

### Questions for Review

1. GDP measures the total income earned from the production of the new final goods and services in the economy, and it measures the total expenditures on the new final goods and services produced in the economy. GDP can measure two things at once because the total expenditures on the new final goods and services by the buyers must be equal to the income earned by the sellers of the new final goods and services. As the circular flow diagram in the text illustrates, these are alternative, equivalent ways of measuring the flow of dollars in the economy.
2. The consumer price index measures the overall level of prices in the economy. It tells us the price of a fixed basket of goods relative to the price of the same basket in the base year.
3. The Bureau of Labor Statistics classifies each person into one of the following three categories: employed, unemployed, or not in the labor force. The unemployment rate, which is the percentage of the labor force that is unemployed, is computed as follows:

$$\text{Unemployment Rate} = \frac{\text{Number of Unemployed}}{\text{Labor Force}} \times 100.$$

Note that the labor force is the number of people employed plus the number of people unemployed.

4. Every month, the Bureau of Labor Statistics (BLS) undertakes two surveys to measure employment. First, the BLS surveys about 60,000 households and thereby obtains an estimate of the share of people who say they are working. The BLS multiplies this share by an estimate of the population to estimate the number of people working. Second, the BLS surveys about 160,000 business establishments and asks how many people they employ. Each survey is imperfect; so the two measures of employment are not identical.

### Problems and Applications

1. A large number of economic statistics are released regularly. These include the following:

**Gross Domestic Product**—the market value of all final goods and services produced in a year.

**The Unemployment Rate**—the percentage of the civilian labor force who do not have a job.

**Corporate Profits**—the income of corporations after payments to workers and creditors. It gives an indication of the general financial health of the corporate sector.

**The Consumer Price Index (CPI)**—a measure of the average price that consumers pay for the goods they buy; changes in the CPI are a measure of inflation.

**The Trade Balance**—the difference between the value of goods exported abroad and the value of goods imported from abroad.

In looking at the economic statistics, most people want to see a low and stable inflation rate of about 2–3 percent, a low and stable unemployment rate of about 5 percent, and GDP growth in the 3–4-percent range. This indicates the economy is “healthy” and per-

forming at its long-run average level. Looking at the economic statistics released in early 2009, the unemployment rate was rising and had reached 8 percent, the inflation rate was near zero, and GDP growth in the last quarter of 2008 was  $-6.3$  percent. This of course indicated the economy was still in the midst of a major recession.

2. Value added by each person is the value of the good produced minus the amount the person paid for the materials needed to make the good. Therefore, the value added by the farmer is  $\$1.00$  ( $\$1 - 0 = \$1$ ). The value added by the miller is  $\$2$ : she sells the flour to the baker for  $\$3$  but paid  $\$1$  for the flour. The value added by the baker is  $\$3$ : she sells the bread to the engineer for  $\$6$  but paid the miller  $\$3$  for the flour. GDP is the total value added, or  $\$1 + \$2 + \$3 = \$6$ . Note that GDP equals the value of the final good (the bread).
3. When a woman marries her butler, GDP falls by the amount of the butler's salary. This happens because measured total income, and therefore measured GDP, falls by the amount of the butler's loss in salary. If GDP truly measured the value of all goods and services, then the marriage would not affect GDP since the total amount of economic activity is unchanged. Actual GDP, however, is an imperfect measure of economic activity because the value of some goods and services is left out. Once the butler's work becomes part of his household chores, his services are no longer counted in GDP. As this example illustrates, GDP does not include the value of any output produced in the home. Similarly, GDP does not include other goods and services, such as the imputed rent on durable goods (e.g., cars and refrigerators) and any illegal trade.
4.
  - a. The airplane sold to the Air Force counts as government purchases because the Air Force is part of the government.
  - b. The airplane sold to American Airlines counts as investment because it is a capital good sold to a private firm.
  - c. The airplane sold to Air France counts as an export because it is sold to a foreigner.
  - d. The airplane sold to Amelia Earhart counts as consumption because it is sold to a private individual.
  - e. The airplane built to be sold next year counts as investment. In particular, the airplane is counted as inventory investment, which is where goods that are produced in one year and sold in another year are counted.
5. Data on parts (a) to (g) can be downloaded from the Bureau of Economic Analysis ([www.bea.doc.gov](http://www.bea.doc.gov)—follow the links to Gross Domestic Product). Most of the data (not necessarily the earliest year) can also be found in the *Economic Report of the President*. By dividing each component (a) to (g) by nominal GDP and multiplying by 100, we obtain the following percentages:

	1950	1980	2005
a. Personal consumption expenditures	65.5%	63.0%	70.0%
b. Gross private domestic investment	18.4%	17.2%	16.9%
c. Government consumption purchases	15.9%	20.3%	18.9%
d. Net exports	0.2%	-0.5%	-5.8%
e. National defense purchases	6.7%	6.0%	4.7%
f. State and local purchases	7.0%	11.6%	11.9%
g. Imports	3.9%	10.5%	16.2%

(Note: These data were downloaded April 17, 2006 from the BEA web site.)

Among other things, we observe the following trends in the economy over the period 1950–2005:

- (a) Personal consumption expenditures have been around two-thirds of GDP, although the share increased markedly between 1980 and 2005.
- (b) The share of GDP going to gross private domestic investment fell slightly from 1950 to 2005.

- (c) The share going to government consumption purchases rose sharply from 1950 to 1980 but has receded somewhat since then.
- (d) Net exports, which were positive in 1950, were substantially negative in 2005.
- (e) The share going to national defense purchases fell from 1980 to 2005.
- (f) The share going to state and local purchases rose from 1950 to 1980.
- (g) Imports have grown rapidly relative to GDP.

6. a. i. Nominal GDP is the total value of goods and services measured at current prices. Therefore,

$$\begin{aligned} \text{Nominal GDP}_{2000} &= (P_{\text{cars}}^{2000} \times Q_{\text{cars}}^{2000}) + (P_{\text{bread}}^{2000} \times Q_{\text{bread}}^{2000}) \\ &= (\$50,000 \times 100) + (\$10 \times 500,000) \\ &= \$5,000,000 + \$5,000,000 \\ &= \$10,000,000. \end{aligned}$$

$$\begin{aligned} \text{Nominal GDP}_{2010} &= (P_{\text{cars}}^{2010} \times Q_{\text{cars}}^{2010}) + (P_{\text{bread}}^{2010} \times Q_{\text{bread}}^{2010}) \\ &= (\$60,000 \times 120) + (\$20 \times 400,000) \\ &= \$7,200,000 + \$8,000,000 \\ &= \$15,200,000. \end{aligned}$$

ii. Real GDP is the total value of goods and services measured at constant prices. Therefore, to calculate real GDP in 2010 (with base year 2000), multiply the quantities purchased in the year 2010 by the 2000 prices:

$$\begin{aligned} \text{Real GDP}_{2010} &= (P_{\text{cars}}^{2000} \times Q_{\text{cars}}^{2010}) + (P_{\text{bread}}^{2000} \times Q_{\text{bread}}^{2010}) \\ &= (\$50,000 \times 120) + (\$10 \times 400,000) \\ &= \$6,000,000 + \$4,000,000 \\ &= \$10,000,000. \end{aligned}$$

Real GDP for 2000 is calculated by multiplying the quantities in 2000 by the prices in 2000. Since the base year is 2000, real GDP<sub>2000</sub> equals nominal GDP<sub>2000</sub>, which is \$10,000,000. Hence, real GDP stayed the same between 2000 and 2010.

iii. The implicit price deflator for GDP compares the current prices of all goods and services produced to the prices of the same goods and services in a base year. It is calculated as follows:

$$\text{Implicit Price Deflator}_{2010} = \frac{\text{Nominal GDP}_{2010}}{\text{Real GDP}_{2010}}.$$

Using the values for Nominal GDP<sub>2010</sub> and real GDP<sub>2010</sub> calculated above:

$$\begin{aligned} \text{Implicit Price Deflator}_{2010} &= \frac{\$15,200,000}{\$10,000,000} \\ &= 1.52. \end{aligned}$$

This calculation reveals that prices of the goods produced in the year 2010 increased by 52 percent compared to the prices that the goods in the economy sold for in 2000. (Because 2000 is the base year, the value for the implicit price deflator for the year 2000 is 1.0 because nominal and real GDP are the same for the base year.)

iv. The consumer price index (CPI) measures the level of prices in the economy. The CPI is called a fixed-weight index because it uses a fixed basket of goods over time to weight prices. If the base year is 2000, the CPI in 2010 is an average of prices in 2010, but weighted by the composition of goods produced in 2000. The CPI<sub>2010</sub> is calculated as follows:

$$\begin{aligned}
\text{CPI}_{2010} &= \frac{(P_{\text{cars}}^{2010} \times Q_{\text{cars}}^{2000}) + (P_{\text{bread}}^{2010} \times Q_{\text{bread}}^{2000})}{(P_{\text{cars}}^{2000} \times Q_{\text{cars}}^{2000}) + (P_{\text{bread}}^{2000} \times Q_{\text{bread}}^{2000})} \\
&= \frac{(\$60,000 \times 100) + (\$20 \times 500,000)}{(\$50,000 \times 100) + (\$10 \times 500,000)} \\
&= \frac{\$16,000,000}{\$10,000,000} \\
&= 1.6.
\end{aligned}$$

This calculation shows that the price of goods purchased in 2010 increased by 60 percent compared to the prices these goods would have sold for in 2000. The CPI for 2000, the base year, equals 1.0.

- b. The implicit price deflator is a Paasche index because it is computed with a changing basket of goods; the CPI is a Laspeyres index because it is computed with a fixed basket of goods. From (6.a.iii), the implicit price deflator for the year 2010 is 1.52, which indicates that prices rose by 52 percent from what they were in the year 2000. From (6.a.iv.), the CPI for the year 2010 is 1.6, which indicates that prices rose by 60 percent from what they were in the year 2000.

If prices of all goods rose by, say, 50 percent, then one could say unambiguously that the price level rose by 50 percent. Yet, in our example, relative prices have changed. The price of cars rose by 20 percent; the price of bread rose by 100 percent, making bread relatively more expensive.

As the discrepancy between the CPI and the implicit price deflator illustrates, the change in the price level depends on how the goods' prices are weighted. The CPI weights the price of goods by the quantities purchased in the year 2000. The implicit price deflator weights the price of goods by the quantities purchased in the year 2010. The quantity of bread consumed was higher in 2000 than in 2010, so the CPI places a higher weight on bread. Since the price of bread increased relatively more than the price of cars, the CPI shows a larger increase in the price level.

- c. There is no clear-cut answer to this question. Ideally, one wants a measure of the price level that accurately captures the cost of living. As a good becomes relatively more expensive, people buy less of it and more of other goods. In this example, consumers bought less bread and more cars. An index with fixed weights, such as the CPI, overestimates the change in the cost of living because it does not take into account that people can substitute less expensive goods for the ones that become more expensive. On the other hand, an index with changing weights, such as the GDP deflator, underestimates the change in the cost of living because it does not take into account that these induced substitutions make people less well off.
7. a. The consumer price index uses the consumption bundle in year 1 to figure out how much weight to put on the price of a given good:

$$\begin{aligned}
\text{CPI}^2 &= \frac{(P_{\text{red}}^2 \times Q_{\text{red}}^1) + (P_{\text{green}}^2 \times Q_{\text{green}}^1)}{(P_{\text{red}}^1 \times Q_{\text{red}}^1) + (P_{\text{green}}^1 \times Q_{\text{green}}^1)} \\
&= \frac{(\$2 \times 10) + (\$1 \times 0)}{(\$1 \times 10) + (\$2 \times 0)} \\
&= 2.
\end{aligned}$$

According to the CPI, prices have doubled.

- b. Nominal spending is the total value of output produced in each year. In year 1 and year 2, Abby buys 10 apples for \$1 each, so her nominal spending remains constant at \$10. For example,

$$\begin{aligned}\text{Nominal Spending}_2 &= (P_{\text{red}}^2 \times Q_{\text{red}}^2) + (P_{\text{green}}^2 \times Q_{\text{green}}^2) \\ &= (\$2 \times 0) + (\$1 \times 10) \\ &= \$10.\end{aligned}$$

- c. Real spending is the total value of output produced in each year valued at the prices prevailing in year 1. In year 1, the base year, her real spending equals her nominal spending of \$10. In year 2, she consumes 10 green apples that are each valued at their year 1 price of \$2, so her real spending is \$20. That is,

$$\begin{aligned}\text{Real Spending}_2 &= (P_{\text{red}}^1 \times Q_{\text{red}}^2) + (P_{\text{green}}^1 \times Q_{\text{green}}^2) \\ &= (\$1 \times 0) + (\$2 \times 10) \\ &= \$20.\end{aligned}$$

Hence, Abby's real spending rises from \$10 to \$20.

- d. The implicit price deflator is calculated by dividing Abby's nominal spending in year 2 by her real spending that year:

$$\begin{aligned}\text{Implicit Price Deflator}_2 &= \frac{\text{Nominal Spending}_2}{\text{Real Spending}_2} \\ &= \frac{\$10}{\$20} \\ &= 0.5.\end{aligned}$$

Thus, the implicit price deflator suggests that prices have fallen by half. The reason for this is that the deflator estimates how much Abby values her apples using prices prevailing in year 1. From this perspective green apples appear very valuable. In year 2, when Abby consumes 10 green apples, it appears that her consumption has increased because the deflator values green apples more highly than red apples. The only way she could still be spending \$10 on a higher consumption bundle is if the price of the good she was consuming fell.

- e. If Abby thinks of red apples and green apples as perfect substitutes, then the cost of living in this economy has not changed—in either year it costs \$10 to consume 10 apples. According to the CPI, however, the cost of living has doubled. This is because the CPI only takes into account the fact that the red apple price has doubled; the CPI ignores the fall in the price of green apples because they were not in the consumption bundle in year 1. In contrast to the CPI, the implicit price deflator estimates the cost of living has been cut in half. Thus, the CPI, a Laspeyres index, overstates the increase in the cost of living and the deflator, a Paasche index, understates it.
8. a. Real GDP falls because Disney does not produce any services while it is closed. This corresponds to a decrease in economic well-being because the income of workers and shareholders of Disney falls (the income side of the national accounts), and people's consumption of Disney falls (the expenditure side of the national accounts).
- b. Real GDP rises because the original capital and labor in farm production now produce more wheat. This corresponds to an increase in the economic well-being of society, since people can now consume more wheat. (If people do not want to consume more wheat, then farmers and farmland can be shifted to producing other goods that society values.)

- c. Real GDP falls because with fewer workers on the job, firms produce less. This accurately reflects a fall in economic well-being.
  - d. Real GDP falls because the firms that lay off workers produce less. This decreases economic well-being because workers' incomes fall (the income side), and there are fewer goods for people to buy (the expenditure side).
  - e. Real GDP is likely to fall, as firms shift toward production methods that produce fewer goods but emit less pollution. Economic well-being, however, may rise. The economy now produces less measured output but more clean air; clean air is not traded in markets and, thus, does not show up in measured GDP, but is nevertheless a good that people value.
  - f. Real GDP rises because the high-school students go from an activity in which they are not producing market goods and services to one in which they are. Economic well-being, however, may decrease. In ideal national accounts, attending school would show up as investment because it presumably increases the future productivity of the worker. Actual national accounts do not measure this type of investment. Note also that future GDP may be lower than it would be if the students stayed in school, since the future work force will be less educated.
  - g. Measured real GDP falls because fathers spend less time producing market goods and services. The actual production of goods and services need not have fallen, however. Measured production (what the fathers are paid to do) falls, but unmeasured production of child-rearing services rises.
9. As Senator Robert Kennedy pointed out, GDP is an imperfect measure of economic performance or well-being. In addition to the left-out items that Kennedy cited, GDP also ignores the imputed rent on durable goods such as cars, refrigerators, and lawnmowers; many services and products produced as part of household activity, such as cooking and cleaning; and the value of goods produced and sold in illegal activities, such as the drug trade. These imperfections in the measurement of GDP do not necessarily reduce its usefulness. As long as these measurement problems stay constant over time, then GDP is useful in comparing economic activity from year to year. Moreover, a large GDP allows us to afford better medical care for our children, newer books for their education, and more toys for their play. Finally, countries with higher levels of GDP tend to have higher levels of life expectancy, better access to clean water and sanitation, and higher levels of education. GDP is therefore a useful measure for comparing the level of growth and development across countries.