MEASURING GDP AND ECONOMIC GROWTH
GDP Defined

GDP or gross domestic product is the market value of all final goods and services produced in a country in a given time period.

This definition has four parts:

- Market value
- Final goods and services
- Produced within a country
- In a given time period
Gross Domestic Product

Market Value

GDP is a market value—goods and services are valued at their market prices.

To add apples and oranges, computers and popcorn, we add the market values so we have a total value of output in dollars.
Gross Domestic Product

Final Goods and Services

GDP is the value of the *final goods and services* produced.

A **final good** (or service) is an **item bought by its final user** during a specified time period.

A final good contrasts with an **intermediate good**:

=> an item that is produced by one firm, bought by another firm, and used as a component of a final good or service.

**Excluding the value of intermediate goods and services avoids counting the same value more than once.**
Final Goods and Services

\[
\text{value added} = \text{the difference between the value of goods as they leave a stage of production and the cost of the goods as they entered that stage.}
\]

\[
\text{value of output} - \text{value of inputs purchased from other producers.}
\]
In calculating GDP, **sum up the value added at each stage of production** or **take the value of final sales**.

We do not use the value of total sales in an economy to measure how much output has been produced.

**TABLE 6.1 Value Added in the Production of a Gallon of Gasoline (Hypothetical Numbers)**

<table>
<thead>
<tr>
<th>Stage of Production</th>
<th>Value of Sales</th>
<th>Value Added</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) Oil drilling</td>
<td>$3.00</td>
<td>$3.00</td>
</tr>
<tr>
<td>(2) Refining</td>
<td>3.30</td>
<td>0.30</td>
</tr>
<tr>
<td>(3) Shipping</td>
<td>3.60</td>
<td>0.30</td>
</tr>
<tr>
<td>(4) Retail sale</td>
<td>4.00</td>
<td>0.40</td>
</tr>
<tr>
<td><strong>Total value added</strong></td>
<td></td>
<td><strong>$4.00</strong></td>
</tr>
</tbody>
</table>
Final Goods and Services

Important concept in product approach: \textit{value added} = \textit{value of output} − \textit{value of inputs} purchased from other producers.

- Firm A output worth RM35,000 of oranges
- Firm B output worth RM40,000 of oranges juice.
- Firm B has to first buy the oranges worth RM25,000. Thus, firms B final output worth RM15,000 (RM40,000-RM25,000).
- Final output is RM35,000 (Firm A) + RM15,000 (Firm B) = RM 50,000
GDP is concerned only with new, or current, production.

Old output is not counted in current GDP because it was already counted when it was produced.

<“Used goods”>

GDP does not count transactions in which money or goods changes hands but in which no new goods and services are produced.
Gross Domestic Product

Produced Within a Country

GDP measures production within a **country**—domestic production => Domestically produced

In a Given Time Period

GDP measures production during **a specific time period**, normally a year or a quarter of a year.
Gross Domestic Product

Exclusion of Output Produced Abroad by Domestically Owned Factors of Production

GDP is the market value of all final goods and services produced in a country in a given time period.

gross national product (GNP) The total market value of all final goods and services produced within a given period by factors of production owned by a country’s citizens, regardless of where the output is produced.

GNP vs. GDP

\[
\text{GDP} = \text{GNP} - \text{NFP} \quad @ \quad \text{GNP} = \text{GDP} + \text{NFP}
\]

NFP = net factor payments from abroad

= payments to domestically owned factors located abroad - payments to foreign factors located domestically
Gross Domestic Product

**expenditure approach**  A method of computing GDP that measures the **total amount spent** on all final goods and services during a given period.

**income approach**  A method of computing GDP that measures the **income received** by all factors of production (i.e. wages, rents, interest, and profits) in producing final goods and services.
GDP and the Circular Flow of Expenditure and Income

GDP measures the value of production, which also equals total expenditure on final goods and total income.

The equality of income and value of production shows the link between productivity and living standards.

* illustrates the equality of income and expenditure.
Gross Domestic Product

The circular flow diagram shows the transactions among households, firms, governments, and the rest of the world.
Households and Firms

Households sell and firms buy the services of labor, capital, and land in factor markets.

For these factor services, firms pay income to households: wages for labor services, interest for the use of capital, and rent for the use of land. A fourth factor of production, entrepreneurship, receives profit.

In the figure, the blue flow, \( Y \), shows total income paid by firms to households.
Firms sell and households buy consumer goods and services in the **goods market**.

**Consumption expenditure** is the total payment for consumer goods and services, shown by the red flow labeled $C$.

Firms buy and sell new capital equipment in the goods market and put unsold output into inventory.

The purchase of new plant, equipment, and buildings and the additions to inventories are **investment**, shown by the red flow labeled $I$. 
Governments

Governments buy goods and services from firms and their expenditure on goods and services is called government expenditure.

Government expenditure is shown as the red flow $G$.

Governments finance their expenditure with taxes and pay financial transfers to households, such as unemployment benefits, and pay subsidies to firms.

These financial transfers are not part of the circular flow of expenditure and income.
Firms in the United States sell goods and services to the rest of the world—exports—and buy goods and services from the rest of the world—imports.

The value of exports ($X$) minus the value of imports ($M$) is called net exports, the red flow ($X - M$).

If net exports are positive, the net flow of goods and services is from U.S. firms to the rest of the world.

If net exports are negative, the net flow of goods and services is from the rest of the world to U.S. firms.
Gross Domestic Product

The sum of the red flows equals the blue flow.

That is:

\[ Y = C + I + G + X - M \]

* Aggregate income = the total amount paid for the use of factors of production: wages, interest, rent, and profit.
Depreciation is the decrease in the value of a firm’s capital that results from wear and tear and obsolescence.

Gross investment is the total amount spent on purchases of new capital and on replacing depreciated capital.

Net investment is the increase in the value of the firm’s capital.

Net investment = Gross investment – Depreciation.

* Gross means before deducting the depreciation of capital.
Gross Domestic Product

*Gross investment* is one of the expenditures included in the expenditure approach to measuring GDP.

So total product is a gross measure.

*Gross profit*, which is a *firm’s profit before subtracting depreciation*, is one of the incomes included in the income approach to measuring GDP.

So total product is a gross measure.
Measuring U.S. GDP

The Expenditure Approach

The *expenditure approach* measures GDP as the sum of consumption expenditure, investment, government expenditure on goods and services, and net exports.

\[ \text{GDP} = C + I + G + (X - M) \]

Table 21.1 on the next slide shows the expenditure approach with data (in billions) for 2012.

\[ \text{GDP} = 11,007 + 2,032 + 3,055 - 616 \]
\[ = 15,478 \text{ billion} \]
**TABLE 21.1 GDP: The Expenditure Approach**

<table>
<thead>
<tr>
<th>Item</th>
<th>Symbol</th>
<th>Amount in 2012 (billions of dollars)</th>
<th>Percentage of GDP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Personal consumption expenditures</td>
<td>$C$</td>
<td>11,007</td>
<td>71.1</td>
</tr>
<tr>
<td>Gross private domestic investment</td>
<td>$I$</td>
<td>2,032</td>
<td>13.1</td>
</tr>
<tr>
<td>Government expenditure on goods and services</td>
<td>$G$</td>
<td>3,055</td>
<td>19.7</td>
</tr>
<tr>
<td>Net exports of goods and services</td>
<td>$X-M$</td>
<td>-616</td>
<td>-4.0</td>
</tr>
<tr>
<td><strong>Gross domestic product</strong></td>
<td>$Y$</td>
<td><strong>15,478</strong></td>
<td><strong>100.0</strong></td>
</tr>
</tbody>
</table>
Measuring U.S. GDP

The Income Approach

The *income approach* measures GDP by *summing the incomes that firms pay households for the factors of production they hire*—wages for labor, interest for capital, rent for land, and profit for entrepreneurship.

- **total income earned by the factors of production owned by a country’s citizens.**
The National Income and Expenditure Accounts divide incomes into two broad categories:

1. Compensation of employees
2. Net operating surplus

Compensation of employees is the payments for labor services. It is the sum of net wages plus taxes withheld plus social security and pension fund contributions.

Net operating surplus is the sum of other factor incomes. It includes net interest, rental income, corporate profits, and proprietor’s income.
compensation of employees  Includes wages, salaries, and various supplements—employer contributions to social insurance and pension funds, for example—paid to households by firms and by the government.

proprietors’ income  The income of unincorporated businesses. E.g. Indonesian workers in Malaysia make a money transfer of their income to Indonesia.

rental income  The income received by property owners in the form of rent.

corporate profits  The income of corporations.

net interest  The interest paid by individuals from business & foreign source minus interest paid by individual.
Measuring U.S. GDP

The sum of all factor incomes is *net domestic income at factor cost.*

✓ **factor cost:** the cost of the factor of production used to produce final goods

Two adjustments must be made to get GDP:

1. **Indirect taxes less subsidies** are added to get from *factor cost* to *market prices.*

2. **Depreciation** is added to get from *net* domestic income to *gross* domestic income.

Table 21.2 on the next slide shows the income approach with data for 2012.
Depreciation is the decrease in the value of a firm’s capital results from wear and tear and obsolescence.

- required to maintain the value of its capital stock.

Table 21.2: GDP: The Income Approach

<table>
<thead>
<tr>
<th>Item</th>
<th>Amount in 2012 (billions of dollars)</th>
<th>Percentage of GDP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compensation of employees</td>
<td>8,348</td>
<td>53.9</td>
</tr>
<tr>
<td>Net interest</td>
<td>696</td>
<td>4.5</td>
</tr>
<tr>
<td>Rental income</td>
<td>445</td>
<td>2.9</td>
</tr>
<tr>
<td>Corporate profits</td>
<td>1,497</td>
<td>9.7</td>
</tr>
<tr>
<td>Proprietors’ income</td>
<td>1,148</td>
<td>7.6</td>
</tr>
<tr>
<td><strong>Net domestic income</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>at factor cost</td>
<td>12,170</td>
<td>78.6</td>
</tr>
<tr>
<td><strong>Indirect taxes less subsidies</strong></td>
<td>1,311</td>
<td>8.5</td>
</tr>
<tr>
<td><strong>Net domestic income</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>at market prices</td>
<td>13,481</td>
<td>87.1</td>
</tr>
<tr>
<td>Depreciation</td>
<td>1,985</td>
<td>12.8</td>
</tr>
<tr>
<td><strong>GDP (income approach)</strong></td>
<td>15,466</td>
<td>99.9</td>
</tr>
<tr>
<td><strong>Statistical discrepancy</strong></td>
<td>12</td>
<td>0.1</td>
</tr>
<tr>
<td><strong>GDP (expenditure approach)</strong></td>
<td>15,478</td>
<td>100.0</td>
</tr>
</tbody>
</table>

statistical discrepancy: Data measurement error.
Nominal GDP and Real GDP

Real GDP is the value of final goods and services produced in a given year when valued at the prices of a reference base year. (at constant price)

Currently, the reference base year is 2005 and we describe real GDP as measured in 2005 dollars.

Nominal GDP is the value of goods and services produced during a given year valued at the prices that prevailed in that same year. (at current price)

Nominal GDP is just a more precise name for GDP.
Measuring U.S. GDP

Calculating Real GDP

Table 21.3(a) shows the quantities produced and the prices in 2005 (the base year).

Nominal GDP in 2005 is $100 million.

Because 2005 is the base year, real GDP equals nominal GDP and is $100 million.

<table>
<thead>
<tr>
<th>Item</th>
<th>Quantity (millions)</th>
<th>Price (dollars)</th>
<th>Expenditure (millions of dollars)</th>
</tr>
</thead>
<tbody>
<tr>
<td>C T-shirts</td>
<td>10</td>
<td>5</td>
<td>50</td>
</tr>
<tr>
<td>I Computer chips</td>
<td>3</td>
<td>10</td>
<td>30</td>
</tr>
<tr>
<td>G Security services</td>
<td>1</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>Y Real and Nominal GDP in 2005</td>
<td>100</td>
<td></td>
<td>100</td>
</tr>
</tbody>
</table>
Measuring U.S. GDP

Table 21.3(b) shows the quantities produced and the prices in 2012.

Nominal GDP in 2012 is $300 million.

Nominal GDP in 2012 is three times its value in 2005.
Measuring U.S. GDP

In Table 21.3(c), we calculate real GDP in 2012.

The quantities are those of 2012, as in part (b).

The prices are those in the base year (2005) as in part (a).

The sum of these expenditures is real GDP in 2012, which is $160 million.

<table>
<thead>
<tr>
<th>Item</th>
<th>Quantity (millions)</th>
<th>Price (dollars)</th>
<th>Expenditure (millions of dollars)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a) In 2005</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C T-shirts</td>
<td>10</td>
<td>5</td>
<td>50</td>
</tr>
<tr>
<td>I Computer chips</td>
<td>3</td>
<td>10</td>
<td>30</td>
</tr>
<tr>
<td>G Security services</td>
<td>1</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>Y Real and Nominal GDP in 2005</td>
<td></td>
<td></td>
<td>100</td>
</tr>
<tr>
<td>(b) In 2012</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C T-shirts</td>
<td>4</td>
<td>5</td>
<td>20</td>
</tr>
<tr>
<td>I Computer chips</td>
<td>2</td>
<td>20</td>
<td>40</td>
</tr>
<tr>
<td>G Security services</td>
<td>6</td>
<td>40</td>
<td>240</td>
</tr>
<tr>
<td>Y Nominal GDP in 2012</td>
<td></td>
<td></td>
<td>300</td>
</tr>
<tr>
<td>(c) Quantities of 2012 valued at prices of 2005</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C T-shirts</td>
<td>4</td>
<td>5</td>
<td>20</td>
</tr>
<tr>
<td>I Computer chips</td>
<td>2</td>
<td>10</td>
<td>20</td>
</tr>
<tr>
<td>G Security services</td>
<td>6</td>
<td>20</td>
<td>120</td>
</tr>
<tr>
<td>Y Real GDP in 2012</td>
<td></td>
<td></td>
<td>160</td>
</tr>
</tbody>
</table>
Economists use estimates of real GDP for two main purposes:

- To compare the **standard of living** over time
- To compare the **standard of living across countries**
The Uses and Limitations of Real GDP

The Standard of Living Over Time

Real GDP per person is real GDP divided by the population. => real GDP per capita

Real GDP per person tells us the value of goods and services that the average person can enjoy.

By using real GDP, we remove any influence that rising prices and a rising cost of living might have had on our comparison.
Long-Term Trend

A handy way of comparing real GDP per person over time is to express it as a ratio of some reference year.

For example, in 1960, real GDP per person was $15,850 and in 2012, it was $43,182.

So real GDP per person in 2012 was 2.7 times its 1960 level—>

\[
\frac{43,182}{15,850} = 2.7.
\]
The Uses and Limitations of Real GDP

Two features of our expanding living standard are:

- The growth of potential GDP per person
- Fluctuations of real GDP around potential GDP

The value of real GDP when all the economy’s factor of production (i.e. labor, capital, land, and entrepreneurial) ability are fully employed is called potential GDP.
The Uses and Limitations of Real GDP

Figure 21.2 shows U.S. real GDP per person.

Potential GDP grows at a steady pace because the quantities of the factors of production and their productivity grow at a steady pace.

Real GDP fluctuates around potential GDP.
Productivity Growth Slowdown

The growth rate of real GDP per person slowed after 1970. How costly was that slowdown?

The answer is provided by a number that we’ll call the Lucas wedge.

The **Lucas wedge** is the dollar value of the accumulated gap between what real GDP per person would have been if the 1960s growth rate had persisted and what real GDP per person turned out to be.
The Uses and Limitations of Real GDP

Figure 21.3 illustrates the Lucas wedge.

The red line is actual real GDP per person.

The thin black line is the trend that real GDP per person would have followed if the 1960s growth rate of potential GDP had persisted.

The shaded area is the Lucas wedge.
Real GDP Fluctuations— The Business Cycle

A business cycle is a periodic but irregular up-and-down movement of total production and other measures of economic activity.

Every cycle has two phases:
1. Expansion
2. Recession

and two turning points:
1. Peak
2. Trough
Figure 21.4 illustrates the business cycle.

An **expansion** is a period during which real GDP increases—from a trough to a peak.

**Recession** is a period during which real GDP decreases—its growth rate is negative for at least two successive quarters.
The Uses and Limitations of Real GDP

The Standard of Living Across Countries

Two problems arise in using real GDP to compare living standards across countries:

1. The real GDP of one country must be converted into the same currency units as the real GDP of the other country.

2. The goods and services in both countries must be valued at the same prices.
The Uses and Limitations of Real GDP

Converted through the rate of exchange is also seem to be problematic due to the different in prices:

- **prices** of particular products in one country may be much less or much more than in the other country.

For example, using the *market exchange rate* to value China’s GDP in U.S. dollars leads to an estimate that in 2012, GDP per person in the United States was 8.4 times GDP per person in China.
Limitations of Real GDP

Real GDP measures the value of goods and services that are bought in markets.

How about activities that are no reported?

Some of the factors that influence the standard of living and that are not part of GDP are

- Household production – online business
- Underground economic activity- smuggling activities
- Leisure time
- Environmental quality - pollution
The Bottom Line

Do we get the **wrong message** about the level and growth of economic well-being and the standard of living by looking at the growth of real GDP?

The influences that are omitted from real GDP are probably large.

It is possible to construct broader measures that combine the many influences that contribute to human happiness.

Despite all the alternatives, real GDP per person remains the most widely used indicator of economic well-being.
Will the U.S. economy expand more rapidly next year or will it sink back into another recession?
To assess the state of the economy and to make big decisions about business expansion, firms use forecasts of GDP.
What exactly is GDP?
How do we use GDP to tell us how rapidly our economy is expanding or whether our economy is in a recession?
How do we take the effects of inflation out of GDP to reveal the growth rate of our economic well-being?
And how do we compare economic well-being across countries?