

Chapter 2: The Data of Macroeconomics

CHAPTER 2 The Data of Macroeconomics

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Gross Domestic Product: Expenditure and Income

Two definitions:

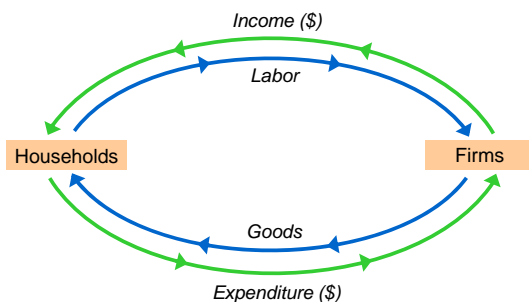
- Total expenditure on domestically-produced final goods and services.
- Total income earned by domestically-located factors of production.

Expenditure equals income because every dollar spent by a buyer becomes income to the seller.

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The Circular Flow



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Value added

Value added:

The value of output minus the value of the intermediate goods used to produce that output

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NOW YOU TRY:

Identifying value-added

- A farmer grows a bushel of wheat and sells it to a miller for \$1.00.
- The miller turns the wheat into flour and sells it to a baker for \$3.00.
- The baker uses the flour to make a loaf of bread and sells it to an engineer for \$6.00.
- The engineer eats the bread.

Compute value added at each stage of production and GDP

Final goods, value added, and GDP

- $GDP = \text{value of final goods produced} = \text{sum of value added at all stages of production.}$
- The value of the final goods already includes the value of the intermediate goods, so including intermediate and final goods in GDP would be double-counting.

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The expenditure components of GDP

- consumption, C
- investment, I
- government spending, G
- net exports, NX

An important identity:

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

value of
total output

aggregate
expenditure

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Consumption (C)

definition: The value of all goods and services bought by households. Includes:

- durable goods**
last a long time
e.g., cars, home appliances
- nondurable goods**
last a short time
e.g., food, clothing
- services**
work done for consumers
e.g., dry cleaning, air travel



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U.S. consumption, 2008

	\$ billions	% of GDP
Consumption	\$ 10,057.9	70.5%
Durables	1,023.2	7.2
Nondurables	2,965.1	20.8
Services	6,069.6	42.6

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Investment (I)

- Spending on goods bought for future use (i.e., capital goods)
- Includes:
 - Business fixed investment**
Spending on plant and equipment
 - Residential fixed investment**
Spending by consumers and landlords on housing units
 - Inventory investment**
The change in the value of all firms' inventories

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U.S. Investment, 2008

	\$ billions	% of GDP
Investment	\$ 1,993.5	14.0%
Business fixed	1,552.8	10.9
Residential	487.7	3.4
Inventory	-47.0	-0.3

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Investment vs. Capital

Note: Investment is spending on new capital.

Example (assumes no depreciation):

- 1/1/2009:
economy has \$500b worth of capital
- during 2009:
investment = \$60b
- 1/1/2010:
economy will have \$560b worth of capital

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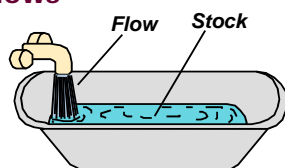
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Stocks vs. Flows

A **stock** is a quantity measured at a point in time.

E.g.,
"The U.S. capital stock was \$26 trillion on January 1, 2009."

A **flow** is a quantity measured per unit of time.
E.g., "U.S. investment was \$2.5 trillion during 2009."



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Stocks vs. Flows - examples

<i>stock</i>	<i>flow</i>
a person's wealth	a person's annual saving
# of people with college degrees	# of new college graduates this year
the govt debt	the govt budget deficit

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NOW YOU TRY: Stock or Flow?

- the balance on your credit card statement
- how much you study economics outside of class
- the size of your compact disc collection
- the inflation rate
- the unemployment rate

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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U.S. Government Spending, 2008

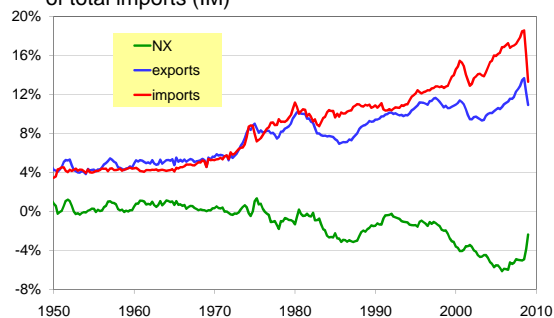
	\$ billions	% of GDP
Govt spending	\$2,882.4	20.2%
- Federal	1,071.9	7.5
Non-defense	337.0	2.4
Defense	734.9	5.2
- State & local	1,810.4	12.7

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Net Exports: $NX = EX - IM$

- def: the value of total exports (EX) minus the value of total imports (IM)



NOW YOU TRY:**An expenditure-output puzzle?**

Suppose a firm:

- produces \$10 million worth of final goods
- only sells \$9 million worth

Does this violate the ***expenditure = output*** identity?

Why output = expenditure

- Unsold output goes into inventory, and is counted as “inventory investment”...
...whether or not the inventory buildup was intentional.
- In effect, we are assuming that firms purchase their unsold output.

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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
 $GNP - GDP = \text{factor payments from abroad} - \text{factor payments to abroad}$
- Examples of factor payments: wages, profits, rent, interest & dividends on assets

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NOW YOU TRY:**Discussion Question**

*In your country,
which would you
want to be bigger,
GDP or GNP?*

Why?

GNP vs. GDP in select countries, 2007

Country	GNP	GDP	GNP – GDP (% of GDP)
Philippines	\$157,087	\$144,062	9.0%
Japan	\$4,530,191	\$4,384,255	3.3%
China	\$3,229,841	\$3,205,507	0.8%
United States	\$13,827,201	\$13,751,400	0.6%
Canada	\$1,318,304	\$1,329,885	-0.9%
South Africa	\$274,141	\$283,007	-3.1%
New Zealand	\$125,936	\$135,667	-7.2%
Peru	\$98,625	\$107,297	-8.1%

GNP and GDP in millions of current U.S. dollars

Real vs. nominal GDP

- GDP is the value of all final goods and services produced.
- nominal GDP** measures these values using current prices.
- real GDP** measure these values using the prices of a base year.

NOW YOU TRY: Real & Nominal GDP

	2006		2007		2008	
	P	Q	P	Q	P	Q
good A	\$30	900	\$31	1,000	\$36	1,050
good B	\$100	192	\$102	200	\$100	205

- Compute nominal GDP in each year.
- Compute real GDP in each year using 2006 as the base year.

NOW YOU TRY: Answers

nominal GDP *multiply Ps & Qs from same year*

2006: \$46,200 = \$30 × 900 + \$100 × 192

2007: \$51,400

2008: \$58,300

real GDP *multiply each year's Qs by 2006 Ps*

2006: \$46,200

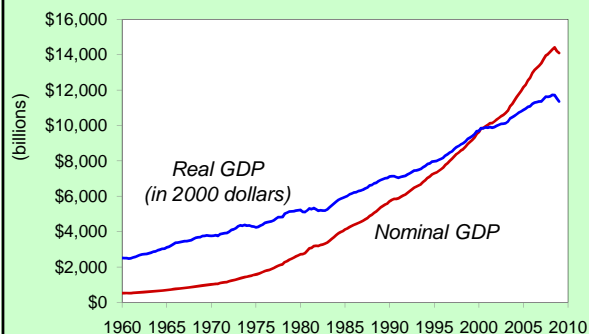
2007: \$50,000

2008: \$52,000 = \$30 × 1050 + \$100 × 205

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.

U.S. Nominal and Real GDP, 1960-2009



GDP Deflator

- Inflation rate**: the percentage increase in the overall level of prices
 - One measure of the price level: **GDP deflator**
- Definition:

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

NOW YOU TRY: GDP deflator and inflation rate

	Nom. GDP	Real GDP	GDP deflator	Inflation rate
2006	\$46,200	\$46,200		<i>n.a.</i>
2007	51,400	50,000		
2008	58,300	52,000		

- Use your previous answers to compute the GDP deflator in each year.
- Use GDP deflator to compute the inflation rate from 2006 to 2007, and from 2007 to 2008.

NOW YOU TRY: Answers

	Nominal GDP	Real GDP	GDP deflator	Inflation rate
2006	\$46,200	\$46,200	100.0	<i>n.a.</i>
2007	51,400	50,000	102.8	2.8%
2008	58,300	52,000	112.1	9.1%

Understanding the GDP deflator

Example with 3 goods

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

NGDP _{t} = Nominal GDP in month t

RGDP _{t} = Real GDP in month t

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Understanding the GDP deflator

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

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

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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Two arithmetic tricks for working with percentage changes

- For any variables X and Y ,
percentage change in $(X \times Y)$
 \approx percentage change in X
 $+$ percentage change in Y

EX: If your hourly wage rises 5% and you work 7% more hours, then your wage income rises approximately 12%.

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Two arithmetic tricks for working with percentage changes

- percentage change in (X/Y)
 \approx percentage change in X
 $-$ percentage change in Y

EX: GDP deflator = $100 \times \text{NGDP}/\text{RGDP}$.

If NGDP rises 9% and RGDP rises 4%, then the inflation rate is approximately 5%.

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Chain-Weighted Real GDP

- Over time, relative prices change, so the base year should be updated periodically.
- In essence, **chain-weighted real GDP** updates the base year every year, so it is more accurate than constant-price GDP.
- Your textbook usually uses constant-price real GDP, because:
 - the two measures are highly correlated.
 - constant-price real GDP is easier to compute.

Consumer Price Index (CPI)

- A measure of the overall level of prices
- Published by the Bureau of Labor Statistics (BLS)
- Uses:
 - tracks changes in the typical household's cost of living
 - adjusts many contracts for inflation ("COLAs")
 - allows comparisons of dollar amounts over time

How the BLS constructs the CPI

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

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

NOW YOU TRY:

Compute the CPI

Basket: 20 pizzas, 10 compact discs

prices:

	pizza	CDs
2002	\$10	\$15
2003	\$11	\$15
2004	\$12	\$16
2005	\$13	\$15

For each year, compute

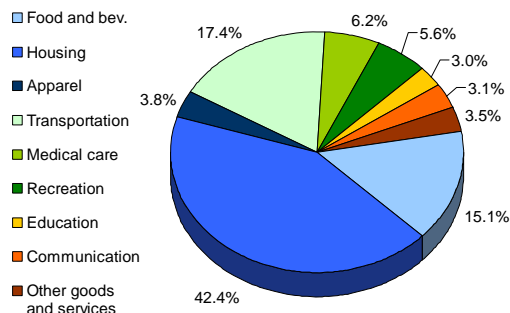
- the cost of the basket
- the CPI (use 2002 as the base year)
- the inflation rate from the preceding year

NOW YOU TRY:

Answers to CPI exercise

	Cost of basket	CPI	Inflation rate
2002	\$350	100.0	<i>n.a.</i>
2003	370	105.7	5.7%
2004	400	114.3	8.1%
2005	410	117.1	2.5%

The composition of the CPI's "basket"



Understanding the CPI

Example with 3 goods

For good $i = 1, 2, 3$

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

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

E_t = the cost of the CPI basket in month t

E_b = the cost of the basket in the base period

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Understanding the CPI

$$\begin{aligned} \text{CPI in month } t &= \frac{E_t}{E_b} = \frac{P_{1t}C_1 + P_{2t}C_2 + P_{3t}C_3}{E_b} \\ &= \left(\frac{C_1}{E_b}\right) P_{1t} + \left(\frac{C_2}{E_b}\right) P_{2t} + \left(\frac{C_3}{E_b}\right) P_{3t} \end{aligned}$$

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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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 size of the CPI's bias

- In 1995, a Senate-appointed panel of experts estimated that the CPI overstates inflation by about 1.1% per year.
- So the BLS made adjustments to reduce the bias.
- Now, the CPI's bias is probably under 1% per year.

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CPI vs. GDP Deflator

Prices of capital goods:

- included in GDP deflator (if produced domestically)
- excluded from CPI

Prices of imported consumer goods:

- included in CPI
- excluded from GDP deflator

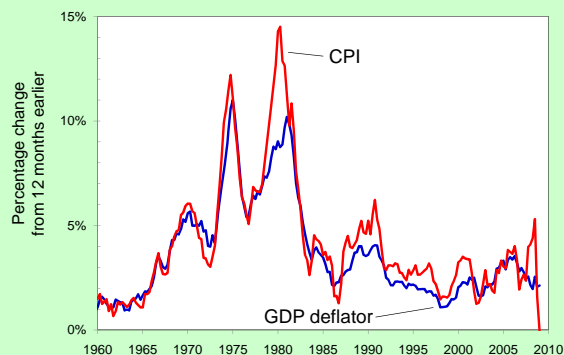
The basket of goods:

- CPI: fixed
- GDP deflator: changes every year

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Two measures of inflation in the U.S.



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
- **labor force participation rate**
the fraction of the adult population that “participates” in the labor force

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NOW YOU TRY:

Computing labor statistics

U.S. adult population by group, May 2009

Number employed	=	140.57 million
Number unemployed	=	14.51 million
Adult population	=	235.45 million

Use the above data to calculate

- the labor force
- the number of people not in the labor force
- the labor force participation rate
- the unemployment rate

NOW YOU TRY:

Answers

data: $E = 140.57$, $U = 14.51$, $POP = 235.45$

- labor force
 $L = E + U = 140.57 + 14.51 = \underline{155.08}$
- not in labor force
 $NILF = POP - L = 235.45 - 155.08 = \underline{80.37}$
- unemployment rate
 $U/L \times 100\% = (14.51/155.08) \times 100\% = \underline{9.4\%}$
- labor force participation rate
 $L/POP \times 100\% = (155.08/235.45) \times 100\% = \underline{65.9\%}$

NOW YOU TRY:

Compute percentage changes in labor statistics

Suppose

- population increases by 1%
- labor force increases by 3%
- number of unemployed persons increases by 2%

Compute the percentage changes in the labor force participation and unemployment rates.

NOW YOU TRY:

Answers

$LFPR = L/POP$

L increases 3%, POP increases 1%, so
LFPR increases $3\% - 1\% = 2\%$

U rate = U/L

U increases 2%, L increases 3%, so
U-rate increases $2\% - 3\% = -1\%$

Note: the changes in LFPR and U-rate are shown as percent of their initial values, not in percentage points! E.g., if initial value of LFPR is 60.0%, a 2% increase would bring it to 61.2%, because 2% of 60 equals 1.2.

The establishment survey

- The BLS obtains a second measure of employment by surveying businesses, asking how many workers are on their payrolls.
- Neither measure is perfect, and they occasionally diverge due to:
 - treatment of self-employed persons
 - new firms not counted in establishment survey
 - technical issues involving population inferences from sample data

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Two measures of employment growth

