In this chapter, you will learn:

…the meaning and measurement of the most important macroeconomic statistics:

- Gross Domestic Product (GDP)
- The Consumer Price Index (CPI)
- The unemployment rate

### 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.*

### The Circular Flow

- **Households**
- **Firms**
- **Income ($)**
- **Labor**
- **Goods**
- **Expenditure ($)**

### Value added

**Value added:**

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

**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 = value of final goods produced
  = 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.

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

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

U.S. consumption, 2009

<table>
<thead>
<tr>
<th>Consumption</th>
<th>$ billions</th>
<th>% of GDP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Consumption</td>
<td>$10,001</td>
<td>70.8%</td>
</tr>
<tr>
<td>Durables</td>
<td>1,027</td>
<td>7.3%</td>
</tr>
<tr>
<td>Nondurables</td>
<td>2,204</td>
<td>15.6%</td>
</tr>
<tr>
<td>Services</td>
<td>6,771</td>
<td>48.0%</td>
</tr>
</tbody>
</table>

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

U.S. Investment, 2009

<table>
<thead>
<tr>
<th>Investment</th>
<th>$ billions</th>
<th>% of GDP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Investment</td>
<td>$1,589</td>
<td>11.3%</td>
</tr>
<tr>
<td>Business fixed</td>
<td>1,364</td>
<td>9.7%</td>
</tr>
<tr>
<td>Residential</td>
<td>352</td>
<td>2.5%</td>
</tr>
<tr>
<td>Inventory</td>
<td>–127</td>
<td>–0.9%</td>
</tr>
</tbody>
</table>
**Investment vs. Capital**

Note: Investment is spending on new capital.

Example \(\text{assumes no depreciation}\):
- 1/1/2012: economy has $500b worth of capital
- during 2012: investment = $60b
- 1/1/2013: economy will have $560b worth of capital

**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, 2010.”

A **flow** is a quantity measured per unit of time.

*E.g.*, “U.S. investment was $2.5 trillion during 2010.”

**Stocks vs. Flows - examples**

<table>
<thead>
<tr>
<th>stock</th>
<th>flow</th>
</tr>
</thead>
<tbody>
<tr>
<td>a person’s wealth</td>
<td>a person’s annual saving</td>
</tr>
<tr>
<td># of people with college degrees</td>
<td># of new college graduates this year</td>
</tr>
<tr>
<td>the govt debt</td>
<td>the govt budget deficit</td>
</tr>
</tbody>
</table>

**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.

**U.S. Government Spending, 2009**

<table>
<thead>
<tr>
<th></th>
<th>$ billions</th>
<th>% of GDP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Govt spending</td>
<td>$2,915</td>
<td>20.6%</td>
</tr>
<tr>
<td>- Federal</td>
<td>1,140</td>
<td>8.1</td>
</tr>
<tr>
<td></td>
<td>368</td>
<td>2.6</td>
</tr>
<tr>
<td>Defense</td>
<td>772</td>
<td>5.5</td>
</tr>
<tr>
<td>- State &amp; local</td>
<td>1,775</td>
<td>12.6</td>
</tr>
</tbody>
</table>
U.S. Net Exports, 2009

<table>
<thead>
<tr>
<th></th>
<th>$ billions</th>
<th>% of GDP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Net exports of g &amp; s</td>
<td>−$368</td>
<td>−2.7%</td>
</tr>
<tr>
<td>Exports</td>
<td>1,578</td>
<td>11.2%</td>
</tr>
<tr>
<td>Goods</td>
<td>1,063</td>
<td>7.5%</td>
</tr>
<tr>
<td>Services</td>
<td>515</td>
<td>3.6%</td>
</tr>
<tr>
<td>Imports</td>
<td>1,965</td>
<td>13.9%</td>
</tr>
<tr>
<td>Goods</td>
<td>1,588</td>
<td>11.2%</td>
</tr>
<tr>
<td>Services</td>
<td>377</td>
<td>2.7%</td>
</tr>
</tbody>
</table>

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.

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

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 = factor payments from abroad minus factor payments to abroad
- Examples of factor payments: wages, profits, rent, interest & dividends on assets

NOW YOU TRY:
Discussion Question

In your country, which would you want to be bigger, GDP or GNP? Why?
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 measures these values using the prices of a base year.

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.

NOW YOU TRY:
Real & Nominal GDP

<table>
<thead>
<tr>
<th></th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
</tr>
</thead>
<tbody>
<tr>
<td>P</td>
<td>$30</td>
<td>$31</td>
<td>$36</td>
</tr>
<tr>
<td>Q</td>
<td>900</td>
<td>1,000</td>
<td>1,050</td>
</tr>
<tr>
<td>P</td>
<td>$100</td>
<td>$102</td>
<td>$100</td>
</tr>
<tr>
<td>Q</td>
<td>192</td>
<td>200</td>
<td>205</td>
</tr>
</tbody>
</table>

- 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
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**

<table>
<thead>
<tr>
<th>Year</th>
<th>Nom. GDP</th>
<th>Real GDP</th>
<th>GDP deflator</th>
<th>Inflation rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>2006</td>
<td>$46,200</td>
<td>$46,200</td>
<td>n.a.</td>
<td></td>
</tr>
<tr>
<td>2007</td>
<td>51,400</td>
<td>50,000</td>
<td>102.8</td>
<td>2.8%</td>
</tr>
<tr>
<td>2008</td>
<td>58,300</td>
<td>52,000</td>
<td>112.1</td>
<td>9.1%</td>
</tr>
</tbody>
</table>

- 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**

<table>
<thead>
<tr>
<th>Year</th>
<th>Nom. GDP</th>
<th>Real GDP</th>
<th>GDP deflator</th>
<th>Inflation rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>2006</td>
<td>$46,200</td>
<td>$46,200</td>
<td>100.0</td>
<td>n.a.</td>
</tr>
<tr>
<td>2007</td>
<td>51,400</td>
<td>50,000</td>
<td>102.8</td>
<td>2.8%</td>
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<td>58,300</td>
<td>52,000</td>
<td>112.1</td>
<td>9.1%</td>
</tr>
</tbody>
</table>

**Two arithmetic tricks for working with percentage changes**

1. For any variables \( X \) and \( Y \),
   
   \[
   \text{percentage change in } (X \times Y) \approx \text{percentage change in } X + \text{percentage change in } Y
   \]

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

**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
   \[
   \frac{\text{Cost of basket in that month}}{\text{Cost of basket in base period}} \times 100
   \]

NOW YOU TRY:
Compute the CPI

Basket: 20 pizzas, 10 compact discs

<table>
<thead>
<tr>
<th>Prices</th>
<th>Pizza</th>
<th>CDs</th>
</tr>
</thead>
<tbody>
<tr>
<td>2002</td>
<td>$10</td>
<td>$15</td>
</tr>
<tr>
<td>2003</td>
<td>$11</td>
<td>$15</td>
</tr>
<tr>
<td>2004</td>
<td>$12</td>
<td>$16</td>
</tr>
<tr>
<td>2005</td>
<td>$13</td>
<td>$15</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Year</th>
<th>Cost of basket</th>
<th>CPI</th>
<th>Inflation rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>2002</td>
<td>$350</td>
<td>100.0</td>
<td>n.a.</td>
</tr>
<tr>
<td>2003</td>
<td>$370</td>
<td>105.7</td>
<td>5.7%</td>
</tr>
<tr>
<td>2004</td>
<td>$400</td>
<td>114.3</td>
<td>8.1%</td>
</tr>
<tr>
<td>2005</td>
<td>$410</td>
<td>117.1</td>
<td>2.5%</td>
</tr>
</tbody>
</table>

The composition of the CPI’s “basket”

- Food and bev.: 17.4%
- Housing: 42.4%
- Apparel: 3.8%
- Transportation: 3.5%
- Medical care: 3.1%
- Recreation: 6.2%
- Education: 5.6%
- Communication: 3.0%
- Other goods and services: 15.1%

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.
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.

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

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

Two measures of inflation in the U.S.

- Percentage change from 12 months earlier

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

NOW YOU TRY:
Computing labor statistics

<table>
<thead>
<tr>
<th>U.S. adult population by group, Oct 2010</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number employed</td>
</tr>
<tr>
<td>Number unemployed</td>
</tr>
<tr>
<td>Adult population</td>
</tr>
</tbody>
</table>

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: \(E = 139.1\), \(U = 14.8\), \(POP = 238.5\)

- labor force
  \(L = E + U = 139.1 + 14.8 = 153.9\)

- not in labor force
  \(NILF = POP - L = 238.5 - 153.9 = 84.6\)

- unemployment rate
  \(U/L \times 100\% = (14.8/153.9) \times 100\% = 9.6\%\)

- labor force participation rate
  \(L/POP \times 100\% = (153.9/238.5) \times 100\% = 64.5\%\)

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

Two measures of employment growth

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, or
- the GDP deflator, the ratio of nominal to real GDP

- The unemployment rate is the fraction of the labor force that is not employed.

Chapter Summary

- Gross Domestic Product (GDP) measures both total income and total expenditure on the economy’s output of goods & services.

- 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.

- GDP is the sum of consumption, investment, government purchases, and net exports.