Answers to Textbook Questions and Problems

CHAPTER 2   The Data of Macroeconomics

Questions for Review

1. GDP measures the total income earned from the production of final goods and services in the economy, and it measures the total expenditure on final goods and services in the economy. GDP can measure both at once because, as a matter of accounting, the total expenditure of buyers must equal the total income of sellers. As the circular flow diagram in the text illustrates, these are equivalent ways of measuring the flow of dollars in the economy.

2. The four components of GDP are consumption, investment, government purchases, and net exports. The consumption category of GDP consists of household expenditures on new final goods and services, such as the purchase of a new television. The investment category of GDP consists of business fixed investment, residential fixed investment, and inventory investment. When a business buys new equipment, this counts as investment. Government purchases consists of purchases of new final goods and services by federal, state, and local governments, such as payments for new military equipment. Net exports measures the value of goods and services sold to other countries minus the value of goods and services foreigners sell to us. When the United States sells corn to foreign countries, it adds to the net export category of GDP.

3. The consumer price index (CPI) 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. The GDP deflator is the ratio of nominal GDP to real GDP in a given year. The measures differ on three dimensions. First, the GDP deflator measures the prices of all goods and services produced, whereas the CPI measures only prices of goods and services bought by consumers. Second, the GDP deflator

includes only domestically produced goods, whereas the CPI includes domestic and imported goods bought by consumers. Third, the CPI is a Laspeyres index that has a fixed basket of goods over time, whereas the GDP deflator is a Paasche index that has prices fixed over time. In practice, the two indexes tend to move together and do not often diverge.

4.   The CPI measures the price of a fixed basket of goods relative to the price of the same basket in the base year. The PCE deflator is the ratio of nominal consumer spending to real consumer spending. The CPI and the PCE deflator are similar in that they both only include the prices of goods purchased by consumers, and they both include the prices of imported goods as well as domestically produced goods. The two measures differ because the CPI measures the change in the price of a fixed basket, whereas the goods measured by the PCE deflator change from year to year, depending on what consumers are purchasing in that particular year.

5.   The BLS 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 calculated 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.

6.   Every month, the BLS undertakes two surveys to measure employment. First, the BLS surveys about 60,000 households to obtain an estimate of the share of people who say they are working. The BLS multiplies this share by an estimate of the population to measure the number of people working. Second, the BLS surveys about 160,000 business establishments and asks how many people they employ. Both surveys are imperfect, so the two measures of employment are not identical.

Problems and Applications

1.   From the main bea.gov website, click on the "Interactive Data" tab at the top, select "GDP & Personal

Income," click on "Begin using the data…," and select Section 1, Table 1.1.1. In the fourth quarter of 2017, real GDP grew at a rate of 2.9 percent. When compared to growth rates of 1.2 percent, 3.1 percent, and 3.2 percent for the first three quarters of 2017, the rate of 2.9 percent was slightly above average. From the main bls.gov website, select the "Data Tools" tab, followed by "Top Picks." Check the box for the unemployment rate and click "Retrieve data." The unemployment rate in February 2018 was 4.1 percent, similar to the previous few months. From the main bls.gov website, select the "Economic Releases" tab and then "Inflation & Prices." Access the report for the CPI and go to Table 1. From January to February 2018, the seasonally adjusted inflation rate for all items was 0.2 percent, which was also the rate excluding food and energy. The inflation rate was below average and below the Federal Reserve's target of 2 percent.

2. The value added by each person is equal to the value of the good produced minus the amount paid for the materials needed to make the good. In this case, the value added by the farmer is $1. The value added by the miller is $2 because the wheat is purchased for $1, and the flour is sold for $3. The value added by the baker is $3 because the flour is purchased for $3, and the bread is sold for $6. 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 GDP measures total income from *market* activities and therefore does not include the value of any output produced in the home. 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.

4. a. A computer sold to a public school counts as government purchases because public schools are part of the government.

   b. A computer sold to an accounting firm counts as investment because it is a capital good sold to a private firm.

   c. A computer sold to a bakery in France counts as an export because it is sold to a foreign firm.

d. A computer sold to Paris Hilton counts as consumption because it is sold to a private individual.

e. A computer built to be sold next year counts as investment. In particular, it counts as inventory investment since it is produced in one year and sold in a later year.

5. Go to the bea.gov website, click on the "Interactive Data" tab at the top, select "GDP & Personal Income," click on "Begin using the data…," and select Section 1, Table 1.1.5. Use the "MODIFY" option to select annual data from 1950 to 2017. By dividing each component by GDP and multiplying by 100, we obtain the following percentages:

	1950	1990	2017
a. Personal consumption expenditures	64.0%	64.0%	69.1%
b. Gross private domestic investment	18.8%	16.6%	16.6%
c. Government consumption purchases	16.9%	20.7%	17.3%
d. Net exports	0.2%	–1.3%	–2.9%
e. National defense purchases	7.6%	6.7%	3.8%
f. Imports	3.9%	10.5%	15.0%

(Note: The above data were downloaded on April 4, 2018, from the BEA website.)

According to the table, as a share of GDP, personal consumption expenditures, gross private domestic investment, and government purchases have been fairly stable over time; GDP shares for net exports and national defense purchases have fallen; and imports have grown rapidly relative to GDP.

6. a. GDP measures the value of the final goods and services produced, which is $1,000,000 for lawn mowing in this case.

b. NNP is equal to GNP minus depreciation. There are no factor payments to or from abroad here, so GNP is equal to GDP. Then, since depreciation is $125,000, NNP is $875,000.

c. National income is equal to NNP, or $875,000.

d. Compensation of employees is $600,000.

e. Proprietors' income measures the income of the owner, which is $150,000 of dividends here.

f. Corporate profits are equal to the sum of corporate taxes, dividends, and retained earnings. Here corporate profits are $50,000 + $150,000 + $75,000 = $275,000.

g. Personal income is equal to employee compensation plus dividends, or $750,000.

h. Disposable personal income is personal income minus personal taxes, or $550,000.

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

$$\text{Nominal GDP}_{2010} = \left(P^{2010}_{\text{hot dogs}} \times Q^{2010}_{\text{hot dogs}} \right) + \left(P^{2010}_{\text{burgers}} \times Q^{2010}_{\text{burgers}} \right)$$

$$= (\$2 \times 200) + (\$3 \times 200)$$

$$= \$400 + \$600$$

$$= \$1,000.$$

$$\text{Nominal GDP}_{2018} = \left(P^{2018}_{\text{hot dogs}} \times Q^{2018}_{\text{hot dogs}} \right) + \left(P^{2018}_{\text{burgers}} \times Q^{2018}_{\text{burgers}} \right)$$

$$= (\$4 \times 250) + (\$4 \times 500)$$

$$= \$1,000 + \$2,000$$

$$= \$3,000.$$

ii. Real GDP is the total value of goods and services measured at base-year prices. In the base year (2010), real GDP is equal to nominal GDP, so real GDP in 2010 is $1,000. To calculate real GDP in 2018, multiply the quantities purchased in 2018 by the 2010 prices:

$$\text{Real GDP}_{2018} = \left(P^{2010}_{\text{hot dogs}} \times Q^{2018}_{\text{hot dogs}} \right) + \left(P^{2010}_{\text{burgers}} \times Q^{2018}_{\text{burgers}} \right)$$

$$= (\$2 \times 250) + (\$3 \times 500)$$

$$= \$500 + \$1,500$$

$$= \$2,000.$$

iii. The implicit price deflator for GDP is the ratio of nominal to real GDP. In the base year (2010), it is equal to 1. In 2018, we have:

$$\text{GDP Deflator}_{2018} = \frac{\$3{,}000}{\$2{,}000} = 1.5.$$

iv. The CPI uses a fixed basket of goods to measure changes in the price level over time. In the base year (2010), it is equal to 1. The CPI for 2018 measures the cost of the 2010 basket of goods in 2018 relative to the cost in 2010:

$$\text{CPI}_{2018} = \frac{(P^{2018}_{\text{hot dogs}} \times Q^{2010}_{\text{hot dogs}}) + (P^{2018}_{\text{burgers}} \times Q^{2010}_{\text{burgers}})}{(P^{2010}_{\text{hot dogs}} \times Q^{2010}_{\text{hot dogs}}) + (P^{2010}_{\text{burgers}} \times Q^{2010}_{\text{burgers}})}$$

$$= \frac{(\$4 \times 200) + (\$4 \times 200)}{(\$2 \times 200) + (\$3 \times 200)}$$

$$= \frac{\$1{,}600}{\$1{,}000}$$

$$= 1.6.$$

b. The GDP deflator is a Paasche index because it has a changing basket of goods, while the CPI is a Laspeyres index because it has a fixed basket of goods. The GDP deflator for 2018 is 1.5, which indicates that prices rose by 50 percent from their 2010 levels. The CPI for 2018 is 1.6, which indicates that prices rose by 60 percent from their 2010 levels.

If the prices of all goods rose by, for example, 50 percent, then one could say unambiguously that the price level rose by 50 percent. In our example, however, relative prices changed. The price of hot dogs rose by 100 percent, while the price of hamburgers rose by 33.33 percent, making hamburgers relatively less expensive. Consumers responded by increasing the quantity of hamburgers purchased relative to the quantity of hot dogs purchased. Since the CPI has a fixed basket of goods, it does not take into account this substitution effect and therefore gives a higher inflation rate than the GDP deflator.

8. a. To calculate the CPI, we fix the basket of goods in year 1 and allow prices to change over time. In the base year the CPI is 1, and in year 2 it is

$$\text{CPI}_2 = \frac{\left(P^2_{red} \times Q^1_{red}\right) + \left(P^2_{green} \times Q^1_{green}\right)}{\left(P^1_{red} \times Q^1_{red}\right) + \left(P^1_{green} \times Q^1_{green}\right)}$$

$$= \frac{\left(\$2 \times 10\right) + \left(\$1 \times 0\right)}{\left(\$1 \times 10\right) + \left(\$2 \times 0\right)}$$

$$= 2.$$

According to the CPI, prices have doubled.

b. In both years, Abby buys 10 apples for $1 each, so her nominal spending is $10.

c. In year 1, the base year, Abby's 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,

$$\text{Real Spending}_2 = \left(P^1_{red} \times Q^2_{red}\right) + \left(P^1_{green} \times Q^2_{green}\right)$$

$$= (\$1 \times 0) + (\$2 \times 10)$$

$$= \$20.$$

Abby's real spending doubles 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, so it is equal to 1 in the base year (year 1) and in year 2 is equal to

$$\text{Implicit Price Deflator}_2 = \frac{\text{Nominal Spending}_2}{\text{Real Spending}_2}$$

$$= \frac{\$10}{\$20}$$

$$= 0.5.$$

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 more 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.

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. The CPI, a Laspeyres price index, indicates that the cost of living doubled, while the implicit price deflator, a Paasche price index, indicates that the cost of living was cut in half. This is because the CPI fails to take into account the changing basket of goods, and the implicit price deflator fails to take into account the changing relative price. This suggests that a combination of the two indexes, such as a chain-weighted index, would be a better measure of the true cost of living.

9. a.   The labor force includes full-time workers, part-time workers, those who run their own businesses, and those who do not have a job but are looking for one. The labor force consists of 70 people. The labor-force participation rate, which is the share of the adult population in the labor force, is $(70/90) \times 100 = 77.8$ percent.

b.   Unemployed workers are those who would like to work and are looking for jobs, so there are 10. The unemployment rate, which is the share of the labor force that is unemployed, is $(10/70) \times 100 = 14.3$ percent.

c.   The household survey estimates total employment by asking a sample of households about their employment status. The household survey would report 60 people employed. The establishment survey estimates total employment by asking a sample of businesses to report how many workers

they are employing. In this case, the establishment survey would report 55 people employed because the 5 people with 2 jobs would be counted twice and the 10 people who run their own businesses would not be counted.

10. 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 remain steady 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.

11. a. Real GDP falls because Disney World 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 World falls (the income side of the national accounts), and people's consumption of Disney World falls (the expenditure side of the national accounts).

    b. Real GDP rises because the original capital and labor in farm production can now produce more wheat. This corresponds to an increase in the economic well-being of society since people can now consume more wheat or some of the capital and labor in farm production can be reallocated to producing other goods that society values.

    c. Real GDP falls because, with fewer workers on the job, firms produce less. The resulting lower income and consumption leads to 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, and there are fewer goods for people to consume.

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 a market good and thus does not show up in measured GDP, but it 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 workforce would be less educated.

g. Measured real GDP falls because fathers spend less time producing market goods and services. The fathers are, however, providing more unmeasured child-rearing services. The well-being of the average person may rise if the fathers and children sufficiently benefit from the extra time they spend together.