- This relationship is clear in the data

$$\% \text{Change in RGDP} = 3\% - (2 * \% \text{Change in Unemployment})$$

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## Chapter Summary

1. Gross Domestic Product (GDP) measures both total income and total expenditure on the economy's output of goods & services.
2. Nominal GDP values output at current prices; real GDP values output at constant prices. Changes in output affect both measures, but changes in prices only affect nominal GDP.
3. GDP is the sum of consumption, investment, government purchases, and net exports.

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## Chapter Summary

4. The overall level of prices can be measured by either
  - the Consumer Price Index (CPI), the price of a fixed basket of goods purchased by the typical consumer
  - the GDP deflator, the ratio of nominal to real GDP
5. The unemployment rate is the fraction of the labor force that is not employed. When unemployment rises, the growth rate of real GDP falls.

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